PREPARE THE MAN

Computer Systems Department

BUIC III COMPUTER PROGRAMMER

COMPILER LANGUAGE WORKBOOK

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Keesler Technical Training Center
Keesler Air Force Base, Mississippi

——————— Designed For ATC Course Use ———————

TABLE OF CONTENTS

DATA DECLARATIONS

A. 1. ITEM GRADE S 10 V(A) V(B) V(C) V(D) V(F) V(E) $

   What is the name of the item?
   What type of item is it?
   How many bits are to be allocated for the item?
   What are the values for each of the status?

2. Declare an item to contain numbers from 0 to 47.

3. Declare an item to contain numbers from -546 to +999 with a precision of 1/16.

4. ITEM RANGE A 13 S 5 $

   What is the name of this item?
   What type of item is it?
   How many bits are to be allocated for the item?
   What is the 5 for?
   What is the largest number this item can hold?

5. Declare an item to contain the name of any state in literal form?

6. Declare an item that can handle the distances involved in traveling from here to Mars.

7. Declare an item to handle the primary points of the compass, N, NW, E, SE, S, SW, W, NW.

8. ITEM XYZ F $

   What is the name of this item?
   What type of item is it?
   How many bits are to be allocated for this item?

9. Declare an item to handle numbers from 100 to 5000.

10. Declare an item to indicate if it is day or night.

B. 1. TABLE CARO V 500 $
BEGIN
 ITEM MAKE H 6 $
  BEGIN 6H(FORD) 6H(CAD) 6H(CHEV) 6H(CAD)
    6H(RAMBLR) 6H(MG) 6H(FORD) END
 ITEM STYLE H 6 $
  BEGIN 6H(SEDAN) 6H(SEDAN) 6H(UNKNWN) 6H(CONVRT) END
 ITEM QUANTITY I 9 U $ BEGIN 7 9 10 3 5 6 8 9 3 END
 ITEM COLOR S V(RED) V(BLUE) V(WHITE) V(GREEN) V(BLACK) $
  BEGIN V(RED) V(RED) V(BLUE) V(RED) V(GREEN) V(BLACK)
   END
END

What type of table has been defined?
What does the 500 following the V mean?
What make of car is in entry 0?
What is the style of car in entry 2?
How many cars in entry 3?
What color are the cars in entry 0?

2. GIVEN: A computer with a 48-bit word and floating point capability.

 Required: 1. Design a table to be used on this computer which will:

   a. Be compiler allocated.

   b. Take up as little computer storage space as possible.

   c. Contain all relevant information, given as follows:

    (1) Airbase identification, where airbases are designated by digit-digit-letter-letter.

    (2) Aircraft assigned, where $7 \leq$ assigned ≤ 128.

    (3) Aircraft on missions (never more than 90% committed).

    (4) Aircraft in for repairs (not to exceed 25% of those assigned).

    (5) Airbase location in reference to sector headquarters, given in 1/32 of a mile, where

$$15 \leq |X| < 1024 \text{ and } 7 \leq |Y| < 1024.$$

  2. The number of airbases will not exceed 20.

3. GIVEN: A computer with a 48-bit word and floating point capability.

Requirement: Design a table to be used on this computer which will fill the following requirements of a local used car dealer.

1. The table must occupy as little computer storage as possible.

2. There must be a capacity to delete and insert records as cars are sold and more cars acquired for sale.

3. The record for each car on the lot must contain all pertinent information about that car. Pertinent information is defined as:

    a. The make of the car.

    b. The year of the car.

    c. The purchase price (what the dealer paid for it--either in cash disbursement or as trade-in on another car).

    d. The selling price (suggested--there is some lee-way at the option of the salesman).

    e. The mechanical condition of the car (good, fair, or poor).

    f. The license number of the car (California, 3 letters and 3 digits).

    g. Price for which sold.

    h. Salesman's number.

