

PLOT SUBROUTINE FOR FORTRAN WITH FORMAT

(1620-FO-004 Version 1)

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<u>DECK KEY</u>

- 1. FORTRAN Plot Demonstration Deck to Read Values from and Compute the Sine, Cosine and Natural Log
- 2. Plot Subroutine Program Deck
- 3. Plot Subroutine Source Deck
- 4. Plot Subroutine Demonstration Data Deck

Plot Subroutine for FORTRAN with Format (1620-FO-004 Version 1)

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- A. <u>Purpose/Description</u>: This program presents a subroutine which can be easily used in FORTRAN for plotting single or multiple curves without the GOTRAN problem of determining which curve has the lower magnitude. Also this method can be used to generate the curves on cards for off-line printing.
- B. Method: N/A
- C. <u>Restrictions and Range</u>: Normally a range of 0-70 should be the limitation for typewriter output since the carriage can handle only 80 to 85 positions. The range for card output should be 72 characters minus the digits in the independent variable.
- D. <u>Accuracy</u>: Negative numbers, floated numbers, and numbers outside of the allowable range produce an ERROR F9 message.
- E. <u>Machine Configuration</u>: Basic 1620 Card system with minimum of 20K memory. The program is designed to work with the FORTRAN system without automatic divide.
- F. Program Requirements: The subroutine requires 432 core locations.
- G. Source Language: Fortran
- H. Program Execution Time: N/A
- I. Check Out Status: N/A
- J. Sample Problem Running Time: Approximately 45 minutes.

K. <u>Comments</u>: Major modifications must be made to use this subroutine with the FORTRAN version with automatic divide. This program and its documentation were written by an IBM employee. It was developed for a specific purpose and submitted for general distribution to interested parties in the hope that it might prove helpful to other members of the data processing community. The program and its documentation are essentially in the author's original form. IBM serves as the distribution agency in supplying this program. Questions concerning the use of the program should be directed to the author's attention.

Plot Subroutine of IBM 1620 FORTRAN with Format

INTRODUCTION

Since many IBM 1620 applications are in areas where a rough plot of the results can be quite useful, it was felt that a subroutine incorporated into FORTRAN was necessary. GOTRAN provides a statement for plotting requiring a separate program and a knowledge of GOTRAN language. This write-up presents a subroutine which can be easily used in FORTRAN for plotting single or multiple curves without the GOTRAN problem of determining which curve has the lower magnitude. Also this method can be used to generate the curves on cards for off-line printing.

METHOD OF USE

Since a method of plotting multiple curves with any special characters was desired, the normal method of output (PRINT or PUNCH) was utilized with the incorporation of a new type FORMAT character Z. This subroutine is used with the output routines rather than the normal arithmetic statement. The basic FORTRAN statements to use this plot subroutine are:

- PRINT 2, X, M, N, J
- 2 FORMAT (F10.5, 3Z *+.)

The first variable in the list is the independent variable which can be either fixed or floated point number. This variable will be handled in the regular output routine where the value is printed. The Z character in the format accomplishes the following:

1. The remaining values in the list will be plotted instead of printed.

- 2. The Z is handled by the compiler in the same routines designed for the H character except that the address compiled will be the address in the symbol table corresponding to the subroutine whereby the FORTRAN input/output package will branch to this address then to the relocated subroutine. The number and type of plot characters are stored similar to the H type.
- 3. The remaining values in the list are assumed to be fixed variables previously scaled to the range of output record minus the digits in the independent variable. (Example: for the case shown, the numbers should be scaled between 0 and 87 minus 10 (or 77). Normally a range of 0-70 should be the limitation for typewriter output since the carriage can handle only 80 to 85 positions. The range for card

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output should be 72 characters minus the digits in the independent variable. Negative numbers, floated numbers, and numbers outside of the allowable range produce an ERROR F9 message.

- 4. The first character after the Z will be used to plot the first variable in the list to be plotted. Remaining list values will use the next character until the list is satisfied. Therefore, no limitation on the number of variables exists except the 72 character statement size. If the number of variables in the list exceeds the number of plot symbols, an ERROR F9 message will occur.
- 5. The range of the plot starts at the next position after the last digit of the independent variable. Therefore, if the value of the variable to be plotted is 0, the plot symbol will be inserted in the first position after the independent variable.

The statement may be either PRINT or PUNCH depending on whether the output is on the typewriter or cards. The subroutine sets up the FORTRAN output area with the independent variable and all plot symbols before giving the write command. For typewriter output, a record mark is inserted in the next position after the highest plot value to conserve typing time (A minimum of 20 characters is always typed). This produces a much faster method than GOTRAN and eliminates all problems of relative magnitude of curves.

