



Systems Reference Library

IBM 1410 Generalized Sorting Program Using IBM 1301 Disk Storage

This publication describes the IBM 1410 Generalized Sorting Program Using 1301 Disk Storage. Included are descriptions of the basic specifications and features of the program, the preparation of control cards, operating instructions and messages, the elements of the program, and methods of modification. Timing tables are also included.

PREFACE

The IBM 1410 generalized sorting program using IBM 1301 Disk Storage has been developed for an IBM 1410 equipped with one or two IBM 1301 Disk Storage modules. The program is considered a generalized sort because it is capable of modifying itself for a particular application according to control information specified by the user.

This program will sort fixed-length or variable-length data records, single or blocked. Basically, it consists of three phases. Phase 1 consists of a series of internal sorts; Phase 2 consists of one or more merging passes; and Phase 3 consists of the final merging pass. To facilitate program scheduling, the sorting program will permit input and/or output through any specified tape or disk unit on either channel. Provisions are included for the processing of header and trailer labels.

The control data upon which the sort is based may consist of as many as ten control-data fields consisting of a maximum of 2799 characters. The control-data fields may be contiguous or may be scattered through the data record, but must not overlap.

Core-storage space in each phase may be reserved for added programming. Exits are provided at logical points in the program to facilitate the inclusion of any additional routines desired by the user.

The sorting program may be loaded either from tape or from the card reader. The control information is normally entered through the card reader, but

the program may easily be modified so that control information may be entered through any other input unit, or left in core storage by a preceding program.

Checkpoint and restart routines are included that enable program operation to be resumed from the beginning of Phase 3.

If desired, the user may specify that a Write Disk Check operation be performed following each write operation on the 1301. When specified, this option is effective throughout all phases of the sort.

It is assumed that the reader has a basic knowledge of sorting techniques, the IBM 1410 Input/Output Control System for card and tape systems and for 1301 Disk Storage, the IBM 1410 Data Processing System, and IBM 1301 Disk Storage. Such information can be obtained from the following publications:

- "Sorting Methods for IBM Data Processing Systems," Form F28-8001.
- "IBM 1410 Principles of Operation," Form A22-0526.
- "IBM 1410 Data Processing System: 1301 Disk Storage," Form A22-6670.
- "IBM 1410 Input/Output Control System for Card and Tape Systems," Form J28-1432.
- "IBM 1410 Input/Output Control System for 1301 Disk Storage," Form J28-0251.
- "1301 Disk Storage with 7631 File Control," Form D22-6576.

This publication, C28-0304, obsoletes and replaces IBM 1410 Generalized Sorting Program Using IBM 1301 Disk Storage Preliminary Specifications and Timing Estimates, Form J28-0246.

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CONTENTS

PART I: SPECIFICATIONS AND FEATURES	5
Equipment Requirements	5
Input Specifications	5
Output Specifications	6
Control Data	7
Tape Label Options	7
Padding	8
Input/Output Error Correction	9
Checkpoint and Restart	9
PART II: SYSTEM OPERATION	12
Preparation of Control Cards	12
Operating Instructions	16
Messages	17
PART III: GENERAL DESCRIPTION	25
Input/Output Control System (IOCS)	25
Loader 1 (DSL1)	25
Loader 2 (DSL2)	25
Sort System Control (DSSC)	25
Control Card Routine (DCTL)	25
Phase 1 (DSPH1)	25
Phase 2 (DSPH2)	27
Phase 3 (DSPH3)	28
Restart (DRST)	29
PART IV: MODIFICATION	30
General Information	30
Automatic Existing Method	31
Phase-to-Phase Information	32
Summary List of Exits Provided	32
Description of Modification Constants and Exits	33
Loader 1 (DSL1) Modification	33
Loader 2 (DSL2) Modification	34
Exits Common to All Phases of the Sort	34
Control Card Routine (DCTL) Exits	35
Phase 1 Modification	36
Phase 3 Modification	39
Restart (DRST) Modification	44
APPENDIX A: TERMS AND DEFINITIONS	46
APPENDIX B: TIMING TABLES	48
INDEX	96

EQUIPMENT REQUIREMENTS

The sorting program requires an IBM 1410 with 40,000, 60,000, or 80,000 positions of core storage, the Processing Overlap and Priority special features, and one or two modules of 1301 Disk Storage. Two modules of disk storage are required to achieve optimum efficiency; however, the program will run with one module. When two modules are provided on separate channels, the program will automatically take advantage of the overlap of reading and writing made possible by this configuration.

Tape Units

Optional tape units can be used as follows:

1. Program Tape Unit: The sorting program can be read into core storage from magnetic tape. The tape used for this purpose is called the program tape. Once the sorting program is loaded, the program tape is no longer used; therefore, the associated tape unit may also be used for any other purpose listed below (see the section "Operating Instructions" for details).

2. Input Tape Unit: Reels 1, 3, 5, etc. of the input file will be read from this unit if an alternate input tape unit is specified. Otherwise, all input reels will be read from this unit. This tape unit may also be used for output.

3. Alternate Input Tape Unit: Reels 2, 4, 6, etc. of the input file will be read from this unit. This tape unit may also be used for output.

4. Dump Tape Unit: A dump tape can be specified only when input is from tape. Although not "closed" until Phase 3, this tape unit can also be used for output.

5. Output Tape Unit: Reels 1, 3, 5, etc. of the output file will be written on this unit if an alternate output tape unit is specified. Otherwise, all output reels will be written on this unit.

6. Alternate Output Tape Unit: Reels 2, 4, 6, etc. of the output file will be written on this unit.

The maximum number of tape units which can be used is six, as listed above; however, it should be noted that with as few as three tape units, even large-volume sorts can be run with no reduction in operating efficiency (i. e., no delays for changing of tape drives will be necessary). Three tape units would be used as follows:

1. Program Tape Unit. After the program is loaded, this unit will be used as the alternate input tape unit, if such a unit is specified. When all input records are read, this unit will be used as the output tape unit.

2. Input Tape Unit. After all input records are read, this unit will be used as the alternate output tape unit, if such a unit is specified.

3. Dump Tape Unit.

Card Reader

The sorting program normally reads control cards and the Output Tape Header Label card from the card reader; however, the program may easily be modified so that this information may be entered through any other input unit, or left in core storage by a preceding program. See "Modification."

Disk Space and Format Requirements

Disk storage space to be used by the sort is specified by the user in the control cards. Two cylinders (80 tracks) are required to store the sorting program. These cylinders must have a format of one 2165-character record per track in the load mode. The sorting program can be stored in these cylinders permanently or, if desired, it can be loaded into disk storage from tape or cards for each sorting application.

Disk space assigned to the program for working storage must be in consecutive cylinders in each module. These cylinders must have a format of one 2800-character record per track in the move mode. The number of disk tracks required for a given sorting application can be estimated by referring to the tables in Appendix B.

When the input and/or output files are in disk storage, the program will assume that the tracks involved have a format of one 2800-character record per track. Under certain conditions, however, as described in the sections "Input Specifications," and "Output Specifications," other formats are acceptable. In any event, the tracks for the input or output files must be consecutive.

INPUT SPECIFICATIONS

Input data may be single or blocked fixed-length records, or single or blocked variable-length records. The input file may be on any specified tape units or in disk storage.

Input Data Record Formats

The required formats for input data records are detailed in the applicable 1410 IOCS bulletins (Form J28-1432 and Form J28-0251); however, Form 1 or Form 3 data records in disk storage, not ending

with a record mark, are not acceptable as input to the sort.

The maximum permissible data-record length is 2800 characters for records that end with a record mark, or 2799 characters for records that do not end with a record mark. The maximum block length from disk storage is 2800 characters. The maximum block length from magnetic tape is 9999 characters. The maximum input blocking factor is 999.

Data records may contain any valid 1410 characters with the following exceptions:

1. Group marks must never appear.
2. A record mark can appear only as the final character of a data record.

When the input file is in disk storage, the sort assumes that the tracks containing the data records have a format of one 2800-character record per track. Since reading operations are in the "Full Track Without Addresses" mode, and further, since the records will be deblocked according to the input blocking factor specified in Control Card Three, any desired format in move mode is acceptable to the sort, providing it is consistent with the specified data-record length and input blocking factor.

Move Mode or Load Mode

When the input file is in disk storage, it must be in the move mode.

When the input file consists of single or blocked fixed-length records or single variable-length records on tape, it may be either in the move mode or the load mode. In either case, the sort will read the records in the move mode; word separator characters on tape will be read into storage as word separator characters. When the input file consists of fixed-length records in the load mode, word marks must be located in the same relative position in each data record, and the control-card entries that define data-record length and control-data fields must reflect the presence of word separator characters. When the input file consists of single variable-length records in the load mode, the control-card entries for maximum data-record length and control-data fields must reflect the presence of word separator characters. With variable-length records, word marks that precede the rightmost defined field (either control-data or record-length) must be located in the same relative position in each data record; word marks that follow the rightmost defined field are unrestricted as to number and location. Blocked variable-length records in the load mode are not acceptable as input to the sort.

OUTPUT SPECIFICATIONS

Output records must conform to the same specifications concerning form, content, and length, as input records. The output file may be on any specified tape units or in disk storage.

Output Blocking Factor

The output blocking factor is independent of the input blocking factor. For fixed-length records, any output blocking factor within the limits of available core storage may be specified, up to a maximum of 999. For blocked variable-length records, any tape-record length, consistent with the maximum data-record length and the limits of available core storage, may be specified.

Blocked records may be specified as output from a sorting application in which input consists of single fixed-length data records not ending with a record mark. In this case, the sorting program will automatically increase the output data-record length by one to accommodate the necessary record mark.

Single fixed-length data records, not ending with a record mark, may be specified as output from a sorting application in which input consists of blocked records. In this case, the sorting program will automatically decrease the output data-record length by one, dropping the final record mark.

Single variable-length records, either with or without a final record mark, may be specified as output from an application in which input consists of blocked variable-length records. Conversely, blocked variable-length records may be specified as output from an application in which input consists of single variable-length records, providing each data record contains a record character-count field. It should be noted that the sorting program will in no case alter the contents of the record character-count field. Any such changes necessitated by the specification of an output format different from input format must be accomplished through the use of modification exits in either Phase 1 or Phase 3. (See "Modification.")

Conversion of data-records from fixed-length to variable-length format, or from variable-length to fixed-length format, may be accomplished through the use of modification exits in either Phase 1 or Phase 3. (See "Modification.")

When the output file is to be placed in disk storage, the sorting program assumes that the tracks specified for this purpose have a format of one 2800-character record per track. Since writing operations in Phase 3 are in the "Full Track Without Addresses"

mode, and further, since the records will be blocked according to the output blocking factor specified in Control Card Three, any desired format in move mode is acceptable, providing it is consistent with the specified data-record length and output blocking factor.

Move Mode or Load Mode

When the output file is to be placed in disk storage, it must be in the move mode.

When the output file is to be written on tape, the program will write the records in the move mode. This procedure is consistent with input operations, as described above, and except for blocked variable-length records makes possible the sorting of a data file that was written in the load mode, and the creation of a sequenced output file that can be processed in the load mode in a following program. In addition, this method eliminates the reduction in efficiency that would result from the use of the load mode for reading and writing during the entire sorting process. Although blocked variable-length records in the load mode are not normally produced as output from the sort, the program can be modified to produce records of this type as output. (See Modification Exit 3C.)

All four forms of data records in the move mode can be processed without modification.

CONTROL DATA

The control data upon which the sort is based may be as long as 2799-characters (maximum data-record length minus one) and may consist of as many as ten control-data fields. The maximum length of any single control-data field is 999 characters. The control-data fields may be contiguous or they may be scattered throughout the record; however, they must not overlap.

TAPE LABEL OPTIONS

Provisions for the processing of tape labels are based upon the recommended tape-labeling practices described in the IOCS bulletin, Form J28-1432. Although this system was designed primarily to handle tapes that contain standard labels, the sorting program will also handle tapes with non-standard labels, or no labels.

Format specifications for standard labels are contained in the IOCS bulletin, Form J28-1432. A non-standard header (trailer) label may be any single record of 80 characters or less that precedes (follows) the data file on tape.

The various tape-label options are specified separately for input, output and dump tapes, thus affording maximum flexibility in meeting the user's tape-label requirements. Modification exits may be used for additional label routines that the user may wish to include.

The options for the handling of labels on tapes used by the sort are shown in Figure 1, together with the codes used to specify the desired options in Fields 6, 11, and 12 of Control Card Two.

<u>Header Label</u>	<u>Header Label Followed by Tape Mark</u>	<u>Trailer Label</u>	<u>Code</u>
Standard	Yes	Yes	0
Standard	Yes	No	1
Standard	No	Yes	2
Standard	No	No	3
Non-Standard	Yes	Yes	4
Non-Standard	Yes	No	5
Non-Standard	No	Yes	6
Non-Standard	No	No	7
None	-	Yes	8
None	-	No	9

Figure 1. Tape-Label Options

Whenever standard header labels are specified for either the dump tape or the output tapes, the sorting program will assume that the current date is located in core-storage positions 00115-00119, as specified by the IOCS. This date will be used for checking the retention cycle of the tapes before writing the new labels.

Input Tapes

The checking of standard header labels against header label control cards is not considered meaningful, since the input file may consist of several different reels from several different data files. Similarly, no reel sequence check is performed since the input reels may be mounted in any sequence and, in some cases, only a portion of a file may be used.

When input tapes contain standard trailer labels, the usual end-of-file or end-of-reel indication in the label (1EOFb or 1EORb) cannot normally be used to indicate to the sorting program the end of the input file. Since the input may consist of several files, or portions of one or more files, an input reel count must always be specified. If desired, Modification Exit 1E may be used to terminate the input if a trailer label is to be used for this purpose. (See the description of Modification Exit 1E.)

Dump Tape

When standard header labels are used, the retention cycle is checked against the current date. This check provides automatic protection of any tape that should be retained but that has been mounted in error.

When standard header labels are specified, the program expects that the dump tape is pre-labeled. If the tape does not contain a header label, or if the header label is not standard, Message 30332 will be typed. Upon the occurrence of the message, the user may either recheck this tape or a new tape, or cause the program to create and write a standard header label with a tape serial number of *****. See Message 30332.

When either standard or non-standard header labels are specified, the label created by the sorting program will contain the fields shown in Figure 2. Modification Exit 1F may be used to alter this format.

1-5	6-10	11-15	16-20	21-30	31-35	36-40	41-80
Flag	Tape Serial No.	File Serial No.	Reel Sequence No.	File Name DSDUMPTAPE	Creation Date	Retention Cycle	Blank
1HDRb	Note 1	Note 1	-001b		Note 2	-000b	

Note 1: When non-standard header labels are specified, or when standard header labels are specified but the dump tape is not pre-labeled, this field contains *****.

Note 2: When non-standard header labels are specified, this field contains 00000.

Figure 2. Dump Tape Header Label

When either standard or nonstandard trailer labels are specified, the label will contain the fields shown in Figure 3.

1-5	6	80
Flag		
1EOFb	Blank	

Figure 3. Dump Tape Trailer Label

Output Tapes

When standard header labels are used, the retention cycle is checked against the current date. This check provides automatic protection of any tape that should be retained but that has been mounted in error.

When standard header labels are specified, the program expects that output tapes are pre-labeled. If the tape does not contain a header label, or if the label is not standard, Message 30332 will be typed. Upon the occurrence of this message, the user may

cause the program to either recheck this tape or a new tape, or create and write a header label with a tape serial number of *****.

When standard header labels are specified, an Output Tape Header Label Card containing the following information must be furnished:

Card Columns	Contents
1-5	1 HDRb
6-10	Not used
11-15	File Serial Number or Blank. If this field is blank, the File Serial Number will be the Tape Serial Number of the first output reel
16-20	Not used
21-30	File Name
31-36	Not used
37-39	Retention Cycle

The remainder of the fields making up the standard header label will be developed automatically.

When non-standard header labels are specified for output tapes, the Output Tape Header Label Card should contain the exact header label the user wishes written.

When either standard or non-standard trailer labels are specified, the labels will contain the fields shown in Figure 4. Modification Exit 3G may be used to alter this format.

1-5	6-10	11	80
Flag	Block Count	Blank	
1EORb	XXXXXX		
Note 1			

Note 1: This field will contain "1EOFb" for the last reel of the output file.

Figure 4. Output Tape Trailer Label

PADDING

When fixed-length records are blocked, padding records are necessary if the number of data records in a file is not evenly divisible by the blocking factor. These padding records must meet the normal requirements for blocked fixed-length data records; that is, they must all be the same length and they must end with a record mark. Since padding is never used with variable-length records, the program automatically eliminates all padding checks whenever the output is to be in this form.

Except for the final record marks, padding records consist entirely of blanks or entirely of nines. When checking for padding, the program will not treat a

record as padding if it contains other characters, even though its control-data fields consist entirely of blanks or entirely of nines.

The program will handle padding records according to the padding option specified in Field 23 of Control Card Three, as follows:

<u>Padding Option</u>	<u>Description</u>
blank	The program will not check for padding records. Added padding, if required, will be nines.
1	The program will check for nines padding only. Added padding, if required, will be nines, and full blocks of nines will be dropped from the output file.
2	The program will check for blanks padding only. Full blocks of blanks will be dropped from the output file. Added padding, if required, will be blanks; however, if records are added or deleted during Phase 3, the program may be required to add nines padding to the last output block.
3	The program will check for both blanks and nines padding, and eliminate all blanks padding. Added padding, if required, will be nines, and full blocks of nines will be dropped from the output file.
4	The program will check for both blanks and nines padding, and full blocks of either type will be dropped. Added padding, if required, will be blanks. If the number of nines padding records in the input file, if any, is known to the user, and is given to Phase 3 in Modification Constant 12, all nines padding records will be dropped. However, if records are added or deleted during Phase 3, the program may be required to add nines padding to the last output block. See "Modification Exit 3A."

A block containing blanks padding will always appear as the first block in the output file, with the blanks padding records appearing as the first records of the block. Similarly, a block containing nines padding will always appear as the last block of the output file, with the nines padding records appearing as the last records of the block.

Phase 3 will add padding records if the total number of output data records is not evenly divisible by the output blocking factor. When Phase 3 is required to check for nines padding records, a calculation is made of the number of data records that can be processed before starting the check. This calculation is based upon the assumptions that:

1. There are no full blocks of nines padding records in the input to Phase 1;
2. When input is from tape, no more than one block in each input reel contains nines padding records.

Whenever an input file contains more nines padding records than the above assumptions will permit, an adjustment of the calculation should be made through the use of Phase 3 Modification Constant 12 in order to insure that the output file will not contain full blocks of nines padding records. See the description of Modification Exit 3A.

INPUT/OUTPUT ERROR CORRECTION

Tape

When the input file is from tape, unreadable input records should seldom occur because of the automatic read-back feature of the 729 and 7330 tape units. Whenever an input tape record is unreadable, however, routines are available that:

1. facilitate correction of the record in core storage;
2. write the error record on the dump tape.

A dump tape must be available if unreadable records are to be eliminated from the file and subsequently reprocessed. Otherwise, this tape is not required.

The sorting program utilizes the standard tape-error correction routines included in the IOCS.

Disk

The sort utilizes the standard disk error-correction routines included in the IOCS. Disk records must be read correctly in order for the sorting program to function properly; there are no provisions to correct invalid records in core storage, or to write such records on the dump tape.

Write Disk Check

If desired, the user may specify that a Write Disk Check operation be performed following each write operation on the 1301. When specified, this option is effective throughout all phases of the sort.

CHECKPOINT AND RESTART

The term checkpoint, as used here, refers to the recording of a portion of core storage at the beginning of Phase 3 to provide a point from which the program may be subsequently restarted. The check-

point record is written on one of the disk tracks designated for storage of the sorting program.

Execution of a restart restores the contents of the portion of core storage recorded at the time of the checkpoint and reloads Phase 3. Processing is then resumed.

PART II: SYSTEM OPERATION

PREPARATION OF CONTROL CARDS

This section contains a brief description of the control-card information required by the sorting program.

Control Card One defines two cylinders (80 tracks) of disk-storage space to be used for storage of the sorting program. This card is used initially by Loader 1, which writes the program on the specified disk tracks. If, after initial loading, the program is retained in disk storage permanently, Control Card One is used by Loader 2 to load the program into core storage from disk storage for each sorting application.

Control Cards Two, Three, and Four define the specific parameters of each sorting application. (Control Card Four is used only when four or more control-data fields are specified.)

It should be noted that Control Cards One and Two define the machine configuration to be used for sorting, while Control Cards Three and Four define the unique characteristics of a particular data file to be sorted. This arrangement will, in many cases, allow the user to standardize the entries in the first two cards, so that only Control Card Three and, when needed, Control Card Four, must be punched for each application.

Although each control card is subject to an extensive validity check, it should be recognized that the program could not possibly protect the user against all possible erroneous entries and inconsistent combinations of entries. The user's responsibility in the accurate preparation of control cards should be recognized.

Control Card One

<u>Field</u>	<u>Card Columns</u>	<u>Information Required</u>
1 (columns 1-9)		Two Cylinders (80 tracks) for Storage of the Sorting Program. This must start at the beginning of a cylinder.
	1	1 for Channel 1; or 2 for Channel 2
	2	Access: Always punch 0
	3	Module: Punch 0, 1, . . . , or 9
	4-9	Address of first track: 1) Track number in columns 4-7. 2) Home Address Identifier HA2 in columns 8-9.

<u>Field</u>	<u>Card Columns</u>	<u>Information Required</u>
2	10-71	Not used
3	72-77	<u>User's Identification</u> Any six characters may be punched as identification for the user.
4	78-80	<u>Control Card One Identifier</u> Punch CC1
<u>Control Card Two</u>		
5	1	<u>Core Storage Size.</u> 3 for 40,000 core-storage positions 4 for 60,000 core-storage positions 5 for 80,000 core-storage positions
6 (columns 2-9)		<u>Input Tape: This field must be blank if the input file is in disk storage.</u>
	2	1 for Channel 1 2 for Channel 2
	3	E for Even Parity O for Odd Parity
	4	0, 1, . . . , or 9 for Input Tape Unit
	5	0, 1, . . . , or 9 for Alternate Input Tape Unit
	6	<u>Input Tape-Label Option:</u> 0 for standard header label with a tape mark and a trailer label 1 for standard header label with a tape mark and no trailer label 2 for standard header label with no tape mark and a trailer label 3 for standard header label with no tape mark and no trailer label 4 for non-standard header label with a tape mark and a trailer label 5 for non-standard header label with a tape mark and no trailer label 6 for non-standard header label with no tape mark and a trailer label

CONTROL CARD 1

Field	1		2																																																														3	4														
Description	Cylinder for Storage of Program		Not Used																																																														User's Identification	CCI														
	Module Access Channel	Low Address																																																																														
Column	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80

CONTROL CARD 2

Field	5	6				7				8				9				10				11				12	13	14	15																																																			
Description	Core Storage Size	Input Tape				Disk Input File				Available Disk Storage Area "A"				Available Disk Storage Area "B"				Disk Output Area				Output Tape				Dump Tape	Write Disk Check	User's Identification	CC2																																																			
		Module Access Channel	Low Address	High Address (Track Only)	Module Access Channel	Low Address	High Address (Track Only)	Module Access Channel	Low Address	High Address (Track Only)	Module Access Channel	Low Address	High Address (Track Only)	Module Access Channel	Low Address	High Address (Track Only)	Module Access Channel	Low Address	High Address (Track Only)	Module Access Channel	Low Address	High Address (Track Only)	Unload Option	Tape Label Option	Units Alternate	Units Output				Parity Mode																																																		
Column	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80

CONTROL CARD 3

Field	16	17	18	19	20	21	22	23	24			25	26	27		28	29	30		31																																																												
Description	Data Record Length	Input Blocking	Maximum Input Block Length (Form 4 Only)	Data Record Length Field Location-Low Order (Form 4 Only)	Maximum Output Block Length (Form 4 Only)	Output Blocking	File Size	Padding Option	Core Storage Reservations			No. of Core Data Files	Total Length of Control Data Fields	Control Data Field 1		Control Data Field 2	Control Data Field 3	User's Identification		CC3																																																												
									Phase 1	Phase 2	Phase 3			Location	Length	Location	Length	Location	Length		Location	Length																																																										
Column	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80

CONTROL CARD 4

Field	32		33		34		35		36		37		38		39	40	41																																																															
Description	Control Data Field 4		Control Data Field 5		Control Data Field 6		Control Data Field 7		Control Data Field 8		Control Data Field 9		Control Data Field 10		Not Used	User's Identification	CC4																																																															
	Location	Length	Location	Length	Location	Length	Location	Length	Location	Length	Location	Length	Location	Length																																																																		
Column	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80

<u>Field</u>	<u>Card Columns</u>	<u>Information Required</u>	<u>Field</u>	<u>Card Columns</u>	<u>Information Required</u>
		7 for non-standard header label with no tape mark and no trailer label			must be the same as columns 23, 24, and 25.
		8 for no header label and a trailer label		36	1 for Channel 1, or 2 for Channel 2
		9 for no header label and no trailer label		37	Access: Always punch 0
	7	Unload Option: Punch Y if input tapes should be unloaded upon reaching end of reel. Punch N if input tapes should be rewound but not unloaded upon reaching end of reel.		38	Module: Punch 0, 1, . . . , or 9
	8-9	Number of tape reels in input file. If desired, the user may punch 00 in columns 8-9 and type in the correct number of input reels on the console printer at object time. See the description of Message 20301.		39-44	Address of first track: 1) Track number in columns 39-42 2) Home Address Identifier (HA2) in columns 43-44
		<u>Disk Address of the Input File</u> This field <u>must</u> be blank if input file is on tape.		45-48	Address of last track: Track number only
7 (columns 10-22)	10	1 for Channel 1, or 2 for Channel 2	10 (columns 49-61)		<u>Disk Address of Output File</u> This field must be blank if output is to be written on tape.
	11	Access: Always punch 0		49	1 for Channel 1, or 2 for Channel 2
	12	Module: Punch 0, 1, . . . , or 9		50	Access: Always punch 0
	13-18	Address of first track 1) Track number in columns 13-16 2) Home Address Identifier (HA2) in columns 17-18.		51	Module: Punch 0, 1, . . . , or 9
	19-22	Address of last track; track number only.		52-57	Address of first track: 1) Track number in columns 52-55. 2) Home Address Identifier (HA2) in columns 56-57.
8 (columns 23-35)		<u>Disk Storage Work Space</u> Module "A" This must start at the beginning of a cylinder.		58-61	Address of last track: Track number only
	23	1 for Channel 1, or 2 for Channel 2			<u>Output Tape</u> This field must be left blank if output is to be written on disk storage.
	24	Access: Always punch 0		62	1 for Channel 1, or 2 for Channel 2
	25	Module: Punch 0, 1, . . . , or 9		63	E for Even Parity O for Odd Parity
	26-31	Address of first track: 1) Track number in columns 26-29 2) Home Address Identifier (HA2) in columns 30-31.		64	0, 1, . . . , or 9 for Output Tape Unit
	32-35	Address of last track: track number only		65	0, 1, . . . , or 9 for Alternate Output Tape Unit
9 (columns 36-48)		<u>Disk Storage Work Space</u> Module "B" This must start at the beginning of a cylinder. If only one module is available, columns 36, 37, and 38		66	Output Tape-Label Option: 0 for standard header label with a tape mark and a trailer label 1 for standard header label with a tape mark and no trailer label 2 for standard header label with no tape mark and a trailer label 3 for standard header label with no tape mark and no trailer label

<u>Field</u>	<u>Card Columns</u>	<u>Information Required</u>	<u>Field</u>	<u>Card Columns</u>	<u>Information Required</u>
		4 for non-standard header label with a tape mark and a trailer label			6 for non-standard header label with no tape mark and a trailer label
		5 for non-standard header label with a tape mark and no trailer label			7 for non-standard header label with no tape mark and no trailer label
		6 for non-standard header label with no tape mark and a trailer label			8 for no header label and a trailer label
		7 for non-standard header label with no tape mark and no trailer label		70	9 for no header label and no trailer label
		8 for no header label and a trailer label			Unload Option: Punch Y if the dump tape should be unloaded when it is closed.
		9 for no header label and no trailer label			Punch N if the dump tape should be rewound but not unloaded when it is closed.
	67	Unload Option: Punch Y if output tapes should be unloaded upon reaching end of reel. Punch N if output tapes should be rewound but not unloaded upon reaching end of reel.	13	71	<u>Write Disk Check</u> Punch Y if a Write Disk Check should be executed following each write operation involving disk storage. Punch N if a Write Disk Check should <u>not</u> be executed following each write operation involving disk storage.
12 (columns 68-70)		<u>Dump Tape</u> A dump tape may be specified only when the input file is on tape. If specified, the dump tape is always on channel 1, unit 9; its parity is the same as that of the input tape.			<u>User's Identification</u> Any six characters may be punched as identification for the user.
	68	Punch Y if a dump tape is desired. Punch N, or leave blank, if a dump tape is not desired.	14	72-77	<u>Control Card Two Identifier</u> Punch CC2
	69	Dump Tape Label Option: 0 for standard header label with a tape mark and a trailer label			
		1 for standard header label with a tape mark and no trailer label			
		2 for standard header label with no tape mark and a trailer label			
		3 for standard header label with no tape mark and no trailer label			
		4 for non-standard header label with a tape mark and a trailer label			
		5 for non-standard header label with a tape mark and no trailer label			
					<u>Control Card Three</u>
			16	1-4	<u>Data-Record Length</u> <u>For fixed-length records:</u> punch the actual length of the data record, including final record mark if any. <u>For variable-length records:</u> the maximum data record length, including final record mark, if any. The data-record length cannot be greater than 2800. If the data-record length is to be changed in Phase 1 and/or Phase 3 by a user modification, punch here the data-record length to be used by the sorting program. See the

<u>Field</u>	<u>Card Columns</u>	<u>Information Required</u>	<u>Field</u>	<u>Card Columns</u>	<u>Information Required</u>
17	5-7	<p>description of Modification Exits 1C and 3C.</p> <p><u>Input Blocking Factor</u> Punch 000 for Form 1 records without a terminal record mark. Punch 001 for Form 1 records with a terminal record mark. Punch the number of data records in each input block for Form 2 records. Punch V00 for Form 3 records without a terminal record mark. Punch V01 for Form 3 records with a terminal record mark. Punch V02 for Form 4 records with a data record-length field of 2 characters. Punch V03 for Form 4 records with a data record-length field of 3 characters. Punch V04 for Form 4 records with a data record-length field of 4 characters. <u>Note:</u> Form 1 or Form 3 data records in disk storage, not ending with a record mark, are not acceptable as input to the sort.</p>	21	20-22	<p><u>Output Blocking Factor</u> Punch 000 for Form 1 records without a terminal record mark. Punch 001 for Form 1 records with a terminal record mark. Punch the number of data records in each output block for Form 2 records. Punch V00 for Form 3 records without a terminal record mark. Punch V01 for Form 3 records with a terminal record mark. Punch V02 for Form 4 records with a data record-length field of 2 characters. Punch V03 for Form 4 records with a data record-length field of 3 characters. Punch V04 for Form 4 records with a data record-length field of 4 characters. <u>Note:</u> Form 1 or Form 3 data records in disk storage not ending with a record mark are not acceptable as output.</p>
18	8-11	<p><u>Maximum Input Block Length</u> This field is for Form 4 data records only; it must be blank for all other forms. Punch the maximum length of the input block, including the block character-count field.</p>	22	23-29	<p><u>File Size.</u> This <u>may</u> be left blank. Punch total number of records in the file, if known. When specified: 1) Phase 1 will check to see whether the disk-storage work space specified in Fields 8 and 9 is large enough for the specified number of records to be sorted, and 2) Phase 1 will check to see whether it received the total number of records specified.</p>
19	12-15	<p><u>Data Record Length Field Location.</u> This field is for Form 4 data records only; it must be blank if neither input nor output is in this form. Punch the position of the low-order character of the data record-length field, relative to the beginning of the data record.</p>	23	30	<p><u>Padding Option.</u> This field is for output consisting of fixed-length records only; it must be blank if output consists of variable-length records. Full output blocks of specified padding will be dropped. Leave blank if no checks for padding are to be made. Punch 1 for nines padding only. Punch 2 for blanks padding only.</p>
20	16-19	<p><u>Maximum Output Block Length</u> This field is for Form 4 data records only; it must be blank for all other forms. Punch the maximum length of the output block, including the block character-count field.</p>			

<u>Field</u>	<u>Card Columns</u>	<u>Information Required</u>
		Punch 3 if Phase 3 should check for both blanks and nines padding and eliminate all blanks padding. Added padding, where required, will be nines.
		Punch 4 if Phase 3 should check for both blanks and nines padding. Added padding, where required, will be blanks. <u>Note:</u> If blank, 2, or 4 is specified, nines padding may be added to the output file if data records are added or deleted through user modification in Phase 3.
		If blank is specified, nines padding may be added to the output file if the number of output data records is not a multiple of the output blocking factor.
24 (columns 31-45)		<u>Core-Storage Reservations</u> Leave blank if <u>no</u> reservation of core-storage is required in any or all phases.
	31-35	Number of core-storage positions to be reserved in Phase 1.
	36-40	Number of core-storage positions to be reserved in Phase 2.
	41-45	Number of core-storage positions to be reserved in Phase 3.
25	46	<u>Number of Control-Data Fields</u> Punch the total number of control-data fields specified. (Punch 0 if ten control-data fields are specified.)
26	47-50	<u>Total Length of Control-Data Fields</u> Punch the sum of the lengths of <u>all</u> control-data fields specified.
27 (columns 51-54)		<u>Control-Data Field 1</u> Punch the location of the low-order position of the major control-data field relative to the beginning of the data record.
	55-57	Punch the length of the major control-data field.

<u>Field</u>	<u>Card Columns</u>	<u>Information Required</u>
28-29	58-71	<u>Locations and Lengths of Control-Data Fields 2 & 3.</u> Punch four digits for each location, followed by three digits for each length (see Field 27).
30	72-77	<u>User's Identification</u> Any six characters may be punched as identification for the user. This field will be placed in Message 10300 and typed by the control card routine.
31	78-80	<u>Control Card Three Identifier</u> Punch CC3.

Control Card Four

This card is needed only if there are more than three Control-Data Fields.

<u>Field</u>	<u>Card Columns</u>	<u>Information Required</u>
32-38 (columns 1-49)		<u>Locations and Lengths of Control-Data Fields 4-10</u> Punch four digits for each location, followed by three digits for each length (see Field 27).
39	50-71	Not used.
40	72-77	<u>User's Identification</u> Any six characters may be punched as identification for the user.
41	78-80	<u>Control Card Four Identifier</u> Punch CC4

OPERATING INSTRUCTIONS

Program Loading

The program tape, as distributed, is shown in Figure 5. It is set up for loading from any tape unit on either Channel 1 or Channel 2. If desired, the program tape may be punched onto cards and loaded via the card reader. After the initial loading, the program will be written in the two cylinders of disk storage whose initial track address is specified in Control Card One. If these two cylinders are not subsequently disturbed, all sorting applications can be executed simply by loading the Loader 2 portion of the program, which is included in the basic program material as a separate card deck. The user

always has the option of reloading the entire program from cards or tape if the utilization of 1301 Disk Storage precludes the reservation of two cylinders for permanent storage of the program. In any event, the sorting program does not reference the program tape after loading, and this tape unit can therefore be used for another function; e.g., for input, output, or dump tape.

The procedure for program loading is as follows:

1. a. If this is the initial loading of the sorting program, ready the tape unit (or card reader) containing the program tape (or program deck).
- b. If this is not the initial loading of the program; i.e., the program has previously been loaded and has been retained in the 1301, ready the card reader (or tape unit) containing the Loader 2 (DSL2) card deck.
2. Place the control cards in the card reader in the following order:
 - a. Control Card One. Note: Upon initial loading (1a above) if the program is loaded from cards, Control Card One must be placed within the program deck, immediately following the "Execute" card, serial 999, identified DSLD1.
 - b. Control Cards Two, Three and if needed, Four.
 - c. Output Tape Header Label card (used only when the output tapes are to contain header labels).
3. DISPLAY: 00001
4. a. For initial loading from tape (1a above) ALTER: L%B000011\$.^V (Modify as required if initial loading is from cards or a different tape unit.)
- b. For loading Loader 2 from cards (1b above) ALTER: L%1100011\$.^V (Modify as required if Loader 2 is on a program tape.)
5. Press COMPUTER RESET and START

Restart Procedures

Execution of a restart from the Phase 3 checkpoint restores the contents of the portion of core storage recorded at the time of the checkpoint and reloads Phase 3. Added programming associated with Phase 3 Modification Exit 3A must be reloaded either prior to, or together with the Restart Program, if this added programming is not still in core storage. In addition, provision must be made for the reloading of branch constants and added programming for all other Phase 3 modification exits. (See "Modification.")

The procedure for loading the Restart Program is as follows:

1. Ready the card reader (or tape unit) containing the Restart Program.
2. Place Control Card One in the card reader.
3. If output tapes are to contain header labels, place the Output Tape Header Label Card in the card reader.
4. DISPLAY: 00001^V
5. ALTER: L%1100011\$.^V (Modify as required if the Restart Program is on tape.)
6. Press COMPUTER RESET and START.

<u>Description</u>	<u>Program Tape</u>	
	<u>Serial Nos.</u> (Cols 73-75)	<u>Identification</u> (Cols 76-80)
Standard 7 Card Load Program	None	None
DSL2	001-044	DSL2
DSL2 Execute Card	999	DSL2
DSSC	001-046	DSSC
DSSC Execute Card	999	DSSC
DSCT1	001-850	DSCT1
DSCT2	001-202	DSCT2
DSCT2 Execute Card	999	DSCT2
DSP11	001-413	DSP11
DSP11 Execute Card	999	DSP11
DSP12	001-013	DSP12
DSP12 Execute Card	999	DSP12
DSP13	001-351	DSP13
DSP13 Execute Card	999	DSP13
DSPH2	001-513	DSPH2
DSPH2 Execute Card	999	DSPH2
DSPH3	001-706	DSPH3
DSPH3 Execute Card	999	DSPH3
DSL2	001-047	DSL2
DSL2 Execute Card	999	DSL2
DSL2 Card Deck		
Standard 7 Card Load Program	None	None
DSL2	001-047	DSL2
DSL2 Execute Card	999	DSL2
DSRST (Restart Program) Card Deck		
Standard 7 Card Load Program	None	None
DSRST	001-040	DSRST
DSRST Execute Card	999	DSRST

Note: Correction cards contained in modification letters for this system will contain the identification of the "Execute" card they precede, and will be serially numbered beginning with C01 for each part. Correction cards for Loader 2 will be issued in duplicate: one for the program tape and one for the separate card deck.

Figure 5. Basic Program Material

MESSAGES

Messages that may occur during the operation of the sorting program are listed on the following pages.

Whenever action is required following a message, the sorting program enters a waiting loop. To assist the machine operator in analyzing the conditions that exist when a waiting loop occurs, the first five characters of each message are a five-digit Identification Code. The digits of the Identification Code are as follows:

1. Ten-Thousands Position (High-Order Position)

The digit in this position indicates the condition that exists at the time the waiting loop and/or message occurs. It also specifies the linkages that follow the waiting loop.

 - 0 indicates a "cannot-proceed condition." Both a message and a dead-end waiting loop are provided. In this type of condition, the waiting loop will not return control to the program.
 - 1 indicates that a routine of particular significance has been executed. The message is not accompanied by a waiting loop and is typed merely to inform the operator.
 - 2 indicates an "await-action condition," and both a message and a waiting loop are provided. It is used when a single course of action (e.g., correcting a control card, dialing a tape unit on-line, trying to correct an error by re-execution of an operation, etc.) must be followed by the operator in order to continue the program. Of course, the operator also has the option of terminating the program. The action for continuation is given in the list of waiting loops and messages. The programmed waiting loop used in an "await-action condition" is always followed by linkage to the routine to be executed next.
 - 3, 4, 5, or 6 indicates an "await-decision condition," and both a message and waiting loop are provided. It is used when the operator must choose one of several alternate courses of action to continue the program.
2. Thousands Position
 - 0 always
3. Hundreds Position
 - 1 indicates an IOCS message and/or waiting loop.
 - 3 indicates a sorting program message and/or waiting loop.
4. Tens & Units Position

The tens and units position contain an arbitrarily assigned number that differentiates the various conditions resulting in Identification Codes that start with the same three digits.

<u>Code</u>	<u>Message, Explanation and Action</u>
00310	00310- N MAX EXCEEDED <u>Explanation:</u> The number of data records processed by Phase 1 up to this point exceeds N MAX, as typed in message 10310. <u>Action:</u> The sort must be restarted from the beginning and either the number of input records must be reduced or the amount of disk storage available to the sort must be increased.
00311	00311- INSUFF. STGE PH1 <u>Explanation:</u> Core-storage space required for data areas in Phase 1 exceeds the amount of core-storage space available after running program and added programming requirements are satisfied. <u>Action:</u> Reduce the Phase 1 core-storage reservation specified in Field 24 of Control Card Three and reload the sort.
00312	00312- INSUFF. STGE PH3 <u>Explanation:</u> Core-storage space required for data areas in Phase 3 exceeds the amount of core storage available after running program and added programming requirements are satisfied. <u>Action:</u> Reduce the Phase 3 core-storage reservation specified in Field 24 of Control Card Three and reload the sort.
00313	00313- xxxxxxx IN yyyyyy OUT <u>Explanation:</u> Phase 1 data-record counts do not balance, xxxxxxx is the number of input data records minus the number, if any, that were dumped, plus the value of the Phase 1 Modification Constant 02. yyyyyy is the number of data records written in Phase 1. <u>Action:</u> Occurrence of this message is indicative of operational failure; the sort must be restarted from the beginning.
00323	00323- xxxxxxx IN yyyyyy OUT <u>Explanation:</u> Phase 2 data-record counts do not balance. xxxxxxx is the number of input data records to Phase 2; yyyyyy is the number of data records written in Phase 2. If these two values are equal to each other, this message indicates that they are not equal to the number of data records written in Phase 1. <u>Action:</u> Occurrence of this message is indicative of operational failure; the sort must be restarted from the beginning.

<u>Code</u>	<u>Message, Explanation and Action</u>	<u>Code</u>	<u>Message, Explanation and Action</u>
00330	00330- OUT OF SEQ <u>Explanation:</u> A data record in one Phase 3 input merge sequence is out of sequence with the previous data record from that sequence. <u>Action:</u> A Phase 3 restart is possible; however, an out-of-sequence condition is usually indicative of operational failure.	10302	10302- FLDS 8/9 EXCHNGD <u>Explanation:</u> The number of disk-storage tracks specified in Field 9 of Control Card One is greater than the number specified in Field 8. Since the program logic assumes that Module A work space is greater than Module B work space, these two fields have been exchanged. <u>Action:</u> None
00333	00333- DATA RCD CNT OFF <u>Explanation:</u> Phase 3 data-record counts do not balance. This unbalance may be expressed as: $a+b-c+d \neq e$, where a is the number of input data records to Phase 3, b is the number of padding records added in Phase 3, c is the number of padding records dropped in Phase 3, d is the value of Phase 3 Modification Constant 06, and e is the number of output data records. <u>Action:</u> A Phase 3 restart is possible; however, an incorrect record count is usually indicative of operational failure.	10310	10310- N MAX xxxxxxxx <u>Explanation:</u> xxxxxxxx is the maximum number of records that can be sorted, based upon the information specified in the control cards. <u>Action:</u> None
00399	00399- END SORT <u>Explanation:</u> End of sort <u>Action:</u> None	10312	10312- I/P xxxxxxxx RCDS <u>Explanation:</u> xxxxxxxx input data records have been processed through Phase 1. This message will not be typed when the number of input data records is equal to the file size specified in Field 22 of Control Card Three <u>Action:</u> None
10100	10100 NR xxxx. . . . <u>Explanation:</u> The input/output device called for in the I/O operation, xxxx. . . ., is not ready. <u>Action:</u> Place the device in ready status. The program will continue when the device is ready.	10313	10313- xy, EOR 10313- xy, EOF <u>Explanation:</u> Input tape y, channel x, has been processed and may be dismantled. EOR indicates that this is not the last reel of the input file; the program is now processing the alternate input tape. EOF indicates that all input reels have been processed. <u>Action:</u> Mount the next input reel, if any, to be read from this tape unit.
10118	10118 SKC <u>Explanation:</u> A seek error has been detected by IOCS; the operation will be re-executed. <u>Action:</u> None	10331	10331- xy, aaa <u>Explanation:</u> Output tape y, channel x, has been closed and may be dismantled. This is reel number aaa of the output file. <u>Action:</u> Mount the next output tape reel to be written from this unit.
10300	10300- xxxxxxx <u>Explanation:</u> This message, typed in the Control Card Routine, indicates the job identification, xxxxxxx, that is specified in Field 30 of Control Card Three. <u>Action:</u> None	10332	10332- 19, DT <u>Explanation:</u> The dump tape has been closed, and may be dismantled. <u>Action:</u> If data records were dumped in Phase 1, the dump tape should be re-processed to recover the dumped records.
10301	10301- I/P TP NO UNLD OPT <u>Explanation:</u> One or both of the input tape units is also to be used for output. Since the unload option was not specified in Field 6 of Control Card Two, this message is typed as a reminder to the operator to be ready to change tapes at the end of Phase 1. <u>Action:</u> None	10335	10335- amtttthh <u>Explanation:</u> The sequenced output file has been written in disk storage. The disk address word for the last track of the output file is amtttthh where a is the access mechanism, m is the module, tttt is the track, and hh is the home address identifier (HA2). <u>Action:</u> None

<u>Code</u>	<u>Message, Explanation and Action</u>	<u>Code</u>	<u>Message, Explanation and Action</u>
10336	10336- aaa BLPAD ADDED, bbbb BLPAD DRPD <u>Explanation:</u> Phase 3 has added and/or dropped blanks padding records as indi- cated. <u>Action:</u> None	20117	20117 ZRL xxxx. <u>Explanation:</u> The first character of an output area for a write tape operation is a group mark with word mark. <u>Action:</u> Typing of this message is indica- tive of operational failure. The sort must be restarted, either from the Phase 3 checkpoint or from the beginning.
10337	10337- aaa 9SPAD ADDED, bbbb 9SPAD DRPD <u>Explanation:</u> Phase 3 has added and/or dropped nines padding records as indi- cated. <u>Action:</u> None	20118	20118 NLR xxxx. <u>Explanation:</u> Ten consecutive noise length records have been detected by the IOCS in executing the operation xxxx. The IOCS considers that a noise record has been read if the calculated length of the record is less than 13 characters. <u>Action:</u> Press INQUIRY REQUEST, then press INQUIRY RELEASE to proceed.
10338	10338- xxxxxxxx RCDS OUT INCL aaa BLPAD bbb 9SPAD <u>Explanation:</u> The sorted output file, con- taining xxxxxxxx records, includes aaa blanks padding records and bbb nines pad- ding records. When output consists of variable-length records, the portion of the message pertaining to padding records is dropped. <u>Action:</u> None	20183	20183 CI <u>Explanation:</u> The last information en- tered through the console was invalid or cancelled by the operator. <u>Action:</u> Press INQUIRY REQUEST, type the correct information, then press IN- QUIRY RELEASE.
10340	10340- CHK PT <u>Explanation:</u> The Phase 3 checkpoint rec- ord has been written. A restart of Phase 3 may be executed any time after the oc- currence of this message. <u>Action:</u> None	20301	20301- REL CNT <u>Explanation:</u> The reel count (number of input reels) in Field 6 of Control Card Two is 00. The number of input reels is needed. <u>Action:</u> Press INQUIRY REQUEST, type the number of reels in the input file, then press INQUIRY RELEASE.
10399	10399- END SORT <u>Explanation:</u> The sorting application has been completed and the program has branched to added programming at EXIT 3H. <u>Action:</u> None	20302	20302- YR/DAY <u>Explanation:</u> Standard header labels have been specified for the dump tape and/or the output tape; however, the field in core-storage positions 00115-00119 is not a valid current date. <u>Action:</u> Press INQUIRY REQUEST, type the current date (two-digit year and three- digit day), then press INQUIRY RELEASE.
20114	20114 DCK xxxx. <u>Explanation:</u> A data check has occurred on a write-tape operation. The IOCS first backspaced the tape and attempted to re- write the record, but the error recurred. The IOCS then performed a backspace- skip-rewrite sequence twenty times, but the error persisted. xxxx. is the I/O operation. <u>Action:</u> Press INQUIRY REQUEST, then INQUIRY RELEASE, to repeat the opera- tion. No other action is valid.	20303	20303- DSK SK xxxxxxxx 20303- DSK RD xxxxxxxx 20303- DSK WR xxxxxxxx 20303- DSK RD/WR xxxxxxxx 20303- DSK NR/BUSY <u>Explanation:</u> An error has been encoun- tered in attempting to execute the disk I/O operation indicated. xxxxxxxx is the disk-address word involved. <u>Action:</u> 1. Press INQUIRY REQUEST, type "1," then press INQUIRY RELEASE to re- peat the operation.
20116	20116 DCK xxxx. <u>Explanation:</u> A data check has occurred in reading Control Card Two, Three, or Four. <u>Action:</u> Correct the error card, and place the corrected card and all following cards in the card reader. Press INQUIRY RE- QUEST, then INQUIRY RELEASE to re- read the card.		