4. The table will be processed only once each day to delete sold cars and transfer significant information to other tables. The designer may invent any method of numbering salesman, etc., given the following information:

    a. The lot deals only in cars manufactured in America by General Motors, Ford and Chrysler Corporations and in no sportscars or "economy cars".

    b. The lot carries cars up to and including ten years old, but no older (in 1962, then, the oldest car possible would be 1952).

    c. At full capacity the lot can handle 1000 cars.

    d. The number of salesman varies but historically has never exceeded 10.

    e. All prices (buying and selling and including taxes, etc.,) are rounded to the nearest 50¢ and do not exceed $5,000,00.

    f. There is no repair or automative service on the lot and none is done on incoming or outgoing cars.

4. GIVEN: TABLE LIST V 1ØØ S D $
                  BEGIN
          ITEM RAM I 12 U $
                  BEGIN
                    86 42 612
          END
              ITEM ROD F $
               BEGIN
               73.4 29.6 4.75
          END
        END

   Required: Declare the following like tables.

               a. A table equivalent to LIST with 2ØØ entries and parallel structure.

               b. A table equivalent to LIST with no packing specified.

               c. A table equivalent to LIST with 1ØØ entries and rigid length.

               d. A table equivalent to LIST with rigid length, 350 entries, parallel structure and no packing.

5. Declare an array which will contain a "fours" multiplication table and load the array with the correct value. How many registers will the array occupy?

4

EXERCISE II

OVERLAYS

A. 1. GIVEN: TAB∅, TAB1, TAB3, and TAB4 as previously declared tables, describe the relationship among them in each of the following declarations:

    a. OVERLAY TAB∅, TAB2 = TAB1, TAB3 $

    b. OVERLAY TAB∅ = TAB1 = TAB2 = TAB3 $

    c. OVERLAY TAB∅, TAB2, TAB3 = TAB1 $

    d. 0(10000) = TAB∅, TAB1 = TAB2 = TAB3 $

2. In (c) above rewrite the declaration to complete the same intent.

B. 1. A temporary storage register is to be used for storing fixed point intermediate results, and literals. Declare the appropriate items and assign them to a common storage register.

2. Given that ITMA and ITMB are previously declared one-word simple items and TAB∅ and TAB1 are previously declared tables:

OVERLAY ITMA, TAB∅ = TAB1, ITMB

a. What will ITMA represent?

b. Draw a picture of the layout given by this OVERLAY declaration.

ASSIGNMENT STATEMENTS

A. 1.   ITEM PRICE F $
      ITEM COST F $
      ITEM O'HEAD F $
      COST = 27 $
      O'HEAD = COST/9 $
      PRICE = COST +2* O'HEAD + 3 $

After program operation, what is the contents of PRICE?

2. Write an assignment that will set RESULT to 6 more than twice NUMBA.

3. Write an assignment that will set RESULT to three times the sum of NUMBA and NUMBB.

4. Write an assignment statement that will set AREA to 17 less than five times the product of LENGTH and WIDTH.

5.   ITEM ALPHA I 48 S $
      ITEM BETA I 48 S $
      ALPHA = 3 $
      BETA = 4 $
      ALPHA = BETA + 5 $
      BETA = 3 * ALPHA $

What are the contents of BETA, after program operation?

6. Write an assignment statement that will set ALPHA to five times BETA.

7. Write a program that will set ALPHA to 5 and then set BETA to 7 more than ALPHA.

8. Write an assignment statement that will set ALPHA to one-fifth the contents now con- contained in ALPHA.

9. Write an assignment statement that will set NUMB to -8.

10. Declare two signed integer items called ROSE and LILLY. Make each capable of handling absolute values as large as 60. Then write a program that will exchange the contents of the two items.

