

UNIVERSITY OF ILLINOIS  
DIGITAL COMPUTER LABORATORY  
ILLIAC PROGRAM LIBRARY

Auxiliary  
Library Routine P 20 - 265

**TITLE:** Data Plotter Output Converter (SADOI Only)  
**TYPE:** Complete Program  
**NUMBER OF WORDS:** 180 in memory locations 100 - 279  
**TEMPORARY STORAGE:** 0, 1  
**TIME:**  $T_m = .56 + .34 (n - 1)$   
n = number of Y's on each line (i.e., between successive CR - LF's). The maximum time,  $T_m$ , for each line is .56 seconds for each line if there is only one Y, with an addition of .34 seconds for each additional Y on each line. This includes output time.

**DESCRIPTION:** This program is intended to convert a data tape from the ILLIAC into a tape prepared for input to the data plotter. The program reads each value of X and all values of Y associated with that X from the tape and converts these into instructions for the data plotter. The program will read and punch any number of Y's for each value of X. However, if there are more than 6 Y's for any X, the parameter in location 6 should be set to 0 so that the symbol select will not be punched, since there are only six symbols on the wheel of the plotter. The integer 1 in location 6 indicates that the symbol select should be punched. The X's and Y's must be arranged in columns with the X-column first, followed by columns of Y's; thus each line must have X first followed by all the corresponding Y's. A CR - LF on the tape is interpreted as signifying the next value will be a new X. Each number read may have a maximum of 11 decimal digits with the sign and decimal point optional. If there are more than 11 decimal digits, the program will stop on an LF --- order at location 196F (ON4).

The integers p, q, r, and s are stored as preset parameters in locations 3, 4, 5, and 6, respectively; p is used to scale X, and q is used to scale Y. Each X is read from

the tape, stored as an integer, and divided by  $10^p$  to convert it to a fraction. The Y's are divided by  $10^q$ . The integer r in location 5 should be 1 or 0; when r = 1, all numbers read that have more than p or q places will not be plotted. This feature can be used to get more accuracy for the remaining numbers plotted. When r = 0, any X read that has more than p places will cause a division hang up at location 153F, and any Y read that has more than q places will cause a division hang up at location 184F. The integer s in location 6 should be 1 or 0; when s = 0, no symbols will be punched; when s = 1, the symbol select will be punched and advanced for each Y.

PARAMETER TAPE:

The following are required:

003K

3) 00 F

00 pF p = maximum number of places for X

4) 00 F

00 qF q = maximum number of places for all Y's

5) 00 F { r = 0 causes a division hang up when X or Y  
have more than p or q places  
00 rF { r = 1 program by-passes numbers with more than  
p or q places

6) 00 F { s = 0 symbol select is omitted  
00 sF { s = 1 symbol select is punched

24 100N to start program

METHOD:

- (1) Read in P 20 - 265 with a clear start.
- (2) Read in parameter tape by moving the black switch to START.
- (3) Read in the data tape by moving the black switch to START.

Fifteen consecutive fifth holes on the data tape stop the program. It can be started again by moving the black switch to START. If the parameters are not changed, another data tape may be read in with a black switch start. A new parameter tape may be read in after a data tape by moving the white switch through EXECUTE to FETCH and then back to RUN.

EXAMPLE:

Data tape print-out from ILLIAC, where  $p = 7$ ,  $q = 6$ ,  
 $r = 0$ , and  $s = 1$ .

X	Y <sub>0</sub>	Y <sub>1</sub>	Y <sub>2</sub>	Y <sub>3</sub>	Y <sub>4</sub>
+ .5623124	-89.5623	+ .5623	3.9637	21.8956	14.6325

Tape for plotter:

J+5623  
LOF-8956N  
L1F+0056N  
L2F+0396N  
L3F+2190N  
L4F+1463N

Data tape print-out from ILLIAC, where  $p = 6$ ,  $q = 5$ ,  
 $r = 1$ , and  $s = 0$ .