FORTRAN Processor Modifications

To make the plot routine useable on a 20K card system, space was used where the ACCEPT TAPE and PUNCH TAPE statements were previously located. If these commands are called, an error message indicating a missing format number will occur. These changes are:

Card No. 3024

Location		New Instruction	Card Col.	
2030	CM	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	21-32	
2042	BNE		33-44	
2054	B		45-52	

Location		New Instruction	Card Col.
2162	в	49 02218 00000	13-24
2174	TDM	15 08719 00001	25-36
2186	TFM	16 03493 19870	37-48
2198	TR	31 17322 17324	49-60
2210	В	49 04118	61-67
Card No. 3053	3		
Location		New Instruction	Card Col.
4070	TFM	$16\ 04243\ 000\overline{3}1$	31-42
4082	BNE	47 02030 01200	43-54
4094	\mathbf{TR}	31 17322 17324	55-66
4106	TFM	16 0349	67-72
Card No. 3054	Ł,		
Location		New Instruction	Card Col.
4112		3 04264	3-8
4118	TFM	$16\ 03620\ 04174$	9-20

These patches allow the processor to check for the Z format, insert the subroutine name location, and set for subroutine load. The instructions at 2174 and 2186 assume that the subroutine will be the first added after the normal six from IBM. If this is not true, then the addresses of 2174 (8719 for subroutine load) and 2186 ($\overline{1}$ 9870 for subroutine address) must be changed. The normal rules for adding a subroutine must be followed.

Plot Subroutine

Enclosed at the end of this write-up is an SPS listing and flow charts of the Plot Subroutine for the FORTRAN subroutine deck without automatic divide. For use with automatic divide, the address for the symbols of the input/output package must be changed. This includes CON2 which refers to the instruction in SWC.

The subroutine requires 432 core locations. The trailer card requires a value of 00434 in Col.1-5 as stated in the FORTRAN write-up.

General Comments

With format control, the output plot can be quite complete. The following technique which can be used in FORTRAN provides a means of printing

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the graph scales:

PRINT 5, 0, 50, 100, 150, etc. PRINT 5, 1, 1, 1, 1, 1, 1, etc. 5 FORMAT (I 11, I5, I5, I5, etc.)

FORTRAN will print the variables in the list as the value of each quantity. The I11 can be made so that the first value prints after the independent variable. Example (using previous example)

> 0 50 100 150 200 250 300 350 400 1 1 1 1 1 1 1 1 1 1 50000 * +

Although the previous sections of this write-up indicates that only one independent variable may be printed, this is not true. Assume it is desired to print x and y and also plot y. This could be done as follows:

PRINT 6, X, Y, MY 6 FÓRMAT (F10. 5, F10. 5, 1Z*)

This will print as follows:

x y +xxx. xxxxx+xxx. xxxxx

Where X and Y are printed and MY (Y after scaling) is plotted. The range of MY must be reduced to keep the over record with limits. The general rule is that any variable to the left of the first plot variable in the list will be printed under normal FORTRAN rules.

The name PLOT must not be used in the program since the compiler will assume this to be a function name.

Modifications for Extra Memory

To convert this program for machines with 40K or 60K, the compiler modifications previously described must be altered. The digit in column 44 of card 3026 (shown as 1) must be changed to $\overline{3}$ or $\overline{5}$ depending on the amount of additional memory.

Sample Program

Included with this write-up is a sample program and listing to illustrate the use of this subroutine. This program works as follows using data values of 1 to 89:

- Switch 1 on switch 2 off SIN, COS and LGN are printed on the typewriter and punched on cards.
- 2. Switch 1 off stops typewriter output.
- Switch 1 on switch 2 on SIN, COS and LGN are punched on cards. SIN and COS are plotted.

It should be noted that without typewriter output, this program permits almost complete overlap of input, output, and computing providing an effective demonstration of the 1620 card buffering.

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SAMPLE PROBLEM LISTING (Con't.)

SAMPLE PROBLEM LISTING

$\overline{0}8300$ C $\overline{0}8300$ C $\overline{0}8300$ C $\overline{0}8300$ C $\overline{0}8300$ 100 $\overline{0}8320$ 100 $\overline{0}8340$ 11 $\overline{0}8508$ $\overline{0}8652$ $\overline{0}8652$ $\overline{0}8684$ 20 $\overline{0}8708$ $\overline{0}8708$ $\overline{0}8708$ $\overline{0}8724$ $\overline{0}8788$ $\overline{0}8828$ $\overline{0}8828$ $\overline{0}88900$ 100 $\overline{0}9048$ $\overline{0}90048$ $\overline{0}90048$ $\overline{0}9144$ 130 $\overline{0}9212$ 150 $\overline{0}9248$ $\overline{0}9248$ 2 $\overline{0}9248$ 2 $\overline{0}9248$ 3 $\overline{0}9248$ 3 $\overline{0}9436$ 2 $\overline{0}94458$ 3 $\overline{0}94458$ 3 $\overline{0}94458$ 3 $\overline{0}94458$ 3 $\overline{0}94458$ 3 $\overline{0}94458$ 3 $\overline{0}94458$ 3 $\overline{0}9456$ 4 $\overline{0}9748$ 7	1620 FØRTRAN DEMØNSTRATIØN TØ READ VALUES FRØM 1 TØ 89 AND CØMPUTE THE SINE,CØSINE AND NATURAL LØG ØF THESE NUMBERS SWITCH 1 ØN TØ ØBTAIN TYPEWRITER ØUTPUT SWITCH 2 ØFF TØL LIST VALUES ØN TØ PLØT SIN AND CØS IF(SENSE SWITCH 1) 10,20 IF(SENSE SWITCH 2) 11,12 PRINT 5,0,1,2,3,4,5,6,7,8,9,10 PRINT 5,1,1,1,1,1,1,1,1,1,1 GØ TØ 20 PRINT 5,1,1,1,1,1,1,1,1,1,1 GØ TØ 20 PRINT 1 PUNCH 1 DØ 150 N=1,89,2 READ 2,1 A=1 X=A*3.1415926 /180. B=SINF(X) C=CØSF(X) D=LØGF(A) PUNCH 3,1,B,C,D IF(SENSE SWITCH 1) 110,150 IF(SENSE SWITCH 1) 110,150 IF(SENSE SWITCH 2) 120,130 MPLØT = 50.*C PRINT 7,1,MPLØT,NPLØT GØ TØ 150 PRINT 4, J,B,C,D CØNTINUE PRINT 4 PAUSE GØ TØ 100 FØRMAT(15) FØRMAT(15,F12.7,F12.7,F12.7) FØRMAT(17,15,15,15,15,15,15,15,15,15,15,15,15,15,
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39869 SURIF 39879 PLØT 39869 PLØTF 39859 0100 39849 0010 39839 0020 39829 0011 39819 0012	- 6 -
39809 0006 39799 0006 39789 0005	- 0 -