<u>Code</u>	<u>Message, Explanation and Action</u>	<u>Code</u>	<u>Message, Explanation and Action</u>
	<p>2. Press INQUIRY REQUEST, type any character other than "1," then press INQUIRY RELEASE to branch to added programming associated with the ERROR STOP Modification Exit.</p> <p>Note: If this exit has not yet been established at the time of the error, this action will cause the operation to be repeated, as in action 1.</p>		<p>and there are more input reels to be processed.</p> <p><u>Action:</u> Mount the next input reel to be processed. Press INQUIRY REQUEST, type a "1," then press INQUIRY RELEASE to proceed with the sort.</p>
20304	<p>20304- NOT START CYL</p> <p>20304- CC1 INVALID</p> <p>20304- CC1 COL x INVALID</p> <p><u>Explanation:</u> Control Card One is invalid for one or more of the reasons specified.</p> <p><u>Action:</u> Correct Control Card One, and replace it in the card reader, press INQUIRY REQUEST, type a "Δ," then press INQUIRY RELEASE to read the corrected card.</p>	20331	<p>20331- xy, aaa</p> <p><u>Explanation:</u> Output tape y, channel x, has been closed and may be dismounted. This is reel number aaa of the output file. This message will occur only when no alternate output tape unit has been specified, and there are more output records to be written.</p> <p><u>Action:</u> Mount the next output tape reel. Press INQUIRY REQUEST, type a "1," then press INQUIRY RELEASE to proceed with the sort.</p>
20305	<p>20305- ERR/EOF RD CC1</p> <p>20305- READER NOT READY</p> <p><u>Explanation:</u> An error condition has been detected while reading Control Card One from the card reader.</p> <p><u>Action:</u> Correct Control Card One if necessary and replace it in the card reader. Press INQUIRY REQUEST, type a "Δ," then press INQUIRY RELEASE to read the corrected card.</p>	20332	<p>20332- 19 , DT</p> <p><u>Explanation:</u> The dump tape has been closed and may be dismounted. This message will appear only when this tape unit will also be used for the output file.</p> <p><u>Action:</u> Mount the first output tape reel to be written from this tape unit. Press INQUIRY REQUEST, type a "1," then press INQUIRY RELEASE to proceed with the sort.</p>
20310	<p>20310- FILE SIZE xxxxxxxx</p> <p><u>Explanation:</u> The file size, xxxxxxxx, specified in Field 22 of Control Card Three is greater than the sort capacity stated in message 10310.</p> <p><u>Action:</u> Press INQUIRY REQUEST, type a "1," then press INQUIRY RELEASE to proceed with the sort as though the file size had not been specified in Control Card Three.</p>	20360	<p>20360- ERR/EOF RD HDR CD</p> <p><u>Explanation:</u> An error condition has been detected while reading the Output Tape Header Label Card from the card reader.</p> <p><u>Action:</u> Correct the label card if necessary and replace it in the card reader. Press INQUIRY REQUEST, type a "1," then press INQUIRY RELEASE to read the corrected card.</p>
20312	<p>20312- I/P xxxxxxxx RCDS, NOT N GIVEN</p> <p><u>Explanation:</u> The number of input data records processed through Phase 1, xxxxxxxx, does not equal the file size specified in Field 22 of Control Card Three.</p> <p><u>Action:</u> Press INQUIRY REQUEST, type a "1," then press INQUIRY RELEASE to accept xxxxxxxx as the correct input file size.</p>	20361	<p>20361- NOT STD HDR CD</p> <p><u>Explanation:</u> Standard header labels have been specified for output tapes; however, the Output Tape Header Label Card does not contain the standard-label indication in columns 1-5.</p> <p><u>Action:</u> Correct the label card and replace it in the card reader. Press INQUIRY REQUEST, type a "1," then press INQUIRY RELEASE to read the corrected card.</p>
20313	<p>20313- xy, EOR</p> <p><u>Explanation:</u> Input tape y, channel x, has been processed and may be dismounted. This message will occur only when no alternate input tape unit has been specified,</p>	30301	<p>30301- BI/BO INVALID</p> <p>30301- CC x INVALID</p> <p>30301- CDF x-DRL OVFLD</p> <p>30301- CDF x AND y OVLDP</p> <p>30301- DATA RCD LNG TIMES BI HI</p> <p>30301- DATA RCD LNG TIMES BO HI</p>

<u>Code</u>	<u>Message, Explanation and Action</u>
	30301- DUP TP SPEC
	30301- FLD x HI ADDR < LO ADDR
	30301- FLD x HI ADDR=LO ADDR
	30301- FLD x NOT START CYL
	30301- FLD x OVLPS y
	30301- FLDS 18-20 ERR
	30301- I/P TP & DSK
	30301- I/P NOT SPEC
	30301- LNG CTL FLD
	30301- NUM CTL FLD
	30301- O/P TP & DSK
	30301- O/P NOT SPEC
	<u>Explanation:</u> Control Cards Two, Three and/or Four are invalid for one or more of the reasons specified.
	<u>Action:</u>
	1. Correct the control card(s) as necessary; then replace the card(s) in the card reader. Press INQUIRY REQUEST, type a " Δ ," then press INQUIRY RELEASE to read the corrected card(s).
	2. Press Stop; Display and Alter the erroneous entries, then press the Reset and Start keys to recheck all entries. (Control Cards Two, Three, and Four are located in core storage, consecutively, beginning at location 01300.)
30302	30302- CC x COLxx
	30302- CTL DATA FLD x INCOMPL
	30302- DATA RCD LNG HI
	30302- DISK IN-DUMP TAPE
	30302- I/P TP INVAL
	30302- I/P DSK INVAL
	30302- I/P DSK 000
	30302- I/P DSK V00
	30302- MAX IN BLK LNG HI
	30302- MAX IN BLK LNG LO
	30302- MAX OUT BLK LNG HI
	30302- MAX OUT BLK LNG LO
	30302- MEM RES x EXCESS
	30302- NO DUMP W/OPTIONS
	30302- O/P TP INVAL
	30302- O/P DSK INVAL
	30302- O/P DSK 000
	30302- O/P DSK V00
	30302- PAD WITH VAR BO
	<u>Explanation:</u> An entry in Control Card Two, Three, and/or Four is not a permissible entry, or is inconsistent with another entry.
	<u>Action:</u>
	1. Correct the control cards as necessary; then replace the cards in the

<u>Code</u>	<u>Message, Explanation and Action</u>
	card reader. Press INQUIRY REQUEST, type a " Δ ," then press INQUIRY RELEASE to read the corrected cards.
	2. Press INQUIRY REQUEST, type the corrected entry, * then press INQUIRY RELEASE to recheck all entries. *Note: If this method is used to correct "DISK IN-DUMP TAPE," the DUMP TAPE ENTRY (Field 12 of Control Card Two) must be corrected. If this method is used to correct "PAD WITH VAR BO," the Padding Option (Field 23 of Control Card Three) must be corrected.
	3. Press STOP; Display and Alter the erroneous entries, then press the Reset and Start keys to recheck all entries. (Control Cards Two, Three, and Four are located in core storage, consecutively, beginning at location 01300.)
30310	30310- xy, NO T/M <u>Explanation:</u> The input tape label option, (Field 6 of Control Card Two) indicates that the header label is followed by a tape mark; however, the sorting program has been unable to locate a tape mark following the header label on input tape y, channel x.
	<u>Action:</u>
	1. Press INQUIRY REQUEST, type a "1," then press INQUIRY RELEASE to recheck the header label and tape mark. If an incorrect tape was mounted, the tape may be replaced before executing this option.
	2. Press INQUIRY REQUEST, type a "2," then press INQUIRY RELEASE to accept this tape without a tape mark. In this case, the first record following the header label will be treated as data.
30311	30311- xy, HDR NOT STD <u>Explanation:</u> The input tape-label option (Field 6 of Control Card Two) indicates that input tapes contain standard header labels; however, the sort has been unable to locate a standard header label on input tape y, channel x.
	<u>Action:</u>
	1. Press INQUIRY REQUEST, type a "1," then press INQUIRY RELEASE to recheck the header label. If an incorrect tape was mounted, the tape may be replaced before taking this action.

<u>Code</u>	<u>Message, Explanation and Action</u>	<u>Code</u>	<u>Message, Explanation and Action</u>
	2. Press INQUIRY REQUEST, type a "2," then press INQUIRY RELEASE to accept the record read as a non-standard header label.		2. Press INQUIRY REQUEST, type a "2," then press INQUIRY RELEASE to ignore the creation date and use the tape for the output file.
30332	30332- xy, HDR NOT STD <u>Explanation:</u> The output tape-label option, (Field 11 of Control Card Two) indicates that output tapes contain standard header labels; however, the sort has been unable to locate a standard header label on output tape y, channel x. <u>Action:</u> 1. Press INQUIRY REQUEST, type a "1," then press INQUIRY RELEASE to recheck the header label. If an incorrect tape was mounted, the tape may be replaced before taking this action. 2. Press INQUIRY REQUEST, type a "2," then press INQUIRY RELEASE to accept the tape without a header label. In this case the sort will create a standard header label with a tape serial number of *****.	40100	40100 NR xxxx...yyyy... <u>Explanation:</u> The 1301 is not ready. xxxx... is the I/O instruction; yyyy... is the disk address word. <u>Action:</u> Press INQUIRY REQUEST, type "RETRY," then press INQUIRY RELEASE to repeat the operation. No other action is valid.
		40117	40117 CHC xxxx... yyyy... <u>Explanation:</u> In attempting to execute the I/O operation xxxx..., with disk address word yyyy..., the IOCS has detected one of the following error conditions: 1. Format Character Check 2. Check Character Code Check 3. Parity Check 4. Write Disk Check <u>Action:</u> Press INQUIRY REQUEST, type "RETRY," then press INQUIRY RELEASE to repeat the operation. No other action is valid.
30333	30333- xy, aaaaa-bbb <u>Explanation:</u> The standard header label on output tape y, channel x, contains a creation date of aaaaa and a retention cycle of bbb; therefore, this tape should not be used for the output file. <u>Action:</u> 1. Press INQUIRY REQUEST, type a "1," then press INQUIRY RELEASE to recheck the header label. If an incorrect tape was mounted, the tape may be replaced before taking this action. 2. Press INQUIRY REQUEST, type a "2," then press INQUIRY RELEASE to ignore the creation date and use the tape for the output file.	40119	40119 LRE xxxx... <u>Explanation:</u> A data check has been detected by the IOCS in attempting to read a tape label (either header or trailer) xxxx... is the I/O operation. <u>Action:</u> 1. Press INQUIRY REQUEST, then 2. a. Type "RETRY" to re-execute the operation, or b. Type "SKIP" to bypass the error record and read the next record as the tape label, or c. Type "PROC" to ignore the error and process the record read as the tape label.
30334	30334- xy, aaaaa <u>Explanation:</u> The standard header label on output tape y, channel x, contains a creation date of aaaaa, which is invalid for one of the following reasons: 1. It contains at least one non-numeric character. 2. It is later than the current date. 3. It indicates that the tape is more than five years old. <u>Action:</u> 1. Press INQUIRY REQUEST, type a "1," then press INQUIRY RELEASE to recheck the header label. If an incorrect tape was mounted, the tape may be replaced before taking this action.	40150	40150 CND xxxx... yyyy... <u>Explanation:</u> In attempting to execute the I/O operation xxxx..., with disk address word yyyy..., the IOCS has detected one of the following error conditions: 1. Wrong Length Format 2. File Control Circuit <u>Action:</u> Press INQUIRY REQUEST, type "RETRY," then press INQUIRY RELEASE to repeat the operation. No other action is valid.
		40151	40151 NRF xxxx... yyyy... <u>Explanation:</u> In attempting to execute the I/O operation xxxx..., with disk address

<u>Code</u>	<u>Message, Explanation and Action</u>
	word yyyy...., the IOCS has detected one of the following error conditions: 1. No Record Found 2. Disk Storage Circuit Check <u>Action:</u> Press INQUIRY REQUEST, type "RETRY," then press INQUIRY RELEASE to repeat the operation. No other action is valid.
40152	40152 ITN xxxx.... yyyy.... <u>Explanation:</u> An invalid track number has been detected by IOCS in executing the operation xxxx....; yyyy.... is the disk address word. <u>Action:</u> Press INQUIRY REQUEST, type "RETRY," then press INQUIRY RELEASE to repeat the operation. No other action is valid.
40153	40153 WLR xxxx.... yyyy.... <u>Explanation:</u> A wrong-length record has been detected by the IOCS in executing the operation xxxx....; yyyy.... is the disk address word. <u>Action:</u> Press INQUIRY REQUEST, type "RETRY," then press INQUIRY RELEASE to repeat the operation. No other action is valid.
60113	60113 DCK xxxx yyyy <u>Explanation:</u> A data check has occurred on a read tape operation. The IOCS has

<u>Code</u>	<u>Message, Explanation and Action</u>
	attempted to read the record twenty times, but the error could not be corrected. xxxx.... is the I/O operation; yyyy is the length of the record read. <u>Action:</u> 1. Press INQUIRY REQUEST, then 2. a. Type "RETRY" to re-execute the operation, or b. Type "SKIP" to bypass the error record and read the next record, or c. Type "PROC" to ignore the error and process the error records, or d. Type "*SCAN" to have the data record scanned and the locations of asterisks typed. After the scan has been completed, this message will be retyped, enabling the operator to take another action to continue processing, or e. Type "DUMP" to write the error record on the dump tape (channel 1 unit 9). After writing the error record on the dump tape, the IOCS will again type this message at which time either the "SKIP" or "PROC" option must be elected. 3. Press INQUIRY RELEASE.

The following descriptive material is not intended to explain the programming techniques employed, but rather to outline the many steps that are taken to execute any given sorting application. It should be noted that those sections of the sorting program that include card-reader operations can be readily modified so that the required information can be entered from any other input unit, or left in core storage from a preceding program. See the section, "Modification." For anyone having more than just a passing interest in the programming techniques used, reference to the program listings is recommended.

INPUT/OUTPUT CONTROL SYSTEM (IOCS)

The sorting program uses the IBM 1410 Input/Output Control System described in the IOCS publications (Forms J28-1432 and J28-0251) listed in the introduction to this manual.

LOADER 1 (DSL1)

Loader 1 reads Control Card One and performs a validity check on its contents. Upon the successful completion of the validity check, Loader 1 loads the entire sorting program and writes it on the disk tracks specified for program storage. After the program has been written on disk, control is passed to Loader 2.

LOADER 2 (DSL2)

When the sorting program is loaded initially, Loader 1 executes a linkage to Loader 2 after the entire program has been written on the disk tracks specified in Control Card One.

If the program is permanently stored in 1301 Disk Storage, Loader 2 is executed as an independent program, eliminating the need to load the program from cards or tape for each application. In this case, Loader 2 reads Control Card One and performs a validity check on its contents.

Loader 2 performs a single function: it reads Sort System Control from disk storage, moves it to its proper location in core storage, and executes a linkage to Sort System Control to load the Control Card Routine.

SORT SYSTEM CONTROL (DSSC)

The Sort System Control is in core storage during all phases of the sort. Its function is to establish the linkage from one phase to the next. Sort System Control loads all phases from disk storage where

they were written during the execution of Loader 1. Since each sorting phase includes its own IOCS, Sort System Control cannot operate in the priority alert mode. The maximum time duration for any given phase-to-phase linkage (i. e., the maximum time not in the priority alert mode) is estimated to be 2 seconds.

CONTROL CARD ROUTINE (DSCTL)

The Control Card Routine reads Control Cards Two, Three, and (when needed) Four, and establishes the control-card storage area. The control information is then subjected to an extensive validity check. This check does not alter the contents of the control-card storage area; thus, in the event that one or more erroneous or inconsistent entries are encountered, corrections may be stored manually from the console.

PHASE 1 (DSPH1)

Assignment Program

The assignment program portion of Phase 1 sets up the running program in accordance with the control information supplied by the user. This is done as follows:

1. Interrupt instructions and IOCS linkage points are established for Phase 1.
2. The branch constants associated with the INQUIRY and ERROR STOP modification exits are interrogated, and exits and return addresses are established as required.
3. The branch constant associated with Phase 1 modification exit 1A is interrogated. If activated, the return address is established, and a branch to the user's routine is executed.
4. If the input file consists of Form 1 or Form 3 data records without record marks (i. e., the input blocking factor is 000 or V00), the data record length in the control-card storage area is incremented by 1.
5. The number of 1301 disk tracks available in each module for working storage is computed.
6. The sort blocking factor is computed. The sort blocking factor is equal to the integral value of 2800 divided by the data record length (or maximum data record length for variable-length data records).
7. Based on the number of core-storage positions available, a calculation is made of the number of data records that can be internally sorted at one time. (This number must be a multiple of the input blocking factor; however, it need not bear any factorial relationship to the sort blocking factor.)

8. Starting addresses for data areas are established.

9. Based on the number of core-storage positions available in Phase 2 and 3, maximum merge orders for these phases are calculated.

10. The maximum number of data records that can be sorted with the given configuration and conditions is calculated.

11. The Phase 1 output disk track addresses are initialized.

12. The internal merge network is initialized as required.

13. If the input file consists of variable-length data records and/or modification exits 1B or 1C have been activated, the input routine that utilizes an input area is initialized.

- a) The branch constants associated with modification exits 1B and 1C are interrogated, and exits and return addresses are established as required.
- b) Instructions within the routine are modified as necessary for the processing of data records of the specified format.
- c) If the input is from disk storage, a Holding Area Control Record is established, and the appropriate linkages to the IOCS are activated and initialized.
- d) If the input is from tape, the appropriate linkages to the IOCS are activated and initialized, and subroutines to perform the designated tape and label options are activated.

14. If the input file consists of fixed-length data records from tape, and modification exits 1B or 1C have not been activated, the input routine that reads records from tape directly into the record storage area is moved to the input routine area. It is then modified as necessary for the processing of data records of the specified format. The subroutines necessary to perform the designated tape and label options are activated.

15. If the input is from tape, and a dump tape has been specified, the dump tape is opened and label checking performed as required.

16. If the input file consists of fixed length data records from disk storage, and neither Modification Exit 1B nor 1C has been specified, the input routine which reads records from disk storage directly into the record storage area is moved to the input routine area. It is then initialized as necessary.

17. Data areas are cleared and word marks set as required.

18. All compare instructions involving the major control-data field are initialized.

19. The running program is optimized for the number of control-data fields specified.

20. The output areas are cleared, and Holding Area Control Records are initialized.

Running Program

The running program portion of Phase 1 consists of a series of sort cycles. The execution of each sort cycle entails:

Binary Insertion Routines: Routines that create sequences of up to 12 data records.

Internal Merging: The merging of up to 12 sequences to form a single sequence. (Phase 1 has a capacity for two internal merge passes.)

The running program refers to the data records through the use of "tags," thereby avoiding extraneous movement of data records. A "tag" consists of the five-character address of the first position of a data record in the record storage area. All compare instructions refer to the low-order position of a control-data field and are indexed by the tags.

Binary Insertion Routines

The Binary Insertion routines begin with the priming of the record storage area. Tags for the first two data records are created and placed in the index registers in proper sequence. As each new tag is created it is inserted in the tag sequence in the index registers. A binary search technique is used to determine the proper location of each new tag. Reading operations continue concurrently with processing until the record storage area has been filled. Each time a full sequence of tags has been created in the index registers, (maximum sequence length is 12) the tag sequence is moved to a tag storage area and the routine re-initialized for processing the next tag sequence. This procedure continues until all records in the record storage area have been processed.

Internal Merge

The Phase 1 internal merge network has a capacity for two passes. The first pass, a memory-to-memory tag merge, is bypassed when the number of sequences produced by the binary insertion routine is equal to or less than 12. The second pass, a memory-to-disk merge, includes the output operations that write the output sequence in disk storage.

During the memory-to-memory merge, as each low record is determined, its tag is moved to a tag storage area where it becomes part of one of the tag sequences to be used as input to the second merge pass.

During the memory-to-disk merge, as each low record is determined, the tag for that record is

used to move the record to the output area. A write linkage to IOCS is executed as soon as an output area is filled with data records. Merging continues while the writing operations are taking place; the records next merged are moved to the alternate output area.

Upon completion of a memory-to-disk merge (i. e., when all the records in the record storage area have been written in one sequence), the program returns to the Binary Insertion routines to begin the next sort cycle.

After all records in the input files have been read, processed, and written, input and output data-record counts are checked. Then, if the number of Phase 1 output sequences is greater than the Phase 3 maximum merge order, a linkage to Sort System Control to load Phase 2 is executed. If the number of Phase 1 output sequences is equal to or less than the Phase 3 maximum merge order, a linkage to Sort System Control to load Phase 3 is executed.

PHASE 2 (DSPH2)

Assignment Program

The assignment program portion of Phase 2 sets up the running program in accordance with the phase-to-phase information established previously. This is done as follows:

1. Interrupt instructions and IOCS linkage points are established for Phase 2.
2. The branch constants associated with the INQUIRY and ERROR STOP modification exits are interrogated, and exits and return addresses are established as required.
3. The running program routine that assigns input and output disk-track addresses is initialized.
4. The merge network is set up based on the maximum Phase 2 merge order. All compare instructions involving the major control-data field are initialized.
5. The running program is optimized for the number of control-data fields specified.
6. Starting addresses for data areas are determined. Two output areas will be used. One input area will be used for each input merge sequence.
7. When only one disk module is available, the running program is modified to bypass the look-ahead routine (see "Running Program").
8. Input and output areas are established using the starting addresses determined previously. This completes the assignment program.

Running Program

The running program portion of Phase 2 begins with the assignment of input and output track addresses,

initialization of counters, and priming of input areas. The look-ahead routine is then executed. This routine examines the last record of each input block to determine which input area will be emptied first. A seek linkage to IOCS is then executed, addressed to the next input block for that merge sequence. Merging is then begun.

The merge network refers to the data records through the use of "tags" which are located in the index registers. There is one tag for each input merge sequence; each tag consists of the five-character address of the first position of the data record next to be merged from that sequence, with zone bits in the tens and hundreds positions to identify the input merge sequence. All compare instructions refer to the low-order position of a control-data field and are indexed by the tags, thus taking fullest advantage of the index-register features of the machine. After the low record is determined, the tag for that record is used to move the record to the output area.

As soon as the last record of an input block has been moved to the output area, a read linkage to IOCS is executed to refill the input area. During the reading operation, the look-ahead routine (with the exception of the final comparison) is executed in preparation for the next seek. Upon completion of the reading operation, the last look-ahead comparison is made, and the next seek linkage to IOCS is executed.

A write linkage to IOCS is executed as soon as an output area is filled with data records. Merging continues while the writing operations are taking place; the records next merged are moved to the alternate output area.

Upon completion of one full merge (i. e., when one output sequence has been written), the program returns to the disk-track assignment routine to set up for the next merge.

Upon completion of a full merge pass (i. e., when all data records have been processed once), input and output data-record counts are checked. If the number of output sequences is equal to, or less than the Phase 3 maximum merge order, a linkage to Sort System Control to load Phase 3 will be executed.

If, upon completion of two full merge passes, the number of Phase 2 output sequences is still greater than the Phase 3 maximum merge order, Phase 2 will be reloaded and re-executed, this time, of course, operating with the reduced number of merge sequences created by the first two merge passes will, of course, be used.

NOTE: A third Phase 2 merge pass will normally be required only for sorts of relatively high volume when available core storage is limited to 40,000 positions.

PHASE 3 (DSPH3)

Assignment Program

The assignment program portion of Phase 3 sets up the running program in accordance with the phase-to-phase information established previously. This is done as follows:

1. If a dump tape was specified, this tape is closed and rewound. The dump-tape indicator in the control-card storage area is changed from "Y" to "N" in order to avoid a second closing of this tape in the event Phase 3 is subsequently restarted.

2. The Phase 3 checkpoint record is written on one of the tracks designated for program storage.

3. The branch constants associated with all Phase 3 exits are interrogated, and exits and return addresses are established as required.

4. If the output file is to be written on tape, and output tapes are to be labeled, the output tape header label card is read from the card reader. (This read operation is bypassed if Modification Exit 3E has been activated.) All necessary linkages to IOCS for tape operations are initialized and the first output tape is opened.

5. If the output file is to be written in disk storage, the linkages to IOCS for disk operations are established. If the output module is the same as one of the work-storage modules, the running program is modified to bypass the look-ahead routine.

6. If the output file consists of fixed-length records, routines for handling padding records are set up according to the padding option specified. When the padding option is 1, 3, or 4, a counter is established indicating the number of Phase 3 input blocks which can be processed before the check for nines padding records must be made. The use of this counter by the running program eliminates the necessity for checking each data record, thus effecting a substantial savings in Phase 3 processing time.

7. Starting addresses for data areas are determined. Two output areas will be used. One input area will be used for each input merge sequence.

8. The merge network is set up according to the number of sequences entering Phase 3, rather than the Phase 3 maximum merge order. Running program instructions and constants are set up as required. All compare instructions involving the major control-data field are initialized.

9. The running program is optimized for the number of control-data fields specified.

10. Input areas are established using the starting addresses determined previously. The input areas are primed. The first data record of each input

block is examined, and the relative order of these records is established.

11. The look-ahead routine in the running program is executed, and a seek linkage to IOCS is then executed.

12. An output area (Output Area 2) is established and, if required, blanks padding records are added to the first output block. Merging is then begun.

13. When the first non-blank data record is ready to be moved to Output Area 2 (Output Area 2 is always the first area written), Output Area 1 is established. This completes the assignment program.

Running Program

The Phase 3 merge network is quite similar to the merge network used in Phase 2, i. e. , the data records are referenced indirectly through the use of "tags" which are located in the index registers. There is one tag for each input merge sequence; each tag consists of the five-character address of the first position of the data record next to be merged from that sequence, with zone bits in the tens and hundreds positions to identify the input merge sequence. All compare instructions refer to the low-order position of a control-data field, and are indexed by the tags. After the low record is determined, the tag for that record is used to move the record to the work area. If the low record is from the same Phase 3 input merge file as the previous low record, a sequence check is executed to insure that the output file is correctly sequenced. If a check for equals has been requested through the use of Phase 3 Modification Constant 09, the sequence check routine performs this function. In this case, each data record is checked.

As soon as the last record of an input block has been moved to the work area, a read linkage to IOCS is executed to refill the input area. During the reading operation, the look ahead routine (with the exception of the final comparison) is executed in preparation for the next seek. Upon completion of the reading operation, the last look-ahead comparison is made, and the next seek linkage to IOCS is executed.

A write linkage to IOCS (either tape or disk storage) is executed as soon as an output area has been filled with data records. Merging continues while the writing operations are taking place; the records next merged are moved to the alternate output area.

When all of the data records have been processed, input and output data-record counts are checked, the output file is closed, and end-of-job messages are typed.

RESTART (DSRST)

Restart is quite similar to Loader 2 in its operation. First, it reads Control Card One and performs a validity check on its contents. Then Restart reads the Phase 3 checkpoint record which includes Sort System Control into its proper core-storage location, and executes a linkage to Sort System Control to load Phase 3.

PART IV: MODIFICATION

GENERAL INFORMATION

Modifications to the sorting program should be made only after careful system analysis indicates that they are more economical than the adoption of alternative procedures such as making equivalent modifications to another program in the system, or even writing a special pre-edit or post-edit program to perform the desired functions. Some factors to be considered before modifying the sorting program are:

1. Processing routines added to the sorting program must, in most cases, include instructions to save and restore index registers.
2. The reservation of core storage for added programming, particularly in a system with 40,000 core-storage positions, may restrict the normal assignment of data areas to the extent that additional Phase 2 merging passes must be executed in order to complete an application. Additional merging passes not only increase sorting time, but also increase the number of disk-storage tracks that must be provided for work space.
3. Other programs in the system may be more readily modified, as well as better known to the programmer.

It is recognized, however, that it will be desirable to add modifications to the sorting program for some applications. In order to simplify the added programming required for such cases, exits and modification constants have been provided in each phase. Exits are activated through the use of "branch constants" which are explained in detail in the section ("Automatic Exiting Method.") Modification constants are DC or DCW entries that provide constants and locations of work areas or routines that may be used by added programming routines. The branch constants and modification constants are located in core-storage positions 02300 through 02399. Phase-to-phase information, including the control card information, is located in core-storage positions 01300 through 01599 and can also be referred to by added programming. The use of branch constants, modification constants and phase-to-phase information will normally eliminate the need for consulting program listings. In addition, since the locations and definitions of these constants are fixed, once modification routines have been programmed and tested satisfactorily, they need never be reassembled even though a subsequent reassembly of the sorting program itself should become necessary. The tested modification routines will run properly in any new version of the sort.

Added programming in any phase should be located as high as possible in core storage and must be located above 32500. Added programming routines associated with assignment program exits are generally erasable; therefore, these routines should normally be located lower in core storage than running-program modifications (see Note). The core-storage reservation specified in Control Card Three (Field 24) should provide only for those instructions and constants that must be saved during execution of the running program. In this way, the areas that contain assignment routines can be used by the running program, thus affording maximum utilization of available core storage.

Note: One notable exception to this, however, is that added programming associated with Exit 3A must be loaded prior to Phase 2 and should therefore be located as high in core storage as possible, thereby minimizing the amount of core storage which must be reserved in Phase 2.

Modification of the sorting program to bypass the card-reader operations associated with Control Card One is accomplished by direct overlay rather than through a program exit, thereby eliminating the need for added programming to perform this function. The program sections using Control Card One are Loader 1 (DSL1D1), Loader 2 (DSL2D2), and Restart (DSRST). Details of the required overlay are included with the procedures for modifications of these program sections.

Added programming associated with modification exits in Phase 1 and Phase 3 may include input/output routines that utilize the IOCS contained in the sort. This may be accomplished as follows:

1. The compilation of the added programming routines must include the following DIOCS entries (no other DIOCS entries may be used):

<u>Label</u>	<u>Operand</u>
DIOCSORG	2400
CHAN 1	TAPE, 1301
CHAN 2	TAPE, 1301
FEATURES	OVERLAP, PRIORITY
READERROR	SCAN, TAPE, 19
DISKARMS	5
DISKOPTION	WRITECHECK, SHARED
OPTIONS	DELETE

2. IOCS macro-instructions that may be used are:
CONSL
GETS
IOBSP
IORWD
IORWU
IOWTM

PUTS
 RTAPE
 RTLBL
 WAITS
 WTAPE
 WTLBL

3. Disk operations in added programming may use up to five modules of disk storage in each phase, including the two modules used for working storage by the sorting program and also including, in Phase 1, the input module (if specified) and, in Phase 3, the output module (if specified).

AUTOMATIC EXITING METHOD

The method by which any of the exits may be activated is as follows:

1. A branch constant, a DCW of five zeros, is provided for each of the exits. For each exit to be activated, the user must place an address in the appropriate branch constant. This address is the location of the added programming associated with that exit. As detailed in the description of each modification exit, which follows, one or more branch instructions, with zero addresses, must be provided as the first instructions in the added programming for each exit.
2. During the assignment portion of each phase, all branch constants for that phase will be interrogated. Whenever a nonzero address is found, a branch to the appropriate point in the user's routine associated with that exit is established at the proper point in the sort. In addition, the re-entry address (or addresses) to be used by the added programming to return to the sort, will be placed in the user's branch instruction (or instructions).
3. The last instruction of an added routine is normally a branch to the first instruction. Under certain conditions the last instruction is a branch to the second or third instruction; for example, to delete a record in Phase 3, the last instruction of the added routine is a branch to the second instruction. As stated above, the sorting program will have placed the applicable return addresses in each of the user's branch instructions.

The following example illustrates the linkage technique for an added routine to delete selected records at Exit 3C. (Exits and associated branch constants are summarized below.)

Branch Constant

1. The branch constant, as assembled in the sorting program, appears as follows:

<u>Location</u>	<u>Contents</u>
	v
02320-24	00000

2. After the user has added a modification routine located at core-storage locations 39800 through 39899, and overlaid the branch constant with the location of his first instruction, the branch constant appears as follows:

<u>Location</u>	<u>Contents</u>
	v
02320-24	39800

Exit

The exit established in the sorting program (the location shown is for illustrative purposes only) appears as follows:

<u>Location</u>	<u>Contents</u>
	v
09623	J39821b

Added Programming Routine

1. As assembled by the user, the added routine appears in outline as follows:

<u>Location</u>	<u>Contents</u>
	v
39800	J00000b
	v
39807	J00000b
	v
39814	J00000b
39821	
.	.
.	.
	v
.	J39800b (normal return)
.	.
.	.
	v
39893	J39807b (to delete a record)

2. After the sorting program has placed the re-entry addresses (the addresses shown are for illustrative purposes only), the added routine appears in outline as follows:

<u>Location</u>	<u>Contents</u>
	v
39800	J09630b (normal return)
	v
39807	J09702b (delete return)
	v
39814	J09736b (summarization return)
39821	. (beginning of modification)
.	v
.	J39800b (normal return)
.	.
.	v
39892	J39807b (to delete a record)

NOTE: Since the number of different possible return addresses varies according to the function of any given exit, the detailed description of each exit must be consulted to determine the number of branch instructions which must be provided as the first instructions of the added routines.

PHASE-TO-PHASE INFORMATION

The area from core-storage locations 01300 through 01599 is used for saving information that must be maintained throughout the sort. All of the fields in this area are available for reference by added routines. The major portion of this area, from locations 01300 through 01539, is used for saving control card information. The remainder of the area is described in detail below. It is important to note that several of the fields are adjusted during the execution of the running program to convey additional information, or to correctly indicate conditions that are subject to change.

<u>Location</u>	<u>Contents</u>
01300-01379	Control Card Two
01380-01459	Control Card Three
01460-01508	Control Card Four (columns 1 through 49)
01509-01517	Control Card One (columns 1 through 9)
01518-01530	Blank
01531-01539	Control Card Four (columns 72 through 80)
01540-01544	Current Date. Two-digit year followed by three-digit day.
01545-01551	Records Processed. Number of data records currently in process.
01552-01555	Module A Sequence Count. Number of sequences to be merged from logical module A.
01556-01559	Module B Sequence Count. Number of sequences to be merged from logical module B.

<u>Location</u>	<u>Contents</u>
01560-01563	Input Sequence Length. The number of tracks in each input sequence to Phase 2 or Phase 3 (adjusted in each merging pass).
01564-01567	Output Sequence Length. The number of tracks in each output sequence from a given Phase 2 merging pass.
01568-01570	Sort blocking factor. The number of data records to be written on each disk track.
01571-01572	Current merge order. The number of sequences currently being merged.
01573-01574	Phase 2 maximum merge order. The maximum number of sequences which Phase 2 can merge at one time.
01575-01576	Phase 3 maximum merge order. The maximum number of sequences which Phase 3 can merge.
01577-01580	Input data record length, when data record length is to be changed in Phase 1 through user modification. Zeros for all other cases. (See Modification Exit 1C.)
01581-01584	Output data record length, when output data record length is to be changed in Phase 3 through user modification. Zeros for all other cases. (See Modification Exit 3C.)
01585-01599	Blank.

SUMMARY LIST OF EXITS PROVIDED

The branch constants provided for the following exits are loaded with (DSL2) Loader 2. All added program cards associated with these exits must be inserted in the program deck immediately preceding the "Execute" card (serial No. 999) identified DSL2.

<u>Exit</u>	<u>Location of Branch Constant</u>	<u>Logical Point of Exit</u>
INQUIRY	02300-02304	After receiving an Inquiry Request. This message is common to all phases of the sorting program.
ERROR STOP	02305-02309	After reaching a "cannot proceed" condition, as illustrated by the message 00310-N MAX EXCEEDED. This exit is common to all phases of the sorting program.

<u>Exit</u>	<u>Location of Branch Constant</u>	<u>Logical Point of Exit</u>
Exit 3A	02310-02314	After loading Phase 3, but before the assignment routines are executed.
Exit 1A	02315-02319	After loading Phase 1, but before the assignment routines are executed.
Exit SA	02320-02324	Before reading Control Cards Two, Three, and Four. Located in Sort System Control.
Exit SB	02325-02329	After reading Control Cards Two, Three, and Four. Located in Sort System Control.

The branch constants provided for the following exits are loaded with Phase 1. All added program cards associated with these exits, including the overlays of the branch constants, must be loaded by the user's load program at the time of Exit 1A.

<u>Exit</u>	<u>Location of Branch Constant</u>	<u>Logical Point of Exit</u>
Exit 1B	02320-02324	Before moving a data record from the input area to the record-storage area.
Exit 1C	02325-02329	Before moving a data record from the input area to the record-storage area.
Exit 1D	02330-02334	After reading an input tape header label.
Exit 1E	02335-02339	After reading an input tape trailer label.
Exit 1F	02340-02344	Before writing the dump tape header label.

The branch constants provided for the following exits are loaded with Phase 3. All added program cards associated with these exits including the overlays of the branch constants must be loaded by the user's load program at the time of Exit 3A.

<u>Exit</u>	<u>Location of Branch Constant</u>	<u>Logical Point of Exit</u>
Exit 3B	02315-02319	At the end of the assignment routines.
Exit 3C	02320-02324	Before moving a data record from the work area to the output area.
Exit 3D	02325-02329	After moving a data record from the work area to the output area.
Exit 3E	02330-02334	Before reading the Output Tape Reader Label Card.
Exit 3F	02335-02339	Before writing an output tape header label.
Exit 3G	02340-02344	Before writing an output tape trailer label.
Exit 3H	02345-02349	At the end of the sort.

DESCRIPTION OF MODIFICATION CONSTANTS AND EXITS

The modification constants and exits provided in each phase of the sort are described in detail in the following pages.

Where significant, procedures are described to illustrate some of the possible uses of the exits. In each case, the description is limited to those operations which are essential to satisfactory program performance. Each modification must, of course, include additional instructions as necessary to meet the user's individual requirements. The programming technique to be used, within the framework of the specifications for each exit, is left to the discretion of the user.

The format used for the description of each of the exits is as follows:

Description: This paragraph describes the logical point at which the sort will branch to added programming.

Branch Constant Location: xxxxx-yyyy -- The address given is the location of the branch constant which must be overlaid by the user to activate this exit.

Load Added Programming: This paragraph explains the procedure for loading added program cards associated with this exit.

Return Branches: This paragraph describes the number and function of the branch instructions which must be provided as the first instructions of the added programming associated with this exit.

Comments on Use: This paragraph explains the use of the modification constants and index registers which are particularly applicable, and describes special techniques which may be utilized.

Required Index Register Conditions on Re-entry: Contents, (including word marks or absence of same) must be restored, or left undisturbed, as specified.

LOADER 1 (DSL D1) MODIFICATION

There are no modification constants or exits in this section.

Loader 1 will bypass the card-reader operations associated with Control Card One if the contents of this card are loaded into core-storage positions 01509 through 01517 at the same time this section of the program is loaded. This may be accomplished by

inserting a program card, punched as follows, into the program deck immediately preceding the "Execute" card (serial No. 999) for Loader 1:

Columns	1	2-6	7	8-12	13	14-22	23-80
Contents	w/s	01509	w/s	00009	w/s	Cols 1-9 of CC1	As desired

LOADER 2 (DSL2) MODIFICATION

Loader 2 will always bypass the card reader operations associated with Control Card One if the sorting program is loaded from tape or from cards, since Loader 1 will already have obtained the necessary Control Card One information. If, however, the program is stored permanently in the 1301, Loader 2 will bypass the reading of Control Card One if the contents of this card are loaded into core-storage positions 01509 through 01517 at the time this section of the program is loaded. This may be accomplished by inserting a program card, punched as follows, in the program deck immediately preceding the "Execute" card (serial No. 999) for Loader 2:

Columns	1	2-6	7	8-12	13	14-22	23-80
Contents	w/s	01509	w/s	00009	w/s	Cols 1-9 of CC1	As desired

DSL2 Modification Constants

The following modification constants are provided in DSL2.

Mod Constant No.	Location	Description
01	02330-02333	This field normally contains four zeros. If the data record length is to be changed through user modification in Phase 1, the input data-record length must be placed here, either at the time of loading Loader 2 or at the time of Exit SA or Exit SB. (Procedures for changing data-record length in Phase 1 are described under "Exit 1C.")
02	02334-02337	This field normally contains four zeros. If the data-record length is to be changed through user modification in Phase 3, the output data-record length must be placed here, either at the time of loading DSL2 or at the time of Exit SA or SB. See Exit 3C. (Procedures for changing data-record length in Phase 3 are described under "Exit 3C.")

DSL2 Branch Constants

Although there are no exits provided in DSL2, added programming for the following exits, as well as overlays for the branch constants associated with these exits, should be loaded with DSL2:

<u>Exit</u>	<u>Branch Constant Location</u>
INQUIRY	02300-02304
ERROR STOP	02305-02309
3A	02310-02314
1A	02315-02319
SA	02320-02324
SB	02325-02329

Through the use of this method, user modifications to the sorting program for different applications can be developed and maintained without disturbing the unmodified sorting program which may be kept in disk storage permanently. In addition, updating the sorting program (i.e. incorporating corrections in modification letters applicable to the sort) effectively updates all of the sorting applications, including user-modified sorts, of the installation.

EXITS COMMON TO ALL PHASES OF THE SORT

INQUIRY Exit

Description: A branch to added programming will be executed following an inquiry interrupt.

Branch Constant Location: 02300-02304

Load Added Programming: The overlay of the branch constant and the added programming associated with this exit should be loaded with DSL2.

Return Branches: The first instruction in the added programming for this exit must be a branch instruction with a zero address. The sorting program will place the proper return address in this instruction, and the user's routine must branch here to return to the sorting program. (The return address will be updated as each new phase is loaded.)

Comments on Use: This exit may be used:

- (1) to temporarily interrupt the sort so that a processing routine of more urgent priority can be executed.
- (2) to enter data into the system from the console for later use by the sorting program or a following program.
- (3) to discontinue the sort in process and go on to another program.

This exit will not be activated following a message and waiting loop that requires operator attention until the conditions that caused typing of the message are satisfied.

Required Index Register Conditions on Re-entry: All index registers must be restored (including word marks or absence of same) or left undisturbed. Index Registers 13, 14, and 15 must be saved prior to, and restored subsequent to, the execution of any IOCS macro-instructions.

ERROR-STOP Exit

Description: A branch to added programming will be executed following the occurrence of a "cannot-proceed" condition.

Branch Constant Location: 02305-02309

Load Added Programming: The overlay of the branch constant and the added programming associated with this exit should be loaded with DSLD2.

Return Branches: There are no returns to the sorting program from this exit; immediately following the typing of any "cannot-proceed" message, the sorting program will branch to the address given in the branch constant.

Comments on Use: This exit may be used to link automatically to another program, e.g., the Storage Print program, in the event of a "cannot-proceed" condition. The occurrence of such a condition is always preceded by a typewriter message, the first two digits of which are zeros.

NOTE: If Exit 3H is not used, the message "00399-END SORT" is considered a "cannot-proceed" condition. If Exit 3H is used, this message is changed to 10399 and is followed by a branch to Exit 3H added programming. Therefore, it is suggested that whenever the Error-Stop exit is used, Exit 3H also be activated to avoid any possible confusion.

Required Index Register Conditions on Re-entry: Not applicable.

CONTROL CARD ROUTINE (DSCTL) EXITS

Exit SA

Description: A branch to added programming will be executed just prior to reading Sort Control Cards Two, Three, and (if needed) Four.

Branch Constant Location: 02320-02324

Load Added Programming: The overlay of the branch constant and the added programming associated with this exit should be loaded with DSLD2.

Return Branches: The first instruction in the added programming for this exit must be a branch instruction with a zero address. The sorting program will place the proper return address in this instruction, and the user's routine must branch here to return to the sorting program.

Comments on Use: This exit is to be used if the control-card information is to be read from an input device other than a channel 1 card reader or is left in core storage by a program preceding the sorting program. Upon re-entry, the sorting program will assume that the proper control-card information (including blanks if Control Card Four is not used) is located in the area from 01300 through 01508 inclusive. (The area from 01509 through 01517 must be left undisturbed by the added routines.)

Required Index Register Contents on Re-entry: Index registers 2 through 15 may be used by the added routines. Word marks, where required, must be positioned by the user's routines.

Exit SB

Description: A branch to added programming will be executed after reading Sort Control Cards Two, Three, and (if needed) Four.

Branch Constant Location: 02325-02329

Load Added Programming: The overlay of the branch constant and the added programming associated with this exit should be loaded with DSLD2.

Return Branches: The first instruction in the added programming for this exit must be a branch instruction with a zero address. The sorting program will place the proper return address in this instruction, and the user's routine must branch here to return to the sorting program.

Comments on Use: This exit may be used to alter any of the fields in Control Cards Two, Three, or Four.

Required Index Register Contents on Re-entry: All 15 index registers may be used by the added routines. Word marks, where required, must be positioned by the user's routines.

PHASE 1 MODIFICATION

Phase 1 Modification Constants

The following modification constants are provided in Phase 1:

Mod Constant No.	Location	Description
01	02345-02349	A five-digit, signed, current record counter, whose value is the number of data records that have been placed in the record storage area but have not yet been processed by Phase 1. This counter must be adjusted by the user whenever records are added to or deleted from the input file.
02	02350-02356	A seven-digit file size adjustment counter, used to balance data-record counts when records are added or deleted in Phase 1.
03	02357-02361	At the time of any given Phase 1 modification exit for label checking (i.e., Exits 1D, 1E, or 1F) this field contains the location of the high-order position of the applicable label read-in or write-out area.
04	02362-02363	A two-digit constant, signed plus, whose value is the number of input reels still to be processed, including the reel currently in process.

Phase 1 Exits

Exit 1A

Description: A branch to added programming will be executed just after Phase 1 is loaded.

Branch Constant Location: 02315-02319

Load Added Programming: The overlay of the branch constant and the added programming associated with this exit must be loaded with DSLD2.

Return Branches: The first instruction in the added programming for this exit must be a branch instruction with a zero address. The sorting program will place the proper return address in this instruction, and the user's routine must branch here to return to the sorting program.

Comments on Use: This exit must be used to overlay branch constants and load added programming associated with Phase 1 Exits 1B through 1F. The added routine may contain a load program or it may simply

execute a linkage to read in the 1410 Standard 7 Card Load Program.

Required Index Register Contents on Re-entry: All 15 index registers may be used by the added routines. Word marks are located in the high-order position of each index register, and must be restored if cleared.

Exit 1B

Description: A branch to added programming will be executed prior to the movement of each data record from the input area to the record storage area.

Branch Constant Location: 02320-02324

Load Added Programming: The overlay of the branch constant and the added programming associated with this exit must be loaded at the time of Exit 1A.

Return Branches: The first two instructions in the added programming for this exit must be branch instructions with zero addresses. The sorting program will place the proper return addresses in these instructions. The first branch must be used to return to the sorting program if a data record is not to be added at the time of this exit; the second branch must be used to return to the sorting program if a data record is to be added at the time of this exit.

Comments on Use: This exit must be used if data records are to be added to the input file in Phase 1. At the time of this exit, Index Register 13 contains the location of the next record to be moved from the input area to the record storage area, and Index Register 14 contains the location in the record storage area to which the next record will be moved. A record may be added to the input file by performing the following operations:

1. Move the record to be added to the location given in Index Register 14. (Note: Each added record must end with a record mark. If the input blocking factor is 000, the length of the added record, including the final record mark, must be 1 greater than the length specified in Field 16 of Control Card Three.)
2. Add + 1 to Modification Constant 01, location at 02345 through 02349.
3. Add + 1 to Modification Constant 02, located at 02350 through 02356.
4. Increment the address in Index Register 14 by the data-record length in core-storage locations 01380 through 01383.
5. Return to the sorting program using the second return branch. The sorting program will re-

turn to this exit before moving the next record in the input area, so that any number of data record may be added in sequence.

If a record is not to be added, return to the sorting program is made via the first return branch.

Required Index Register Conditions on Re-entry:

Index register 14 must be used as noted above. The contents of any other index register used (including word marks or absence of same) must be saved and restored. Index Registers 13, 14, and 15 must be saved prior to, and restored subsequent to, the execution of any IOCS macro-instructions.

Exit 1C

Description: A branch to added programming will be executed prior to the movement of each data record from the input area to the record storage area. (This exit follows Exit 1B, thus facilitating all the functions of both exits in the same sorting application.)

Branch Constant Location: 02325-02329

Load Added Programming: The overlay of the branch constant and the added programming associated with this exit must be loaded at the time of Exit 1A.

Return Branches: The first two instructions in the added programming for this exit must be branch instructions with zero addresses. The sorting program will place the proper return addresses in these instructions. The first branch must be used to return to the sorting program when data records are to be edited (i.e. altered); the second branch must be used to return to the sorting program when data records are to be deleted and/or data-record length is to be changed. Routines that change data-record length may also include editing.

Comments on Use: At the time of this exit, Index Register 13 contains the location of the next record to be moved from the input area to the record storage area, and Index Register 14 contains the location in the record storage area to which the next record will be moved. If the input blocking factor is 000 or V00, a record mark will have been added to the data record in its input location.

If the input file consists of Form 1 or Form 3 data records that do not end with a record mark, and this exit is to be used to change data-record length, Field 16 of Control Card Three must show the new length (or maximum length if variable) of the data record, including a terminal record mark.

Editing of the current data record must be performed in the input area, using Index Register 13 to refer to the record. For these cases, or if the cur-

rent record is unmodified, the return to the sorting program is made via the first return branch.

The length of the current data record may be changed by performing the following operations:

1. Move the data record to the record storage area using Index Registers 13 and 14 for the locations of the data record and the record storage area, respectively:
MRCR 0+X13,0+X14
2. Execute the instructions necessary to add (drop) the desired fields to (from) the data record in the record storage area. This routine must include instructions to overlay the original record mark, and to insert a new record mark at the end of the record.
3. Add the length of the input data record to Index Register 13.
4. For fixed-length records, add the new length of the data record to Index Register 14. For variable-length records, add the maximum data record length to Index Register 14. In either case, this is the length specified in Field 16 of Control Card Three.
5. Return to the sorting program using the second return branch.

The current record may be deleted by performing the following operations:

1. Add the length of the input data record to Index Register 13.
2. Subtract +1 from the current record counter, Modification Constant 01, at core-storage locations 02345 through 02349.
3. Subtract +1 from the file size adjustment counter, Modification Constant 02, at core-storage locations 02350 through 02356.
4. Return to the sorting program using the second return branch.

Required Index Register Conditions on Re-entry:

Index Registers 13 and 14 must be used as noted above. The contents of any other index register used (including word marks or absence of same), must be saved and restored. Index Registers 13, 14, and 15 must be saved prior to, and restored subsequent to, the execution of any IOCS macro-instructions.

Exit 1D

Description: A branch to added programming will be executed after an input tape header label is read.

Branch Constant Location: 02330-02334

Load Added Programming: The overlay of the branch constant and the added programming associated with this exit must be loaded at the time of Exit 1A.

Return Branches: The first two instructions in the added programming for this exit must be branch instructions with zero addresses. The sorting program will place the proper return addresses in these instructions. The first branch must be used to return to the sorting program when the current input tape is to be accepted; the second branch must be used to return to the sorting program when the current input tape is to be rejected.

Comments on Use: This exit will be activated only when Field 6 of Control Card Two indicates that input tapes contain header labels.

As explained in the section "Tape Label Options," checking of header labels against header label control cards is not considered meaningful, since the input file may consist of several different reels from several different data files. This exit may be used to perform any such checking desired by the user with either standard or non-standard header labels. At the time of this exit, the header label has been read, and is located in an area whose beginning location is given in Modification Constant 03 at core-storage locations 02357-02361. If a check of the header label indicates that an incorrect tape has been mounted, a halt or waiting loop should be executed to permit mounting of the correct tape, followed by a return to the sorting program using the second return branch. The sorting program will then open the new tape and return to this exit. When the current input tape is to be accepted, the added programming simply returns to the sorting program using the first return branch.

Required Index Register Conditions on Re-entry: The contents of any index register used (including word marks or absence of same) must be saved and restored.

Exit 1E

Description: A branch to added programming will be executed after reading an input tape trailer label.

Branch Constant Location: 02335-02339

Load Added Programming: The overlay of the branch constant and the added programming associated with this exit must be loaded at the time of Exit 1A.

Return Branches: The first instruction in the added programming for this exit must be a branch instruction with a zero address. The sorting program will place the proper return address in this instruction, and the user's routine must branch here to return to the sorting program.

Comments on Use: This exit will be activated only when Field 6 of Control Card Two indicates that input tapes contain trailer labels.

At the time of this exit the trailer label has been read and is located in an area whose beginning location is given in Modification Constant 03 at core-storage locations 02357 through 02361.

This exit may be used to terminate the input file with the current input reel by performing the following operations (this provision facilitates the use of an end-of-file trailer, rather than the number of input reels, to indicate the end of the input file.):

1. Before executing the sort, punch in Field 6 of Control Card Two, a number equal to or greater than the maximum number of input reels anticipated.
2. When the input is to be terminated (e.g., when an end-of-file trailer label is detected) place a two-digit constant of 01, signed plus, in Modification Constant 04, at core-storage locations 02362-63.
3. If padding option 1, 3, or 4 is specified, in order to avoid unnecessary checking for nines padding records in Phase 3, place a two-digit constant, unsigned, of the exact number of input reels processed, in core-storage positions 01307-08.