B. 1. Write the JOVIAL code to set

   a. $x = a.b.c.$

   b. $y = 25a^3 + 12b^2 + c$

   c. $n = \sqrt{25^a} + 35/b + 3$

   2. Given AA = 6\$

   CC = 3\$

   EE = 2\$

   GG = 4\$

   What does RR equal in each of the following examples:

   a. RR = AA/(GG + EE) + CC \$

   b. RR = AA/CC/EE \$

   c. RR = CC * EE/AA \$

   d. RR = (AA + CC * EE)/GG \$

EXERCISE IV

RELATIONAL AND LOGICAL OPERATIONS

A. 1.   GIVEN   ITEM ABLE I 4 U$
                 ITEM BAKER I 4 U$
                 ITEM CHARLY I 4 U$
                 ITEM TEMP I 4 U$
                 ABLE = 3$
                 BAKER = 4$
                 CHARLY = 8$
                 TEMP = 1$

         For each Program what will be the value of TEMP when the program stops:

         a. IF ABLE * 2 EQ BAKER AND ABLE ** 3 NQ CHARLY $
             TEMP = $\emptyset$ $
             STOP $

         b. IF ABLE NQ BAKER AND ABLE ** 2 NQ CHARLY $
             TEMP = $\emptyset$ $
             STOP $

         c. IF ABLE EQ BAKER AND BAKER EQ CHARLY $
             TEMP = $\emptyset$ $
             STOP $

         d. IF BAKER -1 LQ ABLE OR BAKER + ABLE NQ CHARLY $
             TEMP = $\emptyset$ $
             STOP $

     2.   GIVEN   ABLE = 7 $
                  RST = $\emptyset$ $
                  xyz = $\emptyset$ $
              IF ABLE EQ 7 $
              BEGIN RST = 6 $
                    xyz = 3 $
                    GOTO A1 $
              END
                  RST = 7 $
                  xyz = 4 $
                  STOP $

         When this program stops what will RST and xyz be equal to?

B. 1. GIVEN   ITEM PLANE S V(HOSTILE) V(FRIENDLY) $
              ITEM ALARM I 1 U $
              IF PLANE EQ V(HOSTILE) $
                        ALARM = 1 $
                        ALARM = Ø $
                        STOP $

   This routine is self-contradictory. Without changing the declarations, write two
   different routines to accomplish the intent.

2. Given the following information, set ITEM answer to yes if

   a. the employee number is 10264.

   b. the employee is a male.

   c. the employee does not have a security clearance.

   d. the employee is either between 21 to 25 or 31 to 35 years of age inclusive. If any
      of these conditions do not exist, set ITEM ANSWER to no.

      1) Declare all the items of data used in the problem statement.

      2). Write the code necessary to set ITEM ANSWER.

3. ITEM INDA B $
   ITEM INDB B $
   ITEM INDC B $
   ITEM DIFF F $
   BEGIN
        INDA = 0 $
        INDB = 0 $
        INDC = 0 $
        IF DIFF LS .005 $
            GOTO ABCO $
        IF DIFF LS .05 $
            GOTO BCO $
        IF DIFF LS .5 $ ·
            GOTO CO. $
        GOTO CONT $
   ABCO. INDA = 1 $
    BCO. INDB = 1 $
     CO. INDC = 1 $
            END
   CONT.

   Simplify the above JOVIAL program. The same purpose can be accomplished with
   three processing statements.

INDEXING AND SUBSCRIPTING

A. 1. Given the following FOR statement

$$\text{FOR} \quad N \ = \ 3 \ \$$$

a. What is the code word that tells the compiler that we want to define a subscript?

b. What name is being given to the subscript?

c. What initial value will be placed into the subscript?

2. For how many statements following the FOR statement is the subscript defined?

3. How can the subscript definition created by a FOR statement be made valid for several JOVIAL statements?

4. Write a JOVIAL statement which will define a subscript called P and which will set P initially to the value 5.

5. What is wrong with the following JOVIAL program?

```
        FOR  J = 9  $
AGAIN.  IF  NUMBER  ($J$)  GR  39  $
        NUMBER  ($J$)  =  Ø  $
        J  =  J-1  $
        IF  J  GQ  Ø  $
           GOTO  AGAIN  $
           STOP  $
```

6. Write a JOVIAL program using a subscript called V which will keep a count in item COUNT of all entries of item NUMBR in 1Ø entry table NUMØ, which contain values between 79 and 84 inclusive.