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39419	0007
39399	0004

SW 1 ØFF TØ IGNØRE SUBRØUTINES, PUSH START

- 7 -

PRØCESSING CØMPLETE

COMPUT コン



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SAMPLE PROBLEM OUTPUT

1 0.174524 9998476 0.000000 3 0.523359 .99986295 1.0986122 5 0.0871557 .9961946 1.6094379 7 .1218693 .9925461 1.9459101 9 .1564344 .9876883 2.1972245 11 .1908089 .9816271 2.3978952 13 .2249510 .9743700 2.5649493 15 .2588190 .9659258 2.7080502 17 .2923716 .9563047 2.8332133 19 .3255681 .9455185 2.9444389 21 .358679 .9335804 3.0445224 23 .907311 .9205048 3.1354942 25 .4226182 .9063077 3.2188758 27 .4539904 .8910065 3.2958368 29 .4448096 .8746197 3.6172958 31 .5150380 .871673 .4339872 33 .5446390 .8846705 .4439675 34 .681998	LØAD DATA	4	040(1)	1 011 (1)
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19 .2536679 .9335804 3.0445224 23 .3907311 .9205048 3.1354942 25 .4226182 .9063077 3.2188758 27 .4539904 .8910065 3.2958368 29 .4848096 .8746197 3.3672958 31 .5150380 .8571673 3.4339872 33 .5446390 .8386705 3.4965075 35 .5735764 .8191520 3.553480 37 .6018150 .7986355 3.6109179 39 .6293203 .7771459 3.6635616 41 .6560590 .7547095 3.7135720 43 .6819983 .7313537 3.7612001 45 .7071067 .7071067 .8066624 47 .7313536 .6819983 .8501476 49 .7547095 .6560590 .8918202 51 .7771459 .6560590 .8918202 53 .7986355 .6018150 .9702919 55 .8191520 .5735764 .0073331 57 .8386705	16	22225710	01.55195	2 01/1/280
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23 .3907311 .9205048 3.1354942 25 .4226182 .9063077 3.2188758 27 .4539904 .8910065 3.295368 29 .4848096 .8746197 3.3672958 31 .5150380 .8571673 3.4339872 33 .5446390 .8386705 3.4965075 35 .5735764 .8191520 3.5553480 37 .6018150 .7986355 3.6109179 39 .6293203 .7771459 3.6635616 41 .6560590 .7547095 3.7135720 43 .6819983 .7313537 3.7612001 45 .7071067 .7071067 3.8066624 47 .7313536 .6819983 3.8501476 49 .7547095 .6560590 3.8918202 51 .7771459 .6293204 3.9318256 53 .7986355 .6018150 3.9702919 55 .8191520 .5735764 4.0073331 57 .8386705 .5446390 4.0430512 59 .8571672 .5150381 4.0775374 61 .8746196 .4888096 4.1108788 63 .8910064 .4539906 4.1431347 65 .9063077 .4226182 4.1743872 67 .9205048 .3907312 4.2046926 69 .9335804 .3583680 4.2341065 71 .9455185 .3255682 4.2626798 73 .9563047 .2223717 4.2904594 75 .9659258 .2588190 4.3174881 77 .9743700 .2249510 4.3438054 79 .9816271 .1908090 4.3694478 81 .9876883 .1564345 4.3944491 83 .9925461 .1218694 4.4188406 85 .9961946 .0774558 4.4426512 87 .9986295 .0523360 4.4659081 89 .998476 .0174524 4.4886363 RUN C0MPLETE.PRESS START FØR NEXT SET	21	.3583679	.9335804	3.0445224
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	23	.3907311	•9205048	3.1354942
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	25	4226182	.9063077	3.2188758
29 .4448096 .8746197 3.3672958 31 .5150380 .8571673 3.4339872 33 .5446390 .8386705 3.4965075 35 .5735764 .8191520 3.553480 37 .6018150 .7986355 3.6109179 39 .6293203 .7771459 3.6635616 41 .6560590 .7547095 3.7135720 43 .6819983 .7313537 3.7612001 45 .7071067 .7071067 .8066624 47 .7313536 .6819983 .8501476 49 .7547095 .6560590 .8918202 51 .7771459 .65203204 .9318256 53 .7986355 .6018150 3.9702919 55 .8191520 .5735764 .0073331 57 .8386705 .5446390 .0430512 59 .8571672 .5150381 .0775374 61 .8746196 .4848096 .108738 63 .89100	27	4539904	8910065	3,2958368
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	20	1,81,8004	87/16107	2 2672058
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	29	.4040090	.0/4013/	3.30/2330