X	Y <sub>0</sub>	Y <sub>1</sub>	Y <sub>2</sub>	Y <sub>3</sub>	Y <sub>4</sub>
+ .562312	-89.5623	+ .562	3.964	21.896	14.632

Tape for plotter:

J+5623  
F+0056N  
F+0396N  
F+2190N  
F+1463N

DATE	April 29, 1959
CODED BY	<i>Charlene Sprankel</i>
APPROVED BY	<i>J. Snyder</i>

LOCATION	ORDER	NOTES	PAGE 1
(99)	00 100K		
	L3 6F		-  N  6 → A
	32 (99)		A ≥ 0 do not punch symbols
	26 (100)		Do punch symbols
	L5 (12)		
	40 (37)		
	L5 (42)		
(100)	40 (36)		
	26 (101)		
	L5 (23)		
	40 (37)		
(101)	L5 (24)		
	40 (36)		
	L3 5F		-  N  5 → A
	36 (103)		A ≥ 0 too many places in X or Y causes hang up
	L5 (38)		Overwrite (142) to cause by-passing
(103)	40 (142)		Overwrite (170) to cause by-passing
	L5 (39)		
	40 (170)		
	26 (105)		WASTE
	26 (105)		
	L5 (40)		
(105)	40 (142)		
	L5 (41)		
	40 (170)		
	L1 (35)		
	L4 3F		
	36 (185)		A ≥ 0 stop at LF
	L1 (35)		
(108)	L4 4F		
	36 (185)		A ≥ 0 stop at LF
	L5 3F		
	40 (21)		
	L5 (10)		
	40 (32)		
	L5 (21)		
	L0 (17)		A - 1 → A

LOCATION	ORDER	NOTES	PAGE 2
	40 (21)		
	L1 (21)		
	36 (113)		$A \geq 0$ $10^P$ completed
	50 (32)		
	75 (10)		Unrounded multiplication by 10
	S5 F		
	40 (32)		Store $10^P$ in (32)
	26 (108)		
(113)	L5 4F		
	40 (21)		
	L5 (10)		
	40 (18)		
(115)	L5 (21)		
	L0 (17)		$A - 1 \rightarrow A$
	40 (21)		
	L1 (21)		
	36 (120)		$A \geq 0$ $10^Q$ completed
	50 (18)		
	75 (10)		Unrounded multiplication by 10
	S5 F		
	40 (18)		
	26 (115)		
(120)	92 575F		15 2-hole delays
	92 63F		15 1-hole delays
	41 (19)		Clear A and (19)
	41 (22)		Clear A and location for sign
(121)	41 1F		Clear A and 1F
	92 131F		CR - 1F
(123)	91 4F		5th hole read
	32 (128)		$A \geq 0$ not a 5th hole
	L0 (20)		Subtract decimal point
	40 F		
	L3 F		$-  N  0 \rightarrow A$
	32 (134)		$A \geq 0$ it is decimal point
	F5 (19)		Count 5th holes
	40 (19)		

LOCATION	ORDER	NOTES	PAGE 3
(128)	LO (16) 36 (184) 26 (123) 40 (31) 41 (19) L5 (31) LO (11) 32 (133) L4 (17) 32 (134) L5 (31) 40 1F	$A \geq 0$ 15 (5th) holes stop  Clear A and 5th hole counter  Subtract negative sign $A \geq 0$ it is negative sign  $A \geq 0$ it is positive sign	
(133)	22 (134) L5 (15)		
(134)	40 (22) 91 4F 40 (31) 32 (138) LO (20) 40 F L3 F	Store sign 5th hole read  $A \geq 0$ it is not 5th hole Subtract decimal point  $-  N  0 \rightarrow A$	
(138)	32 (134) 22 (141) 50 1F 75 (10) S5 F L4 (31) 40 1F	$A \geq 0$ , it is decimal point   Unrounded multiplication by 10	
(141)	22 (134) L5 1F		
(142)	LO (32) 26 (143)		
(143)	92 834F 50 (12) L5 1F 66 (32)	Print J   Divide $AQ/N \rightarrow Q$	

LOCATION	ORDER	NOTES	PAGE 4
	41 1F		
	L5 (22)		
	32 (147)		
	S1 F		
(147)	26 (148)		
	S5 F		
(148)	50 4F		
	50 (148)		
	26 (P16)		
	L5 (36)		
(150)	40 (171)		
	41 (19)		
	41 1F		
	41 (31)		
(151)	91 4F		
	32 (156)		
	L0 (20)		
	40 F		
	L3 F		
	32 (162)		
	F5 (19)		
	40 (19)		
	L0 (16)		
	36 (184)		
(156)	26 (151)		
	40 (31)		
	41 (19)		
	L5 (31)		
	L0 (11)		
	32 (161)		
	L4 (17)		
	32 (162)		
	L5 (31)		
	40 1F		
(161)	22 (162)		
	L5 (15)		