B. 1.
```
   SUM = Ø $
   FOR Y = 0, 1, 9 $
   SUM = xx ($Y$) + SUM $
   STOP $
```

What does this program do?

2.
```
   FOR Y = Ø, 1, 9 $
   FOR K = 9, 1 $
      xx ($K$) = AA ($Y$) $
```

What does this program do?

3.
```
   FOR A = 0, 2 $
   FOR B = 0, 1, 99 $
   A1.    BEGIN
          IF xx ($A$) EQ 10 $
             yy ($B$) = xx ($A$) $
   END
          STOP $
```

When will this routine stop?

4. Given:
```
   TABLE AA R 5Ø $
      BEGIN
          ITEM ABLE I 16 S $
          ITEM BAKER I 16 S $
      END
   ITEM SAMPLE I 32 S P Ø $
   FOR I = Ø, 1Ø, 49 $
      BEGIN FOR J = I, 1, I + 9 $
      ABLE ($J$) = BAKER ($J$) $
      SAMPLE = SAMPLE + ABLE ($I$) $
   END
```

What does the value of Sample represent when the routine is finished.

12

5. Given a table with the item HOLY and the following Program steps:

```
IND = 0 $
FOR I = 0, 1, NENT (HOLY)-1 $
BEGIN
    IF  HOLY ($I$) NQ 0 $
BEGIN
    HOLY ($I$) = = HOLY ($I-IND$) $
    TEST $
END
IND = IND + 1 $
END
```

a. What does this program do?

b. What does the value of IND represent when finished?

(Page 14 Blank)

13

FUNCTIONAL MODIFIERS

```
A.  1.   TABLE  TAB  R  100  $
              BEGIN  ITEM  TYPE  H  4  $
                     ITEM  FLOT  F  $
                     ITEM  STATE  B  $
              END
              TABLE  TAB1  V  L  $

              FOR  I  =  ALL  (TAB)  $
              FOR  K  =  Ø  $
              BEGIN  IF  STATE  $
                  BEGIN  IF  BYTE  ($0,2$)  (TYPE  ($I$))  EQ
                  2H  (AA)  $
                  BEGIN  ENT  (TAB1($I$))  =  ENT  (TAB($I$))  $
                       BYTE  ($Ø,2)  (TYPE  ($I$))  =  2H  (   )  $
                       STATE  1  ($K$)  =  Ø  $
                       K  =  K  +  1  $
                       NENT  (TAB1)  =  K  $
                       TEST  $
                  END
              END
```

List and explain the functional modifiers used in the above set of code.

2. If the loop variable J is active at this time what will VAL represent in this assignment statement?

```
VAL  =  LOC  (TAB1)  +  J  *  NWDSEN  (DATA)  $
```

B. 1. Given: ITEM CARD CH   H   120 $
                ITEM NUMB   I   48   U $

Write the program necessary to convert from Binary Coded Hollerith Decimal to Binary the value of the 5 decimal digits in characters 57 thru 61 of CARDCH and restore in NUMB.

NOTE: HOLLERITH constants are 6-bit Hollerith such that the number 531 in Hollerith would be 000101 000011 000001. In converting to binary, consider the place value of each digit.

16

EXERCISE VII

VARIABLE TABLE STRUCTURES

A. 1. Given: The table called INFO containing a maximum of 200 entries of fleet information. Each entry will contain ship type, ship ID, and the payload of each ship type. Information is such that for each type the following relations are made:

If ship type is V(CAR), we are interested in # of aircraft.

. If ship type is V(TANK), only the cargo capacity is of interest.

If ship type is V(SUB), we are interested in # of torpedoes.

If ship type is V(DES), maximum range is of interest.

Since the payload for each type is mutually exclusive, then the same space in each entry could be used for different payloads based on ship type.

a. Declare a table that contains:

```
ITEM  SHIP
ITEM  SHIP ID
ITEM  AIRCRN
ITEM  TORPED
ITEM  CARCAP
ITEM  MAXRNG
```

b. Write a program to count the total number of aircraft in a fleet composed carriers, tankers, destroyers, and submarines using the above table. Keep the count in an ITEM called AIR.