33 5446390 .836705 3.4965075 35 .5735764 .8191520 3.5553480 37 .6018150 .7986355 3.6109179 39 .6293203 .7771459 3.6635616 41 .660590 .7547095 3.7135720 43 .6819983 .7313537 3.7612001 45 .7071067 .7071067 3.8066624 47 .7313536 .6619983 3.8501476 49 .7547095 .6560590 3.8918202 51 .7771459 .6293204 3.9318256 53 .7986355 .6018150 3.9702919 55 .8191520 .5735764 4.0073331 57 .886705 .5446390 4.0430512 59 .8571672 .5150381 4.0775374 61 .8746196 .4848096 4.1108738 63 .8910064 .4539906 4.1431347 65 .9063077 .4226182 4.1743872 67 .9205048 .3907312 4.2046926 69 .9335804 <	31	•5150380	.85/16/3	3.43398/2
35 .5735764 .8191520 3.5553480 37 .6018150 .7986355 3.6109179 39 .6232203 .7771459 3.6635616 41 .6560590 .7547095 3.7135720 43 .6819983 .7313537 3.7612001 45 .7071067 .7071067 3.8066624 47 .7313536 .6819983 3.8501476 49 .7547095 .6560590 3.8918202 51 .7771459 .6293204 .9318256 53 .7986355 .6018150 .9702919 55 .8191520 .5735764 .0073331 57 .8386705 .5446390 4.0430512 59 .8571672 .5150381 4.0775374 61 .8746196 .4848096 4.1108738 63 .8910064 .4539906 4.1431347 65 .9063077 .4226182 .1743872 67 .9205048 .3907312 4.2046926 69 .	. 33	•5446390	.8386705	3.4965075
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	35	.5735764	.8191520	3.5553480
319 .6293203 .7771459 3.6635616 41 .6560590 .7547095 3.7135720 43 .6819983 .7313537 3.7612001 45 .7071067 .7071067 3.806624 47 .7313536 .6819983 3.8501476 49 .7547095 .6293204 3.9318256 53 .7986355 .6018150 3.9702919 55 .8191520 .5735764 4.0073331 57 .8386705 .5446390 4.0430512 59 .8571672 .515081 4.0775374 61 .8746196 .4848096 4.108738 63 .8910064 .4539906 4.1431347 65 .9063077 .4226182 4.1743872 67 .9205048 .3907312 4.2046926 69 .9335804 .3583680 4.2426798 73 .9563047 .2923717 4.2904594 75 .9659258 .2588190 4.3174881 79 <th< td=""><td>27</td><td>6018150</td><td>79863 55</td><td>3.6109179</td></th<>	27	6018150	79863 55	3.6109179
53 .6233 203 .774739 3.603 3010 41 .6560590 .7547095 3.713 5720 43 .6819983 .7313 537 3.7612001 45 .7071067 .7071067 3.806624 47 .7313 536 .6819983 3.8501476 49 .7547095 .6560590 3.8918202 51 .7771459 .6293204 3.9318256 53 .7986355 .6018150 3.9702919 55 .8191520 .5735764 .0073331 57 .8386705 .54463 90 4.0430512 59 .8571672 .5150381 4.0775374 61 .8746196 .4484096 4.1108738 63 .8910064 .4539906 .11431347 65 .9063077 .4226182 .1743872 67 .9205048 .3907312 4.2046926 69 .9335804 .3583680 4.2341065 71 .9455185 .3255682 4.2626798 73	26	6202202	7771450	2 662 5616
41 .650590 .7947095 3.7135720 43 .6819983 .7313537 3.7612001 45 .7071067 .7071067 3.8066624 47 .7313536 .6819983 3.8501476 49 .7547095 .6560590 3.8918202 51 .7771459 .623204 3.9318256 53 .7986355 .6018150 3.9702919 55 .8191520 .5735764 4.0073331 57 .8866705 .5446390 4.0430512 59 .8571672 .5150381 4.0775374 61 .8746196 .4848096 4.1108738 63 .8910064 .4539906 4.1431347 65 .9063077 .4226182 4.1743872 67 .9205048 .3907312 4.2046926 69 .9335804 .3583680 4.2341065 71 .9455185 .3255682 4.2626798 73 .9563047 .2923717 4.2904594 75 .9659258 .2588190 4.3174881 79 .9816271	29	•0235205	•///1+JJ	2 712 5700
43 .6819983 .7313537 3.7612001 45 .7071067 .7071067 3.8066624 47 .7313536 .6819983 3.8501476 49 .7547095 .6560590 3.8918202 51 .7771459 .6233204 3.9318256 53 .7986355 .6018150 3.9702919 55 .8191520 .5735764 4.0073331 57 .8386705 .5446390 4.0430512 59 .8571672 .5150381 4.0775374 61 .8746196 .4848096 4.1108738 63 .8910064 .4539906 4.1431347 65 .9063077 .4226182 4.1743872 67 .9205048 .3907312 4.2046926 69 .9335804 .3583680 4.2341065 71 .9455185 .3255682 4.2626798 73 .9563047 .2223717 4.2904594 75 .9659258 .2588190 4.3174881 79 .9816271 .1908090 4.3694478 81 .987683	41	.0500590	•/54/095	3./135/20