Sign  
 $A \geq 0$ , it is positive sign

Print X

Overwrite (171) to punch symbols  
Clear A and (19)  
Clear A and 1F  
Clear A and location (31)

5th hole read  
 $A \geq 0$ , not 5th hole  
Subtract decimal point

- |N| 0 → A  
 $A \geq 0$ , it is decimal point  
Count 5th holes

$A \geq 0$ , 15 (5th) holes stop program

Clear A and (19)

Subtract negative sign  
 $A \geq 0$  it is negative sign  
Add 1  
 $A \geq 0$  it is positive sign

LOCATION	ORDER	NOTES	PAGE 5
(162)	40 (22) 91 4F 40 (31) 32 (166) L0 (20) 40 F L3 F 32 (162)		Store negative number 5th hole read  $A \geq 0$ Subtract decimal point  $-  N  3 \rightarrow A$ $A \geq 0$ it is decimal point
(166)	22 (169) 50 1F 75 (10) S5 F L4 (31) 40 1F		Unrounded multiplication by 10
(169)	22 (162) L5 1F		
(170)	L0 (18) 26 (1701)		
(1701)	92 131F 26 (171)		CR - LF
(171)	92 962F 92 2F		Print L Print O
(172)	92 898F 50 (12) L5 1F 66 (18) 41 1F L5 (22) 32 (176)		Print F Clear Q  Divide $AQ/10^q$ Clear A and 1F Sign $\rightarrow A$ $A \geq 0$ it is positive sign
(176)	S1 F 26 (177) S5 F		
(177)	50 4F 50 (177) 26 (P16) 92 770F		Print Y  Print N



LOCATION	ORDER	NOTES	PAGE 6
(179)	41 (22) L5 (31) L0 (30) 40 F L3 F 36 (121) L5 (171) L4 (37) 40 (171) 22 (150)		Clear A and location for sign  Subtract CR - LF  -  N  0 → A A ≥ 0  A + 64 → A
(184)	24 100F 26 999F		Stop
(185)	LF F L5 (31)		Stop if p > 11 or q > 11
(186)	L0 (30) 40 F L3 F 36 (121) 91 4F 26 (186)		Subtract CR - LF  -  N  0 → A A ≥ 0, it is CR - LF 5th hole read
(10)	00 F 00 10F		Store "+"
(11)	00 F 00 11F		Store "-"
(12)	00 F 00 F		Zero
(15)	80 F 00 F		Negative sign
(16)	00 F 00 15F		15 5th holes stop program
(17)	00 F 00 1F		Store integer "1"
(18)	00 F 00 10F		Store 10 <sup>D</sup>
(19)	00 F 00 F		5th hole counter

LOCATION	ORDER	NOTES	PAGE 7
(20)	80 F		
	00 10F	Decimal point	
(21)	00 F	Store number of digits	
	00 F		
(22)	00 F	Sign	
	00 F		
(30)	80 F		
	00 2F	CR - LF	
(31)	00 F		
	00 F	Store last number read	
(32)	00 F		
	00 10F	Store 10 <sup>9</sup>	
(35)	00 F	Constant to stop program	
	00 12F	if there are more than 11 places to read	
(36)	92 962F	Print L	
	92 2F	Print 0	
(37)	00 F	Store constant to	
	00 64F	advance symbol punch	
(38)	10 (32)		
	32 (185)	Used to test whether to by-pass X	
(39)	10 (18)		
	36 (179)	Used to test whether to by-pass Y	
(40)	10 (32)		
	26 (143)	Used in loc. (142) when not by-passing	
(41)	10 (18)		
	26 (1701)	Used to overwrite (170)	
(42)	26 (172)		
	26 (172)	Used to overwrite (36)	
(23)	00 F		
	00 64F	Used to overwrite (37)	
(24)	92 962F		
	92 2F	Used to overwrite (36)	
	(P16)00 K		
	24 999N		