Required Index Register Conditions on Re-entry:

The contents of any index register used (including word marks or absence of same) must be saved and restored.

Exit 1F

Description: A branch to added programming will be executed before writing the dump tape header label.

Branch Constant Location: 02340-02344

Load Added Programming: The overlay of the branch constant and the added programming associated with this exit must be loaded at the time of Exit 1A.

Return Branches: The first instruction in the added programming for this exit must be a branch instruction with a zero address. The sorting program will place the proper return address in this instruction, and the user's routine must branch here to return to the sorting program.

Comments on Use: This exit will be activated only when Field 12 of Control Card Two indicates that the dump tape is to contain a header label. At the time of the exit, the header label to be written is located in an area whose beginning address is given in

Modification Constant 03, located at core-storage positions 02357 through 02361.

This exit must be used if the user desires a non-standard header label, or fields in addition to those in the standard header. (When either standard or non-standard header labels are specified, the sorting program will set up a standard header label as described in the section "Tape Label Options.")

Required Index Register Conditions on Re-entry: All 15 index registers may be used by added programming. Word marks are located in the high-order position of each index register and must be restored if cleared.

PHASE 3 MODIFICATION

Phase 3 Modification Constants

The following modification constants are provided in Phase 3:

Mod Constant No.	Location	Description
01	02350-02354	Location of the high-order position of the tape label read-in and write-out area.
02	02355-02359	Location of the high-order position of the work area through which each data record passes.
03	02360-02364	Location of the high-order position of the read-in area for the Output Tape Header Label Card.
04	02365-02367	A three-digit counter, signed plus, that is the number of nines padding records in the current output block.
05	02368-02372	A five-digit counter, normally signed plus, that is the number of core-storage positions remaining in the output area currently being filled with blocked variable-length records. At the time of Exit 3C, the sign of this counter may be changed to minus to force writing of the current block.
06	02373-02379	A seven-digit file size adjustment counter, used to balance data-record counts when records are added or deleted in Phase 3.
07	02380-02384	Location of the low-order position of a three-digit counter, signed plus, whose value is the number of data records needed to fill the current output area.
08	02385-02389	Location of a word-mark switch that can be used to force an end-of-reel condition on output.
09	02390	This core-storage position is normally blank; however, if Exit 3C is to be used for special operations on data records with equal control-data fields (e.g., summarization), an "E" should be placed

Mod Constant No.	Location	Description
10	02391	here at the time of Exit 3A. This core-storage position is a word-mark switch that will be operative when an "E" is placed in Modification Constant 09. At the time of Exit 3B, if this position contains a word mark, the control-data fields of the record next to be merged are equal to the control-data fields of the record in the work area.
11	02392	This core-storage position is a word-mark switch that indicates the processing of the last data record. At the time of Exit 3B, a word mark in this position indicates that the last record to be merged is in the work area.
12	02393-02396	A four-digit constant, signed plus, which may be used to drop all nines padding records when Padding Option 4 is specified. The number of nines padding records in the input file should be placed here at the time of Exit 3A. With Padding Options 1, 3, or 4, if the input file contains one or more full blocks of nines padding records, or if more than one input block in each input reel contains nines padding records, this constant must be used to insure that all full blocks of nines padding records are dropped.

Phase 3 Exits

Exit 3A

Description: A branch to added programming will be executed after Phase 3 has been loaded and the check-point record written.

Branch Constant Location: 02310-02314

Load Added Programming: The overlay of the branch constant and the added programming associated with this exit must be loaded with DSLD2. Whenever a restart is executed, the added programming (but not the branch constant) associated with this exit must be reloaded either prior to or together with, the loading of the Restart Program if this added programming is not in core storage. In addition, since this exit will be reached after the restart is complete, provision must be made for the reloading of branch constants and added programming associated with Phase 3 Exits 3B through 3H.

Return Branches: The first instruction in the added programming for this exit must be a branch instruction with a zero address. The sorting program will

place the proper return address in this instruction and the user's routine must branch here to return to the sorting program.

Comments on Use: This exit must be used to overlay branch constants and load added programming associated with Phase 3 Exits 3B through 3H. The added routine for this exit may contain a load program or it may simply execute a linkage to read in the 1410 Standard 7-Card Load Program.

If Exit 3C is to be used for special operations on data records with equal control-data fields, (e.g., summarization), an "E" should be placed in Modification Constant 09 located at 02390.

If the input to the sort contains full blocks of nines padding records, or if more than one input block in each input reel contains nines padding records, the number of nines padding records in the input file should be placed in Modification Constant 12, located at core-storage positions 02392-96. This will insure that full blocks of nines padding records are dropped. With Padding Option 4, this procedure will insure that all nines padding records are dropped, unless records are added or deleted by Phase 3 added programming.

Required Index Register Contents on Re-entry: All 15 index registers may be used by added programming. Word marks are located in the high-order position of each index register and must be restored if cleared.

Exit 3B

Description: A branch to added programming will be executed at the conclusion of the Phase 3 assignment program.

Branch Constant Location: 02315-02319

Load Added Programming: The overlay of the branch constant and the added programming associated with this exit must be loaded at the time of Exit 3A.

Return Branches: The first instruction in the added programming for this exit must be a branch instruction with a zero address. The sorting program will place the proper return address in this instruction, and the user's routine must branch here to return to the sorting program.

Comments on Use: This exit is provided to allow the user to execute any routines that are of an assignment or housekeeping nature. Addresses used in added programming at other Phase 3 Exits can be set up at this time rather than developed each time they are used; e.g., the location of the work area through which each data record passes (Modification Constant

02). If Exits 3C and/or 3D are to be used to operate on data records in the work area, word marks may be set as desired to define the required fields in the work area subject to the following limitations:

1. Word marks may not be set within any specified control-data field. The sorting program will automatically place a word mark over the high-order position of each specified control-data field.
2. If output consists of blocked variable-length records, word marks may not be set within the specified data record-length field. The sorting program will automatically place a word mark over the high-order position of this field.
3. Except for setting word marks, the work area must be left undisturbed.

Required Index Register Conditions on Re-entry: Index Registers 1, 2, 3, 14 and 15 may not be used by added programming. Index Registers 13, 14, and 15 must be saved prior to, and restored subsequent to, the execution of any IOCS macro-instruction.

Exit 3C

Description: A branch to added programming will be executed prior to the movement of each data record from the work area to the output area.

Branch Constant Location: 02320-02324

Load Added Programming: The overlay of the branch constant and the added programming associated with this exit must be loaded at the time of Exit 3A.

Return Branches: The first three instructions in the added programming for this exit must be branch instructions with zero addresses. The sorting program will place the proper return addresses in these instructions. The first branch must be used to return to the sorting program if the current data record is not to be deleted at the time of this exit; the second branch must be used if the current data record is to be deleted; and the third branch must be used if summarization of records is being performed.

Comments on Use: At the time of this exit, the next data record to be moved to the output area is in the work area whose beginning address is given in Modification Constant 02, located at core-storage positions 02355-02359. The work area will be of sufficient size to contain the largest data record anticipated; i.e., the size will be equal to the larger of Field 16, Control Card Three, or Modification Constant 02 in DSLD2. When the output blocking factor is 000 or V00 the work area will be one position

greater than the largest record anticipated. The work area will contain word marks in the high-order position of each control-data field and, if output consists of blocked variable-length records, in the high-order position of the record character-count field. Additional word marks may be set as desired, but not within these fields.

Padding records, if any, must neither be deleted nor summarized. All padding records must be handled by the Phase 3 running program in accordance with the specified padding option. When Padding Option 2, or 4 is specified, this exit is not activated until after the sorting program has added the required number, if any, of blanks padding records to the first output block; therefore, the added programming routines need not contain checks for blanks padding unless the input file contains padding of this type. This exit is effective, however, during the processing of all nines padding records. The presence of a nines padding record in the work area may easily be detected through the use of Modification Constant 04, located at core-storage positions 02365-67. This counter, initially zero, is increased to one (signed plus) when the first nines padding record has been moved into the work area. Once the first nines padding record has been detected, the interrogation of this counter should be bypassed since, obviously, all subsequent records are also nines padding records.

If a check for records with equal control fields has been requested (by placing an "E" in Modification Constant 09, located at core-storage position 02390, at the time of Exit 3A), the presence of a word mark in Modification Constant 10, located at core-storage position 02391, indicates that the control-data fields of the next record to be merged are equal to the control-data fields of the current record. Index Register 1 contains the location of the next record to be merged.

After interrogation, the word mark in Modification Constant 10 must be cleared before returning to the sorting program. When Modification Constant 11, located at core-storage position 02392, contains a word mark, then the work area contains the last record to be merged.

This exit may be used to produce output of blocked variable-length records in the load mode by moving each data record to an output area in added programming, performing any desired editing (including the positioning of word marks or word separator characters) and writing output blocks as they are filled, using the WTape macro. Return to the sorting program is made using the procedures for deletion of data records as described below.

Editing -- This exit may be used to replace or rearrange data within any or all data records; however, it should be remembered that any changes that

involve the specified control-data fields could result in creating a file that is no longer in sequence. Since the sequence of the output file has already been checked at the time of this exit, any out-of-sequence condition thus created will remain undetected by the sorting program. If the data record in the work area is not to be deleted, the added programming simply returns to the sorting program using the first return branch.

Deletion -- The data record in the work area may be deleted by performing the following operations:

1. Subtract +1 from Modification Constant 06; located at 02373-79.
2. Return to the sorting program using the second return branch.

Changing Data-Record Length -- If this exit is to be used to change data-record length, the output data-record length must be placed in Modification Constant 02 in DSLD2 at the time DSLD2 is loaded.

The length of the data record in the work area may be changed simply by executing the instructions necessary to add or drop the desired fields. The new record thus created must end with a record mark. If the output blocking factor is 000 or V00, the new record length, including the terminal record mark, must be 1 greater than the desired output record length. (The record mark will be dropped by the sorting program prior to writing the output record.) The added programming then returns to the sorting program using the first return branch.

Summarization of Equal Records -- As described here, summarization means the accumulation of fields within records having equal control-data fields and the writing of only the summary record. Another type of summarization, in which summary records are written in addition to all of the data records, is considered, for the purposes of this manual, to be simply an application in which records are added to the output of the sorting program. Procedures for adding records are described under Exit 3D. In order to operate on records with equal control-data fields, an "E" should be placed in Modification Constant 09, located at core-storage position 02390, at the time of Exit 3A.

The following operations should be executed at Exit 3C:

1. Interrogate Modification Constant 11, located at 02392, to determine whether the last record has been processed. If this position contains a word mark, return to the sorting program using the first return branch.
2. Interrogate Modification Constant 04, located at core-storage positions 02365-67, to determine whether the record in the work area is a nines padding record. If the record is a nines padding record, return to the sorting program using the first return branch.

Note: Since all subsequent records must also be nine padding records, the unconditional branch that is hereafter required may be accomplished most easily by setting a word mark in Modification Constant 11, located at core-storage position 02392.

3. Interrogate Modification Constant 10, located at core-storage position 02391, to determine whether the next record to be merged is equal to the record currently in the work area. If the record is not equal, return to the sorting program using the first return branch.
4. Execute any desired routines to add fields from the record whose location is given in Index Register 1, to the summary record that is in the work area.
5. Clear the word mark in Modification Constant 10, located at core-storage position 02391.
6. Subtract +1 from Modification Constant 06, located at core-storage positions 02373-79.
7. Return to the sorting program using the third return branch. This will cause deletion of the record whose location is given in Index Register 1, leaving the summary record in the work area.

Required Index Register Contents on Re-entry: The contents of any index register used (including word marks or absence of same) must be saved and restored. The contents of Index Registers 13, 14, and 15 must be saved prior to, and restored subsequent to, the execution of any IOCS macro-instructions.

Exit 3D

Description: A branch to added programming will be executed after the movement of each data record from the work area to the output area.

Branch Constant Location: 02325-02329

Load Added Programming: The overlay of the branch constant and the added programming associated with this exit must be loaded at the time of Exit 3A.

Return Branches: The first two instructions in the added programming for this exit must be branch instructions with zero addresses. The sorting program will place the proper return addresses in these instructions. The first branch must be used to return to the sorting program if a data record is not to be added at the time of this exit; the second branch must be used to return to the sorting program if a data record is to be added at the time of this exit.

Comments on Use: At the time of this exit, the work area contains the last record moved to the output area, and Index Register 1 contains the location of the next record to be moved to the work area. This exit must be used if data records are to be added in Phase 3. At the time of this exit, a record may be added to the output file by performing the following operations:

1. Move the record to be added into the work area whose location is given in Modification Constant 02, located at core-storage positions 02355-59.

Note: Each added record must end with a record mark. If the output blocking factor is 000 or V00, the length of the added record, including the final record mark, must be 1 greater than the desired output length.

2. Add +1 to Modification Constant 06, located at core-storage positions 02373-79.
3. Return to the sorting program using the second return branch. The sorting program will return to this exit before moving the next record so that any number of records may be added in sequence.

Since this exit is not reached until after the first data record has been moved to the output area, a special procedure must be followed in order to add a record to the output file prior to the first record merged. For this special case, both Exits 3C and 3D must be used. The first time Exit 3C is reached, the record in the work area must be saved in a hold area in the user's added routine, and the first added record must be moved to the work area. (No counters are adjusted and the added programming routine returns to the sorting program using the first Exit 3C return branch.) Then, at the time of Exit 3D, the saved record (from the added programming hold area) is treated as an added record, using the normal procedures detailed above. Through the use of this procedure, as many records as desired may be added both before and after the first sorted record.

Whenever a record is not to be added, the added routine simply returns to the sorting program via the first return branch. The design of this exit is such that the added records need not be in sequence with the sorted output records, thus facilitating a wide variety of applications to which this exit may be applied. For example, heading and/or summary records may be inserted in an output file that is to be used to produce a report; the only format requirement for the added records is that they be the same length (or maximum length if variable-length records are being sorted) as the sorted records.

It should be noted that Exit 3D will be bypassed whenever a record has been deleted at Exit 3C. For an application in which records are sometimes

deleted at Exit 3C and sometimes added at Exit 3D, whenever these two operations are to take place simultaneously, the added programming must make a one-for-one replacement at Exit 3C, thus performing both desired functions at one time.

Force Output End-of-Reel: In some applications, it may be desirable to cause the closing of the output tape at some predetermined point, and the opening of a new tape for those records processed subsequent to that point. When output consists of single records (i.e., the output blocking factor is 000, 001, V00, or V01), this may be accomplished by setting a word mark in the core-storage position whose location is given in Modification Constant 08, located at core-storage locations 02385-89. Return is then made to the sorting program via the first return branch.

When output consists of fixed-length blocked records, the following procedure must be followed:

1. The counter whose location is given in Modification Constant 07, located at core-storage positions 02380-84, must be interrogated to determine the number of nines padding records, if any, that must be added to the current output block.
2. If the numeric value of this counter is equal to the output blocking factor, as specified in Field 21 of Control Card Three, set a word mark in the core-storage position whose location is given in Modification Constant 08, located at positions 02385-89. Return is then made to the sorting program via the first return branch.
3. If the numeric value of this counter is not equal to the output blocking factor, its value equals the number of nines padding records that must be added to fill the current output block, using the normal procedures for adding records, as described above.
4. After the required number of nines padding records have been added, the counter will have been reinitialized to a value equal to the output blocking factor. Proceed as in Step 2.

When output consists of blocked, variable-length records, the following procedure must be followed:

1. Change the sign over the units position of Modification Constant 05, located at core-storage positions 02368-72, from plus to minus.
2. Set a switch in the added programming routine for this exit that will cause Step 4, below, to be executed the next time this exit is reached.
3. Return to the sorting program via the first return branch.
4. The next time Exit 3D is reached, set a work mark in the core-storage position whose location is given in Modification Constant 08,

located at 02385-89. Reset the switch set in Step 2 above. Then return to the sorting program via the first return branch.

Required Index Register Contents on Re-entry: Contents of any index register used (including word marks or absence of same) must be saved and restored. The contents of Index Registers 13, 14, and 15 must be saved prior to, and restored subsequent to, the execution of any IOCS macro-instruction.

Exit 3E

Description: A branch to added programming will be executed just prior to reading the Output Tape Header Label Card.

Branch Constant Location: 02330-02334

Load Added Programming: The overlay of the branch constant and the added programming associated with this exit must be loaded at the time of Exit 3A.

Return Branches: The first instruction in the added programming for this exit must be a branch instruction with a zero address. The sorting program will place the proper return address in this instruction, and the user's routine must branch here to return to the sorting program.

Comments on Use: This exit will be activated only when Field 11 of Control Card Two indicates that output tapes are to contain header labels. It is to be used if the Output Tape Header Label Card is to be read from an input device other than a Channel 1 card reader, or is left in core storage from Phase 1 or by a program preceding the sorting program. Upon re-entry the sorting program will assume that the proper header-label information, not exceeding 80 characters, is located in an area whose beginning address is given in Modification Constant 03, located at core-storage positions 02360-64.

Required Index Register Contents on Re-entry: All 15 index registers may be used by added programming routines. Word marks are located in the high-order position of each index register and must be restored if cleared.

Exit 3F

Description: A branch to added programming will be executed before writing an output tape header label.

Branch Constant Location: 02335-02339

Load Added Programming: The overlay of the branch constant and the added programming associated with this exit must be loaded at the time of Exit 3A.

Return Branches: The first instruction in the added programming for this exit must be a branch instruction with a zero address. The sorting program will place the proper return address in this instruction, and the user's routine must branch here to return to the sorting program.

Comments on Use: This exit will be activated only when Field 11 of Control Card Two indicates that output tapes are to contain header labels. At the time of the exit, the header label to be written is located in an area whose beginning address is given in Modification Constant 01, located at core-storage positions 02350-54.

Required Index Register Contents on Re-entry: Word marks are located in the high-order positions of Index Registers 13, 14, and 15, which may be used in added programming. The contents of any other index register used (including word marks or absence of same) must be saved and restored.

Exit 3G

Description: A branch to added programming will be executed before writing an output tape trailer label.

Branch Constant Location: 02340-02344

Load Added Programming: The overlay of the branch constant and the added programming associated with this exit must be loaded at the time of Exit 3A.

Return Branches: The first instruction in the added programming for this exit must be a branch instruction with a zero address. The sorting program will place the proper return address in this instruction, and the user's routine must branch here to return to the sorting program.

Comments on Use: This exit will be activated only when Field 11 of Control Card Two indicates that output tapes are to contain trailer labels. At the time of the exit, the trailer label to be written (Format 2 of the Standard Trailer Label, as defined in the 1410 IOCS for Card and Tape, Form J28-1432), is located in an area whose beginning address is given in Modification Constant 01, located at core-storage positions 02350-54. This exit may be used to modify the trailer label if some other format is desired.

Required Index Register Contents on Re-entry: Word marks are located in the high-order positions of Index Registers 13, 14, and 15, which may be used in added programming. The contents of any other index register used (including word marks or absence of same) must be saved and restored.

Exit 3H

Description: A branch to added programming will be executed upon completion of the sorting application.

Branch Constant Location: 02345-49

Load Added Programming: The overlay of the branch constant and the added programming for this exit must be loaded at the time of Exit 3A.

Return Branches: There are no returns to the sorting program from this exit; immediately following the typing of the message "10399 END SORT," the sorting program will branch to the address given in the branch constant.

Comments on Use: This exit may be used to execute any additional end-of-job routines desired by the user. For example, the value of Modification Constant 06, located at core-storage positions 02373-79 (i. e., the Phase 3 File Size Adjustment Counter), may be included in a typewriter message. This exit may also be used to link to the next program to be run.

Required Index Register Contents on Re-entry: Not applicable.

RESTART (DSRST) MODIFICATION

There are no modification constants or exits in this section.

Restart will bypass the card reader operations associated with Control Card One if the contents of this card are loaded into core-storage positions 01509 through 01517 at the same time this section of the program is loaded. This may be accomplished by inserting a program card, punched as follows, in the program deck immediately preceding the "Execute" card (serial 999) for Restart.

Columns	1	2-6	7	8-12	13	14-22	23-80
Contents	w/s	01509	w/s	00009	w/s	Cols 1-9 of CC1	As desired

It should be noted that added programming associated with Phase 3 Exit 3A must be reloaded either prior to, or together with, the Restart program if

this added programming is not still in core storage. In addition, since Exit 3A will be reached after the restart is complete, provision must be made for the reloading of branch constants and added programming for all other Phase 3 modification exits.

APPENDIX A: TERMS AND DEFINITIONS

The following terms, used in this manual, are defined here as they pertain to the IBM 1410 Generalized Sorting Program Using IBM 1301 Disk Storage:

Assignment Program	A set of instructions that modifies and/or initializes generalized running-program routines in order to achieve optimum running-program efficiency for a specific application.		
B	<u>Sort Blocking Factor</u> : The number of data records in each disk record, as blocked by the sorting program.	Control-Data Field	A group of characters within a data record upon which the collating sequence of the data records will be based. Up to ten control-data fields containing a maximum of 2,799 characters may be specified for an application.
Bi	<u>Input Blocking Factor</u> : The number of data records in each data-tape or disk record in the input file.	CW	The sum of the lengths of the control-data fields specified for an application.
Bo	<u>Output Blocking Factor</u> : The number of data records in each data-tape or disk record in the output file.	DRL	Data record length.
Binary Insertion	An internal sorting technique that produces sequences of data records as follows: the control-data fields of each data record to be added to the sequence are compared with the control-data fields of the previously ordered data records, employing a binary search technique. Each new data record is thereby inserted in the sequence in its proper position.	Dump Tape	The tape on which input records that are unreadable may be written.
Branch Constant	A DCW of five zeros provided for each of the modification exits. For each exit to be activated, the user must place an address in the appropriate branch constant. This address is the location of the added programming associated with that exit.	Input Blocking Factor	The number of data records in each data tape or disk record in the input file. Abbreviated, Bi.
CC	Control Card	Internal Sort	The sequencing, in Phase 1, of a group of data records stored in core storage, according to the collating sequence of their respective control-data fields.
CDF	Control-data field	IOCS	Input/Output Control System.
CF	See "Control-Data Field"	LNG	Length (used as an abbreviation in several messages).
Checkpoint	The recording of a portion of core storage at the beginning of Phase 3 to provide a point from which the program may be subsequently restarted. The checkpoint record is written on one of the disk tracks designated for storage of the sorting program.	Merge	The process of collating several sequences to form one sequence.
		Modification Constant	A DC or DCW entry that provides a constant, the location of a work area, or the location of a routine, that may be used by added programming routines.
		N MAX	The maximum number of records that can be sorted, based upon the information specified in the control cards.
		Order of Merge	The number of sequences that will be combined during a merging operation.
		Output Blocking Factor	The number of data records in each data-tape or disk record in the output file. Abbreviated, Bo.

RSA	<u>Record Storage Area</u> : An area in Phase 1 in which records are stored during the binary insertion process.	length of each sequence can be one or more data records. Within the merge files, sequence breaks may occur only between blocks of records. Each sequence, however, may consist of several disk records.
Running Program	A series of generalized routines that actually perform the operations on the data file. The routines are initialized and/or modified by the assignment program in order that a specific sorting application may be executed with optimum efficiency.	
Sequence	A group of data records whose control-data fields are in ascending order. The	
	Sort Blocking Factor	The number of data records in each disk record, as blocked for sorting. Abbreviated, B.
	Tag	A five-character field that contains an address referring to a specific data record in core storage.

APPENDIX B: TIMING TABLES

The timing tables in the following pages provide a convenient means for estimating total sorting time for data records ranging from 20 to 2,000 characters in length when using the sorting program with two modules of 1301 Disk Storage, and 729 IV or 7330 tape units for input and output.

The following headings are used in the tables:

FILE SIZE	CW LNG	CYL USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
The number of data records, in thousands, to be sorted.	The length of the control-data field.	The amount of disk storage in cylinders, required by the sorting program for work space.		The time, in minutes and tenths of a minute, required for each phase of the sort, and the total running time.			

The values given in the tables are based upon the following assumptions:

1. No core storage is reserved in any phase for added programming. The effects of core-storage reservation are as follows:
 - a. In Phase 1, reservation of core storage may cause a reduction in the number of data records internally sorted at one time. Although this normally reduces Phase 1 processing time, it may cause an increase in both the processing time and the amount of non-overlapped seek time in Phases 2 and 3. It may cause additional merging passes to be executed in Phase 2, and may also increase the disk-storage requirements for a given sorting application. It should be noted, however, that in some cases, the reduction in Phase 1 processing time (due to a reduced number of records internally sorted at one time) can exceed the total increase in Phase 2 and Phase 3 time. For these special cases, total sorting time can actually be decreased due to a core-storage reservation.
 - b. In Phases 2 and 3, reservation of core storage can cause an increase in the amount of non-overlapped seek time in these Phases. It can cause additional merging passes to be executed in Phase 2, and can also increase the disk-storage requirements for a given sorting application.

2. Data records are of fixed length. Sorting

time for variable-length data records can be approximated by taking the table value for the maximum data-record length and adding to it a value equal to the time required to move each data record once.

3. A single control-data field is specified. For most sorting applications involving multiple control-data fields, a reasonable approximation of total sorting time can be obtained by entering the tables with a value for control-data-field length equal to the sum of the lengths of the individual control-data fields. It is recognized that for some cases, particularly those involving several control-data fields of relatively short length, this method does not provide the desired degree of accuracy. It should be noted that it is impossible to calculate, with any reasonable degree of accuracy, the amount of additional time required to sort files having multiple control-data fields where a large percentage of the time the major control-data fields are equal. The wide range of variable factors which influence any such calculation includes (but is not limited to):

- a. core-storage size
- b. data-record length
- c. input and output blocking factors
- d. file size
- e. number of control-data fields which must be compared to determine sequence
- f. frequency with which records having equal control-data fields come together during the sort
- g. relative lengths of the control-data fields

The problem is further complicated by the fact that any increase in processing time during Phases 2 and 3 is offset by a proportional decrease in the amount of non-overlapped seek time.

In view of these facts, it is felt that the only practical method of calculating sorting time where multiple control-data fields are involved is as follows:

- a. Time several representative sorts of relatively low volume.
- b. Enter the timing tables with data-record length and file size to find a control-data field length that corresponds to the sorting time for the representative sorts.
- c. Use this control-data field length for obtaining estimated running times for other file sizes having the same type of data records.
4. The input and output blocking factors are equal to the sort blocking factor. The sort blocking factor is equal to the integral value of $\frac{2800}{L}$.

5. Two modules of 1301 Disk Storage, on one

channel, are available to the sorting program for work space. When these two modules are on separate channels, the program will automatically take advantage of the overlap of reading and writing made possible by this configuration; however, the savings in sorting time achieved in this manner will be relatively small. It is further assumed that the work space in each module starts at the beginning of a block (i. e., Track 0000, 2000, etc.). Although in most cases sorting time will not be adversely affected when the work space assigned to the sorting program does not start at the beginning of a block there are some rare cases in which sorting time

can be substantially increased due to additional seek time.

6. IBM magnetic tape units are used for the input and output files, and are operated at a density of 556 cpi. When a third module of 1301 Disk Storage is used for the input and/or output files, the sorting times will be approximately the same as those given for 729 IV tape units.

7. The sorting program is stored permanently in 1301 Disk Storage, and is loaded by Loader 2 (DSL2). When the program is to be loaded from a 729 IV Tape Unit, approximately 1 1/4 minutes should be added to each of the sorting times given in the tables.

20 CHARACTER DATA RECORD

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	5	2	1	.6	.3	.2	1.1	1	1	.7	.0	.3	.9
	10			.7	.3	.2	1.2			.7	.0	.3	.9
	15			.7	.3	.2	1.2			.7	.0	.3	1.0
10	5	2	1	1.3	.5	.5	2.3	1	1	1.4	.0	.6	1.9
	10			1.3	.5	.5	2.4			1.4	.0	.6	2.0
	15			1.4	.6	.5	2.5			1.5	.0	.6	2.1
20	5	3	2	2.5	1.0	1.0	4.6	4	2	2.7	1.2	.9	4.8
	10			2.7	1.1	1.1	4.8			2.8	1.2	1.0	5.0
	15			2.8	1.1	1.1	5.0			3.0	1.3	1.0	5.2
30	5	4	3	3.8	1.6	1.7	7.1	6	3	4.1	1.7	1.4	7.2
	10			4.0	1.6	1.8	7.4			4.3	1.8	1.4	7.5
	15			4.2	1.7	1.8	7.7			4.5	1.9	1.5	7.9
40	5	12	4	5.1	4.2	1.9	11.2	7	4	5.4	2.3	2.1	9.8
	10			5.3	4.4	1.9	11.6			5.7	2.4	2.2	10.3
	15			5.6	4.6	2.0	12.1			6.0	2.5	2.2	10.8
50	5	13	5	6.4	5.3	2.3	14.0	8	5	6.8	2.9	2.6	12.3
	10			6.7	5.5	2.4	14.6			7.1	3.0	2.7	12.9
	15			7.0	5.7	2.4	15.2			7.5	3.2	2.8	13.4
75	5	15	7	9.5	7.9	3.5	20.9	10	7	10.1	4.3	4.2	18.7
	10			10.0	8.2	3.6	21.8			10.7	4.6	4.4	19.6
	15			10.5	8.6	3.7	22.7			11.2	4.8	4.6	20.5
100	5	17	9	12.7	10.5	5.2	28.5	12	9	13.5	5.8	5.7	25.0
	10			13.4	11.0	5.4	29.8			14.2	6.1	5.9	26.2
	15			14.0	11.4	5.6	31.0			15.0	6.3	6.1	27.4
125	5	20	12	15.9	13.1	6.6	35.6	15	12	16.9	7.2	7.4	31.5
	10			16.7	13.7	6.8	37.2			17.8	7.6	7.7	33.1
	15			17.5	14.3	7.0	38.8			18.7	7.9	8.0	34.6
150	5	22	14	19.1	15.8	7.9	42.7	17	14	20.3	8.7	9.5	38.4
	10			20.1	16.5	8.1	44.6			21.3	9.1	9.9	40.3
	15			21.0	17.1	8.4	46.5			22.4	9.5	10.3	42.3
175	5	24	16	22.3	18.4	9.2	49.9	19	16	23.6	10.1	11.0	44.8
	10			23.4	19.2	9.5	52.1			24.9	10.6	11.5	47.1
	15			24.5	20.0	9.8	54.3			26.2	11.1	12.0	49.3
200	5	26	18	25.5	21.0	11.3	57.8	21	18	27.0	11.6	12.6	51.2
	10			26.7	21.9	11.7	60.4			28.5	12.1	13.2	53.8
	15			28.0	22.8	12.2	63.0			29.9	12.7	13.7	56.3
250	5	31	23	31.8	26.3	14.1	72.3	59	23	33.8	29.2	11.6	74.6
	10			33.4	27.4	14.7	75.5			35.6	30.6	11.9	78.1
	15			35.0	28.5	15.2	78.8			37.4	31.9	12.2	81.5
300	5	54	27	38.2	47.7	14.0	99.9	63	27	40.5	35.1	14.0	89.5
	10			40.1	49.7	14.3	104.1			42.7	36.7	14.3	93.7
	15			42.0	51.7	14.6	108.4			44.9	38.3	14.6	97.8
350	5	64	32	44.6	55.6	16.3	116.5	68	32	47.3	40.9	16.3	104.5
	10			46.8	58.0	16.7	121.5			49.8	42.8	16.7	109.3
	15			49.0	60.3	17.1	126.4			52.4	44.7	17.1	114.2
400	5	72	36	50.9	63.6	18.6	133.1	72	36	54.0	46.7	18.6	119.4
	10			53.5	66.3	19.1	138.8			56.9	48.9	19.1	124.9
	15			56.0	68.9	19.5	144.5			59.8	51.1	19.5	130.5

30 CHARACTER DATA RECORD

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	5	2	1	.7	.3	.3	1.2	1	1	.7	.0	.3	1.0
	10			.7	.3	.3	1.3			.7	.0	.3	1.0
	15			.7	.3	.3	1.3			.7	.0	.3	1.0
	20			.8	.3	.3	1.4			.8	.0	.4	1.1
10	5	3	2	1.3	.6	.6	2.6	2	1	1.3	.0	.7	2.0
	10			1.4	.6	.6	2.7			1.4	.0	.8	2.1
	15			1.5	.7	.6	2.8			1.5	.0	.8	2.2
	20			1.5	.7	.7	2.9			1.5	.0	.8	2.3
20	5	4	3	2.7	1.2	1.3	5.2	6	3	2.7	1.3	1.1	5.1
	10			2.8	1.3	1.4	5.4			2.8	1.4	1.1	5.3
	15			2.9	1.3	1.4	5.6			3.0	1.4	1.2	5.6
	20			3.0	1.3	1.4	5.8			3.1	1.5	1.2	5.8
30	5	13	5	4.0	3.7	1.7	9.3	8	5	4.0	2.0	1.9	7.9
	10			4.2	3.8	1.7	9.7			4.2	2.1	1.9	8.2
	15			4.4	3.9	1.7	10.0			4.4	2.2	2.0	8.6
	20			4.5	4.1	1.8	10.4			4.6	2.2	2.0	8.9
40	5	14	6	5.3	4.9	2.2	12.4	9	6	5.4	2.7	2.5	10.5
	10			5.6	5.1	2.3	12.9			5.6	2.8	2.6	11.0
	15			5.8	5.2	2.3	13.4			5.9	2.9	2.6	11.4
	20			6.0	5.4	2.4	13.8			6.2	3.0	2.7	11.9
50	5	15	7	6.6	6.1	2.8	15.5	10	7	6.7	3.3	3.3	13.4
	10			6.9	6.3	2.9	16.1			7.1	3.5	3.4	13.9
	15			7.3	6.5	2.9	16.7			7.4	3.6	3.5	14.5
	20			7.6	6.8	3.0	17.3			7.7	3.7	3.6	15.1
75	5	19	11	10.0	9.1	4.7	23.8	14	11	10.1	5.0	5.2	20.2
	10			10.4	9.5	4.8	24.7			10.6	5.2	5.4	21.1
	15			10.9	9.8	4.9	25.6			11.1	5.4	5.5	22.0
	20			11.3	10.2	5.0	26.5			11.6	5.6	5.7	22.9
100	5	22	14	13.3	12.2	6.2	31.7	17	14	13.4	6.6	7.3	27.4
	10			13.9	12.6	6.4	32.9			14.1	6.9	7.6	28.6
	15			14.5	13.1	6.6	34.1			14.8	7.2	7.8	29.8
	20			15.1	13.5	6.7	35.4			15.5	7.5	8.1	31.0
125	5	25	17	16.6	15.2	8.3	40.1	20	17	16.8	8.3	9.1	34.2
	10			17.4	15.8	8.6	41.7			17.7	8.6	9.5	35.7
	15			18.1	16.4	8.8	43.3			18.5	9.0	9.8	37.3
	20			18.9	16.9	9.1	44.9			19.3	9.3	10.1	38.8
150	5	29	21	19.9	18.3	9.9	48.2	57	21	20.2	20.2	8.4	48.7
	10			20.8	19.0	10.3	50.1			21.2	21.0	8.6	50.7
	15			21.8	19.6	10.6	52.0			22.2	21.8	8.7	52.7
	20			22.7	20.3	10.9	53.9			23.2	22.6	8.9	54.7
175	5	32	24	23.3	21.3	11.6	56.2	60	24	23.5	23.5	9.8	56.8
	10			24.3	22.1	12.0	58.4			24.7	24.5	10.0	59.2
	15			25.4	22.9	12.3	60.6			25.9	25.4	10.2	61.5
	20			26.4	23.7	12.7	62.8			27.1	26.4	10.4	63.8
200	5	54	27	26.6	37.1	11.2	74.8	63	27	26.9	26.9	11.2	65.0
	10			27.8	38.4	11.4	77.6			28.2	28.0	11.4	67.6
	15			29.0	39.7	11.6	80.4			29.6	29.0	11.6	70.3
	20			30.2	41.0	11.9	83.1			30.9	30.1	11.9	72.9
250	5	68	34	33.2	46.3	14.0	93.5	70	34	33.6	33.6	14.0	81.2
	10			34.7	48.0	14.3	97.0			35.3	35.0	14.3	84.5
	15			36.3	49.6	14.5	100.5			37.0	36.3	14.5	87.8
	20			37.8	51.3	14.8	103.9			38.7	37.7	14.8	91.2
300	5	82	41	39.9	55.6	16.8	112.3	77	41	40.3	40.3	19.5	100.1
	10			41.7	57.6	17.1	116.4			42.4	41.9	19.9	104.2
	15			43.5	59.6	17.5	120.5			44.4	43.6	20.4	108.4
	20			45.3	61.6	17.8	124.7			46.4	45.2	20.9	112.5
350	5	96	48	46.5	64.9	19.6	131.0	84	48	47.1	47.0	22.7	116.8
	10			48.6	67.2	20.0	135.8			49.4	48.9	23.3	121.6
	15			50.8	69.5	20.4	140.6			51.8	50.8	23.8	126.4
	20			52.9	71.8	20.8	145.5			54.2	52.7	24.4	131.2
400	5	108	54	53.2	74.2	22.4	149.7	90	54	53.8	53.8	25.9	133.5
	10			55.6	76.8	22.8	155.2			56.5	55.9	26.6	139.0
	15			58.0	79.4	23.3	160.7			59.2	58.1	27.2	144.5
	20			60.4	82.1	23.7	166.3			61.9	60.3	27.8	150.0

40 CHARACTER DATA RECORD

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	5	2	1	.7	.3	.3	1.3	1	1	.7	.0	.4	1.0
	10			.7	.4	.3	1.4			.7	.0	.4	1.1
	15			.7	.4	.3	1.4			.7	.0	.4	1.1
	20			.8	.4	.3	1.5			.8	.0	.4	1.2
10	5	3	2	1.4	.7	.7	2.7	4	2	1.4	.7	.7	2.8
	10			1.4	.7	.7	2.8			1.4	.8	.7	2.9
	15			1.5	.7	.7	2.9			1.5	.8	.7	3.0
	20			1.5	.8	.8	3.0			1.6	.8	.7	3.1
20	5	12	4	2.7	2.8	1.3	6.8	7	4	2.7	1.5	1.4	5.7
	10			2.8	2.9	1.3	7.0			2.9	1.5	1.5	5.9
	15			2.9	2.9	1.3	7.2			3.0	1.6	1.5	6.1
	20			3.0	3.0	1.4	7.5			3.1	1.7	1.5	6.3
30	5	14	6	4.1	4.2	2.0	10.2	9	6	4.1	2.2	2.2	8.5
	10			4.2	4.3	2.0	10.5			4.3	2.3	2.2	8.8
	15			4.4	4.4	2.0	10.8			4.5	2.4	2.3	9.1
	20			4.6	4.6	2.1	11.2			4.7	2.5	2.3	9.5
40	5	16	8	5.4	5.5	2.6	13.5	11	8	5.5	3.0	3.1	11.5
	10			5.6	5.7	2.7	14.0			5.7	3.1	3.1	11.9
	15			5.9	5.9	2.7	14.5			6.0	3.2	3.2	12.4
	20			6.1	6.1	2.7	14.9			6.2	3.3	3.3	12.8
50	5	17	9	6.8	6.9	3.6	17.3	12	9	6.8	3.7	3.8	14.4
	10			7.0	7.1	3.7	17.9			7.1	3.9	3.9	14.9
	15			7.3	7.4	3.8	18.5			7.5	4.0	4.0	15.5
	20			7.6	7.6	3.8	19.1			7.8	4.1	4.1	16.0
75	5	22	14	10.1	10.4	5.4	25.9	17	14	10.2	5.6	6.2	22.0
	10			10.6	10.7	5.5	26.8			10.7	5.8	6.4	22.9
	15			11.0	11.1	5.7	27.7			11.2	6.0	6.6	23.8
	20			11.4	11.4	5.8	28.6			11.7	6.2	6.8	24.7
100	5	26	18	13.5	13.9	7.6	35.0	21	18	13.6	7.4	8.3	29.4
	10			14.1	14.3	7.8	36.2			14.3	7.7	8.5	30.5
	15			14.7	14.7	8.0	37.4			14.9	8.0	8.8	31.7
	20			15.2	15.2	8.2	38.7			15.5	8.3	9.1	32.9
125	5	31	23	16.9	17.3	9.5	43.7	21	23	17.0	19.0	8.1	44.2
	10			17.6	17.9	9.8	45.2			17.8	19.7	8.3	45.8
	15			18.3	18.4	10.0	46.8			18.6	20.3	8.4	47.4
	20			19.1	19.0	10.3	48.3			19.4	21.0	8.6	49.0
150	5	54	27	20.3	31.8	9.8	61.8	63	27	20.4	22.8	9.8	53.0
	10			21.1	32.8	9.9	63.8			21.4	23.6	9.9	55.0
	15			22.0	33.7	10.1	65.9			22.4	24.4	10.1	56.9
	20			22.9	34.7	10.3	67.9			23.3	25.2	10.3	58.8
175	5	64	32	23.6	37.1	11.4	72.1	68	32	23.9	26.6	11.4	61.9
	10			24.6	38.2	11.6	74.5			25.0	27.5	11.6	64.1
	15			25.7	39.4	11.8	76.8			26.1	28.5	11.8	66.4
	20			26.7	40.5	12.0	79.2			27.2	29.4	12.0	68.6
200	5	72	36	27.0	42.4	13.0	82.4	72	36	27.3	30.4	13.0	70.7
	10			28.2	43.7	13.3	85.1			28.5	31.5	13.3	73.3
	15			29.3	45.0	13.5	87.8			29.8	32.6	13.5	75.9
	20			30.5	46.3	13.7	90.5			31.1	33.6	13.7	78.4
250	5	90	45	33.8	53.0	16.3	103.0	81	45	34.1	38.0	19.1	91.2
	10			35.2	54.6	16.6	106.4			35.7	39.4	19.4	94.5
	15			36.7	56.2	16.9	109.8			37.3	40.7	19.8	97.8
	20			38.1	57.9	17.1	113.2			38.9	42.0	20.2	101.1
300	5	108	54	40.5	63.6	19.6	123.6	90	54	40.9	45.6	22.9	109.4
	10			42.3	65.5	19.9	127.7			42.8	47.2	23.3	113.4
	15			44.0	67.5	20.2	131.7			44.7	48.8	23.8	117.3
	20			45.7	69.5	20.6	135.8			46.6	50.4	24.2	121.3
350	5	126	63	47.3	74.2	22.8	144.3	99	63	47.7	53.2	26.7	127.6
	10			49.3	76.5	23.2	149.0			49.9	55.1	27.2	132.2
	15			51.3	78.7	23.6	153.7			52.2	57.0	27.7	136.9
	20			53.4	81.0	24.0	158.4			54.4	58.8	28.3	141.5
400	5	136	72	54.0	84.8	29.7	168.5	108	72	54.5	60.8	30.5	145.8
	10			56.3	87.4	30.3	174.1			57.1	63.0	31.1	151.1
	15			58.7	90.0	31.0	179.6			59.6	65.1	31.7	156.4
	20			61.0	92.6	31.6	185.2			62.2	67.2	32.3	161.7

50 CHARACTER DATA RECORD

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	40K CORE STORAGE						60K/80K CORE STORAGE					
		CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	3	2	.7	.4	.4	1.5	2	1	.7	.0	.5	1.1
	20			.8	.4	.4	1.6			.8	.0	.5	1.2
	30			.8	.4	.4	1.7			.9	.0	.5	1.3
	40			.9	.5	.5	1.8			.9	.0	.5	1.4
10	10	4	3	1.4	.8	.9	3.1	6	3	1.5	.9	.8	3.1
	20			1.6	.8	.9	3.3			1.6	.9	.8	3.3
	30			1.7	.9	1.0	3.5			1.7	1.0	.8	3.5
	40			1.8	.9	1.0	3.7			1.8	1.0	.8	3.7
20	10	13	5	2.9	3.2	1.5	7.6	8	5	2.9	1.7	1.7	6.3
	20			3.1	3.4	1.6	8.0			3.2	1.8	1.7	6.8
	30			3.3	3.6	1.6	8.5			3.4	1.9	1.8	7.2
	40			3.6	3.7	1.6	8.9			3.7	2.0	1.9	7.6
30	10	15	7	4.3	4.8	2.3	11.4	10	7	4.4	2.6	2.6	9.6
	20			4.7	5.1	2.3	12.1			4.8	2.7	2.8	10.3
	30			5.0	5.3	2.4	12.7			5.2	2.9	2.9	10.9
	40			5.3	5.6	2.5	13.4			5.5	3.1	3.0	11.6
40	10	17	9	5.8	6.4	3.3	15.5	12	9	5.9	3.4	3.5	12.8
	20			6.2	6.7	3.5	16.4			6.4	3.6	3.7	13.7
	30			6.7	7.1	3.6	17.4			6.9	3.9	3.9	14.6
	40			7.1	7.5	3.7	18.3			7.4	4.1	4.0	15.5
50	10	20	12	7.2	8.0	4.2	19.4	15	12	7.4	4.3	4.6	16.2
	20			7.8	8.4	4.3	20.5			8.0	4.5	4.8	17.3
	30			8.3	8.9	4.5	21.7			8.6	4.8	5.0	18.4
	40			8.9	9.3	4.7	22.9			9.2	5.1	5.2	19.6
75	10	25	17	10.8	12.0	6.6	29.4	20	17	11.0	6.4	6.8	24.3
	20			11.6	12.7	6.9	31.2			12.0	6.8	7.2	26.0
	30			12.5	13.3	7.2	33.0			12.9	7.2	7.5	27.6
	40			13.3	14.0	7.5	34.9			13.8	7.6	7.9	29.3
100	10	31	23	14.4	16.0	8.8	39.2	59	23	14.7	17.5	7.6	39.8
	20			15.5	16.9	9.2	41.6			16.0	18.6	7.8	42.3
	30			16.7	17.8	9.6	44.0			17.2	19.7	8.0	44.9
	40			17.8	18.7	10.1	46.5			18.4	20.7	8.2	47.4
125	10	56	28	18.0	30.7	9.5	58.2	64	28	18.4	21.9	9.5	49.8
	20			19.4	32.3	9.7	61.5			19.9	23.3	9.7	52.9
	30			20.8	33.9	10.0	64.8			21.5	24.6	10.0	56.1
	40			22.2	35.6	10.3	68.1			23.0	25.9	10.3	59.2
150	10	68	34	21.6	36.8	11.3	69.8	70	34	22.1	26.3	11.3	59.8
	20			23.3	38.8	11.7	73.7			23.9	27.9	11.7	63.5
	30			25.0	40.7	12.0	77.7			25.8	29.5	12.0	67.3
	40			26.7	42.7	12.4	81.7			27.6	31.1	12.4	71.1
175	10	80	40	25.2	43.0	13.2	81.4	76	40	25.8	30.7	15.6	72.1
	20			27.2	45.2	13.6	86.0			27.9	32.6	16.2	76.6
	30			29.1	47.5	14.0	90.7			30.1	34.4	16.7	81.2
	40			31.1	49.8	14.4	95.3			32.2	36.3	17.2	85.7
200	10	90	45	28.8	49.1	15.1	93.0	81	45	29.5	35.1	17.9	82.4
	20			31.1	51.7	15.6	98.3			31.9	37.2	18.5	87.6
	30			33.3	54.3	16.0	103.6			34.4	39.3	19.1	92.8
	40			35.6	56.9	16.5	108.9			36.8	41.5	19.7	98.0
250	10	112	56	36.0	61.4	18.9	116.3	92	56	36.8	43.9	22.3	103.0
	20			38.8	64.6	19.5	122.9			39.9	46.5	23.1	109.5
	30			41.6	67.9	20.0	129.5			43.0	49.2	23.8	116.0
	40			44.4	71.1	20.6	136.2			46.0	51.8	24.6	122.5
300	10	131	67	43.2	73.7	26.0	142.9	103	67	44.2	52.6	26.8	123.6
	20			46.6	77.5	26.9	151.1			47.9	55.8	27.7	131.4
	30			50.0	81.4	27.9	159.3			51.6	59.0	28.6	139.2
	40			53.3	85.4	28.8	167.5			55.2	62.2	29.5	147.0
350	10	143	79	50.4	86.0	30.3	166.7	115	79	51.5	61.4	32.7	145.6
	20			54.3	90.5	31.4	176.2			55.8	65.1	34.0	155.0
	30			58.3	95.0	32.5	185.8			60.2	68.8	35.4	164.4
	40			62.2	99.6	33.6	195.4			64.5	72.6	36.8	173.8
400	10	154	90	57.6	98.2	34.7	190.5	126	90	58.9	70.2	37.4	166.4
	20			62.1	103.4	35.9	201.4			63.8	74.4	38.9	177.1
	30			66.6	108.6	37.2	212.4			68.7	78.7	40.4	187.9
	40			71.1	113.8	38.5	223.4			73.7	82.9	42.0	198.6