45 .7071067 .7071067 3.8066624 47 .7313536 .6819983 3.8501476 49 .7547095 .6560590 3.8918202 51 .7771459 .6293204 3.9318256 53 .7986355 .6018150 3.9702919 55 .8191520 .5735764 4.0073331 57 .8386705 .5446390 4.0430512 59 .8571672 .5150381 4.0775374 61 .8746196 .4848096 4.1108738 63 .8910064 .4539906 4.1431347 65 .9063077 .4226182 4.1743872 67 .9205048 .3907312 4.2046926 69 .9335804 .3583680 4.2341065 71 .9455185 .3255682 4.2626798 73 .9563047 .2923717 4.2904594 75 .9659258 .2588190 4.3174881 79 .9816271 .1908090 4.3694478 81 .9876833 .1564345 4.3944491 83 .9925461	43	.6819983	.7313537	3.7612001
47 .7313536 .6819983 3.8501476 49 .7547095 .6560590 3.8918202 51 .7771459 .6293204 3.9318256 53 .7986355 .6018150 3.9702919 55 .8191520 .5735764 4.0073331 57 .8386705 .5446390 4.0430512 59 .8571672 .5150381 4.0775374 61 .8746196 .4848096 4.1108738 63 .8910064 .4539906 4.1431347 65 .9063077 .4226182 4.1743872 67 .9205048 .3907312 4.2046926 69 .3335804 .3583680 4.2341065 71 .9455185 .3255682 4.2626798 73 .9563047 .2923717 4.2904594 75 .9659258 .2588190 4.3174881 77 .9743700 .2249510 4.3438054 79 .9816271 .1908090 4.3694478 81 .9925461 .1218694 4.4188406 85 .9961946	45	.7071067	.7071067	3.8066624
49 .7547095 .6560590 3.8918202 51 .7771459 .6293204 3.9318256 53 .7986355 .6018150 3.9702919 55 .8191520 .5735764 .0073331 57 .8386705 .5446390 4.0430512 59 .8571672 .5150381 4.0775374 61 .8746196 .4848096 4.1108738 63 .8910064 .4539906 .1431347 65 .9063077 .4226182 4.1743872 67 .9205048 .3907312 4.2046926 69 .9335804 .3583680 4.2341065 71 .9455185 .3255682 4.2626798 73 .9563047 .2223717 4.2904594 75 .9659258 .2588190 4.3174881 77 .9743700 .2249510 4.3438054 79 .9816271 .1908090 4.3694478 81 .9876833 .1564345 4.3944491 83 .9925461 .1218694 4.4188406 85 .9961946	47	7313536	6819983	3.8501476
49	77	7517005	6 6 6 0 5 0 0	2 8018202
51 .//1459 .623204 3.9310256 53 .7986355 .6018150 3.9702919 55 .8191520 .5735764 4.0073331 57 .8386705 .5446390 4.0430512 59 .8571672 .5150381 4.0775374 61 .8746196 .4848096 4.1108738 63 .8910064 .4539906 4.1431347 65 .9063077 .4226182 4.1743872 67 .9205048 .3907312 4.2046926 69 .335864 .353680 4.2341065 71 .9455185 .3255682 4.2626798 73 .9563047 .2223717 4.2904594 75 .9659258 .2588190 4.3174881 77 .9743700 .2243710 4.3438054 79 .9816271 .1908090 4.3694478 81 .987683 .15643455 4.3944491 83 .9925461 .1218694 4.4188406 85 .9961946 .0871558 4.4426512 87 .9986295 <	49	•/34/033	•0500550	3.0310202
53 .7986355 .6018150 3.9702919 55 .8191520 .5735764 4.0073331 57 .8386705 .5446390 4.0430512 59 .8571672 .5150381 4.0775374 61 .8746196 .4848096 4.1108738 63 .8910064 .4539906 4.1431347 65 .9063077 .4226182 4.1743872 67 .9205048 .3907312 4.2046926 69 .9335804 .3583680 4.2341065 71 .9455185 .3255682 4.2626798 73 .9563047 .2923717 4.2904594 75 .9659258 .2588190 4.3174881 79 .9816271 .1908090 4.3694478 81 .9876883 .1564345 4.3944491 83 .9925461 .1218694 4.4188406 85 .9961946 .0871558 4.4426512 87 .9986295 .0523360 4.459081 89 .9998476 .0174524 4.4886363 89 .9998476	51	•///1459	.6293204	3.9310250
55 .8191520 .5735764 4.0073331 57 .8386705 .5446390 4.0430512 59 .8571672 .5150381 4.0775374 61 .8746196 .4848096 4.1108738 63 .8910064 .4539906 4.1431347 65 .9063077 .4226182 4.1743872 67 .9205048 .3907312 4.2046926 69 .9335804 .353680 4.2341065 71 .9455185 .3255682 4.2626798 73 .9563047 .2923717 4.2904594 75 .9659258 .2588190 4.3174881 77 .9743700 .2249510 4.3438054 79 .9816271 .1908090 4.3694478 81 .9876883 .1564345 4.3944491 83 .9925461 .1218694 4.4188406 85 .9961946 .0871558 4.4426512 87 .9986295 .0523360 4.4526512 87 <t< td=""><td>53</td><td>•7986355</td><td>.6018150</td><td>3.9702919</td></t<>	53	•7986355	.6018150	3.9702919