B. Given: A Variable Length Entry Table containing input messages in Hollerith such that the first word of each message in the message type and each message is of variable length.

> Table MESTAB V 1000 $
> BEGIN ITEM MSWRD H 8 $
> END

Message types are   4H (FLSH) - Flash
                     4H (DLAY) - Delay
                     4H (RGLR) - Regular

Given: A Variable Length table containing one entry per message. Each entry contains the number of words in a message including message type.

> TABLE COUNT V 100 $
> BEGIN NUMWRD I 32 U $ END

Given: A Variable Length table called Hurry containing an item called FLLOCN (flash location).

> TABLE HURRY   100 $
> BEGIN ITEM FLLOCN I 32 U $
> END

The problem to be solved is the cycling through all of MESTAB, and placing the relative location of each Flash message into the next available entry in Hurry.

18

EXAMPLE:

	MESTAB		COUNT		HURRY (after processing)
0	FLSH	0	3	0	0̸
1	MSWRD	1	2	1	5
2	MSWRD	2	4	2	
3	DLAY	3	5	3	
4	MSWRD	4		4	
5	FLSH	5			
6	MSWRD	6			
7	MSWRD	7			
8	MSWRD	8			
9	RGLR	9			
10					

(Page 20 Blank)

19
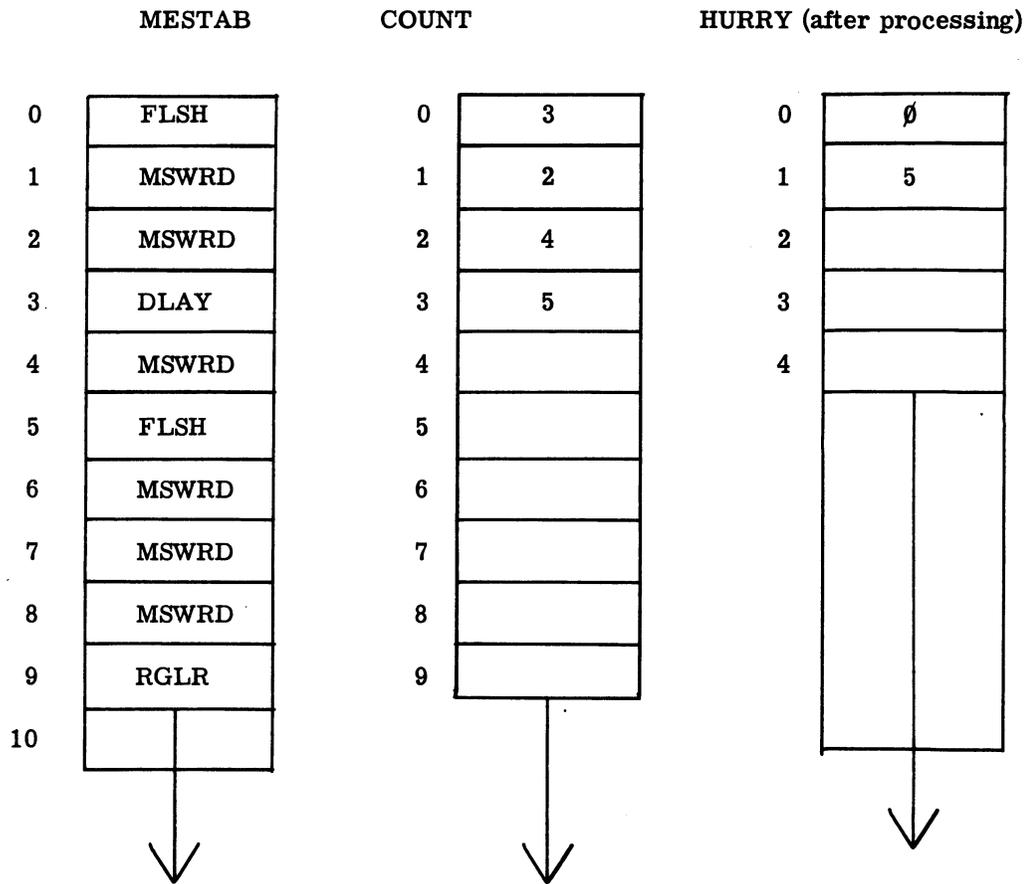
WRITING PROGRAMS

For each of the following problems make all necessary data declarations and write the processing statements.