60 CHARACTER DATA RECORD

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	3	2	.7	.4	.5	1.6	2	1	.8	.0	.5	1.2
	20			.8	.5	.5	1.7			.8	.0	.6	1.3
	30			.8	.5	.5	1.8			.9	.0	.6	1.4
	40			.9	.5	.5	1.9			.9	.0	.6	1.5
10	10	4	3	1.5	.9	1.0	3.3	6	3	1.5	.9	.9	3.3
	20			1.6	.9	1.0	3.5			1.6	1.0	.9	3.5
	30			1.7	1.0	1.1	3.7			1.8	1.1	.9	3.7
	40			1.8	1.0	1.1	3.9			1.9	1.1	.9	3.9
20	10	14	6	2.9	3.6	1.7	8.2	9	6	3.1	1.9	1.9	6.8
	20			3.1	3.7	1.8	8.6			3.3	2.0	2.0	7.2
	30			3.4	3.9	1.8	9.1			3.5	2.1	2.0	7.7
	40			3.6	4.1	1.8	9.5			3.8	2.2	2.1	8.1
30	10	17	9	4.4	5.3	2.8	12.5	12	9	4.6	2.8	3.0	10.4
	20			4.7	5.6	2.9	13.2			4.9	3.0	3.1	11.0
	30			5.0	5.9	3.0	13.9			5.3	3.2	3.2	11.7
	40			5.4	6.1	3.1	14.6			5.7	3.3	3.3	12.3
40	10	19	11	5.9	7.1	3.8	16.7	14	11	6.1	3.8	4.1	13.9
	20			6.3	7.5	3.9	17.6			6.6	4.0	4.2	14.8
	30			6.7	7.8	4.0	18.6			7.1	4.2	4.4	15.7
	40			7.1	8.2	4.2	19.5			7.6	4.4	4.6	16.6
50	10	22	14	7.3	8.9	4.7	20.9	17	14	7.6	4.7	5.3	17.6
	20			7.9	9.3	4.9	22.1			8.2	5.0	5.6	18.8
	30			8.4	9.8	5.0	23.2			8.8	5.3	5.8	19.9
	40			8.9	10.2	5.2	24.3			9.5	5.5	6.1	21.1
75	10	29	21	11.0	13.3	7.4	31.7	57	21	11.4	14.6	6.4	32.5
	20			11.8	14.0	7.7	33.5			12.4	15.4	6.6	34.3
	30			12.6	14.7	8.0	35.3			13.3	16.2	6.7	36.2
	40			13.4	15.3	8.3	37.0			14.2	17.0	6.9	38.1
100	10	56	28	14.7	27.5	8.5	50.7	64	28	15.3	19.5	8.5	43.3
	20			15.7	28.8	8.8	53.2			16.5	20.5	8.8	45.8
	30			16.8	30.0	9.0	55.8			17.7	21.6	9.0	48.3
	40			17.9	31.3	9.2	58.4			18.9	22.6	9.2	50.8
125	10	68	34	18.3	34.4	10.7	63.4	70	34	19.1	24.4	10.7	54.1
	20			19.7	35.9	11.0	66.6			20.6	25.7	11.0	57.2
	30			21.0	37.5	11.2	69.8			22.1	27.0	11.2	60.3
	40			22.3	39.2	11.5	73.0			23.6	28.3	11.5	63.5
150	10	82	41	22.0	41.2	12.8	76.0	77	41	22.9	29.2	15.3	67.4
	20			23.6	43.1	13.1	79.9			24.7	30.8	15.7	71.2
	30			25.2	45.0	13.5	83.7			26.5	32.4	16.2	75.1
	40			26.8	47.0	13.8	87.6			28.4	34.0	16.6	78.9
175	10	96	48	25.6	48.1	14.9	88.7	84	48	26.7	34.1	17.8	78.7
	20			27.5	50.3	15.3	93.2			28.8	35.9	18.3	83.1
	30			29.4	52.6	15.7	97.7			31.0	37.8	18.9	87.6
	40			31.2	54.8	16.1	102.2			33.1	39.6	19.4	92.1
200	10	110	55	29.3	55.0	17.1	101.4	91	55	30.5	39.0	20.4	89.9
	20			31.4	57.5	17.5	106.5			32.9	41.1	21.0	95.0
	30			33.6	60.1	18.0	111.6			35.4	43.2	21.6	100.1
	40			35.7	62.6	18.4	116.8			37.8	45.3	22.1	105.2
250	10	132	68	36.6	68.7	24.6	129.9	104	68	38.1	48.7	25.5	112.4
	20			39.3	71.9	25.3	136.5			41.2	51.3	26.2	118.7
	30			42.0	75.1	26.1	143.1			44.2	54.0	26.9	125.1
	40			44.6	78.3	26.9	149.8			47.3	56.6	27.7	131.5
300	10	146	82	44.0	82.5	29.5	155.9	118	82	45.8	58.5	31.7	136.0
	20			47.2	86.3	30.4	163.8			49.4	61.6	32.9	143.9
	30			50.4	90.1	31.3	171.8			53.1	64.8	34.0	151.8
	40			53.6	94.0	32.3	179.8			56.7	67.9	35.1	159.8
350	10	160	96	51.3	96.2	34.4	181.9	132	96	53.4	68.2	37.0	158.7
	20			55.0	100.6	35.5	191.1			57.6	71.9	38.3	167.9
	30			58.8	105.1	36.5	200.4			61.9	75.5	39.7	177.1
	40			62.5	109.6	37.6	209.7			66.2	79.2	41.0	186.4
400	10	173	109	58.6	110.0	39.3	207.9	145	109	61.0	78.0	43.3	182.3
	20			62.9	115.0	40.5	218.4			65.9	82.1	45.0	193.0
	30			67.1	120.1	41.8	229.0			70.7	86.3	46.7	203.7
	40			71.4	125.3	43.0	239.7			75.6	90.6	48.4	214.5

70 CHARACTER DATA RECORD

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	3	2	.8	.5	.5	1.7	4	2	.8	.5	.5	1.8
	20			.8	.5	.5	1.8			.8	.5	.5	1.9
	30			.9	.5	.5	1.9			.9	.6	.5	2.0
	40			.9	.5	.6	2.0			1.0	.6	.5	2.1
10	10	12	4	1.5	1.9	.9	4.4	7	4	1.6	1.0	1.0	3.6
	20			1.6	2.0	1.0	4.6			1.7	1.1	1.1	3.8
	30			1.7	2.1	1.0	4.8			1.8	1.1	1.1	4.0
	40			1.8	2.2	1.0	5.0			1.9	1.2	1.1	4.2
20	10	15	7	3.0	3.9	1.9	8.8	10	7	3.1	2.0	2.2	7.3
	20			3.2	4.1	1.9	9.2			3.4	2.2	2.2	7.8
	30			3.5	4.2	2.0	9.7			3.6	2.3	2.3	8.2
	40			3.7	4.4	2.0	10.1			3.8	2.4	2.4	8.6
30	10	18	10	4.5	5.8	3.1	13.5	13	10	4.7	3.1	3.3	11.1
	20			4.9	6.1	3.2	14.1			5.0	3.2	3.5	11.7
	30			5.2	6.3	3.3	14.8			5.4	3.4	3.6	12.4
	40			5.5	6.6	3.4	15.5			5.7	3.6	3.7	13.0
40	10	21	13	6.1	7.7	4.1	18.0	16	13	6.2	4.1	4.6	14.9
	20			6.5	8.1	4.3	18.9			6.7	4.3	4.8	15.8
	30			6.9	8.5	4.4	19.8			7.2	4.5	5.0	16.7
	40			7.3	8.8	4.5	20.7			7.7	4.7	5.3	17.7
50	10	24	16	7.6	9.7	5.2	22.4	19	16	7.8	5.1	5.8	18.7
	20			8.1	10.1	5.3	23.6			8.4	5.4	6.0	19.8
	30			8.6	10.6	5.5	24.7			9.0	5.7	6.3	20.9
	40			9.2	11.0	5.7	25.9			9.6	5.9	6.6	22.1
75	10	32	24	11.4	14.5	8.1	34.0	60	24	11.7	15.9	7.1	34.7
	20			12.2	15.2	8.4	35.8			12.6	16.7	7.2	36.5
	30			13.0	15.9	8.7	37.5			13.5	17.5	7.4	38.3
	40			13.8	16.5	9.0	39.3			14.4	18.3	7.6	40.2
100	10	64	32	15.2	30.1	9.4	54.7	68	32	15.6	21.2	9.4	46.2
	20			16.2	31.3	9.7	57.2			16.8	22.3	9.7	48.7
	30			17.3	32.6	9.9	59.8			17.9	23.3	9.9	51.1
	40			18.4	33.9	10.1	62.4			19.1	24.3	10.1	53.6
125	10	80	40	19.0	37.6	11.8	68.4	76	40	19.4	26.5	14.2	60.1
	20			20.3	39.2	12.1	71.5			20.9	27.8	14.5	63.3
	30			21.6	40.8	12.4	74.7			22.4	29.1	14.9	66.4
	40			23.0	42.4	12.6	77.9			23.9	30.4	15.2	69.6
150	10	94	47	22.7	45.1	14.1	82.0	83	47	23.3	31.8	17.0	72.2
	20			24.3	47.0	14.5	85.8			25.1	33.4	17.4	75.9
	30			25.9	48.9	14.8	89.7			26.9	34.9	17.8	79.7
	40			27.5	50.8	15.2	93.5			28.7	36.5	18.3	83.5
175	10	110	55	26.5	52.7	16.5	95.7	91	55	27.2	37.2	19.8	84.2
	20			28.4	54.9	16.9	100.2			29.3	38.9	20.3	88.6
	30			30.3	57.1	17.3	104.6			31.4	40.8	20.8	93.0
	40			32.1	59.3	17.7	109.1			33.5	42.6	21.3	97.4
200	10	126	63	30.3	60.2	18.9	109.4	99	63	31.1	42.5	22.7	96.2
	20			32.5	62.7	19.3	114.5			33.5	44.5	23.2	101.2
	30			34.6	65.2	19.8	119.6			35.9	46.6	23.8	106.3
	40			36.7	67.8	20.2	124.7			38.3	48.7	24.4	111.3
250	10	143	79	37.9	75.2	27.2	140.3	115	79	38.9	53.1	29.3	121.2
	20			40.6	78.4	27.9	146.9			41.9	55.6	30.2	127.7
	30			43.2	81.5	28.7	153.5			44.9	58.2	31.1	134.2
	40			45.9	84.7	29.5	160.1			47.8	60.9	32.0	140.7
300	10	158	94	45.5	90.3	32.6	168.4	130	94	46.7	63.7	35.1	145.5
	20			48.7	94.0	33.5	176.2			50.3	66.8	36.2	153.2
	30			51.9	97.8	34.4	184.1			53.8	69.9	37.3	161.0
	40			55.1	101.6	35.4	192.1			57.4	73.0	38.4	168.9
350	10	174	110	53.1	105.3	38.0	196.5	146	110	54.5	74.3	41.8	170.6
	20			56.8	109.7	39.1	205.6			58.6	77.9	43.2	179.8
	30			60.5	114.1	40.2	214.8			62.8	81.5	44.7	189.0
	40			64.3	118.6	41.3	224.1			67.0	85.2	46.1	198.3
400	10	189	125	60.7	120.4	43.5	224.5	161	125	62.2	84.9	47.8	194.9
	20			64.9	125.4	44.7	235.0			67.0	89.0	49.4	205.4
	30			69.2	130.4	45.9	245.5			71.8	93.2	51.1	216.0
	40			73.4	135.5	47.1	256.1			76.6	97.4	52.7	226.7

80 CHARACTER DATA RECORD

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	3	2	.8	.5	.6	1.8	4	2	.8	.6	.5	1.9
	20			.8	.5	.6	1.9			.9	.6	.5	2.0
	30			.9	.6	.6	2.0			.9	.6	.5	2.1
	40			.9	.6	.6	2.1			1.0	.6	.6	2.2
10	10	12	4	1.5	2.1	1.0	4.7	7	4	1.6	1.1	1.1	3.8
	20			1.6	2.2	1.1	4.9			1.7	1.2	1.2	4.0
	30			1.7	2.3	1.1	5.1			1.8	1.2	1.2	4.2
	40			1.8	2.4	1.1	5.3			1.9	1.3	1.2	4.4
20	10	16	8	3.1	4.2	2.1	9.4	11	8	3.2	2.2	2.4	7.8
	20			3.3	4.4	2.1	9.8			3.4	2.3	2.5	8.2
	30			3.5	4.6	2.2	10.2			3.6	2.4	2.5	8.6
	40			3.7	4.7	2.2	10.6			3.9	2.5	2.6	9.0
30	10	19	11	4.6	6.3	3.4	14.3	14	11	4.8	3.3	3.6	11.7
	20			4.9	6.6	3.5	15.0			5.1	3.5	3.8	12.4
	30			5.2	6.9	3.6	15.7			5.5	3.6	3.9	13.0
	40			5.5	7.1	3.7	16.4			5.8	3.8	4.0	13.7
40	10	23	15	6.2	8.4	4.5	19.1	18	15	6.4	4.4	5.0	15.8
	20			6.6	8.8	4.7	20.0			6.8	4.6	5.2	16.7
	30			7.0	9.1	4.8	20.9			7.3	4.9	5.4	17.6
	40			7.4	9.5	4.9	21.8			7.8	5.1	5.7	18.5
50	10	26	18	7.7	10.5	5.9	24.1	21	18	7.9	5.5	6.3	19.7
	20			8.2	11.0	6.1	25.3			8.5	5.8	6.5	20.9
	30			8.7	11.4	6.3	26.4			9.1	6.1	6.8	22.0
	40			9.2	11.9	6.5	27.6			9.7	6.3	7.1	23.1
75	10	54	27	11.6	24.7	7.8	44.0	63	27	11.9	17.3	7.8	37.0
	20			12.3	25.6	7.9	45.9			12.8	18.1	7.9	38.8
	30			13.1	26.5	8.1	47.7			13.7	18.9	8.1	40.6
	40			13.8	27.5	8.3	49.6			14.5	19.6	8.3	42.4
100	10	72	36	15.4	32.9	10.4	58.7	72	36	15.9	23.1	10.4	49.3
	20			16.4	34.1	10.6	61.1			17.0	24.1	10.6	51.7
	30			17.4	35.4	10.8	63.6			18.2	25.1	10.8	54.2
	40			18.5	36.6	11.0	66.1			19.4	26.2	11.0	56.6
125	10	90	45	19.3	41.1	12.9	73.3	81	45	19.9	28.9	15.7	64.4
	20			20.5	42.7	13.2	76.4			21.3	30.1	16.0	67.5
	30			21.8	44.2	13.5	79.5			22.8	31.4	16.4	70.6
	40			23.1	45.8	13.8	82.7			24.2	32.7	16.7	73.7
150	10	108	54	23.1	49.4	15.5	88.0	90	54	23.8	34.7	18.8	77.3
	20			24.6	51.2	15.9	91.7			25.6	36.2	19.2	81.0
	30			26.2	53.1	16.2	95.5			27.3	37.7	19.6	84.7
	40			27.7	55.0	16.6	99.2			29.1	39.3	20.1	88.4
175	10	126	63	27.0	57.6	18.1	102.7	99	63	27.8	40.4	21.9	90.2
	20			28.7	59.7	18.5	107.0			29.8	42.2	22.4	94.5
	30			30.5	61.9	18.9	111.4			31.9	44.0	22.9	98.8
	40			32.3	64.1	19.3	115.7			33.9	45.8	23.4	103.1
200	10	136	72	30.8	65.8	24.0	120.6	108	72	31.8	46.2	25.1	103.1
	20			32.8	68.3	24.6	125.7			34.1	48.2	25.6	108.0
	30			34.9	70.8	25.2	130.8			36.4	50.3	26.2	112.9
	40			36.9	73.3	25.8	136.0			38.8	52.4	26.8	117.9
250	10	154	90	38.5	82.3	30.0	150.8	126	90	39.7	57.8	32.3	129.7
	20			41.1	85.3	30.7	157.1			42.6	60.3	33.2	136.1
	30			43.6	88.5	31.5	163.5			45.5	62.9	34.1	142.4
	40			46.1	91.6	32.2	170.0			48.4	65.4	35.0	148.9
300	10	172	108	46.2	98.7	36.0	180.9	144	108	47.6	69.3	38.7	155.7
	20			49.3	102.4	36.8	188.5			51.1	72.3	39.8	163.3
	30			52.3	106.1	37.7	196.2			54.6	75.4	40.9	170.9
	40			55.4	109.9	38.7	203.9			58.1	78.5	42.0	178.6
350	10	189	125	53.9	115.2	42.0	211.1	161	125	55.6	80.9	46.0	182.5
	20			57.5	119.5	43.0	220.0			59.7	84.4	47.4	191.5
	30			61.0	123.8	44.0	228.9			63.7	88.0	48.8	200.5
	40			64.6	128.2	45.1	237.9			67.8	91.6	50.2	209.7
400	10	207	143	61.6	131.6	49.5	242.8	179	143	63.5	92.4	52.6	208.5
	20			65.7	136.6	51.1	253.3			68.2	96.5	54.2	218.8
	30			69.8	141.5	52.6	263.9			72.8	100.6	55.8	229.2
	40			73.8	146.6	54.2	274.5			77.5	104.7	57.4	239.6

90 CHARACTER DATA RECORD

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	4	3	.8	.6	.6	2.0	6	3	.8	.6	.6	2.0
	20			.8	.6	.6	2.1			.9	.6	.6	2.1
	30			.9	.6	.7	2.2			.7	.6	.6	2.2
	40			.9	.6	.7	2.2			1.0	.7	.6	2.3
10	10	13	5	1.6	2.3	1.1	5.0	8	5	1.6	1.2	1.2	4.1
	20			1.7	2.4	1.2	5.2			1.7	1.2	1.3	4.3
	30			1.8	2.5	1.2	5.4			1.8	1.3	1.3	4.5
	40			1.9	2.5	1.2	5.6			2.0	1.4	1.3	4.7
20	10	17	9	3.2	4.6	2.5	10.2	12	9	3.2	2.4	2.6	8.2
	20			3.4	4.7	2.5	10.7			3.5	2.5	2.7	8.6
	30			3.6	4.9	2.6	11.1			3.7	2.6	2.7	9.0
	40			3.8	5.1	2.7	11.6			3.9	2.7	2.8	9.4
30	10	21	13	4.8	6.8	3.7	15.3	16	13	4.8	3.6	4.0	12.4
	20			5.1	7.1	3.8	16.0			5.2	3.7	4.2	13.1
	30			5.4	7.4	3.9	16.7			5.5	3.9	4.3	13.7
	40			5.7	7.6	4.0	17.3			5.9	4.1	4.5	14.4
40	10	25	17	6.4	9.1	5.1	20.6	20	17	6.5	4.8	5.3	16.6
	20			6.8	9.5	5.3	21.5			6.9	5.0	5.5	17.4
	30			7.2	9.8	5.4	22.5			7.4	5.2	5.7	18.3
	40			7.6	10.2	5.6	23.4			7.8	5.4	5.9	19.2
50	10	29	21	8.0	11.4	6.4	25.8	57	21	8.1	12.5	5.7	26.3
	20			8.5	11.8	6.6	26.9			8.6	13.0	5.8	27.4
	30			9.0	12.3	6.8	28.1			9.2	13.5	5.9	28.6
	40			9.5	12.7	7.0	29.2			9.8	14.0	6.0	29.8
75	10	62	31	12.0	26.9	8.5	47.3	67	31	12.1	18.8	8.5	39.4
	20			12.7	27.8	8.7	49.1			13.0	19.5	8.7	41.1
	30			13.5	28.7	8.8	51.0			13.8	20.3	8.8	42.9
	40			14.2	29.6	9.0	52.9			14.7	21.1	9.0	44.7
100	10	82	41	15.9	35.8	11.3	63.1	77	41	16.2	25.0	13.8	55.0
	20			17.0	37.0	11.5	65.5			17.3	26.0	14.1	57.4
	30			18.0	38.3	11.8	68.0			18.4	27.0	14.3	59.8
	40			19.0	39.5	12.0	70.5			19.5	28.1	14.6	62.2
125	10	102	51	19.9	44.8	14.1	78.8	87	51	20.2	31.3	17.2	68.8
	20			21.2	46.3	14.4	81.9			21.6	32.5	17.6	71.7
	30			22.5	47.8	14.7	85.0			23.0	33.8	17.9	74.7
	40			23.7	49.4	15.0	88.1			24.4	35.1	18.3	77.8
150	10	122	61	23.9	53.7	17.0	94.6	97	61	24.2	37.6	20.7	82.5
	20			25.4	55.5	17.3	98.3			25.9	39.1	21.1	86.1
	30			27.0	57.4	17.6	102.0			27.6	40.6	21.5	89.7
	40			28.5	59.2	18.0	105.7			29.3	42.1	21.9	93.3
175	10	135	71	27.9	62.7	23.0	113.6	107	71	28.3	43.8	24.1	96.3
	20			29.7	64.8	23.5	118.0			30.3	45.6	24.6	100.4
	30			31.4	66.9	24.0	122.4			32.2	47.3	25.1	104.6
	40			33.2	69.1	24.5	126.9			34.2	49.1	25.6	108.9
200	10	145	81	31.9	71.6	26.3	129.8	117	81	32.3	50.1	28.3	110.7
	20			33.9	74.1	26.8	134.8			34.6	52.1	29.0	115.6
	30			35.9	76.5	27.4	139.9			36.8	54.1	29.7	120.6
	40			38.0	79.0	28.0	145.0			39.1	56.1	30.4	125.6
250	10	165	101	39.9	89.6	32.8	162.2	137	101	40.4	62.6	35.4	138.4
	20			42.4	92.6	33.6	168.5			43.2	65.1	36.2	144.6
	30			44.9	95.6	34.3	174.9			46.0	67.6	37.1	150.8
	40			47.5	98.7	35.0	181.2			48.8	70.2	38.0	157.0
300	10	185	121	47.8	107.5	39.4	194.7	157	121	48.5	75.1	43.2	166.8
	20			50.9	111.1	40.3	202.2			51.9	78.1	44.3	174.3
	30			53.9	114.8	41.2	209.8			55.2	81.1	45.5	181.9
	40			57.0	118.5	42.1	217.5			58.6	84.2	46.7	189.5
350	10	206	142	55.8	125.4	47.3	228.5	178	142	56.6	87.7	50.3	194.6
	20			59.3	129.6	48.6	237.6			60.5	91.1	51.7	203.3
	30			62.9	133.9	50.0	246.7			64.4	94.7	53.1	212.2
	40			66.4	138.2	51.3	256.0			68.4	98.2	54.5	221.1
400	10	226	162	63.8	143.3	54.1	261.1	198	162	64.7	100.2	58.9	223.8
	20			67.8	148.1	55.6	271.5			69.2	104.2	60.8	234.1
	30			71.9	153.0	57.1	282.0			73.7	108.2	62.7	244.5
	40			75.9	158.0	58.6	292.5			78.2	112.3	64.6	255.1

100 CHARACTER DATA RECORD

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	4	3	.7	.6	.7	2.0	6	3	.8	.6	.6	2.1
	20			.8	.6	.7	2.1			.9	.7	.6	2.2
	30			.8	.6	.7	2.2			.9	.7	.6	2.3
	40			.9	.7	.7	2.3			1.0	.7	.6	2.4
10	10	13	5	1.4	2.4	1.2	5.1	8	5	1.7	1.3	1.3	4.3
	20			1.5	2.5	1.2	5.3			1.8	1.3	1.4	4.5
	30			1.6	2.6	1.3	5.5			1.9	1.4	1.4	4.7
	40			1.7	2.7	1.3	5.7			2.0	1.4	1.4	4.9
20	10	17	9	2.8	4.9	2.7	10.4	12	9	3.3	2.5	2.8	8.7
	20			3.0	5.1	2.7	10.8			3.6	2.7	2.9	9.1
	30			3.2	5.2	2.8	11.3			3.8	2.8	2.9	9.5
	40			3.4	5.4	2.9	11.7			4.0	2.9	3.0	9.9
30	10	22	14	4.3	7.3	4.0	15.6	17	14	5.0	3.8	4.4	13.2
	20			4.6	7.6	4.1	16.3			5.3	4.0	4.5	13.8
	30			4.8	7.9	4.2	16.9			5.7	4.1	4.7	14.5
	40			5.1	8.1	4.3	17.6			6.0	4.3	4.8	15.2
40	10	26	18	5.7	9.8	5.5	21.0	21	18	6.7	5.1	5.8	17.6
	20			6.1	10.1	5.7	21.9			7.1	5.3	6.0	18.5
	30			6.4	10.5	5.8	22.8			7.6	5.5	6.2	19.3
	40			6.8	10.8	6.0	23.7			8.0	5.7	6.5	20.2
50	10	31	23	7.1	12.2	6.9	26.3	59	23	8.3	13.5	6.1	27.9
	20			7.6	12.7	7.1	27.4			8.9	13.9	6.2	29.1
	30			8.1	13.1	7.3	28.5			9.4	14.4	6.3	30.2
	40			8.5	13.6	7.5	29.6			10.0	14.9	6.5	31.4
75	10	68	34	10.7	29.0	9.2	48.8	70	34	12.5	20.2	9.2	41.8
	20			11.4	29.8	9.3	50.6			13.3	20.9	9.3	43.6
	30			12.1	30.8	9.5	52.4			14.2	21.7	9.5	45.3
	40			12.8	31.7	9.7	54.1			15.0	22.4	9.7	47.1
100	10	90	45	14.2	38.6	12.2	65.1	81	45	16.6	26.9	15.0	58.6
	20			15.2	39.8	12.4	67.4			17.8	27.9	15.3	60.9
	30			16.1	41.0	12.7	69.8			18.9	28.9	15.5	63.3
	40			17.1	42.2	12.9	72.2			20.0	29.9	15.8	65.7
125	10	112	56	17.8	48.3	15.3	81.3	92	56	20.8	33.6	18.8	73.2
	20			19.0	49.7	15.6	84.3			22.2	34.9	19.1	76.1
	30			20.1	51.3	15.9	87.3			23.6	36.1	19.4	79.1
	40			21.3	52.8	16.1	90.2			25.0	37.4	19.7	82.1
150	10	131	67	21.4	57.9	21.4	100.6	103	67	25.0	40.4	22.5	87.8
	20			22.8	59.7	21.8	104.2			26.7	41.8	22.9	91.4
	30			24.2	61.5	22.2	107.9			28.3	43.3	23.3	95.0
	40			25.6	63.3	22.7	111.6			30.0	44.8	23.7	98.6
175	10	143	79	24.9	67.6	24.9	117.4	115	79	29.1	47.1	26.9	103.1
	20			26.6	69.6	25.4	121.6			31.1	48.8	27.5	107.4
	30			28.2	71.8	25.9	125.9			33.1	50.5	28.1	111.7
	40			29.9	73.9	26.4	130.2			35.0	52.3	28.7	116.0
200	10	154	90	28.5	77.2	28.5	134.2	126	90	33.3	53.8	30.7	117.8
	20			30.4	79.6	29.0	139.0			35.5	55.8	31.4	122.7
	30			32.2	82.0	29.6	143.9			37.8	57.8	32.1	127.6
	40			34.1	84.5	30.2	148.8			40.0	59.8	32.8	132.6
250	10	176	112	35.6	96.5	35.6	167.7	148	112	41.6	67.3	38.9	147.8
	20			37.9	99.5	36.3	173.7			44.4	69.7	39.9	154.0
	30			40.3	102.5	37.0	179.8			47.2	72.2	40.8	160.3
	40			42.6	105.6	37.8	186.0			50.1	74.7	41.8	166.6
300	10	198	134	42.7	115.8	43.9	202.4	170	134	49.9	80.7	46.7	177.4
	20			45.5	119.4	45.0	209.9			53.3	83.7	47.9	184.8
	30			48.4	123.0	46.1	217.5			56.7	86.6	49.0	192.3
	40			51.2	126.7	47.2	225.1			60.1	89.7	50.2	199.9
350	10	221	157	49.8	135.1	51.2	236.2	193	157	58.3	94.2	55.7	208.2
	20			53.1	139.3	52.5	244.9			62.2	97.6	57.3	217.1
	30			56.4	143.5	53.8	253.7			66.1	101.1	58.9	226.2
	40			59.7	147.8	55.1	262.6			70.1	104.6	60.6	235.3
400	10	243	179	57.0	154.4	58.5	269.9	215	179	66.6	107.6	63.7	237.9
	20			60.7	159.2	60.0	279.9			71.1	111.5	65.5	248.1
	30			64.5	164.0	61.5	290.0			75.6	115.5	67.4	258.5
	40			68.2	168.9	63.0	300.1			80.1	119.6	69.3	268.9

120 CHARACTER DATA RECORD

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

		40K CORE STORAGE						60K/80K CORE STORAGE					
		CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
FILE SIZE	CW LNG	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	4	3	.8	.7	.8	2.2	6	3	.9	.7	.7	2.3
	20			.8	.7	.8	2.3			.9	.8	.7	2.4
	30			.8	.7	.8	2.4			1.0	.8	.7	2.5
	40			.9	.8	.8	2.5			1.0	.8	.7	2.6
10	10	14	6	1.5	2.8	1.4	5.7	9	6	1.7	1.5	1.6	4.7
	20			1.6	2.9	1.4	5.9			1.8	1.5	1.6	4.9
	30			1.7	3.0	1.5	6.1			1.9	1.6	1.6	5.1
	40			1.8	3.1	1.5	6.3			2.1	1.6	1.7	5.3
20	10	19	11	3.0	5.6	3.1	11.7	14	11	3.5	2.9	3.3	9.6
	20			3.2	5.8	3.2	12.1			3.7	3.0	3.3	10.0
	30			3.4	6.0	3.2	12.6			3.9	3.1	3.4	10.5
	40			3.5	6.2	3.3	13.0			4.1	3.2	3.5	10.9
30	10	25	17	4.5	8.4	4.8	17.7	20	17	5.2	4.4	4.9	14.5
	20			4.8	8.7	4.9	18.4			5.5	4.5	5.0	15.1
	30			5.0	9.0	5.0	19.0			5.8	4.7	5.2	15.7
	40			5.3	9.2	5.1	19.7			6.2	4.8	5.3	16.3
40	10	30	22	6.0	11.3	6.4	23.6	58	22	6.9	12.4	5.7	25.0
	20			6.4	11.6	6.5	24.5			7.4	12.8	5.8	25.9
	30			6.7	12.0	6.7	25.4			7.8	13.2	5.9	26.8
	40			7.1	12.3	6.8	26.2			8.2	13.6	5.9	27.7
50	10	56	28	7.5	22.4	7.1	37.0	64	28	8.7	15.5	7.1	31.3
	20			8.0	23.0	7.2	38.1			9.2	16.0	7.2	32.4
	30			8.4	23.5	7.3	39.3			9.7	16.5	7.3	33.5
	40			8.9	24.1	7.4	40.4			10.3	17.0	7.4	34.7
60	10	66	33	9.0	26.9	8.5	44.4	69	33	10.4	18.6	8.5	37.5
	20			9.6	27.6	8.6	45.7			11.1	19.2	8.6	38.9
	30			10.1	28.3	8.8	47.1			11.7	19.8	8.8	40.2
	40			10.6	29.0	8.9	48.5			12.3	20.3	8.9	41.6
70	10	78	39	10.5	31.3	9.9	51.8	75	39	12.2	21.7	12.4	46.2
	20			11.2	32.1	10.1	53.4			12.9	22.4	12.5	47.8
	30			11.8	33.0	10.2	55.0			13.6	23.1	12.7	49.4
	40			12.4	33.8	10.4	56.6			14.4	23.7	12.9	51.0
80	10	88	44	12.0	35.8	11.3	59.2	80	44	13.9	24.8	14.1	52.8
	20			12.7	36.7	11.5	61.0			14.7	25.6	14.3	54.6
	30			13.5	37.7	11.7	62.8			15.6	26.3	14.5	56.5
	40			14.2	38.6	11.9	64.7			16.4	27.1	14.7	58.3
90	10	98	49	13.5	40.3	12.7	66.6	85	49	15.6	27.9	15.9	59.4
	20			14.3	41.3	13.0	68.6			16.6	28.8	16.1	61.5
	30			15.1	42.4	13.2	70.7			17.5	29.6	16.3	63.5
	40			16.0	43.4	13.4	72.8			18.5	30.5	16.6	65.6
100	10	110	55	15.0	44.8	14.2	74.0	91	55	17.4	31.0	17.7	66.0
	20			15.9	45.9	14.4	76.2			18.4	32.0	17.9	68.3
	30			16.8	47.1	14.6	78.5			19.5	32.9	18.2	70.6
	40			17.7	48.3	14.9	80.9			20.6	33.9	18.4	72.9
120	10	130	66	18.0	53.7	20.0	91.7	102	66	20.8	37.2	21.2	79.3
	20			19.1	55.1	20.3	94.5			22.1	38.4	21.5	82.0
	30			20.2	56.5	20.6	97.3			23.4	39.5	21.8	84.7
	40			21.3	57.9	21.0	100.2			24.7	40.7	22.1	87.5
140	10	141	77	21.0	62.7	23.3	107.0	113	77	24.3	43.4	25.2	92.9
	20			22.3	64.3	23.7	110.3			25.8	44.8	25.6	96.2
	30			23.6	65.9	24.1	113.6			27.3	46.1	26.1	99.5
	40			24.8	67.6	24.5	116.9			28.8	47.5	26.6	102.8
160	10	151	87	24.1	71.6	26.6	122.3	123	87	27.8	49.6	28.8	106.2
	20			25.5	73.5	27.1	126.0			29.5	51.1	29.3	109.9
	30			26.9	75.3	27.5	129.8			31.2	52.7	29.8	113.7
	40			28.4	77.2	28.0	133.6			32.9	54.3	30.3	117.5
180	10	162	98	27.1	80.6	30.0	137.6	134	98	31.3	55.8	32.4	119.5
	20			28.7	82.7	30.5	141.8			33.2	57.5	33.0	123.7
	30			30.3	84.8	31.0	146.0			35.1	59.3	33.5	127.9
	40			31.9	86.9	31.5	150.3			37.0	61.0	34.1	132.2
200	10	173	109	30.1	89.6	33.3	152.9	145	109	34.7	62.0	36.4	133.2
	20			31.9	91.8	33.8	157.5			36.9	63.9	37.1	137.9
	30			33.7	94.2	34.4	162.2			39.0	65.9	37.8	142.7
	40			35.5	96.6	35.0	167.0			41.1	67.8	38.6	147.5

140 CHARACTER DATA RECORD

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	12	4	.8	1.6	.8	3.2	7	4	.9	.8	.9	2.6
	20			.8	1.6	.8	3.3			1.0	.8	.9	2.7
	30			.9	1.7	.8	3.4			1.0	.9	.9	2.8
	40			.9	1.7	.8	3.5			1.1	.9	.9	2.9
10	10	15	7	1.6	3.1	1.6	6.3	10	7	1.8	1.6	1.8	5.2
	20			1.7	3.2	1.6	6.5			1.9	1.7	1.8	5.4
	30			1.8	3.3	1.6	6.7			2.0	1.7	1.9	5.6
	40			1.8	3.4	1.7	6.9			2.2	1.8	1.9	5.8
20	10	21	13	3.2	6.3	3.5	12.9	16	13	3.7	3.2	3.7	10.6
	20			3.4	6.5	3.5	13.3			3.9	3.3	3.8	11.0
	30			3.5	6.6	3.6	13.8			4.1	3.4	3.9	11.5
	40			3.7	6.8	3.7	14.2			4.3	3.5	4.0	11.9
30	10	27	19	4.8	9.4	5.3	19.5	55	19	5.5	10.4	4.8	20.7
	20			5.0	9.7	5.5	20.2			5.8	10.7	4.9	21.3
	30			5.3	9.9	5.6	20.8			6.1	11.0	4.9	22.0
	40			5.5	10.2	5.7	21.5			6.5	11.2	5.0	22.7
40	10	50	25	6.4	20.1	6.4	32.8	61	25	7.3	13.9	6.4	27.6
	20			6.7	20.5	6.5	33.7			7.8	14.2	6.5	28.5
	30			7.0	21.0	6.6	34.6			8.2	14.6	6.6	29.4
	40			7.4	21.5	6.7	35.5			8.6	15.0	6.7	30.3
50	10	64	32	7.9	25.1	8.0	41.0	68	32	9.2	17.3	8.0	34.5
	20			8.4	25.7	8.1	42.1			9.7	17.8	8.1	35.6
	30			8.8	26.2	8.2	43.3			10.2	18.3	8.2	36.7
	40			9.2	26.8	8.3	44.4			10.8	18.7	8.3	37.8
60	10	76	38	9.5	30.1	9.6	49.2	74	38	11.0	20.8	12.0	43.8
	20			10.1	30.8	9.7	50.6			11.6	21.3	12.1	45.1
	30			10.6	31.5	9.8	51.9			12.3	21.9	12.3	46.5
	40			11.1	32.2	10.0	53.3			12.9	22.5	12.4	47.8
70	10	88	44	11.1	35.2	11.2	57.4	80	44	12.8	24.3	14.0	51.1
	20			11.7	35.9	11.3	59.0			13.6	24.9	14.2	52.6
	30			12.3	36.7	11.5	60.6			14.3	25.6	14.3	54.2
	40			12.9	37.5	11.6	62.1			15.1	26.2	14.5	55.8
80	10	100	50	12.7	40.2	12.8	65.6	86	50	14.6	27.7	16.0	58.4
	20			13.4	41.1	12.9	67.4			15.5	28.5	16.2	60.2
	30			14.1	42.0	13.1	69.2			16.4	29.2	16.4	62.0
	40			14.8	42.9	13.3	71.0			17.2	30.0	16.6	63.8
90	10	114	57	14.3	45.2	14.4	73.8	93	57	16.5	31.2	18.0	65.7
	20			15.1	46.2	14.6	75.8			17.4	32.0	18.2	67.7
	30			15.9	47.2	14.8	77.9			18.4	32.9	18.4	69.7
	40			16.6	48.3	15.0	79.9			19.4	33.7	18.7	71.8
100	10	126	63	15.9	50.2	15.9	82.0	99	63	18.3	34.7	20.0	73.0
	20			16.8	51.3	16.2	84.3			19.4	35.6	20.2	75.2
	30			17.6	52.5	16.4	86.5			20.4	36.5	20.5	77.4
	40			18.5	53.6	16.6	88.8			21.5	37.5	20.7	79.7
120	10	139	75	19.1	60.3	22.5	101.9	111	75	22.0	41.6	24.4	88.0
	20			20.1	61.6	22.9	104.6			23.3	42.7	24.8	90.7
	30			21.1	63.0	23.2	107.3			24.5	43.8	25.1	93.5
	40			22.2	64.4	23.5	110.1			25.8	45.0	25.5	96.3
140	10	152	88	22.2	70.3	26.3	118.8	124	88	25.6	48.5	28.5	102.6
	20			23.5	71.9	26.7	122.0			27.1	49.8	28.9	105.8
	30			24.7	73.5	27.1	125.2			28.6	51.1	29.3	109.1
	40			25.9	75.1	27.5	128.5			30.1	52.5	29.8	112.4
160	10	164	100	25.4	80.4	30.1	135.8	136	100	29.3	55.5	32.5	117.3
	20			26.8	82.1	30.5	139.4			31.0	56.9	33.0	121.0
	30			28.2	84.0	30.9	143.1			32.7	58.4	33.5	124.7
	40			29.6	85.8	31.4	146.8			34.4	60.0	34.0	128.4
180	10	177	113	28.6	90.4	33.8	152.8	149	113	33.0	62.4	37.0	132.3
	20			30.2	92.4	34.3	156.9			34.9	64.0	37.6	136.5
	30			31.7	94.4	34.8	161.0			36.8	65.7	38.2	140.8
	40			33.3	96.5	35.3	165.2			38.7	67.5	38.9	145.1
200	10	189	125	31.8	100.4	37.6	169.8	161	125	36.6	69.3	41.1	147.0
	20			33.5	102.7	38.1	174.3			38.8	71.2	41.8	151.7
	30			35.2	104.9	38.7	178.9			40.9	73.1	42.5	156.4
	40			37.0	107.3	39.2	183.5			43.0	75.0	43.2	161.2

160 CHARACTER DATA RECORD

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	12	4	.8	1.8	.9	3.5	7	4	1.0	.9	1.0	2.9
	20			.9	1.8	.9	3.6			1.0	.9	1.0	2.9
	30			.9	1.9	.9	3.7			1.1	1.0	1.0	3.0
	40			1.0	1.9	.9	3.8			1.1	1.0	1.0	3.1
10	10	16	8	1.7	3.5	1.8	7.0	11	8	1.9	1.8	2.0	5.7
	20			1.8	3.6	1.8	7.2			2.0	1.9	2.1	5.9
	30			1.8	3.7	1.9	7.4			2.1	1.9	2.1	6.1
	40			1.9	3.8	1.9	7.6			2.2	2.0	2.1	6.3
20	10	23	15	3.4	7.1	3.9	14.4	18	15	3.8	3.6	4.2	11.6
	20			3.5	7.3	4.0	14.8			4.0	3.7	4.3	12.0
	30			3.7	7.4	4.1	15.2			4.2	3.8	4.4	12.5
	40			3.9	7.6	4.1	15.6			4.4	3.9	4.5	12.9
30	10	31	23	5.0	10.6	6.0	21.7	59	23	5.7	11.8	5.4	22.9
	20			5.3	10.9	6.2	22.3			6.0	12.1	5.5	23.6
	30			5.5	11.1	6.3	23.0			6.3	12.3	5.6	24.2
	40			5.8	11.4	6.4	23.6			6.6	12.6	5.6	24.9
40	10	60	30	6.7	22.9	7.2	36.8	66	30	7.6	15.7	7.2	30.6
	20			7.1	23.3	7.3	37.7			8.0	16.1	7.3	31.4
	30			7.4	23.7	7.4	38.5			8.4	16.5	7.4	32.3
	40			7.7	24.2	7.5	39.4			8.8	16.8	7.5	33.2
50	10	74	37	8.4	28.6	9.0	46.0	73	37	9.5	19.7	11.5	40.7
	20			8.8	29.1	9.1	47.1			10.0	20.1	11.6	41.8
	30			9.2	29.7	9.3	48.2			10.6	20.6	11.7	42.8
	40			9.6	30.2	9.4	49.3			11.1	21.0	11.8	43.9
60	10	90	45	10.1	34.3	10.8	55.2	81	45	11.4	23.6	13.8	48.8
	20			10.6	35.0	11.0	56.5			12.1	24.1	13.9	50.1
	30			11.1	35.6	11.1	57.8			12.7	24.7	14.1	51.4
	40			11.6	36.3	11.2	59.1			13.3	25.2	14.2	52.7
70	10	104	52	11.8	40.0	12.6	64.4	88	52	13.4	27.5	16.1	57.0
	20			12.3	40.8	12.8	65.9			14.1	28.2	16.3	58.5
	30			12.9	41.6	13.0	67.4			14.8	28.8	16.4	60.0
	40			13.5	42.3	13.1	69.0			15.5	29.4	16.6	61.5
80	10	118	59	13.4	45.8	14.4	73.6	95	59	15.3	31.5	18.4	65.1
	20			14.1	46.6	14.6	75.3			16.1	32.2	18.6	66.8
	30			14.8	47.5	14.8	77.1			16.9	32.9	18.8	68.5
	40			15.4	48.4	15.0	78.8			17.7	33.6	18.9	70.3
90	10	131	67	15.1	51.5	19.3	85.9	103	67	17.2	35.4	20.7	73.3
	20			15.9	52.4	19.6	87.9			18.1	36.2	20.9	75.2
	30			16.6	53.4	19.8	89.8			19.0	37.0	21.1	77.1
	40			17.4	54.4	20.0	91.8			19.9	37.8	21.3	79.1
100	10	138	74	16.8	57.2	21.5	95.5	110	74	19.1	39.3	23.3	81.7
	20			17.6	58.3	21.7	97.6			20.1	40.2	23.6	83.9
	30			18.5	59.4	22.0	99.8			21.1	41.1	23.9	86.1
	40			19.3	60.5	22.3	102.0			22.1	42.1	24.2	88.4
120	10	153	89	20.2	68.7	25.8	114.6	125	89	22.9	47.2	28.0	98.1
	20			21.2	69.9	26.1	117.2			24.1	48.3	28.3	100.7
	30			22.2	71.2	26.4	119.8			25.3	49.4	28.7	103.3
	40			23.1	72.6	26.7	122.4			26.5	50.5	29.0	106.0
140	10	167	103	23.5	80.1	30.0	133.7	139	103	26.7	55.1	32.6	114.4
	20			24.7	81.6	30.4	136.7			28.1	56.3	33.0	117.5
	30			25.8	83.1	30.8	139.7			29.5	57.6	33.4	120.6
	40			27.0	84.7	31.2	142.8			31.0	58.9	33.9	123.7
160	10	182	118	26.9	91.5	34.3	152.8	154	118	30.5	62.9	37.6	131.1
	20			28.2	93.2	34.8	156.2			32.1	64.4	38.1	134.6
	30			29.5	95.0	35.2	159.7			33.8	65.8	38.6	138.2
	40			30.9	96.8	35.6	163.3			35.4	67.3	39.2	141.9
180	10	197	133	30.3	103.0	39.3	172.5	169	133	34.3	70.8	42.3	147.4
	20			31.7	104.9	39.9	176.5			36.2	72.4	42.9	151.4
	30			33.2	106.9	40.5	180.6			38.0	74.0	43.5	155.5
	40			34.7	108.9	41.1	184.7			39.8	75.7	44.1	159.6
200	10	212	148	33.6	114.4	43.6	191.7	184	148	38.1	78.7	47.6	164.4
	20			35.3	116.5	44.3	196.1			40.2	80.4	48.4	169.0
	30			36.9	118.7	45.0	200.7			42.2	82.3	49.2	173.7
	40			38.6	121.0	45.7	205.2			44.2	84.1	50.0	178.4

180 CHARACTER DATA RECORD

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	13	5	.9	2.0	1.0	3.9	8	5	1.0	1.0	1.1	3.1
	20			.9	2.0	1.0	3.9			1.1	1.0	1.1	3.2
	30			1.0	2.0	1.0	4.0			1.1	1.0	1.1	3.3
	40			1.0	2.1	1.0	4.1			1.2	1.1	1.2	3.4
10	10	17	9	1.8	3.9	2.2	7.9	12	9	2.0	2.0	2.2	6.2
	20			1.9	4.0	2.2	8.1			2.1	2.0	2.3	6.4
	30			1.9	4.1	2.2	8.3			2.2	2.1	2.3	6.6
	40			2.0	4.2	2.3	8.5			2.3	2.2	2.4	6.8
20	10	25	17	3.6	7.8	4.5	15.9	20	17	4.0	4.0	4.5	12.5
	20			3.7	8.0	4.5	16.3			4.2	4.1	4.6	12.9
	30			3.9	8.2	4.6	16.7			4.4	4.2	4.7	13.3
	40			4.0	8.3	4.7	17.1			4.6	4.3	4.7	13.7
30	10	50	25	5.4	19.1	6.0	30.4	61	25	6.0	13.1	6.0	25.1
	20			5.6	19.4	6.1	31.1			6.3	13.3	6.1	25.7
	30			5.8	19.7	6.1	31.7			6.6	13.6	6.1	26.4
	40			6.1	20.0	6.2	32.3			6.9	13.9	6.2	27.0
40	10	68	34	7.1	25.4	8.0	40.6	70	34	8.0	17.5	8.0	33.5
	20			7.5	25.9	8.1	41.4			8.4	17.8	8.1	34.3
	30			7.8	26.3	8.2	42.2			8.8	18.1	8.2	35.2
	40			8.1	26.7	8.3	43.1			9.2	18.5	8.3	36.0
50	10	84	42	8.9	31.8	10.0	50.7	78	42	10.0	21.8	12.9	44.7
	20			9.3	32.3	10.1	51.8			10.5	22.2	13.0	45.8
	30			9.7	32.8	10.2	52.8			11.1	22.7	13.1	46.8
	40			10.1	33.4	10.3	53.9			11.6	23.1	13.2	47.9
60	10	100	50	10.7	38.2	12.0	60.9	86	50	12.0	26.2	15.4	53.7
	20			11.2	38.8	12.1	62.1			12.7	26.7	15.6	54.9
	30			11.7	39.4	12.3	63.4			13.3	27.2	15.7	56.2
	40			12.1	40.1	12.4	64.6			13.9	27.8	15.8	57.5
70	10	118	59	12.5	44.5	14.0	71.0	95	59	14.1	30.5	18.0	62.6
	20			13.0	45.2	14.2	72.5			14.8	31.1	18.2	64.1
	30			13.6	46.0	14.3	73.9			15.5	31.8	18.3	65.5
	40			14.2	46.7	14.5	75.4			16.2	32.4	18.5	67.0
80	10	131	67	14.3	50.9	19.1	84.3	103	67	16.1	34.9	20.6	71.6
	20			14.9	51.7	19.3	86.0			16.9	35.6	20.8	73.2
	30			15.5	52.6	19.6	87.7			17.7	36.3	20.9	74.9
	40			16.2	53.4	19.8	89.4			18.5	37.0	21.1	76.6
90	10	139	75	16.1	57.3	21.5	94.9	111	75	18.1	39.3	23.4	80.8
	20			16.8	58.2	21.8	96.7			19.0	40.0	23.7	82.7
	30			17.5	59.1	22.0	98.6			19.9	40.8	23.9	84.7
	40			18.2	60.1	22.2	100.6			20.8	41.6	24.2	86.6
100	10	148	84	17.8	63.6	23.9	105.4	120	84	20.1	43.6	26.0	89.8
	20			18.6	64.6	24.2	107.5			21.1	44.5	26.3	91.9
	30			19.4	65.7	24.4	109.6			22.1	45.4	26.6	94.1
	40			20.2	66.8	24.7	111.7			23.1	46.3	26.9	96.3
120	10	164	100	21.4	76.3	28.7	126.5	136	100	24.1	52.4	31.2	107.7
	20			22.4	77.6	29.0	129.0			25.3	53.4	31.6	110.3
	30			23.3	78.8	29.3	131.5			26.5	54.4	31.9	112.9
	40			24.3	80.1	29.7	134.1			27.7	55.5	32.3	115.5
140	10	181	117	25.0	89.1	33.5	147.6	153	117	28.1	61.1	36.7	125.9
	20			26.1	90.5	33.9	150.5			29.5	62.3	37.1	129.0
	30			27.2	92.0	34.2	153.4			31.0	63.5	37.6	132.1
	40			28.3	93.5	34.6	156.4			32.4	64.8	38.1	135.2
160	10	198	134	28.6	101.8	38.9	169.2	170	134	32.1	69.8	42.0	143.9
	20			29.8	103.4	39.4	172.6			33.7	71.2	42.5	147.4
	30			31.1	105.1	39.9	176.1			35.4	72.6	43.0	150.9
	40			32.4	106.9	40.5	179.7			37.0	74.0	43.5	154.5
180	10	214	150	32.1	114.5	43.7	190.4	186	150	36.1	78.5	47.7	162.4
	20			33.6	116.4	44.3	194.2			38.0	80.1	48.4	166.4
	30			35.0	118.3	44.9	198.2			39.8	81.6	49.1	170.5
	40			36.4	120.2	45.5	202.2			41.6	83.3	49.8	174.7
200	10	231	167	35.7	127.2	48.6	211.5	203	167	40.2	87.3	53.0	180.5
	20			37.3	129.3	49.2	215.8			42.2	89.0	53.8	184.9
	30			38.9	131.4	49.9	220.2			44.2	90.7	54.6	189.5
	40			40.5	133.6	50.6	224.6			46.2	92.5	55.4	194.1