57 .8386705 .5446390 4.0430512 59 .8571672 .5150381 4.0775374 61 .8746196 .4848096 4.1108738 63 .8910064 .4539906 4.1431347 65 .9063077 .4226182 4.1743872 67 .9205048 .3907312 4.2046926 69 .9335804 .3583680 4.2341065 71 .9455185 .3255682 4.2626798 73 .9563047 .2923717 4.2904594 75 .9659258 .2588190 4.3174881 77 .9743700 .2249510 4.3438054 79 .9816271 .1908090 4.3694478 81 .9876883 .1564345 4.3944491 83 .9925461 .1218694 4.4188406 85 .9961946 .0871558 4.4426512 87 .9986295 .0523360 4.4659081 89 .998476 .0174524 4.4886363 RUN COMPLETE, PRESS START FØR NEXT SET	55	.8191520	• 573 5764	4.0073331
59 .8571672 .5150381 4.0775374 61 .8746196 .4848096 4.1108738 63 .90064 .4539906 4.1431347 63 .9063077 .4226182 4.1743872 67 .9205048 .3907312 4.2046926 69 .9335804 .3583680 4.2241065 71 .9455185 .3255682 4.2626798 73 .9563047 .2923717 4.2904594 75 .9659258 .2588190 4.3174881 79 .9816271 .1908090 4.3694478 81 .9876883 .1564345 4.3944491 83 .9925461 .1218694 4.4188406 85 .9961946 .0871558 4.426512 87 .9986295 .0523360 4.4550813 89 .9998476 .0174524 4.4886363 89 .9998476 .0174524 4.4886363 RUN CØMPLETE, PRESS START FØR NEXT SET	57	8386705	54463 90	4.0430512
59 .05/10/2 .5/30501 +.6/73/74 61 .8746196 .4848096 4.1108738 63 .8910064 .4539906 4.1431347 65 .9063077 .4226182 4.1743872 67 .9205048 .3907312 4.2046926 69 .9335804 .3583680 4.2341065 71 .9455185 .3255682 4.2626798 73 .9563047 .2923717 4.2904594 75 .9659258 .2588190 4.3174881 77 .9743700 .2249510 4.3438054 79 .9816271 .1908090 4.3694478 81 .9876883 .1564345 4.3944491 83 .9925461 .1218694 4.4188406 85 .9961946 .0871558 4.4426512 87 .9986295 .0523360 4.4659081 89 .998476 .0174524 4.4886363 RUN C0MPLETE, PRESS START FØR NEXT SET	·)/	9571672	5150281	1 0775274
61 .8/46196 .4840096 4.1106/36 63 .8910064 .4539906 4.1431347 65 .9063077 .4226182 4.1743872 67 .9205048 .3907312 4.2046926 69 .9335804 .3583680 4.2341065 71 .9455185 .3255682 4.2626798 73 .9563047 .2923717 4.2904594 75 .9659258 .2588190 4.3174881 77 .9743700 .2249510 4.3438054 79 .9816271 .1908090 4.3694478 81 .9876883 .1564345 4.3944491 83 .9925461 .1218694 4.4188406 85 .9961946 .0871558 4.4426512 87 .9986295 .0523360 4.4659081 89 .9998476 .0174524 4.4886363 RUN CØMPLETE.PRESS START FØR NEXT SET	59	.05/10/2	• 51 50 501	4.0// 33/4
63 .8910064 .4539906 4.1431347 65 .9063077 .4226182 4.1743872 67 .9205048 .3907312 4.2046926 69 .9335804 .3583680 4.2341065 71 .9455185 .3255682 4.2626798 73 .9563047 .2923717 4.2904594 75 .9659258 .2588190 4.3174881 77 .9743700 .2249510 4.3438054 79 .9816271 .1908090 4.3694478 81 .9876883 .1564345 4.3944491 83 .9925461 .1218694 4.4188406 85 .9961946 .0871558 4.4426512 87 .9986295 .0523360 4.4659081 89 .9998476 .0174524 4.4886363 RUN CØMPLETE, PRESS START FØR NEXT SET	61	.8746196	.4846096	4.1100/30
65 .9063077 .4226182 4.1743872 67 .9205048 .3907312 4.2046926 69 .9335804 .3583680 4.2341065 71 .9455185 .3255682 4.2626798 73 .9563047 .2923717 4.2904594 75 .9659258 .2588190 4.3174881 77 .9743700 .2249510 4.3438054 79 .9816271 .1908090 4.3694478 81 .9876883 .1564345 4.3944491 83 .9925461 .1218694 4.4188406 85 .9961946 .0871558 4.4426512 87 .9986295 .0523360 4.4659081 89 .9998476 .0174524 4.4886363 RUN CØMPLETE, PRESS START FØR NEXT SET	63	.8910064	•4539906	4.1431347
67 .9205048 .3907312 4.2046926 69 .3335804 .3583680 4.2341065 71 .9455185 .3255682 4.2626798 73 .9563047 .2923717 4.2904594 75 .9659258 .2588190 4.3174881 77 .9743700 .2249510 4.3438054 79 .9816271 .1908090 4.3694478 81 .9876883 .1564345 4.3944491 83 .9925461 .1218694 4.4188406 85 .9961946 .0871558 4.4426512 87 .9986295 .0523360 4.4659081 89 .9998476 .0174524 4.4886363 RUN COMPLETE.PRESS STATF FØR NEXT SET	65	.9063077	.4226182	4.1743872