1. Given a table of 100 numbers, write a routine to sort the numbers in ascending order.

2. Given 5 departments with 50 people in each department, process a file that contains man number as an entry to find the smallest man number in each department. Place these numbers in a table called LIST.

3. Given a table of ordered numbers and a number to be inserted into this table, write a routine to form a new ordered table.

4. Given a table containing 5000 entries of the values contained on the first roll of a pair of dice, count the number of wins and losses registered on the first roll based on these conditions.

   a. a 2, 3, or 12 results automatically in losing.

   b. a 7 or 11 results automatically in winning.

   c. any other number is not considered here.

   (Note: Use a switch for DICE values.)

5. Table SCORES contains the results of a 25 question examination given to a maximum of 10,000 people. Write the required statements to set each entry of item MARK to the numberic grade of each student and then stop.

   a. Given each bit of ITEM QUES corresponds to one of the 25 questions where a setting of 1 means the question was answered correctly, and $\emptyset$, incorrectly answered.

   b. The weighing of the test is

QUESTION	VALUE OF EACH QUESTION
1-10	1 PT
11-15	2 PT
16-20	4 PT
21-25	10 PT

SAVE A LIFE

If you observe an accident involving electrical shock,
DON'T JUST STAND THERE - DO SOMETHING!

RESCUE OF SHOCK VICTIM

The victim of electrical shock is dependent upon you to give him prompt first aid. Observe these precautions:

1. Shut off the high voltage.
2. If the high voltage cannot be turned off without delay, free the victim from the live conductor. REMEMBER:
   a. Protect yourself with dry insulating material.
   b. Use a dry board, your belt, dry clothing, or other non-conducting material to free the victim. When possible PUSH - DO NOT PULL the victim free of the high voltage source.
   c. DO NOT touch the victim with your bare hands until the high voltage circuit is broken.

FIRST AID

The two most likely results of electrical shock are: bodily injury from falling, and cessation of breathing. While doctors and pulmotors are being sent for, DO THESE THINGS:

1. Control bleeding by use of pressure or a tourniquet.
2. Begin IMMEDIATELY to use artificial respiration if the victim is not breathing or is breathing poorly:

   a. Turn the victim on his back.

   b. Clean the mouth, nose, and throat. (If they appear clean, start artificial respiration immediately. If foreign matter is present, wipe it away quickly with a cloth or your fingers).
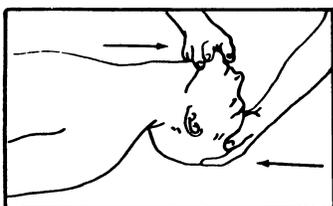
   c. Place the victim's head in the "sword-swallowing" position. (Place the head as far back as possible so that the front of the neck is stretched).

   d. Hold the lower jaw up. (Insert your thumb between the victim's teeth at the midline - pull the lower jaw forcefully outward so that the lower teeth are further forward than the upper teeth. Hold the jaw in this position as long as the victim is unconscious).

   e. Close the victim's nose. (Compress the nose between your thumb and forefinger).

   f. Blow air into the victim's lungs. (Take a deep breath and cover the victim's open mouth with your open mouth, making the contact air-tight. Blow until the chest rises. If the chest does not rise when you blow, improve the position of the victim's air passageway, and blow more forcefully. Blow forcefully into adults, and gently into children.

   g. Let air out of the victim's lungs. (After the chest rises, quickly separate lip contact with the victim allowing him to exhale).

   h. Repeat steps f. and g. at the rate of 12 to 20 times per minute. Continue rhythmically without interruption until the victim starts breathing or is pronounced dead. (A smooth rhythm is desirable, but split-second timing is not essential).

DON'T JUST STAND THERE - DO SOMETHING!