200 CHARACTER DATA RECORD

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	40K CORE STORAGE						60K/80K CORE STORAGE					
		CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	13	5	.9	2.1	1.1	4.1	8	5	.9	1.1	1.2	3.2
	20			1.0	2.1	1.1	4.2			1.0	1.1	1.2	3.3
	30			1.0	2.2	1.1	4.3			1.0	1.1	1.2	3.4
	40			1.1	2.2	1.1	4.4			1.1	1.1	1.2	3.5
10	10	17	9	1.9	4.2	2.3	8.4	12	9	1.9	2.1	2.4	6.4
	20			2.0	4.3	2.4	8.6			2.0	2.2	2.5	6.6
	30			2.0	4.4	2.4	8.8			2.1	2.2	2.5	6.8
	40			2.1	4.4	2.4	9.0			2.2	2.3	2.5	7.0
20	10	26	18	3.8	8.4	4.8	16.9	21	18	3.7	4.2	4.8	12.8
	20			3.9	8.5	4.9	17.3			3.9	4.3	4.9	13.2
	30			4.1	8.7	4.9	17.7			4.1	4.5	5.0	13.6
	40			4.2	8.9	5.0	18.1			4.3	4.6	5.1	13.9
30	10	54	27	5.6	20.4	6.5	32.5	63	27	5.6	14.0	6.5	26.0
	20			5.9	20.7	6.5	33.1			5.9	14.2	6.5	26.7
	30			6.1	21.0	6.6	33.7			6.2	14.5	6.6	27.3
	40			6.3	21.3	6.7	34.3			6.5	14.7	6.7	27.9
40	10	72	36	7.5	27.2	8.6	43.3	72	36	7.5	18.6	8.6	34.7
	20			7.8	27.6	8.7	44.1			7.9	19.0	8.7	35.5
	30			8.1	28.0	8.8	45.0			8.2	19.3	8.8	36.4
	40			8.4	28.4	8.9	45.8			8.6	19.7	8.9	37.2
50	10	90	45	9.4	34.0	10.8	54.1	81	45	9.4	23.3	13.8	46.5
	20			9.8	34.5	10.9	55.2			9.8	23.7	13.9	47.4
	30			10.2	35.0	11.0	56.2			10.3	24.1	14.0	48.5
	40			10.6	35.6	11.1	57.2			10.8	24.6	14.1	49.5
60	10	108	54	11.3	40.8	12.9	65.0	90	54	11.2	27.9	16.6	55.7
	20			11.7	41.4	13.1	66.2			11.8	28.4	16.7	56.9
	30			12.2	42.0	13.2	67.4			12.4	29.0	16.8	58.2
	40			12.7	42.7	13.3	68.7			12.9	29.5	17.0	59.4
70	10	126	63	13.1	47.6	15.1	75.8	99	63	13.1	32.6	19.3	65.0
	20			13.7	48.3	15.2	77.2			13.8	33.2	19.5	66.4
	30			14.2	49.0	15.4	78.7			14.4	33.8	19.6	67.8
	40			14.8	49.8	15.6	80.1			15.1	34.4	19.8	69.3
80	10	136	72	15.0	54.4	20.5	89.9	108	72	15.0	37.2	22.1	74.3
	20			15.6	55.2	20.8	91.6			15.7	37.9	22.3	75.9
	30			16.3	56.0	21.0	93.3			16.5	38.6	22.4	77.5
	40			16.9	56.9	21.2	95.0			17.2	39.3	22.6	79.2
90	10	145	81	16.9	61.2	23.1	101.2	117	81	16.9	41.9	25.1	83.9
	20			17.6	62.1	23.3	103.0			17.7	42.7	25.4	85.7
	30			18.3	63.0	23.6	104.9			18.6	43.4	25.6	87.6
	40			19.0	64.0	23.8	106.8			19.4	44.2	25.9	89.5
100	10	154	90	18.8	68.0	25.7	112.4	126	90	18.7	46.6	27.9	93.2
	20			19.6	69.0	25.9	114.5			19.7	47.4	28.2	95.3
	30			20.3	70.0	26.2	116.6			20.6	48.3	28.5	97.4
	40			21.1	71.1	26.5	118.7			21.6	49.2	28.8	99.5
120	10	172	108	22.5	81.6	30.8	134.9	144	108	22.5	55.9	33.5	111.8
	20			23.5	82.8	31.1	137.4			23.6	56.9	33.8	114.3
	30			24.4	84.0	31.4	139.9			24.7	57.9	34.2	116.8
	40			25.3	85.3	31.8	142.4			25.9	59.0	34.5	119.4
140	10	189	125	26.3	95.2	36.0	157.4	161	125	26.2	65.2	39.4	130.8
	20			27.4	96.6	36.3	160.3			27.5	66.4	39.8	133.7
	30			28.5	98.1	36.7	163.2			28.9	67.6	40.2	136.7
	40			29.6	99.6	37.1	166.2			30.2	68.8	40.7	139.7
160	10	207	143	30.0	108.8	41.7	180.5	179	143	30.0	74.5	45.0	149.4
	20			31.3	110.4	42.2	183.9			31.5	75.8	45.5	152.8
	30			32.5	112.1	42.7	187.3			33.0	77.2	46.0	156.2
	40			33.8	113.8	43.3	190.9			34.5	78.7	46.5	159.6
180	10	225	161	33.8	122.3	46.9	203.0	197	161	33.7	83.8	51.1	168.6
	20			35.2	124.2	47.5	206.9			35.4	85.3	51.8	172.5
	30			36.6	126.1	48.1	210.8			37.1	86.9	52.5	176.5
	40			38.0	128.0	48.7	214.7			38.8	88.5	53.2	180.5
200	10	243	179	37.6	135.9	52.1	225.6	215	179	37.5	93.1	56.8	187.4
	20			39.1	138.0	52.8	229.8			39.3	94.8	57.5	191.7
	30			40.7	140.1	53.4	234.2			41.2	96.5	58.3	196.1
	40			42.2	142.2	54.1	238.6			43.1	98.3	59.1	200.6

220 CHARACTER DATA RECORD

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	14	6	1.0	2.4	1.2	4.6	9	6	1.0	1.2	1.3	3.5
	20			1.0	2.4	1.2	4.6			1.0	1.2	1.3	3.6
	30			1.1	2.4	1.2	4.7			1.1	1.2	1.4	3.7
	40			1.1	2.5	1.2	4.8			1.1	1.3	1.4	3.8
10	10	19	11	2.0	4.7	2.6	9.3	14	11	2.0	2.4	2.7	7.1
	20			2.1	4.8	2.7	9.5			2.1	2.4	2.8	7.2
	30			2.2	4.9	2.7	9.7			2.1	2.5	2.8	7.4
	40			2.2	5.0	2.7	9.9			2.2	2.5	2.9	7.6
15	10	24	16	3.0	7.1	4.0	14.0	19	16	2.9	3.6	4.1	10.6
	20			3.1	7.2	4.0	14.3			3.1	3.6	4.2	10.9
	30			3.2	7.3	4.0	14.6			3.2	3.7	4.2	11.2
	40			3.4	7.4	4.1	14.9			3.3	3.8	4.3	11.4
20	10	29	21	4.0	9.4	5.4	18.8	57	21	3.9	10.6	4.8	19.3
	20			4.2	9.6	5.4	19.2			4.1	10.7	4.9	19.7
	30			4.3	9.7	5.5	19.6			4.3	10.9	4.9	20.1
	40			4.5	9.9	5.6	20.0			4.5	11.0	4.9	20.5
25	10	54	27	5.0	19.3	6.0	30.3	63	27	4.9	13.2	6.0	24.1
	20			5.2	19.5	6.1	30.8			5.1	13.4	6.1	24.6
	30			5.4	19.8	6.1	31.3			5.4	13.6	6.1	25.1
	40			5.6	20.0	6.2	31.8			5.6	13.8	6.2	25.6
30	10	64	32	6.0	23.2	7.2	36.4	68	32	5.9	15.8	7.2	28.9
	20			6.3	23.5	7.3	37.0			6.2	16.1	7.3	29.5
	30			6.5	23.7	7.4	37.6			6.4	16.3	7.4	30.1
	40			6.7	24.1	7.4	38.2			6.7	16.6	7.4	30.7
35	10	74	37	7.0	27.0	8.4	42.5	73	37	6.9	18.5	11.0	36.4
	20			7.3	27.4	8.5	43.2			7.2	18.7	11.1	37.0
	30			7.6	27.7	8.6	43.9			7.5	19.0	11.2	37.7
	40			7.8	28.1	8.7	44.6			7.8	19.3	11.2	38.4
40	10	84	42	8.0	30.9	9.6	48.5	78	42	7.8	21.1	12.6	41.6
	20			8.3	31.3	9.7	49.3			8.2	21.4	12.7	42.3
	30			8.7	31.7	9.8	50.1			8.6	21.8	12.8	43.1
	40			9.0	32.1	9.9	50.9			8.9	22.1	12.8	43.9
45	10	94	47	9.0	34.8	10.8	54.6	83	47	8.8	23.8	14.2	46.8
	20			9.4	35.2	10.9	55.5			9.2	24.1	14.3	47.6
	30			9.7	35.6	11.0	56.4			9.6	24.5	14.4	48.5
	40			10.1	36.1	11.1	57.3			10.0	24.8	14.5	49.3
50	10	106	53	10.0	38.6	12.0	60.7	89	53	9.8	26.4	15.8	52.0
	20			10.4	39.1	12.1	61.7			10.3	26.8	15.9	52.9
	30			10.8	39.6	12.3	62.7			10.7	27.2	16.0	53.9
	40			11.2	40.1	12.4	63.7			11.2	27.6	16.1	54.8
55	10	116	58	11.1	42.5	13.2	66.8	94	58	10.8	29.0	17.3	57.2
	20			11.5	43.0	13.4	67.8			11.3	29.5	17.4	58.2
	30			11.9	43.5	13.5	68.9			11.8	29.9	17.6	59.2
	40			12.3	44.1	13.6	70.0			12.3	30.4	17.7	60.3
60	10	126	63	12.1	46.3	14.4	72.8	99	63	11.8	31.7	18.9	62.4
	20			12.5	46.9	14.6	74.0			12.3	32.1	19.0	63.5
	30			13.0	47.5	14.7	75.2			12.9	32.6	19.2	64.6
	40			13.4	48.1	14.8	76.4			13.4	33.1	19.3	65.8
70	10	137	73	14.1	54.1	20.4	88.5	109	73	13.7	36.9	22.3	73.0
	20			14.6	54.7	20.6	89.9			14.4	37.5	22.5	74.3
	30			15.1	55.4	20.7	91.3			15.0	38.1	22.6	75.7
	40			15.7	56.1	20.9	92.7			15.6	38.7	22.8	77.1
80	10	148	84	16.1	61.8	23.3	101.2	120	84	15.7	42.2	25.5	83.4
	20			16.7	62.5	23.5	102.7			16.4	42.9	25.7	84.9
	30			17.3	63.3	23.7	104.3			17.1	43.5	25.9	86.5
	40			17.9	64.1	23.9	105.9			17.9	44.2	26.1	88.1
90	10	158	94	18.1	69.5	26.2	113.8	130	94	17.7	47.5	28.6	93.8
	20			18.8	70.4	26.4	115.6			18.5	48.2	28.9	95.5
	30			19.5	71.2	26.6	117.4			19.3	48.9	29.1	97.3
	40			20.2	72.2	26.9	119.2			20.1	49.7	29.3	99.1
100	10	169	105	20.1	77.2	29.1	126.4	141	105	19.6	52.8	31.8	104.2
	20			20.9	78.2	29.4	128.4			20.5	53.6	32.1	106.2
	30			21.6	79.2	29.6	130.4			21.4	54.4	32.3	108.1
	40			22.4	80.2	29.9	132.4			22.3	55.2	32.6	110.1

240 CHARACTER DATA RECORD

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	14	6	1.0	2.5	1.3	4.9	9	6	1.0	1.3	1.4	3.7
	20			1.1	2.6	1.3	5.0			1.1	1.3	1.5	3.8
	30			1.1	2.6	1.3	5.1			1.1	1.3	1.5	3.9
	40			1.2	2.7	1.3	5.2			1.2	1.4	1.5	4.0
10	10	20	12	2.1	5.1	2.8	10.0	15	12	2.1	2.6	2.9	7.6
	20			2.2	5.1	2.9	10.2			2.2	2.6	3.0	7.7
	30			2.2	5.2	2.9	10.4			2.2	2.7	3.0	7.9
	40			2.3	5.3	2.9	10.6			2.3	2.7	3.1	8.1
15	10	26	18	3.1	7.6	4.3	15.1	21	18	3.1	3.8	4.4	11.3
	20			3.3	7.7	4.4	15.4			3.2	3.9	4.5	11.6
	30			3.4	7.8	4.4	15.7			3.4	4.0	4.5	11.9
	40			3.5	8.0	4.5	16.0			3.5	4.1	4.6	12.2
20	10	31	23	4.2	10.1	5.8	20.1	59	23	4.1	11.4	5.2	20.7
	20			4.3	10.3	5.9	20.5			4.3	11.6	5.2	21.1
	30			4.5	10.5	5.9	20.9			4.5	11.7	5.3	21.5
	40			4.6	10.6	6.0	21.3			4.7	11.9	5.3	21.9
25	10	58	29	5.2	20.9	6.5	32.6	65	29	5.2	14.3	6.5	25.9
	20			5.4	21.1	6.5	33.1			5.4	14.4	6.5	26.4
	30			5.6	21.4	6.6	33.6			5.6	14.6	6.6	26.9
	40			5.8	21.6	6.7	34.1			5.8	14.9	6.7	27.3
30	10	70	35	6.3	25.1	7.8	39.1	71	35	6.2	17.1	7.8	31.1
	20			6.5	25.3	7.9	39.7			6.5	17.3	7.9	31.7
	30			6.7	25.6	7.9	40.3			6.7	17.6	7.9	32.2
	40			7.0	25.9	8.0	40.9			7.0	17.8	8.0	32.8
35	10	80	40	7.3	29.3	9.1	45.7	76	40	7.2	20.0	12.0	39.2
	20			7.6	29.6	9.2	46.3			7.5	20.2	12.0	39.8
	30			7.9	29.9	9.3	47.0			7.8	20.5	12.1	40.5
	40			8.1	30.3	9.3	47.7			8.2	20.8	12.2	41.1
40	10	92	46	8.4	33.4	10.4	52.2	82	46	8.2	22.8	13.7	44.8
	20			8.7	33.8	10.5	53.0			8.6	23.1	13.8	45.5
	30			9.0	34.2	10.6	53.7			9.0	23.4	13.8	46.2
	40			9.3	34.6	10.7	54.5			9.3	23.8	13.9	47.0
45	10	104	52	9.4	37.6	11.7	58.7	88	52	9.3	25.7	15.4	50.3
	20			9.8	38.0	11.8	59.6			9.7	26.0	15.5	51.2
	30			10.1	38.4	11.9	60.4			10.1	26.4	15.6	52.0
	40			10.4	38.9	12.0	61.3			10.5	26.7	15.7	52.9
50	10	114	57	10.5	41.8	13.0	65.2	93	57	10.3	28.5	17.1	55.9
	20			10.9	42.2	13.1	66.2			10.8	28.9	17.2	56.9
	30			11.2	42.7	13.2	67.2			11.2	29.3	17.3	57.8
	40			11.6	43.2	13.3	68.1			11.7	29.7	17.4	58.8
55	10	126	63	11.5	46.0	14.3	71.8	99	63	11.3	31.4	18.8	61.5
	20			11.9	46.5	14.4	72.8			11.8	31.8	18.9	62.5
	30			12.3	47.0	14.5	73.9			12.3	32.2	19.0	63.6
	40			12.8	47.5	14.7	75.0			12.8	32.7	19.1	64.6
60	10	133	69	12.6	50.1	18.9	81.6	105	69	12.4	34.2	20.5	67.1
	20			13.0	50.7	19.1	82.8			12.9	34.7	20.6	68.2
	30			13.5	51.3	19.2	83.9			13.4	35.2	20.8	69.4
	40			13.9	51.9	19.4	85.1			14.0	35.6	20.9	70.5
70	10	144	80	14.7	58.5	22.1	95.2	116	80	14.4	39.9	24.2	78.5
	20			15.2	59.1	22.2	96.6			15.1	40.5	24.3	79.8
	30			15.7	59.8	22.4	97.9			15.7	41.0	24.5	81.2
	40			16.2	60.5	22.6	99.3			16.3	41.6	24.7	82.6
80	10	155	91	16.8	66.9	25.2	108.9	127	91	16.5	45.6	27.6	89.7
	20			17.4	67.6	25.4	110.4			17.2	46.2	27.8	91.3
	30			18.0	68.4	25.6	111.9			17.9	46.9	28.0	92.8
	40			18.6	69.1	25.8	113.5			18.6	47.5	28.2	94.4
90	10	167	103	18.9	75.2	28.4	122.5	139	103	18.5	51.3	31.1	101.0
	20			19.5	76.0	28.6	124.2			19.4	52.0	31.3	102.7
	30			20.2	76.9	28.8	125.9			20.2	52.7	31.5	104.4
	40			20.9	77.8	29.0	127.7			21.0	53.5	31.7	106.2
100	10	178	114	21.0	83.6	31.5	136.1	150	114	20.6	57.0	34.7	112.4
	20			21.7	84.5	31.8	138.0			21.5	57.8	35.0	114.3
	30			22.5	85.4	32.0	139.9			22.4	58.6	35.3	116.3
	40			23.2	86.4	32.3	141.9			23.3	59.4	35.5	118.3

260 CHARACTER DATA RECORD

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	15	7	1.1	2.7	1.4	5.3	10	7	1.1	1.4	1.6	4.0
	20			1.1	2.8	1.4	5.3			1.1	1.4	1.6	4.1
	30			1.2	2.8	1.4	5.4			1.2	1.4	1.6	4.2
	40			1.2	2.9	1.4	5.5			1.2	1.5	1.6	4.3
10	10	21	13	2.2	5.5	3.1	10.8	16	13	2.2	2.8	3.2	8.2
	20			2.3	5.6	3.1	11.0			2.2	2.8	3.3	8.3
	30			2.4	5.7	3.1	11.2			2.3	2.9	3.3	8.5
	40			2.4	5.7	3.2	11.3			2.4	2.9	3.4	8.7
15	10	27	19	3.3	8.2	4.7	16.2	55	19	3.3	9.3	4.2	16.8
	20			3.4	8.4	4.7	16.5			3.4	9.4	4.2	17.0
	30			3.5	8.5	4.8	16.8			3.5	9.5	4.3	17.3
	40			3.7	8.6	4.9	17.1			3.6	9.6	4.3	17.6
20	10	50	25	4.4	18.2	5.6	28.2	61	25	4.4	12.4	5.6	22.4
	20			4.6	18.4	5.7	28.6			4.5	12.6	5.7	22.7
	30			4.7	18.6	5.7	29.0			4.6	12.7	5.7	23.1
	40			4.9	18.7	5.8	29.4			4.8	12.9	5.8	23.4
25	10	64	32	5.5	22.8	7.0	35.3	68	32	5.5	15.5	7.0	28.0
	20			5.7	23.0	7.1	35.8			5.6	15.7	7.1	28.4
	30			5.9	23.2	7.1	36.2			5.8	15.9	7.1	28.8
	40			6.1	23.4	7.2	36.7			6.0	16.1	7.2	29.3
30	10	76	38	6.6	27.3	8.4	42.4	74	38	6.5	18.6	11.2	36.4
	20			6.9	27.6	8.5	42.9			6.7	18.8	11.3	36.8
	30			7.1	27.8	8.6	43.5			7.0	19.1	11.3	37.3
	40			7.3	28.1	8.6	44.1			7.2	19.3	11.4	37.9
35	10	88	44	7.7	31.9	9.8	49.4	80	44	7.6	21.7	13.1	42.4
	20			8.0	32.2	9.9	50.1			7.8	22.0	13.1	42.9
	30			8.3	32.5	10.0	50.7			8.1	22.2	13.2	43.6
	40			8.5	32.8	10.1	51.4			8.4	22.5	13.3	44.2
40	10	100	50	8.8	36.4	11.2	56.5	86	50	8.7	24.8	14.9	48.5
	20			9.1	36.8	11.3	57.2			8.9	25.1	15.0	49.1
	30			9.4	37.1	11.4	58.0			9.3	25.4	15.1	49.8
	40			9.7	37.5	11.5	58.8			9.6	25.7	15.2	50.5
45	10	114	57	9.9	41.0	12.6	63.5	93	57	9.8	27.9	16.8	54.6
	20			10.3	41.3	12.7	64.4			10.1	28.2	16.9	55.2
	30			10.6	41.8	12.9	65.2			10.5	28.6	17.0	56.0
	40			11.0	42.2	13.0	66.1			10.9	28.9	17.1	56.9
50	10	126	63	11.1	45.5	14.0	70.6	99	63	10.9	31.0	18.7	60.6
	20			11.4	45.9	14.2	71.5			11.2	31.4	18.8	61.3
	30			11.8	46.4	14.3	72.5			11.6	31.8	18.9	62.2
	40			12.2	46.9	14.4	73.4			12.1	32.2	19.0	63.2
55	10	133	69	12.2	50.1	18.9	81.1	105	69	12.0	34.1	20.6	66.7
	20			12.6	50.5	19.0	82.1			12.3	34.5	20.6	67.5
	30			13.0	51.0	19.1	83.2			12.8	34.9	20.7	68.5
	40			13.4	51.6	19.3	84.2			13.3	35.4	20.9	69.5
60	10	139	75	13.3	54.6	20.6	88.5	111	75	13.1	37.2	22.6	72.9
	20			13.7	55.1	20.7	89.6			13.4	37.7	22.7	73.8
	30			14.2	55.7	20.9	90.7			13.9	38.1	22.9	74.9
	40			14.6	56.2	21.0	91.9			14.5	38.6	23.0	76.1
70	10	152	88	15.5	63.7	24.0	103.2	124	88	15.3	43.4	26.4	85.1
	20			16.0	64.3	24.2	104.5			15.7	43.9	26.5	86.1
	30			16.5	65.0	24.4	105.8			16.3	44.5	26.7	87.4
	40			17.0	65.6	24.5	107.2			16.9	45.0	26.9	88.8
80	10	164	100	17.7	72.8	27.5	117.9	136	100	17.5	49.6	30.1	97.2
	20			18.3	73.5	27.6	119.4			17.9	50.2	30.3	98.4
	30			18.9	74.2	27.8	121.0			18.6	50.8	30.5	99.9
	40			19.5	75.0	28.0	122.5			19.3	51.5	30.7	101.4
90	10	177	113	19.9	81.9	30.9	132.7	149	113	19.6	55.8	34.1	109.5
	20			20.6	82.7	31.1	134.4			20.1	56.5	34.3	110.9
	30			21.2	83.5	31.3	136.1			20.9	57.2	34.5	112.6
	40			21.9	84.4	31.5	137.8			21.7	57.9	34.8	114.4
100	10	189	125	22.1	91.0	34.3	147.4	161	125	21.8	62.0	37.8	121.7
	20			22.9	91.9	34.6	149.3			22.4	62.8	38.1	123.2
	30			23.6	92.8	34.8	151.2			23.2	63.5	38.4	125.1
	40			24.3	93.7	35.0	153.1			24.1	64.3	38.6	127.1

280 CHARACTER DATA RECORD

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	15	7	1.1	2.8	1.4	5.4	10	7	1.1	1.4	1.6	4.2
	20			1.2	2.8	1.5	5.5			1.2	1.4	1.6	4.2
	30			1.2	2.9	1.5	5.6			1.2	1.5	1.7	4.3
	40			1.3	2.9	1.5	5.6			1.2	1.5	1.7	4.4
10	10	21	13	2.3	5.6	3.2	11.0	16	13	2.3	2.8	3.3	8.4
	20			2.4	5.7	3.2	11.2			2.3	2.9	3.4	8.5
	30			2.4	5.7	3.2	11.4			2.4	2.9	3.4	8.7
	40			2.5	5.8	3.3	11.6			2.5	3.0	3.5	8.9
15	10	27	19	3.4	8.4	4.8	16.6	55	19	3.4	9.4	4.3	17.2
	20			3.5	8.5	4.9	16.9			3.5	9.5	4.4	17.4
	30			3.6	8.6	4.9	17.2			3.6	9.6	4.4	17.6
	40			3.8	8.7	5.0	17.5			3.7	9.8	4.5	17.9
20	10	50	25	4.6	18.4	5.8	28.7	61	25	4.6	12.5	5.8	22.9
	20			4.7	18.6	5.8	29.1			4.7	12.7	5.8	23.2
	30			4.9	18.8	5.9	29.5			4.8	12.9	5.9	23.5
	40			5.0	19.0	5.9	29.9			5.0	13.0	5.9	23.9
25	10	64	32	5.7	23.0	7.2	35.9	68	32	5.7	15.7	7.2	28.6
	20			5.9	23.2	7.3	36.4			5.8	15.9	7.3	29.0
	30			6.1	23.5	7.4	36.9			6.0	16.1	7.4	29.4
	40			6.3	23.7	7.4	37.4			6.2	16.3	7.4	29.9
30	10	76	38	6.8	27.6	8.7	43.1	74	38	6.9	18.8	11.3	37.0
	20			7.1	27.9	8.8	43.7			7.0	19.0	11.4	37.4
	30			7.3	28.2	8.8	44.3			7.2	19.3	11.5	37.9
	40			7.5	28.5	8.9	44.9			7.4	19.5	11.5	38.5
35	10	88	44	8.0	32.2	10.1	50.3	80	44	8.0	21.9	13.2	43.2
	20			8.2	32.5	10.2	51.0			8.2	22.2	13.3	43.7
	30			8.5	32.9	10.3	51.7			8.4	22.5	13.4	44.2
	40			8.8	33.2	10.4	52.3			8.7	22.8	13.4	44.9
40	10	100	50	9.1	36.8	11.6	57.5	86	50	9.2	25.1	15.1	49.4
	20			9.4	37.2	11.7	58.3			9.3	25.4	15.2	49.9
	30			9.7	37.5	11.8	59.0			9.6	25.7	15.3	50.5
	40			10.0	37.9	11.9	59.8			9.9	26.0	15.4	51.3
45	10	114	57	10.3	41.4	13.0	64.7	93	57	10.3	28.2	17.0	55.5
	20			10.6	41.8	13.2	65.5			10.5	28.6	17.1	56.2
	30			10.9	42.2	13.3	66.4			10.8	28.9	17.2	56.9
	40			11.3	42.7	13.4	67.3			11.2	29.3	17.3	57.7
50	10	126	63	11.4	46.0	14.5	71.9	99	63	11.4	31.4	18.9	61.7
	20			11.8	46.5	14.6	72.8			11.7	31.7	19.0	62.4
	30			12.1	46.9	14.7	73.8			12.0	32.1	19.1	63.2
	40			12.5	47.4	14.9	74.8			12.4	32.5	19.2	64.1
55	10	133	69	12.5	50.6	19.2	82.3	105	69	12.6	34.5	20.8	67.9
	20			12.9	51.1	19.3	83.4			12.8	34.9	20.9	68.7
	30			13.3	51.6	19.5	84.5			13.2	35.3	21.0	69.5
	40			13.8	52.2	19.6	85.5			13.6	35.8	21.1	70.5
60	10	139	75	13.7	55.2	21.0	89.8	111	75	13.7	37.6	22.9	74.2
	20			14.1	55.7	21.1	91.0			14.0	38.1	23.0	75.1
	30			14.6	56.3	21.3	92.1			14.3	38.6	23.2	76.1
	40			15.0	56.9	21.4	93.3			14.9	39.0	23.3	77.3
70	10	152	88	15.9	64.4	24.4	104.8	124	88	16.0	43.9	26.7	86.6
	20			16.5	65.0	24.6	106.1			16.4	44.4	26.9	87.6
	30			17.0	65.7	24.8	107.5			16.7	45.0	27.0	88.8
	40			17.5	66.4	25.0	108.9			17.4	45.5	27.2	90.1
80	10	164	100	18.2	73.6	27.9	119.7	136	100	18.3	50.2	30.5	99.0
	20			18.8	74.3	28.1	121.3			18.7	50.8	30.7	100.2
	30			19.4	75.1	28.3	122.8			19.1	51.4	30.9	101.4
	40			20.0	75.9	28.5	124.4			19.8	52.1	31.1	103.0
90	10	177	113	20.5	82.8	31.4	134.7	149	113	20.6	56.4	34.5	111.5
	20			21.2	83.6	31.7	136.4			21.0	57.1	34.7	112.9
	30			21.8	84.5	31.9	138.2			21.5	57.8	35.0	114.3
	40			22.5	85.4	32.1	140.0			22.3	58.6	35.3	116.1
100	10	189	125	22.8	92.0	34.9	149.7	161	125	22.9	62.7	38.3	123.9
	20			23.5	92.9	35.2	151.6			23.4	63.5	38.6	125.4
	30			24.3	93.9	35.4	153.5			23.9	64.3	38.9	127.1
	40			25.0	94.8	35.7	155.5			24.8	65.1	39.2	129.0

300 CHARACTER DATA RECORD

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	20	15	7	1.2	3.1	1.6	5.9	10	7	1.2	1.5	1.8	4.6
	40			1.3	3.2	1.6	6.1			1.3	1.6	1.8	4.7
	60			1.4	3.2	1.6	6.2			1.4	1.7	1.9	4.9
	80			1.4	3.3	1.7	6.4			1.4	1.7	1.9	5.1
10	20	22	14	2.5	6.2	3.5	12.1	17	14	2.5	3.1	3.6	9.2
	40			2.6	6.3	3.5	12.4			2.6	3.2	3.7	9.5
	60			2.7	6.5	3.6	12.8			2.7	3.3	3.8	9.9
	80			2.9	6.7	3.7	13.2			2.9	3.4	3.9	10.2
15	20	29	21	3.7	9.2	5.3	18.2	57	21	3.7	10.4	4.7	18.8
	40			3.9	9.5	5.4	18.8			3.8	10.6	4.8	19.3
	60			4.1	9.7	5.5	19.4			4.1	10.9	4.9	19.9
	80			4.3	10.0	5.6	19.9			4.3	11.1	5.0	20.4
20	20	56	28	4.9	20.3	6.3	31.6	64	28	4.9	13.9	6.3	25.1
	40			5.2	20.7	6.4	32.3			5.1	14.2	6.4	25.7
	60			5.5	21.1	6.5	33.1			5.5	14.5	6.5	26.5
	80			5.8	21.5	6.6	33.9			5.8	14.9	6.6	27.3
25	20	70	35	6.1	25.4	7.9	39.5	71	35	6.2	17.3	7.9	31.4
	40			6.5	25.9	8.0	40.4			6.4	17.7	8.0	32.2
	60			6.9	26.4	8.1	41.4			6.8	18.1	8.1	33.1
	80			7.2	26.9	8.3	42.4			7.2	18.6	8.3	34.1
30	20	84	42	7.4	30.5	9.5	47.4	78	42	7.4	20.8	12.5	40.7
	40			7.8	31.1	9.6	48.5			7.7	21.3	12.6	41.6
	60			8.2	31.7	9.8	49.7			8.2	21.8	12.7	42.7
	80			8.7	32.3	9.9	50.9			8.7	22.3	12.9	43.8
35	20	98	49	8.6	35.6	11.1	55.3	85	49	8.6	24.3	14.6	47.5
	40			9.1	36.2	11.2	56.6			9.0	24.8	14.7	48.5
	60			9.6	36.9	11.4	57.9			9.6	25.4	14.9	49.8
	80			10.1	37.7	11.6	59.3			10.1	26.0	15.0	51.2
40	20	112	56	9.8	40.7	12.6	63.2	92	56	9.9	27.8	16.7	54.3
	40			10.4	41.4	12.8	64.7			10.3	28.4	16.8	55.5
	60			11.0	42.2	13.0	66.2			10.9	29.0	17.0	56.9
	80			11.5	43.0	13.2	67.8			11.6	29.7	17.2	58.5
45	20	126	63	11.0	45.8	14.2	71.1	99	63	11.1	31.2	18.8	61.1
	40			11.7	46.6	14.4	72.7			11.5	31.9	18.9	62.4
	60			12.3	47.5	14.7	74.5			12.3	32.6	19.1	64.1
	80			13.0	48.4	14.9	76.3			13.0	33.4	19.3	65.8
50	20	134	70	12.3	50.9	19.2	82.3	106	70	12.3	34.7	20.9	67.9
	40			13.0	51.8	19.5	84.2			12.8	35.5	21.0	69.3
	60			13.7	52.8	19.7	86.2			13.7	36.3	21.2	71.2
	80			14.4	53.8	20.0	88.2			14.5	37.1	21.5	73.1
55	20	141	77	13.5	55.9	21.1	90.6	113	77	13.6	38.2	23.1	74.9
	40			14.3	57.0	21.4	92.7			14.1	39.0	23.4	76.5
	60			15.1	58.0	21.7	94.8			15.0	39.9	23.7	78.6
	80			15.9	59.2	22.0	97.0			15.9	40.8	24.0	80.8
60	20	148	84	14.7	61.0	23.1	98.8	120	84	14.8	41.6	25.3	81.7
	40			15.6	62.1	23.3	101.1			15.4	42.6	25.5	83.5
	60			16.4	63.3	23.7	103.4			16.4	43.5	25.9	85.8
	80			17.3	64.6	24.0	105.8			17.4	44.6	26.2	88.1
70	20	162	98	17.2	71.2	26.9	115.3	134	98	17.3	48.6	29.5	95.3
	40			18.2	72.5	27.2	117.9			17.9	49.6	29.8	97.4
	60			19.2	73.9	27.6	120.7			19.1	50.8	30.2	100.1
	80			20.2	75.3	28.0	123.5			20.3	52.0	30.5	102.8
80	20	176	112	19.6	81.4	30.7	131.8	148	112	19.7	55.5	33.8	109.1
	40			20.8	82.9	31.1	134.8			20.5	56.7	34.3	111.5
	60			21.9	84.4	31.5	137.9			21.9	58.0	34.7	114.6
	80			23.1	86.1	32.0	141.1			23.2	59.4	35.2	117.8
90	20	189	125	22.1	91.5	34.6	148.2	161	125	22.2	62.5	38.1	122.7
	40			23.4	93.2	35.0	151.6			23.1	63.8	38.6	125.5
	60			24.7	95.0	35.5	155.1			24.6	65.3	39.1	129.0
	80			26.0	96.8	35.9	158.7			26.1	66.8	39.6	132.6
100	20	203	139	24.5	101.7	38.9	165.1	175	139	24.6	69.4	42.3	136.3
	40			26.0	103.6	39.5	169.0			25.6	70.9	42.9	139.4
	60			27.4	105.5	40.1	173.1			27.3	72.5	43.4	143.3
	80			28.8	107.6	40.8	177.2			29.0	74.3	44.1	147.3

400 CHARACTER DATA RECORD

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	20	17	9	1.5	3.9	2.2	7.6	12	9	1.6	1.9	2.3	5.8
	40			1.6	4.0	2.2	7.8			1.6	2.0	2.3	5.9
	60			1.6	4.0	2.3	7.9			1.7	2.0	2.3	6.0
	80			1.7	4.1	2.3	8.1			1.7	2.1	2.4	6.2
10	20	26	18	3.1	7.8	4.5	15.3	21	18	3.1	3.9	4.5	11.5
	40			3.1	7.9	4.5	15.6			3.2	4.0	4.6	11.8
	60			3.2	8.1	4.6	15.9			3.3	4.1	4.7	12.1
	80			3.3	8.3	4.7	16.3			3.4	4.2	4.7	12.3
15	20	54	27	4.6	19.4	6.1	30.0	63	27	4.7	13.2	6.1	23.9
	40			4.7	19.6	6.1	30.5			4.8	13.4	6.1	24.4
	60			4.8	19.9	6.2	30.9			5.0	13.6	6.2	24.8
	80			5.0	20.2	6.3	31.5			5.1	13.9	6.3	25.2
20	20	72	36	6.1	25.8	8.1	40.0	72	36	6.2	17.6	8.1	31.9
	40			6.3	26.2	8.2	40.6			6.4	17.9	8.2	32.5
	60			6.4	26.6	8.3	41.2			6.6	18.2	8.3	33.1
	80			6.7	26.9	8.4	42.0			6.8	18.5	8.4	33.7
25	20	90	45	7.7	32.3	10.1	50.0	81	45	7.8	22.0	13.3	43.1
	40			7.8	32.7	10.2	50.8			8.0	22.3	13.4	43.8
	60			8.0	33.2	10.3	51.6			8.3	22.7	13.5	44.5
	80			8.3	33.7	10.5	52.5			8.5	23.1	13.6	45.2
30	20	108	54	9.2	38.7	12.1	60.1	90	54	9.4	26.4	16.0	51.7
	40			9.4	39.3	12.3	60.9			9.6	26.8	16.1	52.5
	60			9.6	39.8	12.4	61.9			9.9	27.3	16.2	53.4
	80			10.0	40.4	12.6	63.0			10.2	27.7	16.3	54.3
35	20	126	63	10.7	45.2	14.1	70.1	99	63	10.9	30.8	18.7	60.3
	40			11.0	45.8	14.3	71.1			11.2	31.3	18.8	61.3
	60			11.2	46.5	14.5	72.2			11.6	31.8	18.9	62.3
	80			11.7	47.2	14.7	73.5			11.9	32.4	19.1	63.3
40	20	136	72	12.3	51.7	19.6	83.5	108	72	12.5	35.2	21.3	69.0
	40			12.5	52.4	19.8	84.7			12.8	35.7	21.5	70.0
	60			12.8	53.1	20.0	85.9			13.2	36.3	21.6	71.2
	80			13.3	53.9	20.2	87.4			13.6	37.0	21.8	72.3
45	20	145	81	13.8	58.1	22.1	94.0	117	81	14.0	39.6	24.2	77.8
	40			14.1	58.9	22.3	95.3			14.5	40.2	24.4	79.0
	60			14.4	59.7	22.5	96.7			14.9	40.9	24.6	80.4
	80			15.0	60.6	22.7	98.4			15.3	41.6	24.9	81.7
50	20	154	90	15.3	64.6	24.5	104.4	126	90	15.6	43.9	26.9	86.4
	40			15.7	65.5	24.8	105.9			16.1	44.7	27.1	87.8
	60			16.0	66.4	25.0	107.4			16.5	45.4	27.4	89.3
	80			16.7	67.4	25.3	109.3			17.0	46.2	27.6	90.8
55	20	163	99	16.8	71.0	27.0	114.8	135	99	17.2	48.3	29.5	95.1
	40			17.2	72.0	27.2	116.5			17.7	49.1	29.8	96.6
	60			17.6	73.0	27.5	118.2			18.2	50.0	30.1	98.2
	80			18.3	74.1	27.8	120.2			18.7	50.9	30.4	99.9
60	20	172	108	18.4	77.5	29.4	125.3	144	108	18.7	52.7	32.2	103.7
	40			18.8	78.5	29.7	127.1			19.3	53.6	32.5	105.4
	60			19.2	79.7	30.0	128.9			19.8	54.5	32.8	107.1
	80			20.0	80.8	30.3	131.1			20.3	55.5	33.1	109.0
70	20	189	125	21.4	90.4	34.3	146.2	161	125	21.8	61.5	37.8	121.2
	40			21.9	91.6	34.7	148.2			22.5	62.5	38.1	123.2
	60			22.4	92.9	35.0	150.4			23.1	63.6	38.5	125.3
	80			23.3	94.3	35.4	153.0			23.7	64.7	39.0	127.4
80	20	207	143	24.5	103.3	39.6	167.4	179	143	25.0	70.3	43.2	138.5
	40			25.1	104.7	40.1	169.9			25.7	71.5	43.6	140.8
	60			25.7	106.2	40.6	172.5			26.4	72.7	44.0	143.1
	80			26.6	107.8	41.1	175.6			27.1	74.0	44.5	145.6
90	20	225	161	27.6	116.2	44.5	188.3	197	161	28.1	79.1	48.9	156.1
	40			28.2	117.8	45.1	191.1			28.9	80.4	49.4	158.7
	60			28.9	119.5	45.7	194.0			29.7	81.8	50.1	161.5
	80			30.0	121.3	46.3	197.5			30.5	83.2	50.7	164.5
100	20	243	179	30.6	129.2	49.5	209.3	215	179	31.2	87.9	54.3	173.4
	40			31.3	130.9	50.1	212.4			32.1	89.3	54.9	176.4
	60			32.1	132.8	50.7	215.6			33.0	90.9	55.6	179.5
	80			33.3	134.7	51.4	219.4			33.9	92.5	56.3	182.7

500 CHARACTER DATA RECORD

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	20	21	13	1.9	5.2	2.9	10.0	16	13	1.9	2.6	3.0	7.5
	40			1.9	5.2	2.9	10.1			2.0	2.6	3.1	7.6
	60			2.0	5.3	3.0	10.2			2.0	2.7	3.1	7.8
	80			2.0	5.4	3.0	10.4			2.1	2.7	3.2	7.9
10	20	50	25	3.8	17.6	5.3	26.6	61	25	3.9	11.9	5.3	21.0
	40			3.8	17.7	5.3	26.8			3.9	12.0	5.3	21.3
	60			3.9	17.8	5.4	27.1			4.0	12.2	5.4	21.6
	80			4.0	18.0	5.4	27.4			4.1	12.3	5.4	21.8
15	20	76	38	5.7	26.3	7.9	39.9	74	38	5.8	17.9	10.9	34.6
	40			5.8	26.5	8.0	40.3			5.9	18.1	10.9	34.9
	60			5.9	26.8	8.0	40.7			6.0	18.2	11.0	35.3
	80			5.9	27.0	8.1	41.1			6.2	18.4	11.0	35.6
20	20	100	50	7.6	35.1	10.5	53.2	86	50	7.7	23.9	14.5	46.1
	40			7.7	35.4	10.6	53.7			7.9	24.1	14.6	46.5
	60			7.8	35.7	10.7	54.2			8.1	24.3	14.6	47.0
	80			7.9	36.0	10.8	54.8			8.2	24.6	14.7	47.5
25	20	126	63	9.5	43.9	13.2	66.5	99	63	9.6	29.8	18.1	57.6
	40			9.6	44.2	13.3	67.1			9.9	30.1	18.2	58.2
	60			9.8	44.6	13.4	67.8			10.1	30.4	18.3	58.8
	80			9.9	45.0	13.5	68.5			10.3	30.7	18.4	59.4
30	20	139	75	11.3	52.7	19.7	83.8	111	75	11.6	35.8	21.9	69.3
	40			11.5	53.1	19.9	84.5			11.8	36.1	22.0	70.0
	60			11.7	53.5	20.0	85.2			12.1	36.5	22.2	70.7
	80			11.9	54.0	20.2	86.1			12.3	36.9	22.3	71.5
35	20	152	88	13.2	61.4	23.0	97.7	124	88	13.5	41.8	25.6	80.9
	40			13.5	61.9	23.2	98.6			13.8	42.1	25.7	81.7
	60			13.7	62.5	23.3	99.5			14.1	42.6	25.9	82.5
	80			13.9	63.0	23.5	100.4			14.4	43.0	26.0	83.4
40	20	164	100	15.1	70.2	26.3	111.7	136	100	15.4	47.7	29.2	92.4
	40			15.4	70.8	26.5	112.6			15.8	48.2	29.4	93.3
	60			15.6	71.4	26.7	113.7			16.1	48.7	29.5	94.3
	80			15.9	72.0	26.9	114.7			16.5	49.2	29.7	95.4
45	20	177	113	17.0	79.0	29.6	125.6	149	113	17.4	53.7	33.0	104.1
	40			17.3	79.6	29.8	126.7			17.7	54.2	33.2	105.1
	60			17.6	80.3	30.0	127.9			18.1	54.7	33.4	106.3
	80			17.8	81.0	30.2	129.1			18.5	55.3	33.6	107.5
50	20	189	125	18.9	87.8	32.9	139.6	161	125	19.3	59.6	36.7	115.7
	40			19.2	88.5	33.1	140.8			19.7	60.2	36.9	116.8
	60			19.5	89.2	33.4	142.1			20.1	60.8	37.1	118.1
	80			19.8	90.0	33.6	143.4			20.6	61.5	37.4	119.4
55	20	202	138	20.8	96.5	36.5	153.8	174	138	21.2	65.6	40.4	127.2
	40			21.1	97.3	36.8	155.2			21.7	66.2	40.6	128.5
	60			21.5	98.1	37.1	156.7			22.2	66.9	40.8	129.9
	80			21.8	99.0	37.4	158.3			22.6	67.6	41.1	131.4
60	20	214	150	22.7	105.3	39.8	167.8	186	150	23.1	71.6	44.2	139.0
	40			23.1	106.1	40.1	169.4			23.7	72.2	44.5	140.4
	60			23.4	107.1	40.5	171.0			24.2	73.0	44.8	142.0
	80			23.8	108.0	40.8	172.7			24.7	73.8	45.2	143.7
65	20	227	163	24.6	114.1	43.1	181.8	199	163	25.1	77.5	47.9	150.5
	40			25.0	115.0	43.5	183.5			25.6	78.3	48.2	152.1
	60			25.4	116.0	43.9	185.2			26.2	79.1	48.6	153.8
	80			25.8	117.0	44.2	187.0			26.7	79.9	48.9	155.6
70	20	239	175	26.5	122.9	46.4	195.8	211	175	27.0	83.5	51.6	162.1
	40			26.9	123.8	46.8	197.6			27.6	84.3	51.9	163.8
	60			27.3	124.9	47.2	199.5			28.2	85.1	52.3	165.7
	80			27.7	126.0	47.6	201.4			28.8	86.1	52.7	167.6
75	20	247	192	28.4	131.7	49.8	209.8	224	188	28.9	89.5	55.3	173.7
	40			28.8	132.7	50.2	211.7			29.6	90.3	55.7	175.5
	60			29.3	133.8	50.6	213.7			30.2	91.2	56.0	177.5
	80			29.7	135.0	51.0	215.8			30.9	92.2	56.5	179.6

750 CHARACTER DATA RECORD

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

		40K CORE STORAGE						60K/80K CORE STORAGE					
		CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
FILE SIZE	CW LNG	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	20	29	21	3.0	8.5	4.6	16.1	57	21	3.0	9.8	4.1	16.9
	40			3.0	8.5	4.6	16.1			3.0	9.8	4.1	17.0
	60			3.0	8.5	4.7	16.2			3.0	9.8	4.1	17.0
	80			3.0	8.5	4.7	16.2			3.0	9.9	4.2	17.1
10	20	84	42	6.1	28.9	8.2	43.2	78	42	6.1	19.6	11.8	37.4
	40			6.1	28.9	8.2	43.3			6.1	19.6	11.8	37.5
	60			6.1	29.0	8.3	43.4			6.1	19.7	11.8	37.5
	80			6.1	29.0	8.4	43.4			6.1	19.7	11.8	37.6
15	20	126	63	9.1	43.4	12.3	64.8	99	63	9.1	29.4	17.6	56.2
	40			9.1	43.4	12.4	64.9			9.1	29.4	17.7	56.2
	60			9.1	43.5	12.4	65.0			9.1	29.5	17.7	56.3
	80			9.1	43.5	12.5	65.2			9.1	29.6	17.7	56.4
20	20	148	84	12.2	57.8	21.1	91.0	120	84	12.2	39.2	23.8	75.2
	40			12.2	57.9	21.1	91.2			12.2	39.3	23.8	75.3
	60			12.2	58.0	21.2	91.3			12.2	39.3	23.9	75.3
	80			12.2	58.0	21.3	91.5			12.2	39.4	23.9	75.5
25	20	169	105	15.2	72.3	26.3	113.8	141	105	15.2	49.0	29.7	94.0
	40			15.2	72.4	26.4	114.0			15.2	49.1	29.8	94.1
	60			15.2	72.4	26.5	114.2			15.2	49.1	29.9	94.2
	80			15.2	72.5	26.6	114.3			15.2	49.3	29.9	94.4
30	20	189	125	18.2	86.8	31.6	136.6	161	125	18.2	58.8	35.9	113.0
	40			18.2	86.8	31.7	136.8			18.2	58.9	36.0	113.1
	60			18.2	86.9	31.8	137.0			18.2	59.0	36.1	113.3
	80			18.2	87.0	32.0	137.2			18.2	59.1	36.2	113.5
40	20	231	167	24.3	115.7	42.5	182.5	203	167	24.3	78.4	48.1	150.8
	40			24.3	115.8	42.7	182.8			24.3	78.5	48.2	151.0
	60			24.3	115.9	42.9	183.2			24.3	78.6	48.3	151.2
	80			24.3	116.0	43.1	183.5			24.3	78.8	48.5	151.6
45	20	250	192	27.6	131.2	48.2	207.0	225	189	27.6	89.0	54.5	171.1
	40			27.6	131.3	48.5	207.3			27.6	89.0	54.7	171.3
	60			27.6	131.4	48.7	207.7			27.6	89.1	54.8	171.5
	80			27.6	131.6	48.9	208.1			27.6	89.4	55.0	171.9

1000 CHARACTER DATA RECORD

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

		40K CORE STORAGE						60K/80K CORE STORAGE					
		CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
FILE SIZE	CW LNG	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	20	64	32	4.4	21.5	5.8	31.6	68	32	4.4	14.6	5.8	24.8
	40			4.4	21.5	5.8	31.7			4.4	14.6	5.8	24.8
	60			4.4	21.5	5.8	31.7			4.4	14.6	5.8	24.9
	80			4.4	21.5	5.9	31.8			4.4	14.6	5.9	24.9
10	20	126	63	8.8	42.9	11.6	63.3	99	63	8.8	29.2	17.0	55.0
	40			8.8	43.0	11.6	63.4			8.8	29.2	17.0	55.0
	60			8.8	43.0	11.7	63.5			8.8	29.3	17.1	55.1
	80			8.8	43.1	11.7	63.6			8.8	29.3	17.1	55.1
15	20	158	94	13.2	64.4	22.7	100.3	130	94	13.2	43.8	26.1	83.1
	40			13.2	64.5	22.8	100.4			13.2	43.8	26.1	83.1
	60			13.2	64.5	22.8	100.5			13.2	43.9	26.1	83.2
	80			13.2	64.6	22.9	100.6			13.2	43.9	26.2	83.3
20	20	189	125	17.6	85.9	30.3	133.7	161	125	17.6	58.4	35.2	111.2
	40			17.6	86.0	30.3	133.9			17.6	58.4	35.2	111.3
	60			17.6	86.0	30.4	134.0			17.6	58.5	35.3	111.3
	80			17.6	86.1	30.5	134.2			17.6	58.6	35.3	111.4
25	20	221	157	22.0	107.3	38.5	167.8	193	157	22.0	73.0	44.4	139.3
	40			22.0	107.4	38.6	168.0			22.0	73.1	44.4	139.4
	60			22.0	107.6	38.7	168.2			22.0	73.1	44.4	139.5
	80			22.0	107.7	38.8	168.4			22.0	73.2	44.4	139.6
30	20	247	192	26.4	128.8	46.2	201.3	224	188	26.4	87.6	53.2	167.2
	40			26.4	128.9	46.3	201.6			26.4	87.7	53.3	167.3
	60			26.4	129.1	46.4	201.9			26.4	87.8	53.3	167.4
	80			26.4	129.2	46.6	202.1			26.4	87.8	53.3	167.5

1500 CHARACTER DATA RECORD

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

		40K CORE STORAGE						60K/80K CORE STORAGE					
		CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
FILE SIZE	CW LNG	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
1	20	21	13	1.6	4.7	2.1	8.4	16	13	1.6	2.4	2.1	6.1
	40			1.6	4.7	2.1	8.4			1.6	2.4	2.1	6.1
	60			1.6	4.7	2.1	8.4			1.6	2.4	2.1	6.1
	80			1.6	4.7	2.1	8.4			1.6	2.4	2.1	6.1
2	20	50	25	3.2	14.1	4.1	21.5	61	25	3.2	9.4	4.1	16.8
	40			3.2	14.2	4.1	21.5			3.2	9.4	4.1	16.8
	60			3.2	14.2	4.1	21.6			3.2	9.4	4.1	16.8
	80			3.2	14.2	4.2	21.6			3.2	9.5	4.2	16.9
3	20	76	38	4.9	21.2	6.2	32.2	74	38	4.9	14.1	6.2	25.2
	40			4.9	21.2	6.2	32.3			4.9	14.2	6.2	25.2
	60			4.9	21.3	6.2	32.3			4.9	14.2	6.2	25.3
	80			4.9	21.3	6.2	32.4			4.9	14.2	6.3	25.3
4	20	100	50	6.5	28.3	8.2	43.0	86	50	6.5	18.8	8.3	33.6
	40			6.5	28.3	8.3	43.1			6.5	18.9	8.3	33.7
	60			6.5	28.3	8.3	43.1			6.5	18.9	8.3	33.7
	80			6.5	28.4	8.3	43.2			6.5	18.9	8.4	33.8
5	20	126	63	8.1	35.3	10.3	53.7	99	63	8.1	23.6	10.3	42.0
	40			8.1	35.4	10.3	53.8			8.1	23.6	10.4	42.1
	60			8.1	35.4	10.4	53.9			8.1	23.6	10.4	42.1
	80			8.1	35.5	10.4	54.0			8.1	23.7	10.5	42.2
10	20	189	125	16.2	70.7	20.6	107.5	161	125	16.2	47.1	20.7	84.1
	40			16.2	70.8	20.7	107.7			16.2	47.2	20.8	84.3
	60			16.2	70.9	20.8	107.9			16.2	47.2	21.0	84.4
	80			16.2	71.0	20.9	108.1			16.2	47.3	21.1	84.6
15	20	247	192	24.4	106.0	31.0	161.4	224	188	24.4	70.7	31.1	126.1
	40			24.4	106.2	31.2	161.7			24.4	70.8	31.3	126.4
	60			24.4	106.3	31.4	162.0			24.4	70.9	31.4	126.7
	80			24.4	106.4	31.5	162.3			24.4	71.0	31.6	126.9