69 .9335804 .3583680 4.2341065 71 .9455185 .3255682 4.2626798 73 .9563047 .2923717 4.2904594 75 .9659258 .2588190 4.3174881 77 .9743700 .2249510 4.3438054 79 .9816271 .1908090 4.3694478 81 .9876883 .1564345 4.3944491 83 .9925461 .1218694 4.4188406 85 .9961946 .0871558 4.4426512 87 .9986295 .0523360 4.4659081 89 .9998476 .0174524 4.4886363 RUN CØMPLETE, PRESS START FØR NEXT SET	67	9205048	.3907312	4.2046926
71 9455185 3255682 4.2626798 73 9563047 2923717 4.2904594 75 9659258 2588190 4.3174881 77 9745700 2249510 4.3438054 79 9816271 1908090 4.3694478 81 9876883 1564345 4.3944491 83 9925461 1218694 4.4188406 85 9961946 0871558 4.4426512 87 9986295 0523360 4.4659081 89 9998476 0174524 4.4886363 RUN CØMPLETE.PRESS START FØR NEXT SET	čà	0235804	3 583 680	4.2341065
71 .945105 .923602 +.2620790 73 .9563047 .2923717 4.2904594 75 .9659258 .2588190 4.3174881 77 .9743700 .2249510 4.3438054 79 .9816271 .1908090 4.3694478 81 .9876883 .1564345 4.3944491 83 .9925461 .1218694 4.4188406 85 .9961946 .0871558 4.4426512 87 .9986295 .0523360 4.4659081 89 .9998476 .0174524 4.4886363 RUN CØMPLETE, PRESS START FØR NEXT SET	71	0/55195	2255682	1 2626708
73 .9563047 .2923717 4.2904994 75 .9659258 .2588190 4.3174881 77 .9743700 .2249510 4.3438054 79 .9816271 .1908090 4.3694478 81 .9876883 .1564345 4.3944491 83 .9925461 .1218694 4.4188406 85 .9961946 .0871558 4.4426512 87 .9986295 .0523360 4.4659081 89 .9998476 .0174524 4.4886363 RUN CØMPLETE, PRESS START FØR NEXT SET	/!	•9433103	.5255002	4.2020/90
75 .9659258 .2588190 4.3174881 77 .9743700 .2249510 4.3438054 79 .9816271 .1908090 4.3694478 81 .9876883 .1564345 4.3944491 83 .9925461 .1218694 4.4188406 85 .9961946 .0871558 4.4426512 87 .9986295 .0523360 4.4659081 89 .9998476 .0174524 4.4886363 RUN CØMPLETE.PRESS START FØR NEXT SET	13	.956304/	.2923/1/	4.2904594
77 .9743700 .2249510 4.3438054 79 .9816271 .1908090 4.3694478 81 .9876883 .1564345 4.3944491 83 .9925461 .1218694 4.4188406 85 .9961946 .0871558 4.4426512 87 .9986295 .0523360 4.4659081 89 .9998476 .0174524 4.4886363 RUN CØMPLETE, PRESS START FØR NEXT SET	75	•9659258	.2588190	4.3174881
79 .9816271 .1908090 4.3694478 81 .9876883 .1564345 4.3944491 83 .9925461 .1218694 4.4188406 85 .9961946 .0871558 4.4426512 87 .9986295 .0523360 4.4659081 89 .9998476 .0174524 4.4886363 RUN CØMPLETE, PRESS START FØR NEXT SET	77	.9743700	.2249510	4.3438054
81 .9876883 .1564345 4.3944491 83 .9925461 .1218694 4.4188406 85 .9961946 .0871558 4.4426512 87 .9986295 .0523360 4.4659081 89 .9998476 .0174524 4.4886363 RUN CØMPLETE.PRESS START FØR NEXT SET	79	9816271	1908090	4.3694478
83 .9925461 .1218694 4.4188406 85 .9961946 .0871558 4.4426512 87 .9986295 .0523360 4.4659081 89 .9998476 .0174524 4.4886363 RUN CØMPLETE, PRESS START FØR NEXT SET	ล์	9876882	1564345	4.3944491
65 .9925461 .1210094 4.4106406 85 .9961946 .0871558 4.4426512 87 .9986295 .0523360 4.4659081 89 .9998476 .0174524 4.4886363 RUN CØMPLETE.PRESS START FØR NEXT SET	02	0025164	1219604	1, 1,199104
85 .9961946 .08/1558 4.4426512 87 .9986295 .0523360 4.4659081 89 .9998476 .0174524 4.4886363 RUN CØMPLETE.PRESS START FØR NEXT SET	05	• 77 2 3401	.1210034	4.4100400
87 .9986295 .0523360 4.4659081 89 .9998476 .0174524 4.4886363 RUN CØMPLETE.PRESS START FØR NEXT SET	85	.9961946	.08/1558	4.4426512
89 .9998476 .0174524 4.4886363 RUN CØMPLETE PRESS START FØR NEXT SET	87	.9986295	•0523360	4.4659081
RUN COMPLETE PRESS START FOR NEXT SET	89	.9998476	.0174524	4.4886363
	RUN COMPL	ETE PRESS	START FØR NI	EXT SET