2000 CHARACTER DATA RECORD

INPUT AND OUTPUT 729 IV TAPES - 556 CPI

		40K CORE STORAGE						60K/80K CORE STORAGE					
		CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
FILE SIZE	CW LNG	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
1	20	21	13	1.8	4.7	2.3	8.8	16	13	1.8	2.4	2.3	6.4
	40			1.8	4.7	2.3	8.8			1.8	2.4	2.3	6.4
	60			1.8	4.7	2.3	8.8			1.8	2.4	2.3	6.4
	80			1.8	4.7	2.3	8.8			1.8	2.4	2.3	6.5
2	20	50	25	3.5	14.1	4.6	22.2	61	25	3.5	9.4	4.6	17.5
	40			3.5	14.2	4.6	22.2			3.5	9.4	4.6	17.5
	60			3.5	14.2	4.6	22.3			3.5	9.4	4.6	17.6
	80			3.5	14.2	4.6	22.3			3.5	9.5	4.6	17.6
3	20	76	38	5.3	21.2	6.8	33.3	74	38	5.3	14.1	6.9	26.3
	40			5.3	21.2	6.9	33.4			5.3	14.2	6.9	26.3
	60			5.3	21.3	6.9	33.4			5.3	14.2	6.9	26.4
	80			5.3	21.3	6.9	33.5			5.3	14.2	7.0	26.4
4	20	100	50	7.0	28.3	9.1	44.4	86	50	7.0	18.8	9.2	35.0
	40			7.0	28.3	9.2	44.5			7.0	18.9	9.2	35.1
	60			7.0	28.3	9.2	44.6			7.0	18.9	9.2	35.2
	80			7.0	28.4	9.2	44.6			7.0	18.9	9.3	35.2
5	20	126	63	8.8	35.3	11.4	55.5	99	63	8.8	23.6	11.4	43.8
	40			8.8	35.4	11.4	55.6			8.8	23.6	11.5	43.9
	60			8.8	35.4	11.5	55.7			8.8	23.6	11.5	43.9
	80			8.8	35.5	11.5	55.8			8.8	23.7	11.6	44.0
10	20	189	125	17.6	70.7	22.9	111.1	161	125	17.6	47.1	23.0	87.7
	40			17.6	70.8	23.0	111.3			17.6	47.2	23.1	87.8
	60			17.6	70.9	23.1	111.5			17.6	47.2	23.2	88.0
	80			17.6	71.0	23.2	111.7			17.6	47.3	23.3	88.2
15	20	247	192	26.4	106.0	34.4	166.8	224	188	26.4	70.7	34.4	131.5
	40			26.4	106.2	34.6	167.1			26.4	70.8	34.6	131.8
	60			26.4	106.3	34.7	167.4			26.4	70.9	34.8	132.0
	80			26.4	106.4	34.9	167.7			26.4	71.0	35.0	132.3

20 CHARACTER DATA RECORD

INPUT AND OUTPUT 7330 TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	5	2	1	.7	.3	.2	1.2	1	1	.7	.0	.3	1.0
	10			.7	.3	.2	1.3			.8	.0	.3	1.0
	15			.8	.3	.3	1.3			.8	.0	.3	1.1
10	5	2	1	1.4	.6	.5	2.4	1	1	1.5	.0	.6	2.0
	10			1.4	.6	.5	2.5			1.6	.0	.6	2.1
	15			1.5	.6	.5	2.6			1.6	.0	.7	2.2
20	5	3	2	2.7	1.1	1.1	5.0	4	2	3.0	1.3	1.0	5.2
	10			2.9	1.2	1.1	5.2			3.1	1.4	1.0	5.5
	15			3.0	1.2	1.1	5.4			3.3	1.4	1.0	5.7
30	5	4	3	4.1	1.7	1.7	7.6	6	3	4.5	1.9	1.4	7.8
	10			4.3	1.8	1.8	7.9			4.7	2.0	1.5	8.2
	15			4.5	1.8	1.9	8.2			4.9	2.1	1.5	8.5
40	5	12	4	5.5	4.6	1.9	12.0	7	4	5.9	2.6	2.2	10.7
	10			5.7	4.7	2.0	12.5			6.2	2.7	2.2	11.2
	15			6.0	4.9	2.0	13.0			6.5	2.8	2.3	11.6
50	5	13	5	6.9	5.7	2.4	15.0	8	5	7.4	3.2	2.7	13.4
	10			7.2	5.9	2.5	15.6			7.8	3.4	2.8	14.0
	15			7.5	6.2	2.5	16.2			8.2	3.5	2.9	14.5
75	5	15	7	10.3	8.6	3.6	22.5	10	7	11.1	4.9	4.4	20.4
	10			10.8	8.9	3.7	23.4			11.7	5.1	4.5	21.3
	15			11.3	9.2	3.8	24.3			12.2	5.3	4.7	22.2
100	5	17	9	13.7	11.4	5.4	30.6	12	9	14.9	6.5	5.8	27.2
	10			14.4	11.9	5.6	31.8			15.6	6.8	6.0	28.4
	15			15.0	12.3	5.7	33.1			16.3	7.0	6.2	29.6
125	5	20	12	17.2	14.3	6.8	38.2	15	12	18.6	8.1	7.6	34.3
	10			18.0	14.8	7.0	39.8			19.5	8.4	7.9	35.8
	15			18.8	15.4	7.2	41.3			20.4	8.8	8.2	37.4
150	5	22	14	20.6	17.1	8.1	45.8	17	14	22.3	9.7	9.7	41.7
	10			21.6	17.8	8.4	47.7			23.4	10.1	10.1	43.6
	15			22.5	18.5	8.6	49.6			24.5	10.5	10.5	45.5
175	5	24	16	24.0	20.0	9.5	53.5	19	16	26.0	11.3	11.3	48.7
	10			25.2	20.8	9.8	55.7			27.3	11.8	11.8	50.9
	15			26.3	21.6	10.1	57.9			28.5	12.3	12.3	53.1
200	5	26	18	27.5	22.8	11.6	62.0	21	18	29.7	13.0	13.0	55.6
	10			28.7	23.7	12.1	64.5			31.2	13.5	13.5	58.2
	15			30.0	24.6	12.5	67.1			32.6	14.1	14.1	60.7
250	5	31	23	34.3	28.6	14.5	77.4	59	23	37.1	32.6	12.1	81.8
	10			35.9	29.7	15.1	80.7			38.9	33.9	12.3	85.2
	15			37.5	30.8	15.6	83.9			40.8	35.3	12.6	88.7
300	5	54	27	41.2	51.7	14.5	107.4	63	27	44.6	39.1	14.5	98.1
	10			43.1	53.7	14.8	111.6			46.7	40.7	14.8	102.3
	15			45.0	55.7	15.1	115.9			48.9	42.4	15.1	106.4
350	5	64	32	48.1	60.3	16.9	125.3	68	32	52.0	45.6	16.9	114.5
	10			50.3	62.7	17.3	130.3			54.5	47.5	17.3	119.3
	15			52.5	65.0	17.7	135.2			57.1	49.4	17.7	124.2
400	5	72	36	54.9	69.0	19.3	143.2	72	36	59.4	52.1	19.3	130.8
	10			57.5	71.6	19.7	148.9			62.3	54.3	19.7	136.3
	15			60.0	74.3	20.2	154.5			65.2	56.5	20.2	141.9

30 CHARACTER DATA RECORD

INPUT AND OUTPUT 7330 TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	5	2	1	.7	.3	.3	1.3	1	1	.7	.0	.3	1.0
	10			.7	.3	.3	1.4			.8	.0	.4	1.1
	15			.8	.3	.3	1.4			.8	.0	.4	1.1
	20			.8	.4	.3	1.5			.8	.0	.4	1.2
10	5	3	2	1.4	.7	.6	2.7	2	1	1.5	.0	.8	2.2
	10			1.5	.7	.7	2.8			1.5	.0	.8	2.3
	15			1.6	.7	.7	2.9			1.6	.0	.8	2.4
	20			1.6	.7	.7	3.0			1.7	.0	.8	2.5
20	5	4	3	2.9	1.3	1.4	5.5	6	3	2.9	1.5	1.2	5.6
	10			3.0	1.3	1.4	5.7			3.1	1.5	1.2	5.8
	15			3.1	1.4	1.4	6.0			3.2	1.6	1.2	6.0
	20			3.2	1.4	1.5	6.2			3.3	1.6	1.2	6.2
30	5	13	5	4.3	3.9	1.8	10.0	8	5	4.4	2.2	1.9	8.5
	10			4.5	4.1	1.8	10.3			4.6	2.3	2.0	8.9
	15			4.7	4.2	1.8	10.7			4.8	2.4	2.0	9.2
	20			4.8	4.3	1.9	11.0			5.0	2.4	2.1	9.5
40	5	14	6	5.7	5.2	2.3	13.3	9	6	5.8	2.9	2.6	11.4
	10			6.0	5.4	2.4	13.8			6.1	3.0	2.7	11.8
	15			6.2	5.6	2.4	14.2			6.4	3.1	2.7	12.3
	20			6.5	5.8	2.5	14.7			6.7	3.3	2.8	12.7
50	5	15	7	7.2	6.5	2.9	16.6	10	7	7.3	3.7	3.4	14.4
	10			7.5	6.8	3.0	17.2			7.6	3.8	3.5	15.0
	15			7.8	7.0	3.0	17.8			8.0	3.9	3.7	15.6
	20			8.1	7.2	3.1	18.4			8.3	4.1	3.8	16.1
75	5	19	11	10.8	9.8	4.9	25.4	14	11	11.0	5.5	5.4	21.8
	10			11.2	10.2	5.0	26.3			11.5	5.7	5.5	22.7
	15			11.7	10.5	5.1	27.3			12.0	5.9	5.7	23.6
	20			12.1	10.8	5.2	28.2			12.5	6.1	5.9	24.5
100	5	22	14	14.3	13.1	6.5	33.9	17	14	14.6	7.3	7.5	29.5
	10			14.9	13.5	6.6	35.1			15.3	7.6	7.8	30.7
	15			15.6	14.0	6.8	36.3			16.0	7.9	8.1	31.9
	20			16.2	14.4	7.0	37.6			16.6	8.1	8.4	33.1
125	5	25	17	17.9	16.4	8.6	42.9	20	17	18.3	9.1	9.4	36.8
	10			18.7	16.9	8.9	44.5			19.1	9.5	9.8	38.3
	15			19.4	17.5	9.1	46.0			20.0	9.8	10.1	39.9
	20			20.2	18.0	9.4	47.6			20.8	10.2	10.5	41.4
150	5	29	21	21.5	19.6	10.3	51.5	57	21	21.9	22.2	8.8	52.8
	10			22.4	20.3	10.6	53.4			22.9	23.0	8.9	54.8
	15			23.3	21.0	10.9	55.3			23.9	23.8	9.1	56.8
	20			24.2	21.7	11.3	57.2			25.0	24.6	9.3	58.8
175	5	32	24	25.1	22.9	12.0	60.0	60	24	25.6	25.9	10.2	61.6
	10			26.2	23.7	12.4	62.3			26.8	26.8	10.4	64.0
	15			27.2	24.5	12.8	64.5			27.9	27.8	10.6	66.3
	20			28.3	25.3	13.1	66.7			29.1	28.7	10.8	68.6
200	5	54	27	28.7	39.7	11.7	80.1	63	27	29.2	29.5	11.7	70.5
	10			29.9	41.1	11.9	82.9			30.6	30.6	11.9	73.1
	15			31.1	42.4	12.1	85.6			31.9	31.7	12.1	75.8
	20			32.3	43.7	12.4	88.4			33.3	32.8	12.4	78.4
250	5	68	34	35.9	49.7	14.6	100.1	70	34	36.5	36.9	14.6	88.1
	10			37.4	51.3	14.9	103.6			38.2	38.3	14.9	91.4
	15			38.9	53.0	15.2	107.0			39.9	39.6	15.2	94.7
	20			40.4	54.6	15.4	110.5			41.6	41.0	15.4	98.0
300	5	82	41	43.0	59.6	17.5	120.1	77	41	43.8	44.3	20.1	108.3
	10			44.8	61.6	17.9	124.3			45.9	45.9	20.6	112.4
	15			46.7	63.6	18.2	128.4			47.9	47.6	21.1	116.6
	20			48.5	65.6	18.5	132.6			49.9	49.2	21.6	120.7
350	5	96	48	50.2	69.5	20.4	140.2	84	48	51.1	51.7	23.5	126.4
	10			52.3	71.8	20.8	145.0			53.5	53.6	24.1	131.2
	15			54.4	74.2	21.2	149.8			55.9	55.5	24.6	136.0
	20			56.6	76.5	21.6	154.7			58.2	57.4	25.2	140.8
400	5	108	54	57.4	79.5	23.4	160.2	90	54	58.5	59.1	26.9	144.4
	10			59.8	82.1	23.8	165.7			61.2	61.3	27.5	149.9
	15			62.2	84.8	24.3	171.2			63.9	63.4	28.1	155.4
	20			64.7	87.4	24.7	176.8			66.6	65.6	28.8	160.9

40 CHARACTER DATA RECORD

INPUT AND OUTPUT 7330 TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	5	2	1	.7	.4	.3	1.4	1	1	.7	.0	.4	1.1
	10			.8	.4	.3	1.5			.8	.0	.4	1.1
	15			.8	.4	.4	1.5			.8	.0	.4	1.2
	20			.8	.4	.4	1.6			.8	.0	.4	1.2
10	5	3	2	1.4	.7	.7	2.9	4	2	1.5	.8	.7	3.0
	10			1.5	.8	.8	3.0			1.5	.8	.7	3.1
	15			1.6	.8	.8	3.1			1.6	.9	.7	3.2
	20			1.6	.8	.8	3.2			1.7	.9	.7	3.3
20	5	12	4	2.9	2.9	1.4	7.2	7	4	2.9	1.6	1.5	6.1
	10			3.0	3.0	1.4	7.4			3.1	1.7	1.5	6.3
	15			3.1	3.1	1.4	7.7			3.2	1.7	1.6	6.5
	20			3.2	3.2	1.4	7.9			3.3	1.8	1.6	6.7
30	5	14	6	4.3	4.4	2.1	10.8	9	6	4.4	2.4	2.3	9.1
	10			4.5	4.6	2.1	11.2			4.6	2.5	2.3	9.4
	15			4.7	4.7	2.1	11.5			4.8	2.6	2.4	9.8
	20			4.9	4.8	2.2	11.9			5.0	2.7	2.4	10.1
40	5	16	8	5.8	5.9	2.7	14.4	11	8	5.9	3.2	3.2	12.3
	10			6.0	6.1	2.8	14.9			6.1	3.4	3.3	12.8
	15			6.3	6.3	2.8	15.3			6.4	3.5	3.3	13.2
	20			6.5	6.4	2.9	15.8			6.7	3.6	3.4	13.7
50	5	17	9	7.2	7.4	3.8	18.4	12	9	7.4	4.1	4.0	15.4
	10			7.5	7.6	3.8	19.0			7.7	4.2	4.1	16.0
	15			7.8	7.8	3.9	19.6			8.0	4.3	4.2	16.5
	20			8.1	8.0	4.0	20.2			8.3	4.5	4.3	17.1
75	5	22	14	10.9	11.1	5.6	27.6	17	14	11.0	6.1	6.4	23.6
	10			11.3	11.4	5.8	28.5			11.5	6.3	6.6	24.5
	15			11.7	11.7	5.9	29.4			12.0	6.5	6.9	25.4
	20			12.2	12.1	6.0	30.3			12.5	6.7	7.1	26.3
100	5	26	18	14.5	14.7	7.9	37.2	21	18	14.7	8.1	8.6	31.4
	10			15.1	15.2	8.1	38.4			15.4	8.4	8.9	32.6
	15			15.7	15.6	8.3	39.6			16.0	8.7	9.1	33.8
	20			16.2	16.1	8.6	40.9			16.6	8.9	9.4	35.0
125	5	31	23	18.1	18.4	9.9	46.5	59	23	18.4	20.7	8.6	47.6
	10			18.8	19.0	10.2	48.0			19.2	21.3	8.7	49.2
	15			19.6	19.6	10.4	49.6			20.0	22.0	8.8	50.8
	20			20.3	20.1	10.7	51.1			20.8	22.7	9.0	52.5
150	5	54	27	21.7	33.8	10.3	65.8	63	27	22.1	24.8	10.3	57.2
	10			22.6	34.7	10.4	67.8			23.1	25.6	10.4	59.1
	15			23.5	35.7	10.6	69.8			24.0	26.4	10.6	61.0
	20			24.4	36.7	10.8	71.8			25.0	27.2	10.8	63.0
175	5	64	32	25.4	39.4	12.0	76.7	68	32	25.8	28.9	12.0	66.7
	10			26.4	40.5	12.2	79.1			26.9	29.9	12.2	68.9
	15			27.4	41.7	12.4	81.4			28.0	30.8	12.4	71.2
	20			28.4	42.8	12.6	83.8			29.1	31.7	12.6	73.4
200	5	72	36	29.0	45.0	13.7	87.7	72	36	29.5	33.0	13.7	76.2
	10			30.1	46.3	13.9	90.4			30.7	34.1	13.9	78.8
	15			31.3	47.6	14.1	93.1			32.0	35.2	14.1	81.4
	20			32.5	48.9	14.4	95.8			33.3	36.3	14.4	83.9
250	5	90	45	36.2	56.3	17.1	109.6	81	45	36.8	41.3	19.8	97.9
	10			37.7	57.9	17.4	113.0			38.4	42.6	20.2	101.2
	15			39.1	59.5	17.7	116.3			40.0	44.0	20.6	104.6
	20			40.6	61.2	18.0	119.7			41.6	45.3	21.0	107.9
300	5	108	54	43.5	67.5	20.5	131.5	90	54	44.2	49.6	23.7	117.5
	10			45.2	69.5	20.9	135.6			46.1	51.2	24.2	121.5
	15			47.0	71.4	21.2	139.6			48.0	52.8	24.7	125.5
	20			48.7	73.4	21.6	143.7			49.9	54.4	25.1	129.5
350	5	126	63	50.7	78.8	24.0	153.4	99	63	51.6	57.8	27.7	137.1
	10			52.7	81.0	24.4	158.2			53.8	59.7	28.2	141.7
	15			54.8	83.3	24.8	162.9			56.0	61.6	28.8	146.4
	20			56.8	85.6	25.2	167.6			58.3	63.5	29.3	151.1
400	5	136	72	58.0	90.0	30.9	178.9	108	72	58.9	66.1	31.7	156.7
	10			60.3	92.6	31.6	184.5			61.5	68.2	32.3	162.0
	15			62.6	95.2	32.2	190.1			64.0	70.4	32.9	167.3
	20			64.9	97.9	32.9	195.7			66.6	72.5	33.5	172.6

50 CHARACTER DATA RECORD

INPUT AND OUTPUT 7330 TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	3	2	.8	.4	.4	1.6	2	1	.8	.0	.5	1.2
	20			.8	.4	.4	1.7			.9	.0	.5	1.3
	30			.9	.5	.5	1.8			.9	.0	.5	1.4
	40			.9	.5	.5	1.9			1.0	.0	.6	1.5
10	10	4	3	1.5	.8	.9	3.3	6	3	1.6	.9	.8	3.3
	20			1.7	.9	.9	3.5			1.7	1.0	.8	3.5
	30			1.8	.9	1.0	3.7			1.8	1.0	.8	3.7
	40			1.9	1.0	1.0	3.9			2.0	1.1	.9	3.9
20	10	13	5	3.1	3.4	1.6	8.0	8	5	3.2	1.8	1.8	6.8
	20			3.3	3.6	1.6	8.5			3.4	2.0	1.8	7.2
	30			3.5	3.7	1.7	8.9			3.7	2.1	1.9	7.6
	40			3.8	3.9	1.7	9.4			3.9	2.2	2.0	8.0
30	10	15	7	4.6	5.1	2.4	12.1	10	7	4.8	2.8	2.8	10.3
	20			5.0	5.3	2.5	12.7			5.1	2.9	2.9	11.0
	30			5.3	5.6	2.5	13.4			5.5	3.1	3.0	11.6
	40			5.6	5.9	2.6	14.1			5.9	3.3	3.1	12.3
40	10	17	9	6.2	6.7	3.5	16.4	12	9	6.3	3.7	3.7	13.7
	20			6.6	7.1	3.6	17.3			6.8	3.9	3.9	14.6
	30			7.1	7.5	3.8	18.3			7.3	4.1	4.0	15.5
	40			7.5	7.8	3.9	19.2			7.8	4.3	4.2	16.4
50	10	20	12	7.7	8.4	4.4	20.5	15	12	7.9	4.6	4.8	17.3
	20			8.3	8.9	4.5	21.7			8.6	4.9	5.0	18.4
	30			8.8	9.3	4.7	22.9			9.2	5.2	5.2	19.5
	40			9.4	9.8	4.9	24.0			9.8	5.4	5.4	20.7
75	10	25	17	11.5	12.7	6.9	31.1	20	17	11.9	6.9	7.1	26.0
	20			12.4	13.3	7.2	32.9			12.8	7.3	7.5	27.6
	30			13.2	14.0	7.5	34.7			13.8	7.7	7.8	29.3
	40			14.1	14.7	7.8	36.6			14.7	8.2	8.2	31.0
100	10	31	23	15.4	16.9	9.2	41.4	59	23	15.9	18.8	8.0	42.7
	20			16.5	17.8	9.6	43.9			17.1	19.9	8.2	45.2
	30			17.6	18.7	10.0	46.3			18.3	21.0	8.4	47.7
	40			18.8	19.6	10.5	48.8			19.6	22.1	8.7	50.3
125	10	56	28	19.2	32.3	10.0	61.5	64	28	19.8	23.6	10.0	53.4
	20			20.6	33.9	10.3	64.8			21.4	24.9	10.3	56.5
	30			22.0	35.6	10.5	68.1			22.9	26.2	10.5	59.7
	40			23.4	37.2	10.8	71.5			24.5	27.6	10.8	62.8
150	10	68	34	23.1	38.8	12.0	73.8	70	34	23.8	28.3	12.0	64.0
	20			24.8	40.7	12.3	77.8			25.7	29.9	12.3	67.8
	30			26.4	42.7	12.6	81.8			27.5	31.5	12.6	71.6
	40			28.1	44.6	13.0	85.8			29.3	33.1	13.0	75.4
175	10	80	40	26.9	45.2	14.0	86.1	76	40	27.8	33.0	16.3	77.0
	20			28.9	47.5	14.4	90.7			29.9	34.8	16.8	81.6
	30			30.8	49.8	14.8	95.4			32.1	36.7	17.3	86.1
	40			32.8	52.1	15.1	100.1			34.2	38.6	17.9	90.7
200	10	90	45	30.8	51.7	15.9	98.4	81	45	31.7	37.7	18.6	88.0
	20			33.0	54.3	16.4	103.7			34.2	39.8	19.2	93.2
	30			35.3	56.9	16.9	109.0			36.7	42.0	19.8	98.5
	40			37.5	59.5	17.3	114.3			39.1	44.1	20.4	103.7
250	10	112	56	38.4	64.6	19.9	123.0	92	56	39.7	47.1	23.2	110.0
	20			41.3	67.9	20.5	129.6			42.8	49.8	24.0	116.5
	30			44.1	71.1	21.1	136.3			45.8	52.5	24.8	123.1
	40			46.9	74.4	21.6	142.9			48.9	55.1	25.5	129.6
300	10	131	67	46.1	77.5	27.1	150.8	103	67	47.6	56.5	27.9	132.1
	20			49.5	81.4	28.1	159.0			51.3	59.7	28.8	139.9
	30			52.9	85.4	29.0	167.3			55.0	62.9	29.7	147.7
	40			56.3	89.3	30.0	175.6			58.7	66.2	30.7	155.5
350	10	143	79	53.8	90.5	31.7	175.9	115	79	55.6	66.0	34.0	155.5
	20			57.8	95.0	32.8	185.5			59.9	69.7	35.3	164.9
	30			61.7	99.6	33.9	195.2			64.2	73.4	36.7	174.3
	40			65.6	104.2	35.0	204.8			68.5	77.2	38.1	183.8
400	10	154	90	61.5	103.4	36.2	201.1	126	90	63.5	75.4	38.8	177.7
	20			66.0	108.6	37.4	212.0			68.4	79.6	40.4	188.4
	30			70.5	113.8	38.7	223.0			73.3	83.9	42.0	199.2
	40			75.0	119.1	40.0	234.1			78.3	88.2	43.5	210.0

60 CHARACTER DATA RECORD

INPUT AND OUTPUT 7330 TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	40K CORE STORAGE						60K/80K CORE STORAGE					
		CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	3	2	.8	.5	.5	1.7	2	1	.8	.0	.5	1.3
	20			.8	.5	.5	1.8			.9	.0	.6	1.4
	30			.9	.5	.5	1.9			.9	.0	.6	1.5
	40			.9	.5	.5	2.0			1.0	.0	.6	1.6
10	10	4	3	1.6	.9	1.0	3.5	6	3	1.7	1.0	.9	3.6
	20			1.7	1.0	1.1	3.7			1.8	1.1	.9	3.8
	30			1.8	1.0	1.1	3.9			1.9	1.1	.9	4.0
	40			1.9	1.1	1.1	4.1			2.0	1.2	1.0	4.2
20	10	14	6	3.1	3.7	1.8	8.7	9	6	3.3	2.0	2.0	7.4
	20			3.3	3.9	1.9	9.1			3.5	2.1	2.1	7.7
	30			3.6	4.1	1.9	9.5			3.8	2.2	2.1	8.1
	40			3.8	4.3	1.9	10.0			4.0	2.3	2.2	8.6
30	10	17	9	4.7	5.6	3.0	13.3	12	9	5.0	3.0	3.1	11.2
	20			5.0	5.9	3.1	13.9			5.3	3.2	3.2	11.7
	30			5.3	6.1	3.2	14.6			5.7	3.4	3.4	12.4
	40			5.6	6.4	3.3	15.3			6.0	3.5	3.5	13.0
40	10	19	11	6.3	7.5	4.0	17.7	14	11	6.7	4.0	4.3	15.0
	20			6.7	7.8	4.1	18.6			7.1	4.3	4.4	15.8
	30			7.1	8.2	4.2	19.5			7.6	4.5	4.6	16.7
	40			7.5	8.5	4.3	20.4			8.0	4.7	4.8	17.5
50	10	22	14	7.9	9.3	4.9	22.1	17	14	8.4	5.1	5.5	18.9
	20			8.3	9.8	5.1	23.2			8.8	5.3	5.8	20.0
	30			8.9	10.2	5.3	24.4			9.4	5.6	6.1	21.1
	40			9.4	10.7	5.4	25.5			10.1	5.9	6.3	22.3
75	10	29	21	11.8	14.0	7.7	33.5	57	21	12.5	15.6	6.8	34.9
	20			12.5	14.7	8.1	35.2			13.3	16.4	6.9	36.6
	30			13.3	15.3	8.4	37.0			14.2	17.2	7.1	38.4
	40			14.1	16.0	8.7	38.8			15.1	18.0	7.3	40.3
100	10	56	28	15.7	28.8	9.0	53.5	64	28	16.7	20.8	9.0	46.5
	20			16.7	30.0	9.3	56.0			17.7	21.8	9.3	48.8
	30			17.8	31.3	9.5	58.6			18.9	22.9	9.5	51.3
	40			18.8	32.6	9.7	61.2			20.1	24.0	9.7	53.8
125	10	68	34	19.6	35.9	11.3	66.9	70	34	20.9	26.0	11.3	58.2
	20			20.9	37.5	11.6	70.0			22.1	27.3	11.6	61.0
	30			22.2	39.2	11.9	73.2			23.6	28.6	11.9	64.1
	40			23.5	40.8	12.2	76.5			25.1	29.9	12.2	67.2
150	10	82	41	23.6	43.1	13.6	80.2	77	41	25.1	31.2	15.9	72.2
	20			25.0	45.0	13.9	84.0			26.5	32.7	16.4	75.6
	30			26.6	47.0	14.2	87.9			28.3	34.3	16.8	79.5
	40			28.2	48.9	14.6	91.7			30.2	35.9	17.3	83.3
175	10	96	48	27.5	50.3	15.8	93.6	84	48	29.3	36.4	18.6	84.2
	20			29.2	52.6	16.2	98.0			30.9	38.2	19.1	88.2
	30			31.1	54.8	16.6	102.5			33.1	40.0	19.6	92.7
	40			32.9	57.1	17.0	107.0			35.2	41.9	20.2	97.2
200	10	110	55	31.4	57.5	18.1	107.0	91	55	33.4	41.5	21.2	96.2
	20			33.4	60.1	18.5	112.0			35.3	43.7	21.8	100.8
	30			35.5	62.6	19.0	117.1			37.8	45.8	22.4	106.0
	40			37.6	65.2	19.4	122.3			40.2	47.9	23.0	111.1
250	10	132	68	39.3	71.9	25.7	136.8	104	68	41.8	51.9	26.5	120.3
	20			41.7	75.1	26.5	143.3			44.2	54.6	27.3	126.0
	30			44.4	78.3	27.2	150.0			47.2	57.2	28.0	132.5
	40			47.1	81.5	28.0	156.6			50.3	59.9	28.8	138.9
300	10	146	82	47.1	86.3	30.8	164.2	118	82	50.2	62.3	33.0	145.5
	20			50.1	90.1	31.8	171.9			53.0	65.5	34.2	152.7
	30			53.3	94.0	32.7	179.9			56.7	68.7	35.3	160.6
	40			56.5	97.9	33.6	188.0			60.3	71.9	36.5	168.6
350	10	160	96	55.0	100.6	36.0	191.6	132	96	58.5	72.7	38.6	169.8
	20			58.4	105.1	37.0	200.6			61.8	76.4	39.9	178.1
	30			62.2	109.6	38.1	209.9			66.1	80.1	41.2	187.4
	40			65.9	114.2	39.3	219.3			70.4	83.8	42.6	196.8
400	10	173	109	62.8	115.0	41.1	218.9	145	109	66.9	83.1	45.1	195.1
	20			66.8	120.1	42.3	229.3			70.7	87.3	46.8	204.7
	30			71.0	125.3	43.6	239.9			75.5	91.5	48.5	215.5
	40			75.3	130.5	44.9	250.6			80.4	95.8	50.2	226.4

70 CHARACTER DATA RECORD

INPUT AND OUTPUT 7330 TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	3	2	.9	.5	.5	1.9	4	2	.9	.5	.5	1.9
	20			.9	.5	.6	2.0			.9	.6	.5	2.0
	30			.9	.5	.6	2.0			1.0	.6	.5	2.1
	40			1.0	.6	.6	2.1			1.0	.6	.5	2.2
10	10	12	4	1.7	2.0	1.0	4.7	7	4	1.8	1.1	1.1	3.9
	20			1.8	2.1	1.0	4.9			1.9	1.1	1.1	4.1
	30			1.9	2.2	1.0	5.1			2.0	1.2	1.1	4.3
	40			1.9	2.3	1.1	5.3			2.0	1.3	1.2	4.5
20	10	15	7	3.4	4.1	2.0	9.4	10	7	3.6	2.2	2.3	8.0
	20			3.6	4.2	2.0	9.7			3.7	2.3	2.4	8.4
	30			3.7	4.4	2.1	10.2			3.9	2.4	2.4	8.8
	40			3.9	4.6	2.1	10.6			4.1	2.5	2.5	9.1
30	10	18	10	5.1	6.1	3.3	14.5	13	10	5.3	3.3	3.5	12.1
	20			5.3	6.3	3.4	15.0			5.6	3.4	3.6	12.7
	30			5.6	6.6	3.5	15.6			5.9	3.6	3.8	13.2
	40			5.8	6.9	3.6	16.3			6.1	3.8	3.9	13.8
40	10	21	13	6.8	8.1	4.4	19.3	16	13	7.1	4.4	4.8	16.3
	20			7.1	8.5	4.5	20.1			7.5	4.6	5.0	17.1
	30			7.4	8.8	4.6	20.8			7.8	4.8	5.3	17.9
	40			7.8	9.2	4.8	21.7			8.2	5.0	5.5	18.7
50	10	24	16	8.5	10.1	5.4	24.1	19	16	8.9	5.4	6.0	20.4
	20			8.9	10.6	5.6	25.1			9.3	5.7	6.3	21.4
	30			9.3	11.0	5.8	26.1			9.8	6.0	6.6	22.4
	40			9.7	11.5	5.9	27.1			10.2	6.3	6.9	23.3
75	10	32	24	12.8	15.2	8.5	36.5	60	24	13.4	16.9	7.4	37.6
	20			13.3	15.9	8.8	38.0			14.0	17.6	7.4	39.0
	30			13.9	16.5	9.1	39.5			14.7	18.4	7.8	41.0
	40			14.5	17.2	9.4	41.2			15.3	19.2	8.0	42.6
100	10	64	32	17.0	31.3	9.8	58.2	68	32	17.8	22.5	9.8	50.1
	20			17.8	32.6	9.8	60.2			18.7	23.5	9.8	52.1
	30			18.5	33.9	10.5	62.9			19.6	24.6	10.5	54.6
	40			19.4	35.2	10.7	65.2			20.4	25.6	10.7	56.8
125	10	80	40	21.3	39.2	12.3	72.7	76	40	22.3	28.1	14.8	65.1
	20			22.2	40.8	12.3	75.3			23.4	29.4	15.1	67.9
	30			23.2	42.4	13.1	78.6			24.5	30.7	15.5	70.7
	40			24.2	44.0	13.4	81.5			25.6	32.0	15.9	73.5
150	10	94	47	25.5	47.0	14.7	87.3	83	47	26.7	33.7	17.7	78.2
	20			26.7	48.9	14.7	90.3			28.0	35.3	18.1	81.5
	30			27.8	50.8	15.7	94.3			29.3	36.9	18.6	84.8
	40			29.1	52.7	16.0	97.8			30.7	38.5	19.0	88.1
175	10	110	55	29.8	54.8	17.2	101.8	91	55	31.2	39.4	20.7	91.2
	20			31.1	57.1	17.2	105.4			32.7	41.2	21.2	95.0
	30			32.4	59.3	18.3	110.0			34.2	43.0	21.7	98.9
	40			33.9	61.5	18.7	114.2			35.8	44.9	22.2	102.8
200	10	126	63	34.0	62.7	19.7	116.4	99	63	35.6	45.0	23.6	104.2
	20			35.5	65.2	19.7	120.4			37.4	47.1	24.2	108.6
	30			37.0	67.8	20.9	125.7			39.1	49.2	24.8	113.1
	40			38.8	70.3	21.4	130.5			40.9	51.3	25.4	117.5
250	10	143	79	42.6	78.4	28.5	149.4	115	79	44.5	56.2	30.5	131.2
	20			44.4	81.5	29.2	155.2			46.7	58.8	31.4	137.0
	30			46.3	84.7	30.0	161.0			48.9	61.5	32.3	142.7
	40			48.4	87.9	30.8	167.1			51.1	64.1	33.3	148.5
300	10	158	94	51.1	94.0	34.1	179.2	130	94	53.4	67.5	36.6	157.5
	20			53.3	97.8	35.1	186.2			56.1	70.6	37.7	164.3
	30			55.6	101.6	36.0	193.2			58.7	73.7	38.8	171.3
	40			58.1	105.5	36.9	200.6			61.3	76.9	40.0	178.2
350	10	174	110	59.6	109.7	39.8	209.1	146	110	62.3	78.7	43.5	184.6
	20			62.2	114.1	40.9	217.2			65.4	82.4	45.0	192.8
	30			64.8	118.6	42.0	225.4			68.5	86.0	46.5	201.0
	40			67.8	123.1	43.1	234.0			71.6	89.7	47.9	209.2
400	10	189	125	68.1	125.4	45.5	239.0	161	125	71.2	90.0	49.8	211.0
	20			71.1	130.4	46.8	248.3			74.8	94.1	51.4	220.3
	30			74.1	135.5	48.0	257.6			78.3	98.3	53.1	229.7
	40			77.5	140.7	49.2	267.4			81.8	102.6	54.8	239.1

80 CHARACTER DATA RECORD

INPUT AND OUTPUT 7330 TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	3	2	.9	.5	.6	2.0	4	2	.9	.6	.6	2.1
	20			.9	.6	.6	2.1			1.0	.6	.6	2.2
	30			1.0	.6	.6	2.2			1.0	.6	.6	2.2
	40			1.0	.6	.6	2.2			1.1	.7	.6	2.3
10	10	12	4	1.8	2.2	1.1	5.1	7	4	1.9	1.2	1.2	4.2
	20			1.9	2.3	1.1	5.3			2.0	1.2	1.2	4.4
	30			1.9	2.4	1.1	5.4			2.1	1.3	1.3	4.6
	40			2.0	2.5	1.1	5.6			2.1	1.3	1.3	4.8
20	10	16	8	3.6	4.4	2.2	10.2	11	8	3.8	2.3	2.5	8.6
	20			3.7	4.6	2.2	10.6			4.0	2.5	2.6	9.0
	30			3.9	4.7	2.2	10.9			4.1	2.6	2.7	9.3
	40			4.0	4.9	2.2	11.2			4.3	2.7	2.7	9.7
30	10	19	11	5.4	6.6	3.5	15.5	14	11	5.7	3.5	3.8	13.0
	20			5.6	6.8	3.7	16.2			5.9	3.7	4.0	13.6
	30			5.8	7.1	3.8	16.7			6.2	3.8	4.1	14.1
	40			6.0	7.4	3.9	17.3			6.4	4.0	4.2	14.7
40	10	23	15	7.2	8.8	4.6	20.6	18	15	7.6	4.7	5.3	17.5
	20			7.5	9.1	4.9	21.5			7.9	4.9	5.5	18.3
	30			7.8	9.5	5.1	22.3			8.2	5.1	5.7	19.1
	40			8.0	9.8	5.2	23.1			8.6	5.3	5.9	19.8
50	10	26	18	9.0	11.0	6.2	26.2	21	18	9.5	5.9	6.6	21.9
	20			9.4	11.4	6.4	27.2			9.9	6.1	6.9	22.9
	30			9.7	11.9	6.6	28.2			10.3	6.4	7.1	23.8
	40			10.1	12.3	6.8	29.2			10.7	6.7	7.4	24.8
75	10	54	27	13.5	25.6	8.4	47.5	63	27	14.2	18.3	8.4	40.9
	20			14.0	26.5	8.4	49.0			14.8	19.0	8.4	42.3
	30			14.6	27.5	8.4	50.5			15.5	19.8	8.4	43.7
	40			15.1	28.4	8.4	52.0			16.1	20.6	8.4	45.1
100	10	72	36	18.0	34.1	11.2	63.4	72	36	18.9	24.3	11.2	54.5
	20			18.7	35.4	11.2	65.3			19.8	25.4	11.2	56.4
	30			19.4	36.6	11.2	67.3			20.6	26.4	11.2	58.3
	40			20.1	37.9	11.2	69.3			21.5	27.5	11.2	60.2
125	10	90	45	22.5	42.7	14.0	79.2	81	45	23.7	30.4	15.9	70.0
	20			23.4	44.2	14.0	81.7			24.7	31.7	16.7	73.1
	30			24.3	45.8	14.1	84.1			25.8	33.0	17.0	75.8
	40			25.1	47.4	14.1	86.6			26.8	34.3	17.4	78.6
150	10	108	54	27.0	51.2	16.8	95.1	90	54	28.4	36.5	19.1	84.0
	20			28.1	53.1	16.9	98.0			29.7	38.1	20.0	87.7
	30			29.1	55.0	16.9	100.9			30.9	39.6	20.5	91.0
	40			30.2	56.9	16.9	103.9			32.2	41.2	20.9	94.3
175	10	126	63	31.5	59.7	19.7	110.9	99	63	33.1	42.6	22.3	98.0
	20			32.8	61.9	19.7	114.3			34.6	44.4	23.4	102.4
	30			34.0	64.1	19.7	117.8			36.1	46.2	23.9	106.2
	40			35.2	66.3	19.7	121.2			37.6	48.1	24.4	110.0
200	10	136	72	36.0	68.3	24.4	128.8	108	72	37.8	48.7	25.5	112.0
	20			37.4	70.8	25.7	133.9			39.5	50.7	26.7	117.0
	30			38.8	73.3	26.3	138.5			41.2	52.8	27.3	121.3
	40			40.2	75.8	27.0	143.0			42.9	54.9	27.9	125.7
250	10	154	90	45.0	85.3	30.6	160.9	126	90	47.3	60.9	33.6	141.8
	20			46.8	88.4	32.2	167.4			49.4	63.4	34.5	147.4
	30			48.5	91.6	32.9	173.1			51.6	66.0	35.5	153.0
	40			50.3	94.8	33.7	178.8			53.7	68.6	36.4	158.7
300	10	172	108	54.1	102.4	36.7	193.1	144	108	56.8	73.0	40.4	170.2
	20			56.2	106.1	38.6	200.9			59.3	76.1	41.4	176.9
	30			58.3	109.9	39.5	207.7			61.9	79.2	42.6	183.6
	40			60.4	113.7	40.4	214.5			64.4	82.4	43.7	190.5
350	10	189	125	63.1	119.5	42.8	225.3	161	125	66.2	85.2	47.9	199.4
	20			65.5	123.8	45.0	234.4			69.2	88.8	49.3	207.4
	30			68.0	128.2	46.1	242.3			72.2	92.4	50.8	215.4
	40			70.4	132.7	47.2	250.3			75.1	96.1	52.3	223.5
400	10	207	143	72.1	136.5	51.9	260.5	179	143	75.7	97.4	54.8	227.8
	20			74.9	141.5	53.4	269.8			79.1	101.5	56.4	237.0
	30			77.7	146.6	55.0	279.2			82.5	105.6	58.0	246.2
	40			80.5	151.6	56.6	288.7			85.9	109.8	59.7	255.4

90 CHARACTER DATA RECORD

INPUT AND OUTPUT 7330 TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	4	3	1.0	.6	.6	2.2	6	3	1.0	.6	.6	2.3
	20			1.0	.6	.6	2.2			1.0	.7	.6	2.3
	30			1.0	.6	.7	2.4			1.1	.7	.6	2.4
	40			1.1	.6	.7	2.4			1.1	.7	.6	2.5
10	10	13	5	1.9	2.4	1.3	5.6	8	5	2.0	1.3	1.3	4.6
	20			2.0	2.5	1.3	5.7			2.1	1.3	1.3	4.7
	30			2.1	2.5	1.3	5.9			2.2	1.4	1.3	4.8
	40			2.1	2.6	1.3	6.0			2.2	1.4	1.4	5.1
20	10	17	9	3.9	4.7	2.6	11.2	12	9	4.0	2.5	2.6	9.1
	20			4.0	4.9	2.6	11.5			4.2	2.6	2.8	9.6
	30			4.2	5.1	2.6	11.9			4.3	2.7	2.9	9.9
	40			4.3	5.3	2.8	12.4			4.5	2.8	3.0	10.3
30	10	21	13	5.8	7.1	3.9	16.8	16	13	6.0	3.8	4.2	14.0
	20			6.0	7.4	3.9	17.3			6.2	3.9	4.4	14.5
	30			6.2	7.6	3.9	17.8			6.5	4.1	4.5	15.1
	40			6.4	7.9	4.2	18.6			6.7	4.3	4.7	15.7
40	10	25	17	7.7	9.5	5.2	22.5	20	17	8.0	5.0	5.6	18.7
	20			8.0	9.8	5.6	23.4			8.3	5.2	5.8	19.4
	30			8.3	10.2	5.7	24.2			8.6	5.5	6.0	20.1
	40			8.6	10.5	5.9	25.0			9.0	5.7	6.2	20.9
50	10	29	21	9.7	11.8	6.5	28.1	57	21	10.0	13.1	6.3	29.5
	20			10.0	12.3	7.0	29.3			10.4	13.6	6.3	30.4
	30			10.4	12.7	7.2	30.3			10.8	14.2	6.3	31.3
	40			10.7	13.2	7.4	31.3			11.2	14.7	6.3	32.2
75	10	62	31	14.5	27.8	9.5	51.8	67	31	15.0	19.7	9.5	44.2
	20			15.0	28.7	9.5	53.2			15.6	20.5	9.5	45.6
	30			15.6	29.6	9.5	54.7			16.2	21.2	9.5	46.9
	40			16.1	30.6	9.5	56.2			16.8	22.0	9.5	48.3
100	10	82	41	19.4	37.0	12.7	69.0	77	41	20.0	26.3	14.4	60.6
	20			20.1	38.2	12.7	71.0			20.8	27.3	14.4	62.5
	30			20.8	39.5	12.7	72.9			21.6	28.3	14.4	64.3
	40			21.5	40.7	12.7	74.9			22.4	29.3	15.2	67.0
125	10	102	51	24.2	46.3	15.8	86.3	87	51	25.0	32.8	18.0	75.8
	20			25.1	47.8	15.8	88.7			26.0	34.1	18.0	78.1
	30			26.0	49.4	15.8	91.1			27.0	35.4	18.0	80.4
	40			26.8	50.9	15.8	93.6			28.0	36.7	19.0	83.7
150	10	122	61	29.0	55.5	19.0	103.6	97	61	30.0	39.4	21.6	91.0
	20			30.1	57.4	19.0	106.5			31.2	40.9	21.6	93.7
	30			31.1	59.2	19.0	109.4			32.4	42.5	21.6	96.5
	40			32.2	61.1	19.0	112.3			33.6	44.0	22.8	100.5
175	10	135	71	33.9	64.8	24.1	122.8	107	71	35.0	46.0	25.2	106.1
	20			35.1	66.9	24.1	126.2			36.4	47.7	25.2	109.3
	30			36.3	69.1	24.1	129.6			37.8	49.5	25.2	112.5
	40			37.6	71.3	25.7	134.5			39.2	51.3	26.6	117.2
200	10	145	81	38.7	74.0	27.5	140.3	117	81	40.0	52.5	28.8	121.3
	20			40.1	76.5	27.6	144.2			41.6	54.6	30.2	126.4
	30			41.5	79.0	27.6	148.1			43.2	56.6	30.9	130.8
	40			42.9	81.5	29.4	153.8			44.8	58.7	31.7	135.2
250	10	165	101	48.4	92.5	34.4	175.4	137	101	50.0	65.7	36.0	151.6
	20			50.2	95.6	34.4	180.2			52.0	68.2	37.8	158.0
	30			51.9	98.7	34.5	185.1			54.0	70.8	38.7	163.5
	40			53.7	101.9	36.7	192.2			56.1	73.3	39.6	169.0
300	10	185	121	58.1	111.1	41.3	210.5	157	121	60.0	78.8	45.0	183.7
	20			60.2	114.7	41.3	216.3			62.4	81.8	46.2	190.4
	30			62.3	118.5	41.4	222.1			64.8	84.9	47.4	197.1
	40			64.4	122.2	44.0	230.7			67.3	88.0	48.6	203.9
350	10	206	142	67.8	129.6	48.2	245.6	178	142	70.0	91.9	52.5	214.4
	20			70.2	133.9	50.9	255.0			72.8	95.5	53.8	222.1
	30			72.7	138.2	52.3	263.2			75.6	99.1	55.3	230.0
	40			75.1	142.6	53.7	271.4			78.5	102.7	56.7	237.9
400	10	226	162	77.5	148.1	55.1	280.6	198	162	80.0	105.1	61.4	246.4
	20			80.3	153.0	58.2	291.5			83.2	109.1	63.3	255.6
	30			83.1	157.9	59.8	300.8			86.4	113.2	65.3	264.9
	40			85.9	163.0	61.3	310.1			89.7	117.4	67.2	274.3

100 CHARACTER DATA RECORD

INPUT AND OUTPUT 7330 TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	4	3	.9	.6	.7	2.3	6	3	1.1	.7	.7	2.4
	20			1.0	.6	.7	2.3			1.1	.7	.7	2.5
	30			1.0	.7	.8	2.4			1.1	.7	.7	2.6
	40			1.0	.7	.8	2.5			1.2	.8	.7	2.6
10	10	13	5	1.9	2.5	1.4	5.8	8	5	2.1	1.3	1.5	4.9
	20			1.9	2.6	1.4	5.9			2.2	1.4	1.5	5.1
	30			2.0	2.7	1.4	6.1			2.3	1.4	1.5	5.2
	40			2.0	2.8	1.4	6.2			2.4	1.5	1.5	5.3
20	10	17	9	3.7	5.1	2.9	11.7	12	9	4.3	2.7	2.9	9.9
	20			3.8	5.2	2.9	12.0			4.4	2.8	2.9	10.1
	30			3.9	5.4	2.9	12.3			4.6	2.9	3.1	10.6
	40			4.0	5.6	2.9	12.5			4.7	3.0	3.2	10.9
30	10	22	14	5.6	7.6	4.4	17.5	17	14	6.4	4.0	4.6	15.0
	20			5.7	7.9	4.4	17.9			6.6	4.2	4.8	15.6
	30			5.9	8.1	4.4	18.4			6.9	4.3	4.9	16.1
	40			6.1	8.4	4.4	18.8			7.1	4.5	5.1	16.7
40	10	26	18	7.4	10.1	5.8	23.4	21	18	8.5	5.4	6.1	20.0
	20			7.6	10.5	5.8	23.9			8.9	5.6	6.3	20.8
	30			7.8	10.8	6.2	24.9			9.2	5.8	6.6	21.5
	40			8.1	11.2	6.3	25.6			9.5	6.0	6.8	22.3
50	10	31	23	9.3	12.7	7.3	29.2	59	23	10.7	14.1	7.0	31.7
	20			9.5	13.1	7.3	29.9			11.1	14.6	7.0	32.6
	30			9.8	13.6	7.7	31.1			11.5	15.1	7.0	33.6
	40			10.1	14.0	7.9	32.0			11.9	15.6	7.0	34.5
75	10	68	34	13.9	29.8	10.5	54.3	70	34	16.0	21.1	10.5	47.6
	20			14.3	30.7	10.5	55.6			16.6	21.8	10.5	49.0
	30			14.7	31.7	10.5	56.9			17.2	22.6	10.5	50.3
	40			15.1	32.6	10.5	58.3			17.8	23.4	10.5	51.7
100	10	90	45	18.5	39.8	14.0	72.3	81	45	21.3	28.1	15.9	65.4
	20			19.1	41.0	14.0	74.1			22.1	29.1	15.9	67.2
	30			19.6	42.2	14.1	75.9			22.9	30.1	16.0	69.0
	40			20.2	43.5	14.1	77.7			23.7	31.1	16.0	70.9
125	10	112	56	23.1	49.7	17.6	90.4	92	56	26.6	35.1	19.9	81.7
	20			23.8	51.2	17.6	92.6			27.7	36.4	19.9	84.0
	30			24.5	52.8	17.6	94.9			28.7	37.6	19.9	86.3
	40			25.2	54.3	17.6	97.1			29.7	38.9	19.9	88.6
150	10	131	67	27.8	59.7	22.9	110.4	103	67	32.0	42.2	23.9	98.0
	20			28.6	61.5	22.9	113.0			33.2	43.7	23.9	100.8
	30			29.4	63.3	22.9	115.7			34.4	45.2	23.9	103.5
	40			30.3	65.2	22.9	118.4			35.6	46.7	23.9	106.3
175	10	143	79	32.4	69.6	26.7	128.8	115	79	37.3	49.2	27.9	114.4
	20			33.4	71.7	26.7	131.9			38.7	50.9	27.9	117.6
	30			34.3	73.9	26.7	135.0			40.1	52.7	29.2	122.1
	40			35.3	76.1	26.8	138.1			41.6	54.5	29.9	125.9
200	10	154	90	37.0	79.6	30.5	147.2	126	90	42.6	56.2	31.9	130.7
	20			38.1	82.0	30.6	150.7			44.3	58.2	31.9	134.4
	30			39.2	84.4	30.6	154.3			45.9	60.2	33.4	139.5
	40			40.3	86.9	30.6	157.8			47.5	62.3	34.1	143.9
250	10	176	112	46.3	99.5	38.2	184.0	148	112	53.3	70.3	39.9	163.4
	20			47.7	102.5	38.2	188.4			55.3	72.8	41.6	169.6
	30			49.0	105.6	38.2	192.8			57.3	75.3	42.6	175.2
	40			50.4	108.7	38.2	197.3			59.4	77.9	43.6	180.8
300	10	198	134	55.6	119.4	45.8	220.8	170	134	64.0	84.3	47.9	196.1
	20			57.2	123.0	45.9	226.0			66.4	87.3	49.9	203.6
	30			58.9	126.7	48.3	233.8			68.8	90.4	51.1	210.2
	40			60.5	130.4	49.4	240.3			71.2	93.4	52.3	217.0
350	10	221	157	64.8	139.3	53.5	257.5	193	157	74.6	98.4	58.1	231.1
	20			66.7	143.5	53.5	263.7			77.4	101.9	59.7	239.0
	30			68.7	147.8	56.3	272.8			80.3	105.4	61.4	247.1
	40			70.6	152.1	57.7	280.4			83.1	109.0	63.1	255.2
400	10	243	179	74.1	159.2	61.1	294.3	215	179	85.3	112.4	66.4	264.1
	20			76.3	164.0	61.1	301.4			88.5	116.4	68.2	273.2
	30			78.5	168.9	64.4	311.7			91.8	120.5	70.2	282.4
	40			80.7	173.9	65.9	320.4			95.0	124.6	72.1	291.7

120 CHARACTER DATA RECORD

INPUT AND OUTPUT 7330 TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	4	3	1.0	.7	.9	2.6	6	3	1.2	.8	.8	2.8
	20			1.1	.7	.9	2.6			1.2	.8	.8	2.9
	30			1.1	.8	.9	2.7			1.3	.8	.8	2.9
	40			1.1	.8	.9	2.7			1.3	.8	.8	3.0
10	10	14	6	2.1	2.9	1.7	6.7	9	6	2.4	1.5	1.8	5.6
	20			2.1	3.0	1.7	6.8			2.4	1.6	1.8	5.8
	30			2.2	3.1	1.7	7.0			2.5	1.6	1.8	5.9
	40			2.2	3.2	1.7	7.1			2.6	1.7	1.8	6.0
20	10	19	11	4.2	5.8	3.5	13.5	14	11	4.7	3.0	3.5	11.3
	20			4.3	6.0	3.5	13.8			4.9	3.1	3.5	11.6
	30			4.4	6.2	3.5	14.0			5.0	3.3	3.5	11.8
	40			4.5	6.3	3.5	14.3			5.2	3.4	3.7	12.3
30	10	25	17	6.2	8.7	5.3	20.2	20	17	7.1	4.6	5.3	16.9
	20			6.4	9.0	5.3	20.6			7.3	4.7	5.3	17.3
	30			6.6	9.2	5.3	21.0			7.6	4.9	5.3	17.7
	40			6.7	9.5	5.3	21.5			7.8	5.0	5.6	18.4
40	10	30	22	8.3	11.6	7.0	26.9	58	22	9.5	12.9	6.8	29.1
	20			8.5	12.0	7.0	27.5			9.8	13.3	6.8	29.8
	30			8.7	12.3	7.0	28.1			10.1	13.7	6.8	30.5
	40			8.9	12.7	7.0	28.6			10.4	14.1	6.8	31.2
50	10	56	28	10.4	23.0	8.5	41.8	64	28	11.8	16.1	8.5	36.4
	20			10.7	23.5	8.5	42.7			12.2	16.6	8.5	37.3
	30			10.9	24.1	8.5	43.5			12.6	17.1	8.5	38.1
	40			11.2	24.7	8.5	44.4			13.0	17.6	8.5	39.0
60	10	66	33	12.5	27.5	10.2	50.2	69	33	14.2	19.3	10.2	43.7
	20			12.8	28.2	10.2	51.2			14.7	19.9	10.2	44.7
	30			13.1	29.0	10.2	52.2			15.1	20.5	10.2	45.8
	40			13.4	29.7	10.2	53.3			15.6	21.1	10.2	46.8
70	10	78	39	14.6	32.1	11.9	58.6	75	39	16.6	22.5	13.5	52.6
	20			14.9	33.0	11.9	59.8			17.1	23.2	13.5	53.8
	30			15.3	33.8	11.9	61.0			17.6	23.9	13.5	55.0
	40			15.7	34.6	11.9	62.2			18.2	24.6	13.5	56.3
80	10	88	44	16.7	36.7	13.6	67.0	80	44	18.9	25.7	15.4	60.1
	20			17.1	37.7	13.6	68.3			19.5	26.5	15.4	61.5
	30			17.5	38.6	13.6	69.7			20.1	27.3	15.4	62.9
	40			17.9	39.6	13.6	71.0			20.7	28.1	15.4	64.3
90	10	98	49	18.7	41.3	15.3	75.3	85	49	21.3	29.0	17.4	67.6
	20			19.2	42.4	15.3	76.8			22.0	29.8	17.4	69.2
	30			19.7	43.4	15.3	78.4			22.7	30.7	17.4	70.8
	40			20.1	44.5	15.3	79.9			23.3	31.6	17.4	72.3
100	10	110	55	20.8	45.9	16.9	83.7	91	55	23.7	32.2	19.3	75.1
	20			21.3	47.1	17.0	85.4			24.4	33.1	19.3	76.9
	30			21.9	48.3	17.0	87.1			25.2	34.1	19.3	78.6
	40			22.4	49.5	17.0	88.8			25.9	35.1	19.3	80.4
120	10	130	66	25.0	55.1	22.2	102.2	102	66	28.4	38.6	23.1	90.2
	20			25.6	56.5	22.2	104.3			29.3	39.8	23.2	92.2
	30			26.2	57.9	22.2	106.3			30.2	41.0	23.2	94.3
	40			26.8	59.4	22.2	108.4			31.1	42.2	23.2	96.4
140	10	141	77	29.2	64.3	25.9	119.3	113	77	33.2	45.0	27.0	105.2
	20			29.9	65.9	25.9	121.6			34.2	46.4	27.0	107.6
	30			30.6	67.6	25.9	124.0			35.3	47.8	27.0	110.1
	40			31.3	69.3	25.9	126.4			36.3	49.2	27.0	112.5
160	10	151	87	33.3	73.5	29.5	136.3	123	87	37.9	51.5	30.9	120.2
	20			34.1	75.3	29.6	139.0			39.1	53.0	30.9	123.0
	30			35.0	77.2	29.6	141.8			40.3	54.6	30.9	125.8
	40			35.8	79.2	29.6	144.5			41.5	56.2	30.9	128.6
180	10	162	98	37.5	82.6	33.2	153.4	134	98	42.6	57.9	34.7	135.3
	20			38.4	84.7	33.3	156.4			44.0	59.7	34.7	138.4
	30			39.3	86.9	33.3	159.5			45.3	61.4	34.8	141.5
	40			40.3	89.0	33.3	162.6			46.7	63.2	34.8	144.7
200	10	173	109	41.7	91.8	36.9	170.4	145	109	47.4	64.4	38.6	150.3
	20			42.7	94.2	36.9	173.8			48.9	66.3	38.6	153.8
	30			43.7	96.5	37.0	177.2			50.4	68.3	38.6	157.3
	40			44.7	98.9	37.0	180.6			51.9	70.3	40.2	162.3

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	12	4	1.2	1.6	1.0	3.8	7	4	1.3	.8	1.0	3.2
	20			1.2	1.7	1.0	3.8			1.4	.9	1.0	3.2
	30			1.2	1.7	1.0	3.9			1.4	.9	1.0	3.3
	40			1.2	1.7	1.0	4.0			1.4	.9	1.0	3.4
10	10	15	7	2.3	3.2	2.0	7.5	10	7	2.6	1.7	2.0	6.4
	20			2.4	3.3	2.0	7.6			2.7	1.7	2.0	6.5
	30			2.4	3.4	2.0	7.8			2.8	1.8	2.0	6.6
	40			2.5	3.5	2.0	7.9			2.9	1.8	2.0	6.7
20	10	21	13	4.6	6.4	4.1	15.2	16	13	5.3	3.4	4.1	12.7
	20			4.7	6.6	4.1	15.4			5.4	3.5	4.1	13.0
	30			4.8	6.8	4.1	15.7			5.6	3.6	4.1	13.2
	40			4.9	7.0	4.1	16.0			5.7	3.7	4.1	13.5
30	10	27	19	7.0	9.7	6.1	22.7	55	19	7.9	10.7	5.9	24.5
	20			7.1	9.9	6.1	23.1			8.1	11.0	5.9	25.0
	30			7.3	10.2	6.1	23.6			8.3	11.3	5.9	25.6
	40			7.4	10.5	6.1	24.0			8.6	11.6	5.9	26.1
40	10	50	25	9.3	20.5	7.9	37.7	61	25	10.5	14.3	7.9	32.7
	20			9.5	21.0	7.9	38.3			10.8	14.7	7.9	33.4
	30			9.7	21.4	7.9	39.0			11.1	15.1	7.9	34.1
	40			9.9	21.9	7.9	39.7			11.4	15.5	7.9	34.8
50	10	64	32	11.6	25.7	9.8	47.1	68	32	13.2	17.9	9.8	40.9
	20			11.9	26.2	9.8	47.9			13.5	18.4	9.8	41.7
	30			12.1	26.8	9.8	48.7			13.9	18.8	9.8	42.6
	40			12.3	27.4	9.8	49.6			14.3	19.3	9.8	43.5
60	10	76	38	13.9	30.8	11.8	56.5	74	38	15.8	21.5	13.4	50.6
	20			14.2	31.5	11.8	57.5			16.2	22.0	13.4	51.7
	30			14.5	32.2	11.8	58.5			16.7	22.6	13.4	52.7
	40			14.8	32.9	11.8	59.5			17.1	23.2	13.4	53.7
70	10	88	44	16.3	35.9	13.8	65.9	80	44	18.4	25.0	15.6	59.1
	20			16.6	36.7	13.8	67.1			18.9	25.7	15.6	60.3
	30			16.9	37.5	13.8	68.2			19.5	26.4	15.6	61.5
	40			17.3	38.4	13.8	69.4			20.0	27.1	15.6	62.7
80	10	100	50	18.6	41.1	15.7	75.4	86	50	21.0	28.6	17.8	67.5
	20			19.0	42.0	15.7	76.7			21.6	29.4	17.9	68.9
	30			19.4	42.9	15.7	78.0			22.2	30.2	17.9	70.3
	40			19.7	43.8	15.7	79.3			22.8	30.9	17.9	71.7
90	10	114	57	20.9	46.2	17.7	84.8	93	57	23.7	32.2	20.1	76.0
	20			21.3	47.2	17.7	86.3			24.3	33.1	20.1	77.5
	30			21.8	48.3	17.7	87.7			25.0	33.9	20.1	79.0
	40			22.2	49.3	17.7	89.2			25.7	34.8	20.1	80.6
100	10	126	63	23.2	51.3	19.7	94.2	99	63	26.3	35.8	22.3	84.4
	20			23.7	52.5	19.7	95.8			27.1	36.7	22.3	86.1
	30			24.2	53.6	19.7	97.5			27.8	37.7	22.3	87.8
	40			24.7	54.8	19.7	99.2			28.6	38.7	22.3	89.6
120	10	139	75	27.9	61.6	25.7	115.1	111	75	31.6	42.9	26.8	101.3
	20			28.5	62.9	25.7	117.1			32.5	44.1	26.8	103.3
	30			29.0	64.3	25.7	119.1			33.4	45.2	26.8	105.4
	40			29.6	65.8	25.7	121.1			34.3	46.4	26.8	107.5
140	10	152	88	32.5	71.8	29.9	134.3	124	88	36.8	50.1	31.3	118.2
	20			33.2	73.4	29.9	136.6			37.9	51.4	31.3	120.6
	30			33.9	75.1	29.9	138.9			38.9	52.8	31.3	123.0
	40			34.6	76.7	30.0	141.2			40.0	54.2	31.3	125.4
160	10	164	100	37.2	82.1	34.2	153.5	136	100	42.1	57.3	35.7	135.1
	20			38.0	83.9	34.2	156.1			43.3	58.8	35.7	137.8
	30			38.7	85.8	34.2	158.7			44.5	60.3	35.7	140.5
	40			39.5	87.7	34.2	161.4			45.7	61.9	35.8	143.3
180	10	177	113	41.8	92.4	38.5	172.7	149	113	47.3	64.4	40.2	152.0
	20			42.7	94.4	38.5	175.6			48.7	66.1	40.2	155.0
	30			43.6	96.5	38.5	178.6			50.0	67.9	40.2	158.1
	40			44.4	98.6	38.5	181.6			51.4	69.6	40.2	161.3
200	10	189	125	46.5	102.6	42.8	191.9	161	125	52.6	71.6	44.7	168.8
	20			47.4	104.9	42.8	195.1			54.1	73.5	44.7	172.2
	30			48.4	107.2	42.8	198.4			55.6	75.4	44.7	175.7
	40			49.4	109.6	42.8	201.8			57.1	77.4	44.7	179.2

160 CHARACTER DATA RECORD

INPUT AND OUTPUT 7330 TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	12	4	1.3	1.8	1.1	4.2	7	4	1.4	.9	1.2	3.6
	20			1.3	1.9	1.1	4.3			1.5	1.0	1.2	3.6
	30			1.3	1.9	1.1	4.4			1.5	1.0	1.2	3.7
	40			1.4	1.9	1.1	4.4			1.5	1.0	1.2	3.7
10	10	16	8	2.6	3.6	2.3	8.5	11	8	2.9	1.9	2.4	7.1
	20			2.6	3.7	2.3	8.6			2.9	1.9	2.4	7.2
	30			2.7	3.8	2.3	8.7			3.0	2.0	2.4	7.4
	40			2.7	3.9	2.3	8.9			3.1	2.0	2.4	7.5
20	10	23	15	5.2	7.3	4.7	17.1	18	15	5.7	3.7	4.7	14.2
	20			5.2	7.4	4.7	17.4			5.9	3.9	4.7	14.5
	30			5.3	7.6	4.7	17.6			6.0	4.0	4.7	14.7
	40			5.4	7.8	4.7	17.9			6.2	4.1	4.7	15.0
30	10	31	23	7.7	10.9	7.1	25.7	59	23	8.6	12.1	6.8	27.6
	20			7.9	11.1	7.1	26.1			8.8	12.4	6.8	28.1
	30			8.0	11.4	7.1	26.5			9.0	12.7	6.8	28.5
	40			8.1	11.7	7.1	26.9			9.3	13.0	6.8	29.0
40	10	60	30	10.3	23.3	9.1	42.7	66	30	11.5	16.2	9.1	36.8
	20			10.5	23.7	9.1	43.3			11.8	16.5	9.1	37.4
	30			10.7	24.2	9.1	44.0			12.1	16.9	9.1	38.1
	40			10.8	24.6	9.1	44.6			12.3	17.3	9.1	38.7
50	10	74	37	12.9	29.1	11.4	53.4	73	37	14.4	20.2	13.0	47.5
	20			13.1	29.7	11.4	54.2			14.7	20.7	13.0	48.3
	30			13.3	30.2	11.4	54.9			15.1	21.1	13.0	49.2
	40			13.6	30.8	11.4	55.7			15.4	21.6	13.0	50.0
60	10	90	45	15.5	35.0	13.6	64.1	81	45	17.2	24.2	15.6	57.0
	20			15.7	35.6	13.6	65.0			17.7	24.8	15.6	58.0
	30			16.0	36.3	13.7	65.9			18.1	25.4	15.6	59.0
	40			16.3	37.0	13.7	66.9			18.5	25.9	15.6	60.0
70	10	104	52	18.0	40.8	15.9	74.7	88	52	20.1	28.3	18.1	66.6
	20			18.4	41.5	15.9	75.8			20.6	28.9	18.2	67.7
	30			18.7	42.3	15.9	76.9			21.1	29.6	18.2	68.8
	40			19.0	43.1	15.9	78.0			21.6	30.2	18.2	70.0
80	10	118	59	20.6	46.6	18.2	85.4	95	59	23.0	32.3	20.7	76.1
	20			21.0	47.5	18.2	86.6			23.6	33.1	20.7	77.4
	30			21.3	48.4	18.2	87.9			24.1	33.8	20.8	78.7
	40			21.7	49.3	18.2	89.2			24.7	34.6	20.8	80.0
90	10	131	67	23.2	52.4	22.3	97.9	103	67	25.9	36.4	23.3	85.6
	20			23.6	53.4	22.3	99.3			26.5	37.2	23.3	87.0
	30			24.0	54.4	22.3	100.8			27.1	38.0	23.4	88.5
	40			24.4	55.4	22.3	102.2			27.8	38.9	23.4	90.0
100	10	138	74	25.8	58.3	24.8	108.8	110	74	28.7	40.4	25.9	95.1
	20			26.2	59.3	24.8	110.4			29.4	41.3	26.0	96.7
	30			26.7	60.5	24.8	112.0			30.1	42.3	26.0	98.4
	40			27.1	61.6	24.8	113.6			30.8	43.2	26.0	100.0
120	10	153	89	30.9	69.9	29.8	130.6	125	89	34.5	48.5	31.1	114.1
	20			31.5	71.2	29.8	132.5			35.3	49.6	31.1	116.1
	30			32.0	72.6	29.8	134.3			36.2	50.7	31.2	118.0
	40			32.5	73.9	29.8	136.3			37.0	51.8	31.2	120.0
140	10	167	103	36.1	81.6	34.7	152.4	139	103	40.2	56.6	36.3	133.1
	20			36.7	83.1	34.7	154.5			41.2	57.8	36.3	135.4
	30			37.3	84.6	34.8	156.7			42.2	59.2	36.3	137.7
	40			38.0	86.2	34.8	159.0			43.2	60.5	36.4	140.0
160	10	182	118	41.2	93.2	39.7	174.1	154	118	46.0	64.7	41.5	152.2
	20			42.0	95.0	39.7	176.6			47.1	66.1	41.5	154.8
	30			42.7	96.7	39.7	179.1			48.2	67.6	41.6	157.4
	40			43.4	98.6	39.7	181.7			49.3	69.1	41.6	160.0
180	10	197	133	46.4	104.9	44.7	195.9	169	133	51.7	72.7	46.7	171.2
	20			47.2	106.8	44.7	198.7			53.0	74.4	46.7	174.1
	30			48.0	108.8	44.7	201.5			54.3	76.1	46.7	177.1
	40			48.8	110.9	44.7	204.4			55.5	77.8	46.8	180.0
200	10	212	148	51.5	116.5	49.6	217.7	184	148	57.5	80.8	51.9	190.2
	20			52.4	118.7	49.6	220.8			58.9	82.6	51.9	193.5
	30			53.3	120.9	49.7	223.9			60.3	84.5	51.9	196.7
	40			54.2	123.2	49.7	227.1			61.7	86.4	52.0	200.1

180 CHARACTER DATA RECORD

INPUT AND OUTPUT 7330 TAPES - 556 CPI

		40K CORE STORAGE						60K/80K CORE STORAGE					
		CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
FILE SIZE	CW LNG	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	13	5	1.4	2.0	1.3	4.7	8	5	1.6	1.0	1.3	3.9
	20			1.4	2.0	1.3	4.8			1.6	1.1	1.3	4.0
	30			1.5	2.1	1.3	4.8			1.6	1.1	1.3	4.1
	40			1.5	2.1	1.3	4.9			1.7	1.1	1.3	4.1
10	10	17	9	2.8	4.0	2.7	9.5	12	9	3.1	2.1	2.7	7.9
	20			2.9	4.1	2.7	9.6			3.2	2.1	2.7	8.0
	30			2.9	4.2	2.7	9.8			3.3	2.2	2.7	8.1
	40			3.0	4.3	2.7	9.9			3.4	2.2	2.7	8.2
20	10	25	17	5.7	8.0	5.3	19.0	20	17	6.3	4.1	5.3	15.7
	20			5.8	8.2	5.3	19.3			6.4	4.2	5.3	16.0
	30			5.9	8.3	5.3	19.5			6.6	4.3	5.3	16.2
	40			6.0	8.5	5.3	19.8			6.7	4.4	5.3	16.5
30	10	50	25	8.5	19.4	7.7	35.6	61	25	9.4	13.4	7.7	30.5
	20			8.7	19.7	7.7	36.1			9.6	13.7	7.7	31.0
	30			8.8	20.0	7.7	36.5			9.9	13.9	7.7	31.5
	40			9.0	20.4	7.7	37.0			10.1	14.2	7.7	32.0
40	10	68	34	11.4	25.8	10.3	47.5	70	34	12.6	17.9	10.3	40.7
	20			11.6	26.3	10.3	48.1			12.9	18.2	10.3	41.3
	30			11.8	26.7	10.3	48.7			13.1	18.6	10.3	42.0
	40			11.9	27.1	10.3	49.4			13.4	19.0	10.3	42.6
50	10	84	42	14.2	32.3	12.8	59.4	78	42	15.7	22.3	14.6	52.7
	20			14.5	32.8	12.8	60.1			16.1	22.8	14.6	53.5
	30			14.7	33.4	12.8	60.9			16.4	23.2	14.7	54.3
	40			14.9	33.9	12.8	61.7			16.8	23.7	14.7	55.1
60	10	100	50	17.1	38.8	15.4	71.3	86	50	18.9	26.8	17.6	63.2
	20			17.4	39.4	15.4	72.2			19.3	27.3	17.6	64.2
	30			17.6	40.1	15.4	73.1			19.7	27.9	17.6	65.2
	40			17.9	40.7	15.4	74.0			20.1	28.4	17.6	66.1
70	10	118	59	19.9	45.2	18.0	83.1	95	59	22.0	31.3	20.5	73.8
	20			20.3	46.0	18.0	84.2			22.5	31.9	20.5	74.9
	30			20.6	46.7	18.0	85.3			23.0	32.5	20.5	76.0
	40			20.9	47.5	18.0	86.4			23.5	33.2	20.5	77.2
80	10	131	67	22.8	51.7	22.4	96.9	103	67	25.2	35.7	23.4	84.3
	20			23.2	52.5	22.4	98.1			25.7	36.4	23.4	85.6
	30			23.5	53.4	22.4	99.3			26.3	37.2	23.4	86.9
	40			23.9	54.3	22.4	100.6			26.8	37.9	23.5	88.2
90	10	139	75	25.6	58.2	25.2	109.0	111	75	28.3	40.2	26.4	94.9
	20			26.0	59.1	25.2	110.4			28.9	41.0	26.4	96.3
	30			26.4	60.1	25.2	111.8			29.6	41.8	26.4	97.8
	40			26.9	61.1	25.2	113.2			30.2	42.6	26.4	99.2
100	10	148	84	28.5	64.6	28.0	121.1	120	84	31.5	44.7	29.3	105.4
	20			28.9	65.7	28.0	122.6			32.2	45.5	29.3	107.0
	30			29.4	66.8	28.0	124.2			32.9	46.5	29.3	108.6
	40			29.8	67.9	28.0	125.7			33.6	47.4	29.3	110.3
120	10	164	100	34.2	77.5	33.6	145.3	136	100	37.7	53.6	35.2	126.5
	20			34.7	78.8	33.6	147.2			38.6	54.7	35.2	128.4
	30			35.3	80.1	33.6	149.0			39.4	55.7	35.2	130.4
	40			35.8	81.4	33.6	150.9			40.3	56.9	35.2	132.3
140	10	181	117	39.9	90.5	39.2	169.6	153	117	44.0	62.5	41.0	147.6
	20			40.5	91.9	39.2	171.7			45.0	63.8	41.1	149.8
	30			41.1	93.5	39.2	173.9			46.0	65.0	41.1	152.1
	40			41.8	95.0	39.3	176.0			47.0	66.3	41.1	154.4
160	10	198	134	45.6	103.4	44.8	193.8	170	134	50.3	71.5	46.9	168.7
	20			46.3	105.1	44.9	196.2			51.4	72.9	46.9	171.2
	30			47.0	106.8	44.9	198.7			52.6	74.3	46.9	173.8
	40			47.7	108.6	44.9	201.2			53.7	75.8	47.0	176.4
180	10	214	150	51.3	116.3	50.4	218.0	186	150	56.6	80.4	52.8	189.8
	20			52.1	118.2	50.5	220.8			57.9	82.0	52.8	192.7
	30			52.9	120.2	50.5	223.5			59.1	83.6	52.8	195.6
	40			53.7	122.2	50.5	226.4			60.4	85.3	52.8	198.5
200	10	231	167	57.0	129.2	56.0	242.3	203	167	62.9	89.3	58.7	210.9
	20			57.9	131.4	56.1	245.3			64.3	91.1	58.7	214.1
	30			58.8	133.5	56.1	248.4			65.7	92.9	58.7	217.3
	40			59.7	135.7	56.1	251.5			67.1	94.8	58.7	220.6

200 CHARACTER DATA RECORD

INPUT AND OUTPUT 7330 TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	13	5	1.5	2.1	1.4	5.1	8	5	1.6	1.1	1.5	4.1
	20			1.6	2.2	1.4	5.2			1.6	1.1	1.5	4.2
	30			1.6	2.2	1.4	5.2			1.6	1.1	1.5	4.3
	40			1.6	2.3	1.4	5.3			1.7	1.2	1.5	4.3
10	10	17	9	3.1	4.3	2.9	10.3	12	9	3.2	2.2	2.9	8.3
	20			3.1	4.3	2.9	10.4			3.2	2.2	2.9	8.4
	30			3.2	4.4	2.9	10.5			3.3	2.3	2.9	8.5
	40			3.2	4.5	2.9	10.7			3.3	2.3	2.9	8.6
20	10	26	18	6.2	8.5	5.8	20.5	21	18	6.4	4.4	5.8	16.6
	20			6.3	8.7	5.8	20.8			6.5	4.5	5.8	16.8
	30			6.4	8.9	5.8	21.1			6.6	4.6	5.8	17.0
	40			6.5	9.0	5.8	21.3			6.7	4.7	5.8	17.2
30	10	54	27	9.3	20.7	8.4	38.4	63	27	9.5	14.3	8.4	32.2
	20			9.4	21.0	8.4	38.9			9.7	14.5	8.4	32.7
	30			9.6	21.3	8.4	39.3			9.9	14.8	8.4	33.1
	40			9.7	21.7	8.4	39.8			10.0	15.1	8.4	33.5
40	10	72	36	12.4	27.6	11.2	51.2	72	36	12.7	19.0	11.2	43.0
	20			12.6	28.0	11.2	51.8			12.9	19.4	11.2	43.6
	30			12.8	28.4	11.2	52.4			13.2	19.7	11.2	44.1
	40			12.9	28.9	11.2	53.1			13.4	20.1	11.2	44.7
50	10	90	45	15.5	34.5	14.0	64.0	81	45	15.9	23.8	15.9	55.6
	20			15.7	35.0	14.0	64.8			16.2	24.2	15.9	56.3
	30			15.9	35.5	14.1	65.5			16.4	24.7	15.9	57.1
	40			16.2	36.1	14.1	66.3			16.7	25.1	15.9	57.8
60	10	108	54	18.6	41.4	16.8	76.8	90	54	19.1	28.5	19.1	66.7
	20			18.9	42.0	16.9	77.7			19.4	29.1	19.1	67.6
	30			19.1	42.7	16.9	78.7			19.7	29.6	19.1	68.5
	40			19.4	43.3	16.9	79.6			20.1	30.2	19.1	69.3
70	10	126	63	21.7	48.3	19.7	89.6	99	63	22.2	33.3	22.3	77.8
	20			22.0	49.0	19.7	90.7			22.6	33.9	22.3	78.9
	30			22.3	49.8	19.7	91.8			23.0	34.5	22.3	79.9
	40			22.6	50.5	19.7	92.9			23.4	35.2	22.3	80.9
80	10	136	72	24.8	55.2	24.4	104.4	108	72	25.4	38.1	25.5	89.0
	20			25.2	56.0	24.4	105.6			25.9	38.8	25.5	90.1
	30			25.5	56.9	24.4	106.8			26.3	39.5	25.5	91.3
	40			25.9	57.8	24.4	108.1			26.7	40.2	25.5	92.5
90	10	145	81	27.9	62.1	27.5	117.4	117	81	28.6	42.8	28.7	100.1
	20			28.3	63.0	27.5	118.8			29.1	43.6	28.7	101.4
	30			28.7	64.0	27.5	120.2			29.6	44.4	28.7	102.7
	40			29.1	65.0	27.5	121.6			30.1	45.2	28.7	104.0
100	10	154	90	31.0	69.0	30.5	130.5	126	90	31.8	47.6	31.9	111.2
	20			31.4	70.0	30.5	132.0			32.3	48.5	31.9	112.7
	30			31.9	71.1	30.5	133.5			32.9	49.4	31.9	114.1
	40			32.3	72.2	30.6	135.1			33.4	50.3	31.9	115.6
120	10	172	108	37.2	82.8	36.6	156.6	144	108	38.1	57.1	38.2	133.5
	20			37.7	84.0	36.6	158.4			38.8	58.1	38.3	135.2
	30			38.3	85.3	36.7	160.2			39.5	59.2	38.3	137.0
	40			38.8	86.6	36.7	162.1			40.1	60.3	38.3	138.7
140	10	189	125	43.4	96.5	42.7	182.7	161	125	44.5	66.6	44.6	155.7
	20			44.0	98.0	42.7	184.8			45.3	67.8	44.7	157.8
	30			44.7	99.5	42.8	186.9			46.0	69.1	44.7	159.8
	40			45.3	101.1	42.8	189.1			46.8	70.4	44.7	161.9
160	10	207	143	49.6	110.3	48.9	208.8	179	143	50.8	76.1	51.0	178.0
	20			50.3	112.0	48.9	211.2			51.7	77.5	51.0	180.3
	30			51.0	113.7	48.9	213.7			52.6	79.0	51.0	182.6
	40			51.8	115.5	48.9	216.2			53.5	80.4	51.1	185.0
180	10	225	161	55.8	124.1	55.0	234.9	197	161	57.2	85.6	57.4	200.3
	20			56.6	126.0	55.0	237.6			58.2	87.2	57.4	202.8
	30			57.4	128.0	55.0	240.4			59.2	88.8	57.4	205.5
	40			58.2	129.9	55.0	243.2			60.2	90.5	57.5	208.1
200	10	243	179	62.0	137.9	61.1	261.0	215	179	63.6	95.2	63.8	222.5
	20			62.9	140.0	61.1	264.0			64.7	96.9	63.8	225.4
	30			63.8	142.2	61.1	267.1			65.8	98.7	63.8	228.3
	40			64.7	144.4	61.1	270.2			66.9	100.5	63.8	231.2

220 CHARACTER DATA RECORD

INPUT AND OUTPUT 7330 TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	14	6	1.7	2.4	1.6	5.7	9	6	1.7	1.2	1.6	4.6
	20			1.7	2.4	1.6	5.7			1.7	1.2	1.6	4.6
	30			1.7	2.5	1.6	5.8			1.8	1.3	1.7	4.7
	40			1.8	2.5	1.6	5.9			1.8	1.3	1.7	4.7
10	10	19	11	3.4	4.8	3.3	11.5	14	11	3.4	2.4	3.3	9.2
	20			3.4	4.9	3.3	11.6			3.5	2.5	3.3	9.3
	30			3.5	4.9	3.3	11.7			3.5	2.5	3.3	9.4
	40			3.5	5.0	3.3	11.8			3.6	2.6	3.3	9.5
15	10	24	16	5.1	7.2	4.9	17.2	19	16	5.2	3.7	4.9	13.8
	20			5.2	7.3	4.9	17.4			5.2	3.7	5.0	13.9
	30			5.2	7.4	4.9	17.6			5.3	3.8	5.0	14.1
	40			5.3	7.6	4.9	17.8			5.4	3.9	5.0	14.2
20	10	29	21	6.8	9.6	6.6	22.9	57	21	6.9	10.7	6.3	23.9
	20			6.9	9.7	6.6	23.2			7.0	10.9	6.3	24.2
	30			7.0	9.9	6.6	23.4			7.1	11.1	6.3	24.5
	40			7.1	10.1	6.6	23.7			7.2	11.3	6.3	24.8
25	10	54	27	8.5	19.5	7.9	35.9	63	27	8.6	13.4	7.9	29.9
	20			8.6	19.8	7.9	36.3			8.7	13.6	7.9	30.3
	30			8.7	20.0	7.9	36.7			8.8	13.8	7.9	30.6
	40			8.8	20.3	7.9	37.1			9.0	14.1	7.9	31.0
30	10	64	32	10.2	23.4	9.5	43.1	68	32	10.3	16.1	9.5	35.9
	20			10.3	23.7	9.5	43.6			10.5	16.4	9.5	36.3
	30			10.5	24.0	9.5	44.0			10.6	16.6	9.5	36.7
	40			10.6	24.4	9.5	44.5			10.8	16.9	9.5	37.2
35	10	74	37	11.9	27.4	11.1	50.3	73	37	12.0	18.8	12.7	43.5
	20			12.1	27.7	11.1	50.8			12.2	19.1	12.7	44.0
	30			12.2	28.1	11.1	51.3			12.4	19.4	12.7	44.5
	40			12.4	28.4	11.1	51.9			12.6	19.7	12.7	45.0
40	10	84	42	13.6	31.3	12.7	57.5	78	42	13.7	21.5	14.5	49.7
	20			13.8	31.7	12.7	58.1			13.9	21.8	14.5	50.3
	30			14.0	32.1	12.7	58.7			14.2	22.2	14.5	50.8
	40			14.1	32.5	12.7	59.3			14.4	22.5	14.5	51.4
45	10	94	47	15.3	35.2	14.2	64.7	83	47	15.5	24.2	16.3	56.0
	20			15.5	35.6	14.2	65.4			15.7	24.5	16.3	56.6
	30			15.7	36.1	14.3	66.0			15.9	24.9	16.3	57.2
	40			15.9	36.5	14.3	66.7			16.1	25.3	16.3	57.8
50	10	106	53	17.0	39.1	15.8	71.9	89	53	17.2	26.9	18.1	62.2
	20			17.2	39.6	15.8	72.6			17.4	27.3	18.1	62.8
	30			17.4	40.1	15.8	73.4			17.7	27.7	18.1	63.5
	40			17.7	40.6	15.8	74.1			17.9	28.1	18.1	64.2
55	10	116	58	18.7	43.0	17.4	79.1	94	58	18.9	29.5	19.9	68.4
	20			18.9	43.5	17.4	79.9			19.2	30.0	20.0	69.1
	30			19.2	44.1	17.4	80.7			19.5	30.5	20.0	69.9
	40			19.4	44.7	17.4	81.5			19.7	30.9	20.0	70.6
60	10	126	63	20.4	46.9	19.0	86.3	99	63	20.6	32.2	21.8	74.6
	20			20.7	47.5	19.0	87.1			20.9	32.7	21.8	75.4
	30			20.9	48.1	19.0	88.0			21.2	33.2	21.8	76.2
	40			21.2	48.7	19.0	88.9			21.5	33.8	21.8	77.1
70	10	137	73	23.8	54.7	24.2	102.7	109	73	24.1	37.6	25.4	87.1
	20			24.1	55.4	24.3	103.8			24.4	38.2	25.4	88.0
	30			24.4	56.1	24.3	104.8			24.8	38.8	25.4	89.0
	40			24.7	56.8	24.3	105.8			25.1	39.4	25.4	89.9
80	10	148	84	27.2	62.5	27.7	117.4	120	84	27.5	43.0	29.0	99.5
	20			27.5	63.3	27.7	118.6			27.9	43.6	29.0	100.6
	30			27.9	64.1	27.7	119.8			28.3	44.3	29.1	101.7
	40			28.3	65.0	27.7	121.0			28.7	45.0	29.1	102.8
90	10	158	94	30.6	70.3	31.2	132.1	130	94	30.9	48.4	32.7	111.9
	20			31.0	71.2	31.2	133.4			31.4	49.1	32.7	113.1
	30			31.4	72.1	31.2	134.7			31.8	49.9	32.7	114.4
	40			31.8	73.1	31.2	136.1			32.3	50.6	32.7	115.6
100	10	169	105	34.0	78.2	34.6	146.8	141	105	34.4	53.7	36.3	124.4
	20			34.4	79.1	34.7	148.2			34.9	54.5	36.3	125.7
	30			34.9	80.1	34.7	149.7			35.4	55.4	36.3	127.1
	40			35.3	81.2	34.7	151.2			35.9	56.3	36.3	128.5

		40K CORE STORAGE						60K/80K CORE STORAGE					
		CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
FILE SIZE	CW LNG	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	14	6	1.8	2.6	1.7	6.1	9	6	1.9	1.3	1.8	5.0
	20			1.8	2.6	1.7	6.2			1.9	1.3	1.8	5.0
	30			1.9	2.7	1.7	6.2			1.9	1.4	1.8	5.1
	40			1.9	2.7	1.7	6.3			1.9	1.4	1.8	5.1
10	10	20	12	3.6	5.1	3.6	12.4	15	12	3.7	2.6	3.6	9.9
	20			3.7	5.2	3.6	12.5			3.8	2.7	3.6	10.0
	30			3.7	5.3	3.6	12.6			3.8	2.7	3.6	10.1
	40			3.8	5.4	3.6	12.7			3.9	2.8	3.6	10.2
15	10	26	18	5.5	7.7	5.4	18.6	21	18	5.6	3.9	5.4	14.9
	20			5.5	7.8	5.4	18.7			5.6	4.0	5.4	15.0
	30			5.6	8.0	5.4	18.9			5.7	4.1	5.4	15.2
	40			5.7	8.1	5.4	19.1			5.8	4.2	5.4	15.4
20	10	31	23	7.3	10.3	7.2	24.7	59	23	7.4	11.6	6.9	25.9
	20			7.4	10.5	7.2	25.0			7.5	11.7	6.9	26.2
	30			7.5	10.6	7.2	25.2			7.6	11.9	6.9	26.4
	40			7.5	10.8	7.2	25.5			7.7	12.1	6.9	26.7
25	10	58	29	9.1	21.1	8.6	38.9	65	29	9.3	14.5	8.6	32.4
	20			9.2	21.4	8.6	39.2			9.4	14.7	8.6	32.7
	30			9.3	21.6	8.6	39.6			9.5	14.9	8.6	33.1
	40			9.4	21.9	8.6	39.9			9.6	15.1	8.6	33.4
30	10	70	35	10.9	25.3	10.4	46.6	71	35	11.1	17.4	10.4	38.9
	20			11.1	25.6	10.4	47.0			11.3	17.6	10.4	39.3
	30			11.2	25.9	10.4	47.5			11.4	17.9	10.4	39.7
	40			11.3	26.2	10.4	47.9			11.6	18.1	10.4	40.1
35	10	80	40	12.8	29.6	12.1	54.4	76	40	13.0	20.3	13.8	47.1
	20			12.9	29.9	12.1	54.9			13.1	20.6	13.8	47.6
	30			13.1	30.2	12.1	55.4			13.3	20.9	13.9	48.0
	40			13.2	30.6	12.1	55.9			13.5	21.1	13.9	48.5
40	10	92	46	14.6	33.8	13.8	62.2	82	46	14.8	23.2	15.8	53.8
	20			14.7	34.2	13.8	62.7			15.0	23.5	15.8	54.3
	30			14.9	34.6	13.8	63.3			15.2	23.8	15.8	54.9
	40			15.1	35.0	13.8	63.9			15.4	24.2	15.8	55.4
45	10	104	52	16.4	38.0	15.5	69.9	88	52	16.7	26.1	17.8	60.5
	20			16.6	38.4	15.5	70.6			16.9	26.4	17.8	61.1
	30			16.8	38.9	15.6	71.2			17.1	26.8	17.8	61.7
	40			17.0	39.3	15.6	71.9			17.4	27.2	17.8	62.4
50	10	114	57	18.2	42.2	17.3	77.7	93	57	18.5	29.0	19.8	67.3
	20			18.4	42.7	17.3	78.4			18.8	29.4	19.8	67.9
	30			18.6	43.2	17.3	79.1			19.0	29.8	19.8	68.6
	40			18.9	43.7	17.3	79.9			19.3	30.2	19.8	69.3
55	10	126	63	20.0	46.4	19.0	85.5	99	63	20.4	31.9	21.8	74.0
	20			20.3	47.0	19.0	86.2			20.7	32.3	21.8	74.7
	30			20.5	47.5	19.0	87.0			20.9	32.8	21.8	75.5
	40			20.7	48.1	19.0	87.8			21.2	33.2	21.8	76.2
60	10	133	69	21.9	50.7	22.7	95.2	105	69	22.2	34.8	23.7	80.7
	20			22.1	51.2	22.7	96.0			22.5	35.2	23.7	81.5
	30			22.4	51.8	22.7	96.9			22.8	35.7	23.7	82.3
	40			22.6	52.4	22.7	97.8			23.1	36.3	23.8	83.2
70	10	144	80	25.5	59.1	26.4	111.1	116	80	25.9	40.6	27.7	94.2
	20			25.8	59.8	26.5	112.0			26.3	41.1	27.7	95.1
	30			26.1	60.5	26.5	113.0			26.6	41.7	27.7	96.1
	40			26.4	61.2	26.5	114.1			27.0	42.3	27.7	97.0
80	10	155	91	29.1	67.6	30.2	126.9	127	91	29.6	46.4	31.7	107.7
	20			29.5	68.3	30.2	128.1			30.0	47.0	31.7	108.7
	30			29.8	69.1	30.2	129.2			30.5	47.7	31.7	109.8
	40			30.2	69.9	30.3	130.4			30.9	48.3	31.7	110.9
90	10	167	103	32.8	76.0	34.0	142.8	139	103	33.3	52.2	35.6	121.1
	20			33.2	76.9	34.0	144.1			33.8	52.9	35.6	122.3
	30			33.6	77.8	34.0	145.3			34.3	53.6	35.7	123.5
	40			33.9	78.7	34.0	146.7			34.7	54.4	35.7	124.8
100	10	178	114	36.4	84.5	37.8	158.7	150	114	37.1	58.0	39.6	134.6
	20			36.9	85.4	37.8	160.1			37.6	58.7	39.6	135.9
	30			37.3	86.4	37.8	161.5			38.1	59.6	39.6	137.3
	40			37.7	87.4	37.8	163.0			38.6	60.4	39.6	138.7

260 CHARACTER DATA RECORD

INPUT AND OUTPUT 7330 TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	15	7	2.0	2.8	1.9	6.6	10	7	2.0	1.4	2.0	5.4
	20			2.0	2.8	1.9	6.7			2.0	1.4	2.0	5.4
	30			2.0	2.9	1.9	6.8			2.0	1.5	2.0	5.5
	40			2.0	2.9	1.9	6.8			2.1	1.5	2.0	5.5
10	10	21	13	3.9	5.6	3.9	13.4	16	13	4.0	2.8	3.9	10.7
	20			4.0	5.6	3.9	13.5			4.0	2.9	3.9	10.8
	30			4.0	5.7	3.9	13.6			4.1	2.9	3.9	10.9
	40			4.1	5.8	3.9	13.8			4.1	3.0	3.9	11.0
15	10	27	19	5.9	8.3	5.9	20.1	55	19	5.9	9.4	5.6	21.0
	20			5.9	8.5	5.9	20.3			6.0	9.6	5.6	21.2
	30			6.0	8.6	5.9	20.5			6.1	9.7	5.7	21.4
	40			6.1	8.7	5.9	20.7			6.2	9.8	5.7	21.6
20	10	50	25	7.8	18.4	7.5	33.7	61	25	7.9	12.6	7.5	28.0
	20			7.9	18.6	7.5	34.0			8.0	12.7	7.5	28.3
	30			8.0	18.7	7.5	34.3			8.1	12.9	7.5	28.5
	40			8.1	18.9	7.5	34.6			8.2	13.1	7.5	28.8
25	10	64	32	9.8	23.0	9.4	42.2	68	32	9.9	15.7	9.4	35.0
	20			9.9	23.2	9.4	42.5			10.0	15.9	9.4	35.4
	30			10.0	23.4	9.4	42.9			10.1	16.1	9.4	35.7
	40			10.1	23.7	9.4	43.2			10.3	16.3	9.4	36.0
30	10	76	38	11.8	27.6	11.3	50.6	74	38	11.9	18.9	13.0	43.7
	20			11.9	27.8	11.3	51.0			12.0	19.1	13.0	44.1
	30			12.0	28.1	11.3	51.4			12.2	19.3	13.0	44.5
	40			12.2	28.4	11.3	51.9			12.3	19.6	13.0	44.9
35	10	88	44	13.7	32.1	13.2	59.1	80	44	13.9	22.0	15.1	51.0
	20			13.9	32.5	13.2	59.5			14.0	22.3	15.1	51.5
	30			14.0	32.8	13.2	60.0			14.2	22.6	15.1	51.9
	40			14.2	33.1	13.2	60.5			14.4	22.9	15.1	52.4
40	10	100	50	15.7	36.7	15.1	67.5	86	50	15.8	25.2	17.3	58.3
	20			15.9	37.1	15.1	68.0			16.0	25.5	17.3	58.8
	30			16.0	37.5	15.1	68.6			16.2	25.8	17.3	59.3
	40			16.2	37.9	15.1	69.2			16.4	26.1	17.3	59.9
45	10	114	57	17.7	41.3	16.9	75.9	93	57	17.8	28.3	19.5	65.6
	20			17.8	41.7	16.9	76.5			18.0	28.7	19.5	66.2
	30			18.0	42.2	17.0	77.2			18.3	29.0	19.5	66.7
	40			18.2	42.6	17.0	77.8			18.5	29.4	19.5	67.3
50	10	126	63	19.6	45.9	18.8	84.4	99	63	19.8	31.5	21.6	72.9
	20			19.8	46.4	18.8	85.0			20.0	31.8	21.6	73.5
	30			20.0	46.9	18.8	85.7			20.3	32.2	21.6	74.2
	40			20.3	47.3	18.8	86.5			20.5	32.6	21.6	74.8
55	10	133	69	21.6	50.5	22.7	94.8	105	69	21.8	34.6	23.8	80.2
	20			21.8	51.0	22.7	95.5			22.1	35.0	23.8	80.9
	30			22.0	51.5	22.7	96.3			22.3	35.5	23.8	81.6
	40			22.3	52.1	22.7	97.1			22.6	35.9	23.8	82.3
60	10	139	75	23.5	55.1	24.8	103.4	111	75	23.8	37.7	26.0	87.5
	20			23.8	55.7	24.8	104.2			24.1	38.2	26.0	88.2
	30			24.1	56.2	24.8	105.1			24.3	38.7	26.0	89.0
	40			24.3	56.8	24.8	105.9			24.6	39.2	26.0	89.8
70	10	152	88	27.5	64.3	28.9	120.6	124	88	27.7	44.0	30.3	102.1
	20			27.8	64.9	28.9	121.6			28.1	44.6	30.3	102.9
	30			28.1	65.6	28.9	122.6			28.4	45.1	30.3	103.9
	40			28.4	66.3	28.9	123.6			28.7	45.7	30.3	104.8
80	10	164	100	31.4	73.5	33.0	137.9	136	100	31.7	50.3	34.6	116.6
	20			31.7	74.2	33.0	139.0			32.1	50.9	34.6	117.7
	30			32.1	75.0	33.0	140.1			32.5	51.6	34.6	118.7
	40			32.4	75.8	33.0	141.2			32.9	52.2	34.7	119.7
90	10	177	113	35.3	82.7	37.1	155.1	149	113	35.7	56.6	39.0	131.2
	20			35.7	83.5	37.2	156.3			36.1	57.3	39.0	132.4
	30			36.1	84.3	37.2	157.6			36.5	58.0	39.0	133.5
	40			36.5	85.2	37.2	158.9			37.0	58.8	39.0	134.7
100	10	189	125	39.2	91.8	41.3	172.3	161	125	39.6	62.9	43.3	145.8
	20			39.7	92.8	41.3	173.7			40.1	63.7	43.3	147.1
	30			40.1	93.7	41.3	175.1			40.6	64.5	43.3	148.4
	40			40.5	94.7	41.3	176.5			41.1	65.3	43.3	149.7