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Return to Subroutine for Next Value. (See Previous Page) PLØT

DØRG 5000

*+35,BLK10+11,0

*+23,2,010

PLØT+35,2,010

SWC+6,CØN1+6,1

BLK5+6,2,10

P,2,10

TFM PT+18,QZ+40

T3+2,1,10

ERRØR,,0

RX

RX,P

ERRØR,,0

*+24,RX,0

ERRØR,,0

PLØT2+6,RX,0

PLØT2+6,RX,0

PLØT2+6,BLK5+6,0

PLØT2+11,PLØT+35,01

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RX-9,ZØTZ-10

*+23,SWC-1,0

ERRØR,RX-3,0

BRBK

DØRG ***-3**

T3+2

TF

AM

TF

AM

TF

AM

SM

В

ΒN

TR

TF

TF

BNF

BNL

BNF

В

TF

A

Α.

TF

С

PLØT1 SM



PLØT2 TF

С

BNL

TF

BD 🛛

TF

В

AM

BB

ERRØR RCTY

ERCØNT DS

Τ2

ZØTZ

CØNT

CØN2

T3

SWC

RX

Ρ

BLK10 DS

BLK5 DS

В

DS

DS

B

DC

DS

DS

DS

DS

PLØT3

0,0

TFM SWH+6,BRBK

DØRG *-3

DØRG *-9

WATY ERCØNT

,7807

,6320

,98

PLØT1,,0

7,4307876

SOURCE LISTING

05000

	05000	2 6	05035	07275		
	05012	T1	05035	00002		
	05024	26	07428	00000		
	05036	TI	0 503 5	00002		
	05048	26	04998	05420		
	05060	11	063 26	00002		
	05072	12	07807	00002	· · .	
,	05084	16	07778	08093		
	05096	49	0 736 0	00000		•
	05104					
	0 51 04	12	07428	00001		
	05116	47	05378	01300		•
	05128	31'	00089	07994		
	05140	2 6	05163	04991		
	05152	26	00098	00000		
	05164	4 4	05378	00095	-	
	05176	24	86000	07807		
	05188	T 46	05378	01300	•	
· .	05200	4 4	05224	00098		

05212 49 05378 00000

05224 26 05278 06326

05236 21 05278 00098

05248 21 05278 00098

05260 26 05283 05035

SOURCE LISTING

0,0	•
PT+18,PLØT2+6,1	05272 26 00000 00000
*+24,,0	05284 24 07778 05278
PT+18,PLØT2+6,1	05296 46 05320 01300
PLØT3,T2,0	05308 26 07778 05278
SWH+6,BRBK	05320 4 05364 05365
SWC+6,CØN2,1	05332 16 07850 07360
SWD	05344 26 04998 05432
*-3	05356 49 04692 00000
PLØT+35.2.010	05364
FL91733,2,010	05364 T1 05035 00002
*-9	05376 42 00000 00000
	05378
ERCØNT	05378 34 00000 00102
PLØT2+480	05390 39 07977 00100
.7977	05402 49 05320 00000
•5365	07977 00000
.8004	05365 00000
PLØT10	08004 00000
7.4307876	05414 49 05104 00000
.7264	05432 00007
.7426	07264 00000
.4992	07426 00000
.98	04992 00000
.7807	00098 00000
.6320	07807 00000
	063 20 00000

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SOURCE LISTING

- 16 -

	РТ	DS ⁻	,7760	τ.		
	07	DS	.8053		t.	07760 00000
		00	72(0			08053 00000
	BKBK	D2 .	,/360			07360 00000
	SWD	DS	,4692			04602 00000
	SWH	DS	,7844			04892 00000
÷		DEND				07844 00000
		02.10				00000

END ØF PASSII

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