280 CHARACTER DATA RECORD

INPUT AND OUTPUT 7330 TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	10	15	7	2.1	2.8	2.0	6.9	10	7	2.1	1.4	2.0	5.6
	20			2.1	2.9	2.0	6.9			2.1	1.5	2.0	5.6
	30			2.1	2.9	2.0	7.0			2.1	1.5	2.0	5.7
	40			2.1	3.0	2.0	7.1			2.2	1.5	2.0	5.7
10	10	21	13	4.1	5.7	4.1	13.9	16	13	4.2	2.9	4.1	11.1
	20			4.2	5.7	4.1	14.0			4.2	2.9	4.1	11.2
	30			4.2	5.8	4.1	14.1			4.3	3.0	4.1	11.3
	40			4.3	5.9	4.1	14.2			4.3	3.0	4.1	11.4
15	10	27	19	6.2	8.5	6.1	20.8	55	19	6.3	9.5	5.9	21.7
	20			6.3	8.6	6.1	21.0			6.3	9.7	5.9	21.9
	30			6.3	8.7	6.1	21.2			6.4	9.8	5.9	22.1
	40			6.4	8.9	6.1	21.4			6.5	9.9	5.9	22.3
20	10	50	25	8.3	18.6	7.9	34.7	61	25	8.4	12.7	7.9	28.9
	20			8.4	18.8	7.9	35.0			8.5	12.9	7.9	29.2
	30			8.5	19.0	7.9	35.3			8.6	13.0	7.9	29.5
	40			8.5	19.2	7.9	35.6			8.7	13.2	7.9	29.7
25	10	64	32	10.4	23.2	9.8	43.4	68	32	10.5	15.9	9.8	36.2
	20			10.5	23.5	9.8	43.8			10.6	16.1	9.8	36.5
	30			10.6	23.7	9.8	44.1			10.7	16.3	9.8	36.8
	40			10.7	24.0	9.8	44.5			10.8	16.5	9.8	37.2
30	10	76	38	12.4	27.9	11.8	52.1	74	38	12.5	19.1	13.4	45.0
	20			12.6	28.1	11.8	52.5			12.7	19.3	13.4	45.4
	30			12.7	28.4	11.8	52.9			12.8	19.6	13.4	45.8
	40			12.8	28.7	11.8	53.4			13.0	19.8	13.4	46.2
35	10	88	44	14.5	32.5	13.8	60.8	80	44	14.6	22.3	15.6	52.5
	20			14.6	32.8	13.8	61.3			14.8	22.5	15.6	52.9
	30			14.8	33.2	13.8	61.8			15.0	22.8	15.6	53.4
	40			14.9	33.5	13.8	62.3			15.1	23.1	15.6	53.9
40	10	100	50	16.6	37.1	15.7	69.4	86	50	16.7	25.4	17.8	60.0
	20			16.7	37.5	15.7	70.0			16.9	25.8	17.8	60.5
	30			16.9	37.9	15.7	70.6			17.1	26.1	17.8	61.0
	40			17.1	38.3	15.7	71.2			17.3	26.4	17.8	61.6
45	10	114	57	18.6	41.8	17.7	78.1	93	57	18.8	28.6	20.0	67.5
	20			18.8	42.2	17.7	78.8			19.0	29.0	20.1	68.1
	30			19.0	42.7	17.7	79.4			19.2	29.4	20.1	68.7
	40			19.2	43.1	17.7	80.1			19.5	29.7	20.1	69.3
50	10	126	63	20.7	46.4	19.7	86.8	99	63	20.9	31.8	22.3	75.0
	20			20.9	46.9	19.7	87.5			21.1	32.2	22.3	75.6
	30			21.1	47.4	19.7	88.2			21.4	32.6	22.3	76.3
	40			21.4	47.9	19.7	88.9			21.6	33.0	22.3	77.0
55	10	133	69	22.8	51.1	23.5	97.3	105	69	23.0	35.0	24.5	82.5
	20			23.0	51.6	23.5	98.1			23.3	35.4	24.5	83.2
	30			23.3	52.1	23.5	98.9			23.5	35.9	24.5	83.9
	40			23.5	52.7	23.5	99.7			23.8	36.3	24.5	84.7
60	10	139	75	24.9	55.7	25.6	106.2	111	75	25.1	38.2	26.8	90.0
	20			25.1	56.3	25.6	107.0			25.4	38.6	26.8	90.8
	30			25.4	56.9	25.6	107.9			25.7	39.1	26.8	91.6
	40			25.6	57.5	25.7	108.8			26.0	39.6	26.8	92.4
70	10	152	88	29.0	65.0	29.9	123.9	124	88	29.3	44.5	31.2	105.0
	20			29.3	65.7	29.9	124.9			29.6	45.1	31.2	105.9
	30			29.6	66.4	29.9	125.9			29.9	45.7	31.2	106.8
	40			29.9	67.1	29.9	126.9			30.3	46.3	31.2	107.8
80	10	164	100	33.1	74.3	34.2	141.6	136	100	33.4	50.9	35.7	120.0
	20			33.5	75.1	34.2	142.7			33.8	51.5	35.7	121.0
	30			33.8	75.8	34.2	143.9			34.2	52.2	35.7	122.1
	40			34.2	76.7	34.2	145.0			34.6	52.9	35.7	123.2
90	10	177	113	37.3	83.6	38.4	159.3	149	113	37.6	57.3	40.2	135.0
	20			37.7	84.4	38.4	160.6			38.1	58.0	40.2	136.2
	30			38.1	85.3	38.5	161.8			38.5	58.7	40.2	137.4
	40			38.4	86.2	38.5	163.2			38.9	59.5	40.2	138.6
100	10	189	125	41.4	92.9	42.7	177.0	161	125	41.8	63.6	44.6	150.0
	20			41.9	93.8	42.7	178.4			42.3	64.4	44.6	151.3
	30			42.3	94.8	42.7	179.8			42.8	65.2	44.6	152.6
	40			42.7	95.8	42.8	181.3			43.3	66.1	44.7	154.0

300 CHARACTER DATA RECORD

INPUT AND OUTPUT 7330 TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNS	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	20	15	7	2.2	3.1	2.1	7.5	10	7	2.2	1.6	2.2	6.1
	40			2.3	3.2	2.1	7.6			2.3	1.6	2.2	6.2
	60			2.3	3.3	2.1	7.7			2.3	1.7	2.2	6.3
	80			2.3	3.4	2.1	7.9			2.4	1.7	2.2	6.4
10	20	22	14	4.5	6.2	4.4	15.1	17	14	4.5	3.2	4.5	12.1
	40			4.5	6.4	4.4	15.4			4.6	3.3	4.5	12.3
	60			4.6	6.6	4.4	15.6			4.7	3.4	4.5	12.5
	80			4.7	6.7	4.4	15.9			4.8	3.5	4.5	12.7
15	20	29	21	6.7	9.4	6.6	22.7	57	21	6.7	10.5	6.4	23.7
	40			6.8	9.6	6.6	23.0			6.9	10.8	6.4	24.1
	60			6.9	9.9	6.6	23.4			7.0	11.0	6.4	24.5
	80			7.0	10.1	6.7	23.8			7.1	11.3	6.4	24.9
20	20	56	28	8.9	20.5	8.6	38.0	64	28	9.0	14.1	8.6	31.6
	40			9.1	20.9	8.6	38.5			9.2	14.4	8.6	32.1
	60			9.2	21.3	8.6	39.1			9.3	14.7	8.6	32.6
	80			9.4	21.7	8.6	39.7			9.5	15.1	8.6	33.2
25	20	70	35	11.1	25.6	10.7	47.5	71	35	11.2	17.6	10.7	39.5
	40			11.3	26.1	10.7	48.1			11.5	18.0	10.7	40.1
	60			11.5	26.6	10.7	48.9			11.7	18.4	10.7	40.8
	80			11.7	27.2	10.7	49.6			11.9	18.8	10.7	41.5
30	20	84	42	13.4	30.8	12.8	57.0	78	42	13.5	21.1	14.6	49.2
	40			13.6	31.3	12.8	57.8			13.7	21.6	14.6	49.9
	60			13.8	32.0	12.9	58.6			14.0	22.1	14.6	50.7
	80			14.1	32.6	12.9	59.5			14.3	22.6	14.7	51.5
35	20	98	49	15.6	35.9	15.0	66.4	85	49	15.7	24.6	17.1	57.4
	40			15.9	36.6	15.0	67.4			16.0	25.2	17.1	58.3
	60			16.1	37.3	15.0	68.4			16.4	25.7	17.1	59.2
	80			16.4	38.0	15.0	69.4			16.7	26.4	17.1	60.1
40	20	112	56	17.8	41.0	17.1	75.9	92	56	18.0	28.1	19.5	65.6
	40			18.1	41.8	17.1	77.0			18.3	28.7	19.5	66.6
	60			18.4	42.6	17.1	78.2			18.7	29.4	19.5	67.6
	80			18.8	43.4	17.1	79.4			19.1	30.1	19.5	68.7
45	20	126	63	20.0	46.2	19.2	85.4	99	63	20.2	31.6	21.9	73.8
	40			20.4	47.0	19.3	86.7			20.6	32.3	22.0	74.9
	60			20.7	47.9	19.3	88.0			21.0	33.1	22.0	76.1
	80			21.1	48.9	19.3	89.3			21.4	33.9	22.0	77.3
50	20	134	70	22.3	51.3	23.3	96.9	106	70	22.5	35.1	24.4	82.0
	40			22.7	52.2	23.3	98.2			22.9	35.9	24.4	83.2
	60			23.1	53.3	23.4	99.7			23.4	36.8	24.4	84.6
	80			23.5	54.3	23.4	101.1			23.8	37.7	24.4	85.9
55	20	141	77	24.5	56.4	25.7	106.6	113	77	24.7	38.7	26.8	90.2
	40			24.9	57.5	25.7	108.1			25.2	39.5	26.9	91.6
	60			25.4	58.6	25.7	109.6			25.7	40.5	26.9	93.0
	80			25.8	59.7	25.7	111.2			26.2	41.4	26.9	94.5
60	20	148	84	26.7	61.5	28.0	116.2	120	84	27.0	42.2	29.3	98.4
	40			27.2	62.7	28.0	117.9			27.5	43.1	29.3	99.9
	60			27.7	63.9	28.0	119.6			28.0	44.1	29.3	101.5
	80			28.1	65.2	28.1	121.4			28.6	45.2	29.3	103.1
70	20	162	98	31.2	71.8	32.7	135.6	134	98	31.5	49.2	34.2	114.8
	40			31.7	73.1	32.7	137.5			32.1	50.3	34.2	116.6
	60			32.3	74.6	32.7	139.5			32.7	51.5	34.2	118.4
	80			32.8	76.0	32.7	141.6			33.3	52.7	34.2	120.3
80	20	176	112	35.6	82.1	37.3	155.0	148	112	35.9	56.2	39.1	131.2
	40			36.2	83.6	37.3	157.2			36.7	57.5	39.1	133.3
	60			36.9	85.2	37.4	159.5			37.4	58.8	39.1	135.4
	80			37.5	86.9	37.4	161.8			38.1	60.3	39.2	137.5
90	20	189	125	40.1	92.3	42.0	174.4	161	125	40.4	63.3	44.0	147.7
	40			40.8	94.0	42.0	176.8			41.2	64.7	44.0	149.9
	60			41.5	95.9	42.0	179.4			42.1	66.2	44.0	152.3
	80			42.2	97.8	42.1	182.0			42.9	67.8	44.0	154.7
100	20	203	139	44.5	102.6	46.7	193.8	175	139	44.9	70.3	48.8	164.1
	40			45.3	104.5	46.7	196.5			45.8	71.9	48.9	166.6
	60			46.1	106.5	46.8	199.4			46.7	73.6	48.9	169.2
	80			46.9	108.6	46.8	202.3			47.6	75.3	48.9	171.9

400 CHARACTER DATA RECORD

INPUT AND OUTPUT 7330 TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	20	17	9	2.9	3.9	2.9	9.7	12	9	2.9	2.0	2.9	7.8
	40			2.9	4.0	2.9	9.8			2.9	2.0	2.9	7.9
	60			2.9	4.1	2.9	9.9			3.0	2.1	2.9	8.0
	80			3.0	4.2	2.9	10.0			3.0	2.1	2.9	8.1
10	20	26	18	5.7	7.8	5.8	19.4	21	18	5.8	3.9	5.8	15.6
	40			5.8	8.0	5.8	19.6			5.9	4.1	5.8	15.8
	60			5.9	8.2	5.8	19.9			6.0	4.2	5.8	16.0
	80			5.9	8.3	5.8	20.1			6.1	4.3	5.8	16.2
15	20	54	27	8.6	19.5	8.4	36.5	63	27	8.7	13.3	8.4	30.4
	40			8.7	19.8	8.4	36.9			8.8	13.5	8.4	30.8
	60			8.8	20.1	8.4	37.3			9.0	13.8	8.4	31.2
	80			8.9	20.4	8.4	37.7			9.1	14.0	8.4	31.6
20	20	72	36	11.4	26.0	11.2	48.7	72	36	11.6	17.7	11.2	40.6
	40			11.6	26.4	11.2	49.2			11.8	18.0	11.2	41.1
	60			11.7	26.7	11.3	49.7			12.0	18.4	11.3	41.6
	80			11.9	27.1	11.3	50.3			12.1	18.7	11.3	42.1
25	20	90	45	14.3	32.5	14.0	60.8	81	45	14.5	22.2	15.9	52.6
	40			14.5	32.9	14.1	61.5			14.7	22.6	15.9	53.2
	60			14.7	33.4	14.1	62.2			14.9	23.0	15.9	53.8
	80			14.8	33.9	14.1	62.8			15.2	23.4	15.9	54.5
30	20	108	54	17.2	39.0	16.9	73.0	90	54	17.4	26.6	19.1	63.1
	40			17.4	39.5	16.9	73.8			17.7	27.1	19.1	63.8
	60			17.6	40.1	16.9	74.6			17.9	27.5	19.1	64.6
	80			17.8	40.7	16.9	75.4			18.2	28.0	19.1	65.3
35	20	126	63	20.0	45.5	19.7	85.2	99	63	20.3	31.1	22.2	73.6
	40			20.3	46.1	19.7	86.1			20.6	31.6	22.3	74.4
	60			20.5	46.8	19.7	87.0			20.9	32.1	22.3	75.3
	80			20.8	47.5	19.7	88.0			21.2	32.7	22.3	76.2
40	20	136	72	22.9	52.0	24.4	99.3	108	72	23.2	35.5	25.4	84.1
	40			23.2	52.7	24.4	100.3			23.6	36.1	25.4	85.1
	60			23.5	53.5	24.4	101.4			23.9	36.7	25.5	86.1
	80			23.8	54.3	24.4	102.5			24.3	37.4	25.5	87.1
45	20	145	81	25.7	58.5	27.4	111.7	117	81	26.1	39.9	28.6	94.7
	40			26.1	59.3	27.5	112.8			26.5	40.6	28.7	95.8
	60			26.4	60.2	27.5	114.0			26.9	41.3	28.7	96.9
	80			26.7	61.1	27.5	115.3			27.3	42.1	28.7	98.1
50	20	154	90	28.6	65.0	30.5	124.1	126	90	29.0	44.4	31.8	105.2
	40			29.0	65.9	30.5	125.4			29.4	45.1	31.8	106.4
	60			29.3	66.8	30.5	126.7			29.9	45.9	31.9	107.7
	80			29.7	67.8	30.5	128.1			30.3	46.7	31.9	109.0
55	20	163	99	31.5	71.5	33.5	136.5	135	99	31.9	48.8	35.0	115.7
	40			31.9	72.5	33.6	137.9			32.4	49.6	35.0	117.0
	60			32.3	73.5	33.6	139.4			32.9	50.5	35.1	118.4
	80			32.7	74.6	33.6	140.9			33.4	51.4	35.1	119.9
60	20	172	108	34.3	78.0	36.6	148.9	144	108	34.8	53.2	38.2	126.2
	40			34.8	79.1	36.6	150.4			35.3	54.1	38.2	127.7
	60			35.2	80.2	36.6	152.0			35.9	55.1	38.2	129.2
	80			35.6	81.4	36.7	153.7			36.4	56.1	38.3	130.8
70	20	189	125	40.1	91.0	42.7	173.7	161	125	40.6	62.1	44.6	147.3
	40			40.6	92.2	42.7	175.5			41.2	63.1	44.6	149.0
	60			41.1	93.6	42.7	177.4			41.8	64.3	44.7	150.8
	80			41.6	95.0	42.8	179.3			42.5	65.4	44.7	152.6
80	20	207	143	45.8	104.0	48.8	198.6	179	143	46.4	71.0	51.0	168.3
	40			46.4	105.4	48.9	200.6			47.1	72.2	51.0	170.3
	60			46.9	107.0	48.9	202.8			47.8	73.4	51.0	172.3
	80			47.5	108.6	48.9	205.0			48.5	74.8	51.1	174.4
90	20	225	161	51.5	117.0	54.9	223.4	197	161	52.2	79.8	57.4	189.4
	40			52.1	118.6	55.0	225.7			53.0	81.2	57.4	191.6
	60			52.8	120.3	55.0	228.1			53.8	82.6	57.4	193.9
	80			53.4	122.1	55.0	230.6			54.6	84.1	57.5	196.2
100	20	243	179	57.2	130.0	61.0	248.2	215	179	58.0	88.7	63.7	210.4
	40			57.9	131.8	61.1	250.8			58.9	90.2	63.8	212.9
	60			58.7	133.7	61.1	253.5			59.8	91.8	63.8	215.4
	80			59.4	135.7	61.2	256.2			60.7	93.5	63.9	218.0

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	C% LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	20	21	13	3.6	5.2	3.8	12.6	16	13	3.6	2.6	3.9	10.1
	40			3.6	5.3	3.8	12.7			3.7	2.6	3.9	10.2
	60			3.6	5.4	3.8	12.8			3.7	2.7	3.9	10.3
	80			3.7	5.4	3.8	12.9			3.7	2.7	3.9	10.4
10	20	50	25	7.1	17.6	7.4	32.1	61	25	7.2	12.0	7.4	26.6
	40			7.2	17.8	7.4	32.3			7.3	12.1	7.4	26.8
	60			7.3	17.9	7.4	32.6			7.4	12.2	7.4	27.0
	80			7.3	18.1	7.4	32.8			7.5	12.4	7.4	27.3
15	20	76	38	10.7	26.4	11.0	48.2	74	38	10.9	18.0	12.7	41.6
	40			10.8	26.6	11.1	48.5			11.0	18.2	12.7	41.9
	60			10.9	26.9	11.1	48.8			11.1	18.4	12.7	42.2
	80			11.0	27.1	11.1	49.2			11.2	18.6	12.8	42.6
20	20	100	50	14.3	35.2	14.7	64.3	86	50	14.5	24.0	17.0	55.4
	40			14.4	35.5	14.7	64.7			14.7	24.2	17.0	55.8
	60			14.5	35.8	14.8	65.1			14.8	24.5	17.0	56.3
	80			14.7	36.2	14.8	65.6			15.0	24.8	17.0	56.8
25	20	126	63	17.9	44.0	18.4	80.3	99	63	18.1	30.0	21.2	69.3
	40			18.0	44.4	18.4	80.8			18.3	30.3	21.2	69.8
	60			18.2	44.8	18.4	81.4			18.5	30.6	21.2	70.4
	80			18.3	45.2	18.5	82.0			18.7	30.9	21.3	70.9
30	20	139	75	21.4	52.8	24.3	98.6	111	75	21.7	36.0	25.5	83.2
	40			21.6	53.3	24.3	99.2			22.0	36.3	25.5	83.8
	60			21.8	53.7	24.3	99.9			22.2	36.7	25.5	84.5
	80			22.0	54.3	24.3	100.6			22.5	37.1	25.6	85.2
35	20	152	88	25.0	61.6	28.3	115.0	124	88	25.3	42.0	29.8	97.1
	40			25.2	62.1	28.3	115.7			25.6	42.4	29.8	97.8
	60			25.4	62.7	28.4	116.5			25.9	42.8	29.8	98.6
	80			25.7	63.3	28.4	117.3			26.2	43.3	29.8	99.4
40	20	164	100	28.6	70.4	32.4	131.4	136	100	29.0	48.0	34.0	110.9
	40			28.8	71.0	32.4	132.2			29.3	48.4	34.0	111.8
	60			29.1	71.7	32.4	133.1			29.7	48.9	34.1	112.7
	80			29.3	72.3	32.4	134.1			30.0	49.5	34.1	113.6
45	20	177	113	32.2	79.3	36.4	147.8	149	113	32.6	54.0	38.3	124.9
	40			32.4	79.9	36.4	148.8			33.0	54.5	38.3	125.8
	60			32.7	80.6	36.5	149.8			33.4	55.1	38.4	126.8
	80			33.0	81.4	36.5	150.8			33.7	55.7	38.4	127.8
50	20	189	125	35.7	88.1	40.4	164.3	161	125	36.2	59.9	42.6	138.7
	40			36.0	88.8	40.5	165.3			36.6	60.5	42.6	139.8
	60			36.3	89.6	40.5	166.4			37.1	61.2	42.6	140.9
	80			36.6	90.4	40.5	167.6			37.5	61.9	42.7	142.0
55	20	202	138	39.3	96.9	44.6	180.8	174	138	39.8	65.9	46.8	152.6
	40			39.7	97.7	44.6	181.9			40.3	66.6	46.9	153.8
	60			40.0	98.5	44.6	183.2			40.8	67.3	46.9	155.0
	80			40.3	99.5	44.7	184.4			41.2	68.1	46.9	156.3
60	20	214	150	42.9	105.7	48.6	197.2	186	150	43.4	71.9	51.1	166.5
	40			43.3	106.5	48.7	198.5			44.0	72.6	51.2	167.8
	60			43.6	107.5	48.7	199.8			44.5	73.4	51.2	169.1
	80			44.0	108.5	48.7	201.2			45.0	74.3	51.2	170.5
65	20	227	163	46.5	114.5	52.7	213.6	199	163	47.1	77.9	55.4	180.4
	40			46.9	115.4	52.7	215.0			47.6	78.7	55.4	181.8
	60			47.3	116.4	52.8	216.5			48.2	79.5	55.5	183.2
	80			47.6	117.5	52.8	218.0			48.7	80.5	55.5	184.7
70	20	239	175	50.0	123.3	56.7	230.1	211	175	50.7	83.9	59.7	194.3
	40			50.5	124.3	56.8	231.5			51.3	84.8	59.7	195.7
	60			50.9	125.4	56.8	233.1			51.9	85.7	59.7	197.3
	80			51.3	126.6	56.9	234.7			52.5	86.6	59.8	198.9
75	20	247	192	53.6	132.1	60.8	246.5	224	188	54.3	89.9	63.9	208.2
	40			54.1	133.2	60.8	248.1			55.0	90.8	64.0	209.7
	60			54.5	134.4	60.9	249.8			55.6	91.8	64.0	211.4
	80			55.0	135.6	60.9	251.5			56.2	92.8	64.1	213.1

750 CHARACTER DATA RECORD

INPUT AND OUTPUT 7330 TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	20	29	21	5.6	8.5	6.0	20.1	57	21	5.6	9.8	5.8	21.2
	40			5.6	8.5	6.0	20.1			5.6	9.8	5.8	21.2
	60			5.6	8.5	6.0	20.1			5.6	9.8	5.8	21.2
	80			5.6	8.5	6.1	20.1			5.6	9.9	5.8	21.3
10	20	84	42	11.2	28.9	11.6	51.7	78	42	11.2	19.6	13.5	44.3
	40			11.2	28.9	11.6	51.7			11.2	19.6	13.5	44.3
	60			11.2	29.0	11.6	51.8			11.2	19.7	13.5	44.4
	80			11.2	29.0	11.6	51.8			11.2	19.7	13.5	44.5
15	20	126	63	16.8	43.4	17.4	77.5	99	63	16.8	29.4	20.3	66.4
	40			16.8	43.4	17.4	77.6			16.8	29.4	20.3	66.5
	60			16.8	43.5	17.4	77.6			16.8	29.5	20.3	66.5
	80			16.8	43.5	17.4	77.7			16.8	29.6	20.3	66.7
20	20	148	84	22.4	57.8	25.7	105.9	120	84	22.4	39.2	27.2	88.7
	40			22.4	57.9	25.7	105.9			22.4	39.3	27.2	88.8
	60			22.4	58.0	25.7	106.0			22.4	39.3	27.2	88.9
	80			22.4	58.0	25.7	106.1			22.4	39.5	27.2	89.1
25	20	169	105	27.9	72.3	32.1	132.3	141	105	27.9	49.0	33.9	110.9
	40			27.9	72.4	32.1	132.4			27.9	49.1	34.0	111.0
	60			27.9	72.4	32.1	132.5			27.9	49.1	34.0	111.1
	80			27.9	72.5	32.1	132.6			27.9	49.4	34.0	111.3
30	20	189	125	33.5	86.8	38.5	158.8	161	125	33.5	58.8	40.9	133.2
	40			33.5	86.8	38.5	158.9			33.5	58.9	40.9	133.3
	60			33.5	86.9	38.5	159.0			33.5	59.0	40.9	133.4
	80			33.5	87.0	38.6	159.1			33.5	59.2	40.9	133.7
40	20	231	167	44.7	115.7	51.5	211.9	203	167	44.7	78.4	54.6	177.7
	40			44.7	115.8	51.5	212.1			44.7	78.5	54.6	177.8
	60			44.7	115.9	51.6	212.2			44.7	78.6	54.6	178.0
	80			44.7	116.0	51.6	212.4			44.7	79.0	54.7	178.4
45	20	250	192	50.7	131.2	58.4	240.3	225	189	50.7	89.0	61.9	201.5
	40			50.7	131.3	58.5	240.5			50.7	89.0	61.9	201.7
	60			50.7	131.4	58.5	240.6			50.7	89.2	62.0	201.8
	80			50.7	131.6	58.5	240.8			50.7	89.6	62.0	202.3

1000 CHARACTER DATA RECORD

INPUT AND OUTPUT 7330 TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
5	20	64	32	7.9	21.5	8.2	37.5	68	32	7.9	14.6	8.2	30.6
	40			7.9	21.5	8.2	37.5			7.9	14.6	8.2	30.6
	60			7.9	21.5	8.2	37.6			7.9	14.6	8.2	30.7
	80			7.9	21.5	8.2	37.6			7.9	14.6	8.2	30.7
10	20	126	63	15.7	42.9	16.3	75.0	99	63	15.7	29.2	19.2	64.1
	40			15.7	43.0	16.3	75.0			15.7	29.2	19.2	64.2
	60			15.7	43.0	16.4	75.1			15.7	29.3	19.2	64.2
	80			15.7	43.1	16.4	75.2			15.7	29.3	19.2	64.2
15	20	158	94	23.6	64.4	27.3	115.3	130	94	23.6	43.8	29.1	96.5
	40			23.6	64.5	27.3	115.4			23.6	43.8	29.1	96.5
	60			23.6	64.5	27.3	115.4			23.6	43.9	29.1	96.6
	80			23.6	64.6	27.4	115.5			23.6	43.9	29.2	96.7
20	20	189	125	31.5	85.9	36.4	153.7	161	125	31.5	58.4	39.0	128.9
	40			31.5	86.0	36.4	153.8			31.5	58.4	39.1	129.0
	60			31.5	86.0	36.4	153.9			31.5	58.5	39.1	129.0
	80			31.5	86.1	36.5	154.1			31.5	58.6	39.1	129.1
25	20	221	157	39.3	107.3	45.8	192.4	193	157	39.3	73.0	49.0	161.3
	40			39.3	107.4	45.8	192.6			39.3	73.1	49.0	161.4
	60			39.3	107.6	45.9	192.7			39.3	73.1	49.0	161.5
	80			39.3	107.7	45.9	192.9			39.3	73.2	49.1	161.6
30	20	247	192	47.2	128.8	55.0	230.9	224	188	47.2	87.6	58.8	193.5
	40			47.2	128.9	55.0	231.1			47.2	87.7	58.8	193.6
	60			47.2	129.1	55.1	231.3			47.2	87.8	58.9	193.8
	80			47.2	129.2	55.1	231.5			47.2	87.8	58.9	193.9

1500 CHARACTER DATA RECORD

INPUT AND OUTPUT 7330 TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
1	20	21	13	2.7	4.7	2.8	10.3	16	13	2.7	2.4	2.8	7.9
	40			2.7	4.7	2.9	10.3			2.7	2.4	2.9	7.9
	60			2.7	4.7	2.9	10.3			2.7	2.4	2.9	7.9
	80			2.7	4.7	2.9	10.3			2.7	2.4	2.9	8.0
2	20	50	25	5.5	14.1	5.7	25.3	61	25	5.5	9.4	5.7	20.6
	40			5.5	14.2	5.7	25.3			5.5	9.4	5.7	20.6
	60			5.5	14.2	5.7	25.3			5.5	9.4	5.7	20.6
	80			5.5	14.2	5.7	25.4			5.5	9.5	5.7	20.6
3	20	76	38	8.2	21.2	8.5	37.9	74	38	8.2	14.1	8.5	30.9
	40			8.2	21.2	8.6	38.0			8.2	14.2	8.6	30.9
	60			8.2	21.3	8.6	38.0			8.2	14.2	8.6	30.9
	80			8.2	21.3	8.6	38.0			8.2	14.2	8.6	31.0
4	20	100	50	10.9	28.3	11.4	50.6	86	50	10.9	18.8	11.4	41.2
	40			10.9	28.3	11.4	50.6			10.9	18.9	11.4	41.2
	60			10.9	28.3	11.4	50.7			10.9	18.9	11.4	41.2
	80			10.9	28.4	11.4	50.7			10.9	18.9	11.4	41.3
5	20	126	63	13.6	35.3	14.2	63.2	99	63	13.6	23.6	14.2	51.5
	40			13.6	35.4	14.3	63.3			13.6	23.6	14.3	51.5
	60			13.6	35.4	14.3	63.4			13.6	23.6	14.3	51.5
	80			13.6	35.5	14.3	63.4			13.6	23.7	14.3	51.6
10	20	189	125	27.3	70.7	28.5	126.5	161	125	27.3	47.1	28.5	102.9
	40			27.3	70.8	28.5	126.6			27.3	47.2	28.5	103.0
	60			27.3	70.9	28.6	126.7			27.3	47.2	28.6	103.1
	80			27.3	71.0	28.6	126.8			27.3	47.3	28.6	103.2
15	20	247	192	40.9	106.0	42.7	189.7	224	188	40.9	70.7	42.7	154.4
	40			40.9	106.2	42.8	189.9			40.9	70.8	42.8	154.5
	60			40.9	106.3	42.8	190.1			40.9	70.9	42.8	154.6
	80			40.9	106.4	42.9	190.2			40.9	71.0	42.9	154.8

2000 CHARACTER DATA RECORD

INPUT AND OUTPUT 7330 TAPES - 556 CPI

40K CORE STORAGE

60K/80K CORE STORAGE

FILE SIZE	CW LNG	CYL. USED		SORTING TIME IN MINUTES				CYL. USED		SORTING TIME IN MINUTES			
		MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME	MOD A	MOD B	PHASE 1	PHASE 2	PHASE 3	TOTAL TIME
1	20	21	13	3.1	4.7	3.3	11.1	16	13	3.1	2.4	3.3	8.8
	40			3.1	4.7	3.3	11.1			3.1	2.4	3.3	8.8
	60			3.1	4.7	3.3	11.1			3.1	2.4	3.3	8.8
	80			3.1	4.7	3.3	11.2			3.1	2.4	3.3	8.8
2	20	50	25	6.3	14.1	6.5	27.0	61	25	6.3	9.4	6.5	22.2
	40			6.3	14.2	6.5	27.0			6.3	9.4	6.5	22.3
	60			6.3	14.2	6.5	27.0			6.3	9.4	6.5	22.3
	80			6.3	14.2	6.6	27.0			6.3	9.5	6.6	22.3
3	20	76	38	9.4	21.2	9.8	40.4	74	38	9.4	14.1	9.8	33.4
	40			9.4	21.2	9.8	40.5			9.4	14.2	9.8	33.4
	60			9.4	21.3	9.8	40.5			9.4	14.2	9.8	33.4
	80			9.4	21.3	9.8	40.5			9.4	14.2	9.8	33.5
4	20	100	50	12.6	28.3	13.1	53.9	86	50	12.6	18.8	13.1	44.5
	40			12.6	28.3	13.1	54.0			12.6	18.9	13.1	44.5
	60			12.6	28.3	13.1	54.0			12.6	18.9	13.1	44.6
	80			12.6	28.4	13.1	54.1			12.6	18.9	13.1	44.6
5	20	126	63	15.7	35.3	16.3	67.4	99	63	15.7	23.6	16.3	55.6
	40			15.7	35.4	16.3	67.5			15.7	23.6	16.3	55.7
	60			15.7	35.4	16.4	67.5			15.7	23.6	16.4	55.7
	80			15.7	35.5	16.4	67.6			15.7	23.7	16.4	55.8
10	20	189	125	31.5	70.7	32.7	134.8	161	125	31.5	47.1	32.7	111.2
	40			31.5	70.8	32.7	134.9			31.5	47.2	32.7	111.3
	60			31.5	70.9	32.7	135.0			31.5	47.2	32.7	111.4
	80			31.5	71.0	32.8	135.2			31.5	47.3	32.8	111.5
15	20	247	192	47.2	106.0	49.0	202.2	224	188	47.2	70.7	49.0	166.9
	40			47.2	106.2	49.0	202.4			47.2	70.8	49.0	167.0
	60			47.2	106.3	49.1	202.6			47.2	70.9	49.1	167.1
	80			47.2	106.4	49.1	202.7			47.2	71.0	49.1	167.3

INDEX

- Added Programming Routine 31
- Alternate Tape Units 5
- Assignment Program 25, 27, 28, 46
(See also Control Card Routine)
- Automatic Exiting Method 30, 31
- "Await Action" and "Await Decision" 18
(See also Messages)

- Binary Insertions 26, 27, 46
- Block Length, Maximum and Minimum Input 15
- Blocked Fixed-Length Records 8
- Blocked Variable-Length Records 6, 7
- Blocking Factor
 - Input 6, 15, 46
 - Output 6, 7, 9, 15, 46
 - Sort 25, 46
- Branch Constant 25, 26, 31, 33, 34, 46

- "Cannot Proceed" 18
(See also Messages)
- Card Load Program 17
- Card Reader 5
- Checkpoint 46
- Checkpoint and Restart 2, 10
- Computer Reset 17
- Constants and Exits, Modification 33
- Control Cards 17
 - Preparation of 12-16
 - Routines 25, 34, 35(See also Program Loading)
- Control Data 7
- Control Data Fields 2, 16, 46
- Core Storage 2, 12, 15, 30, 32
- Correction Cards 17
- Current Date 32

- Data Records 2, 6, 14, 15
- Date, current 32
- Definitions of Terms 46
- Disk Address of Output File 13
- Disk Check, Write 9, 14
- Disk Error-Correction 9
- Disk-In Dump Tape 22
(See also Dump Tape)
- Disk Space and Format 5
- Disk Storage Work Space 13
- 1301 Disk Storage 5, 49
- Dump Tape 8, 9, 14, 46
 - Labels 8
 - Entry 22
- Dump Tape Unit 5

- End-of-File Label 7
- End-of-Reel Label 7
- End-of-Reel Force Output 43
- Equal Records, Summarization of 41
- Equipment Requirements 5
- Error Correction, Input/Output 9

- Execute Card 17
- Exits
 - Common to all Sort Phases 34
 - Control Card Routine 35
 - Phase 1, Phase 3 36, 38, 39, 44
 - Summary List of 32

- Fields, Control Data 2, 15
- File Size 15
- Fixed Length Data Records 2, 6, 8, 14
- Force Output End-of-Reel 43
- Full Track without Addresses 6

- Header Label 8
(See also Standard and Nonstandard Labels)

- Identifier
 - Card 12, 14, 16
 - Home Address 12
- Identification Code, Message 18
- Index Register Conditions 33, 35
- Input Block Length 15
- Input Blocking Factor 15, 46
- Input Data Record 5, 32
- Input File 49
 - Disk Address of 12
- Input/Output Control System (IOCS) 25
- Input/Output Error Correction 9
- Input Reel Count 7
- Input Sequence Length 32
 - Specifications 5
 - Tapes 7, 12
 - Tape Unit 5
- Inquiry Exit 34
- Inquiry Request 20-23
- Inquiry Release 20-23
- Internal Merge 26
- Internal Sort 2, 46
- Introduction 2

- Labels
 - Header and Trailer 7
 - Standard and Nonstandard 7
- Load Added Programming 33, 34
- Loader 1, Loader 2 25
(See also Input/Output Control System)
- Loader Modification 33, 34
- Load Mode 6
- Logical Point of Exit 32, 33
- Loop, Waiting 18

- Magnetic Tape Units 49
- Maximum Merge Order 32
- Merge 46
- Merge, order of 46
- Merging Passes 2
- Messages
 - Explanation and Action 17-24
 - Identification Code 18

- Modification 30
 - Automatic Exiting 31
 - Exits 6,7,32,33,34
 - Loader 33,34
 - Phase 1 36
 - Phase 3 39
 - Phase-to-Phase Exits 32
 - Restart 44
 - Summary List of Exits 32
- Modification Constants 8,33,34,39,46
- Move Mode or Load Mode 6,7

- Nonstandard Header Labels 7,8,12

- Operating Instructions 16
- Options, Tape Label 7
- Output Blocking Factor 46
- Output Data Record Length 6
- Output File 49
 - Disk Address of 13
- Output Header Label Card 5,8
- Output Sequence Length 32
- Output Tape 13
- Output Tape Unit 5

- Padding 8
- Padding Option 9,15,41
- Phase 1

- Modification 37
 - Assignment Program 25
 - Exits 36,38

- Phase 2
 - Assignment Program 25

- Phase 3
 - Assignment 28
 - Modification 39
 - Running Program 28
 - Exits 39-44

- Phase-to-Phase Information 32
- Point of Exit, Logical 32
- Processing Overlap and Priority 5
- Program Loading 16
- Program Tape 16
- Program Tape Unit 5

- Record Length Field Location 15
- Record Storage Area 47

- Records Processed 32
- Reel Count, Input 7
- Reel Sequence Check 7
- Reservations, Core Storage 15,48
- Reset Computer 17
- Restart 10,29
 - Modification 44
 - Procedures 17
- Retention Cycle 8
- Return Branches 33,34
- Running Program 26,27,28,47

- Separator Characters, Word 5
- Sequence 47
- Sequence Check, Reel 7
- Sequence Count 32
- Sort Blocking Factor 25,32,46
- Sort System Control (DSSSC) 25
- Sorting Program 16
 - Modifications of 30
 - Storage 12
- Sorting Time 48
- Standard Header Labels 7,8,12
- Storage Area, Record 47
- Summary List of Exits Provided 32
- Summarization of Equal Records 41
- System Operation 12

- Tag 47
- Tape Label 7
- Tape Label Options 7,8,12
- Tape Units
 - Input, Alternate Input, Dump,
 - Output, Alternate Output, Program 5
- Terms and Definitions 46
- Timing Tables 48

- Unload Option 14
- User's Identification 12,14,16

- Variable Length Records 2,6,12

- Waiting Loop 18
- Word Separation Characters 6
- Work Space, Disk Storage 13
- Write Disk Check 2,9,14

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**IBM 1410 GENERALIZED SORTING PROGRAM
USING 1301 DISK STORAGE**

This newsletter contains replacement pages and notes for corrections to the publication, IBM 1410 Generalized Sorting Program Using 1301 Disk Storage, Form C28-0304.

Since the changes affecting pages 34 and 37 are extensive, pages 33, 34, 37, and 38 have been replaced. Text changes are indicated by a vertical bar at the left of the lines affected.

Other changes are to be made as shown below:

<u>Page</u>	<u>Amendment</u>
27	In column two, the paragraph preceding the Note should read: "... will be reloaded and re-executed. This time, the reduced number of merge sequences created by the first two merge passes will, of course, be used."
30	In column one, under General Information, the third line should read: "... are more economical than the adoption of alternate ..."
30	In column one, the tenth line from the bottom should read: "... constants and phase-to-phase information will nor-..."

<u>Exit</u>	<u>Location of Branch Constant</u>	<u>Logical Point of Exit</u>
Exit 3A	02310-02314	After loading Phase 3, but before the assignment routines are executed.
Exit 1A	02315-02319	After loading Phase 1, but before the assignment routines are executed.
Exit SA	02320-02324	Before reading Control Cards Two, Three, and Four. Located in Sort System Control.
Exit SB	02325-02329	After reading Control Cards Two, Three, and Four. Located in Sort System Control.

The branch constants provided for the following exits are loaded with Phase 1. All added program cards associated with these exits, including the overlays of the branch constants, must be loaded by the user's load program at the time of Exit 1A.

<u>Exit</u>	<u>Location of Branch Constant</u>	<u>Logical Point of Exit</u>
Exit 1B	02320-02324	Before moving a data record from the input area to the record-storage area.
Exit 1C	02325-02329	Before moving a data record from the input area to the record-storage area.
Exit 1D	02330-02334	After reading an input tape header label.
Exit 1E	02335-02339	After reading an input tape trailer label.
Exit 1F	02340-02344	Before writing the dump tape header label.

The branch constants provided for the following exits are loaded with Phase 3. All added program cards associated with these exits including the overlays of the branch constants must be loaded by the user's load program at the time of Exit 3A.

<u>Exit</u>	<u>Location of Branch Constant</u>	<u>Logical Point of Exit</u>
Exit 3B	02315-02319	At the end of the assignment routines.
Exit 3C	02320-02324	Before moving a data record from the work area to the output area.
Exit 3D	02325-02329	After moving a data record from the work area to the output area.
Exit 3E	02330-02334	Before reading the Output Tape Reader Label Card.
Exit 3F	02335-02339	Before writing an output tape header label.
Exit 3G	02340-02344	Before writing an output tape trailer label.
Exit 3H	02345-02349	At the end of the sort.

DESCRIPTION OF MODIFICATION CONSTANTS AND EXITS

The modification constants and exits provided in each phase of the sort are described in detail in the following pages.

Where significant, procedures are described to illustrate some of the possible uses of the exits. In each case, the description is limited to those operations which are essential to satisfactory program performance. Each modification must, of course, include additional instructions as necessary to meet the user's individual requirements. The programming technique to be used, within the framework of the specifications for each exit, is left to the discretion of the user.

The format used for the description of each of the exits is as follows:

Description: This paragraph describes the logical point at which the sort will branch to added programming.

Branch Constant Location: xxxxx-yyyyy -- The address given is the location of the branch constant which must be overlaid by the user to activate this exit.

Load Added Programming: This paragraph explains the procedure for loading added program cards associated with this exit.

Return Branches: This paragraph describes the number and function of the branch instructions which must be provided as the first instructions of the added programming associated with this exit.

Comments on Use: This paragraph explains the use of the modification constants and index registers which are particularly applicable, and describes special techniques which may be utilized.

Required Index Register Conditions on Re-entry: Contents, (including word marks or absence of same) must be restored, or left undisturbed, as specified.

LOADER 1 (DSL1) MODIFICATION

There are no modification constants or exits in this section.

Loader 1 will bypass the card-reader operations associated with Control Card One if the contents of this card are loaded into core-storage positions 01509 through 01517 at the same time this section of the program is loaded. This may be accomplished by

inserting a program card, punched as follows, into the program deck immediately preceding the "Execute" card (serial No. 999) for Loader 1:

Columns	1	2-6	7	8-12	13	14-22	23-80
Contents	w/s	01509	w/s	00009	w/s	Cols 1-9 of CC1	As desired

LOADER 2 (DSL2) MODIFICATION

Loader 2 will always bypass the card reader operations associated with Control Card One if the sorting program is loaded from tape or from cards, since Loader 1 will already have obtained the necessary Control Card One information. If, however, the program is stored permanently in the 1301, Loader 2 will bypass the reading of Control Card One if the contents of this card are loaded into core-storage positions 01509 through 01517 at the time this section of the program is loaded. This may be accomplished by inserting a program card, punched as follows, in the program deck immediately preceding the "Execute" card (serial No. 999) for Loader 2:

Columns	1	2-6	7	8-12	13	14-22	23-80
Contents	w/s	01509	w/s	00009	w/s	Cols 1-9 of CC1	As desired

DSL2 Modification Constants

The following modification constants are provided in DSL2.

Mod Constant No.	Location	Description
01	02330-02333	This field normally contains four zeros. If the data record length is to be changed through user modification in Phase 1, the input data-record length must be placed here at the time of loading DSL2. (Procedures for changing data-record length in Phase 1 are described under "Exit 1C.")
02	02334-02337	This field normally contains four zeros. If the data-record length is to be changed through user modification in Phase 3, the output data-record length must be placed here at the time of loading DSL2. See Exit 3C. (Procedures for changing data-record length in Phase 3 are described under "Exit 3C.")

DSL2 Branch Constants

Although there are no exits provided in DSL2, added programming for the following exits, as well as overlays for the branch constants associated with these exits, should be loaded with DSL2:

Exit	Branch Constant Location
INQUIRY	02300-02304
ERROR STOP	02305-02309
3A	02310-02314
1A	02315-02319
SA	02320-02324
SB	02325-02329

Through the use of this method, user modifications to the sorting program for different applications can be developed and maintained without disturbing the unmodified sorting program which may be kept in disk storage permanently. In addition, updating the sorting program (i.e. incorporating corrections in modification letters applicable to the sort) effectively updates all of the sorting applications, including user-modified sorts, of the installation.

EXITS COMMON TO ALL PHASES OF THE SORT

INQUIRY Exit

Description: A branch to added programming will be executed following an inquiry interrupt.

Branch Constant Location: 02300-02304

Load Added Programming: The overlay of the branch constant and the added programming associated with this exit should be loaded with DSL2.

Return Branches: The first instruction in the added programming for this exit must be a branch instruction with a zero address. The sorting program will place the proper return address in this instruction, and the user's routine must branch here to return to the sorting program. (The return address will be updated as each new phase is loaded.)

Comments on Use: This exit may be used:

- (1) to temporarily interrupt the sort so that a processing routine of more urgent priority can be executed.
- (2) to enter data into the system from the console for later use by the sorting program or a following program.
- (3) to discontinue the sort in process and go on to another program.

turn to this exit before moving the next record in the input area, so that any number of data record may be added in sequence.

If a record is not to be added, return to the sorting program is made via the first return branch.

Required Index Register Conditions on Re-entry:

Index register 14 must be used as noted above. The contents of any other index register used (including word marks or absence of same) must be saved and restored. Index Registers 13, 14, and 15 must be saved prior to, and restored subsequent to, the execution of any IOCS macro-instructions.

Exit 1C

Description: A branch to added programming will be executed prior to the movement of each data record from the input area to the record storage area. (This exit follows Exit 1B, thus facilitating all the functions of both exits in the same sorting application.)

Branch Constant Location: 02325-02329

Load Added Programming: The overlay of the branch constant and the added programming associated with this exit must be loaded at the time of Exit 1A.

Return Branches: The first two instructions in the added programming for this exit must be branch instructions with zero addresses. The sorting program will place the proper return addresses in these instructions. The first branch must be used to return to the sorting program when data records are to be edited (i. e. altered); the second branch must be used to return to the sorting program when data records are to be deleted and/or data-record length is to be changed. Routines that change data-record length may also include editing.

Comments on Use: At the time of this exit, Index Register 13 contains the location of the next record to be moved from the input area to the record storage area, and Index Register 14 contains the location in the record storage area to which the next record will be moved. If the input blocking factor is 000 or V00, a record mark will have been added to the data record in its input location.

When this exit is to be used to change data-record length the input data-record length (or maximum input length if variable) must be placed in modification constant 01 at the time of loading DSLD2. Field 16 of Control Card Three must show the new length (or maximum length if variable) of the data record, including a record mark. The record mark will be added by the program, if the input file consists of Form 1 or Form 3 data records that do not end with a record mark.

Editing of the current data record must be performed in the input area, using Index Register 13 to refer to the record. For these cases, or if the cur-

rent record is unmodified, the return to the sorting program is made via the first return branch.

The length of the current data record may be changed by performing the following operations:

1. Move the data record to the record storage area using Index Registers 13 and 14 for the locations of the data record and the record storage area, respectively:
MRCR 0+X13,0+X14
2. Execute the instructions necessary to add (drop) the desired fields to (from) the data record in the record storage area. This routine must include instructions to overlay the original record mark, and to insert a new record mark at the end of the record.
3. Add the length of the input data record to Index Register 13.
4. For fixed-length records, add the new length of the data record to Index Register 14. For variable-length records, add the maximum data record length to Index Register 14. In either case, this is the length specified in Field 16 of Control Card Three.
5. Return to the sorting program using the second return branch.

The current record may be deleted by performing the following operations:

1. Add the length of the input data record to Index Register 13.
2. Subtract +1 from the current record counter, Modification Constant 01, at core-storage locations 02345 through 02349.
3. Subtract +1 from the file size adjustment counter, Modification Constant 02, at core-storage locations 02350 through 02356.
4. Return to the sorting program using the second return branch.

Required Index Register Conditions on Re-entry:

Index Registers 13 and 14 must be used as noted above. The contents of any other index register used (including word marks or absence of same), must be saved and restored. Index Registers 13, 14, and 15 must be saved prior to, and restored subsequent to, the execution of any IOCS macro-instructions.

Exit 1D

Description: A branch to added programming will be executed after an input tape header label is read.

Branch Constant Location: 02330-02334

Load Added Programming: The overlay of the branch constant and the added programming associated with this exit must be loaded at the time of Exit 1A.

Return Branches: The first two instructions in the added programming for this exit must be branch instructions with zero addresses. The sorting program will place the proper return addresses in these instructions. The first branch must be used to return to the sorting program when the current input tape is to be accepted; the second branch must be used to return to the sorting program when the current input tape is to be rejected.

Comments on Use: This exit will be activated only when Field 6 of Control Card Two indicates that input tapes contain header labels.

As explained in the section "Tape Label Options," checking of header labels against header label control cards is not considered meaningful, since the input file may consist of several different reels from several different data files. This exit may be used to perform any such checking desired by the user with either standard or non-standard header labels. At the time of this exit, the header label has been read, and is located in an area whose beginning location is given in Modification Constant 03 at core-storage locations 02357-02361. If a check of the header label indicates that an incorrect tape has been mounted, a halt or waiting loop should be executed to permit mounting of the correct tape, followed by a return to the sorting program using the second return branch. The sorting program will then open the new tape and return to this exit. When the current input tape is to be accepted, the added programming simply returns to the sorting program using the first return branch.

Required Index Register Conditions on Re-entry: The contents of any index register used (including word marks or absence of same) must be saved and restored.

Exit 1E

Description: A branch to added programming will be executed after reading an input tape trailer label.

Branch Constant Location: 02335-02339

Load Added Programming: The overlay of the branch constant and the added programming associated with this exit must be loaded at the time of Exit 1A.

Return Branches: The first instruction in the added programming for this exit must be a branch instruction with a zero address. The sorting program will place the proper return address in this instruction, and the user's routine must branch here to return to the sorting program.

Comments on Use: This exit will be activated only when Field 6 of Control Card Two indicates that input tapes contain trailer labels.

At the time of this exit the trailer label has been read and is located in an area whose beginning location is given in Modification Constant 03 at core-storage locations 02357 through 02361.

This exit may be used to terminate the input file with the current input reel by performing the following operations (this provision facilitates the use of an end-of-file trailer, rather than the number of input reels, to indicate the end of the input file.):

1. Before executing the sort, punch in Field 6 of Control Card Two, a number equal to or greater than the maximum number of input reels anticipated.
2. When the input is to be terminated (e.g., when an end-of-file trailer label is detected) place a two-digit constant of 01, signed plus, in Modification Constant 04, at core-storage locations 02362-63.
3. If padding option 1, 3, or 4 is specified, in order to avoid unnecessary checking for nines padding records in Phase 3, place a two-digit constant, unsigned, of the exact number of input reels processed, in core-storage positions 01307-08.

Required Index Register Conditions on Re-entry: The contents of any index register used (including word marks or absence of same) must be saved and restored.

Exit 1F

Description: A branch to added programming will be executed before writing the dump tape header label.

Branch Constant Location: 02340-02344

Load Added Programming: The overlay of the branch constant and the added programming associated with this exit must be loaded at the time of Exit 1A.

Return Branches: The first instruction in the added programming for this exit must be a branch instruction with a zero address. The sorting program will place the proper return address in this instruction, and the user's routine must branch here to return to the sorting program.

Comments on Use: This exit will be activated only when Field 12 of Control Card Two indicates that the dump tape is to contain a header label. At the time of the exit, the header label to be written is located in an area whose beginning address is given in



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