PROGRAM TITLE: AFIT 019 FLOATING DECIMAL OUTPUT

PROGRAM CLASSIFICATION: Subroutine

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PURPOSE: This is a subroutine which converts RECOMP'S floating
                          binary numbers into floating decimal numbers for output
                          on the typewriter. It is provided with a number of
                          entries, so that it can deal with a single number, with
                          a series of numbers to be typed in column, a series to
                          be typed in tabular form, or with a fixed point number.

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I.   AFIT 019 is a subroutine which converts RECOMP'S floating binary numbers into floating decimal numbers for output on the typewriter. It is provided with a number of entries, so that it can deal with a single number, with a series of numbers to be typed in column, a series to be typed in tabular form, or with a fixed point number.

The output form is a characteristic, followed by an exponent. The number of digits in the characteristic is stipulated by the user and may be as large as desired, although it will have no value beyond twelve digits; the characteristic is not rounded. Signs are typed only if negative. The number may be of any magnitude that RECOMP can contain. If it exceeds 10^{1000} in magnitude, the machine types "EXP TOO HIGH" and stops. If the characteristic is zero, the machine types "ZERO" and if the exponent is negative and too large in magnitude for the routine to handle, it types "VIRTUAL ZERO."

II.   <u>COMMAND —15 00 n</u>

where n is a two-digit octal number which indicates the number of digits to be typed in the characteristic.

This form types out a single floating point binary number, which must be in the A and R registers when the negative command is encountered.

Return is made to the command next following the negative command -- 15 00 n.

The number is typed at the position at which the typewriter stands; any initial or final positioning commands for the typewriter must be provided in the main program.

If the machine types "EXP TOO HIGH, and stops at LC 1176.0, touching the START button will cause it to return to the main program.

III.   <u>Command —16 nb</u>

where n is a two-digit octal number which indicates the number of digits to be typed in the characteristic and b is a two-digit octal number which indicates binary scale.

This form types out a single fixed point binary number which must be in the A register when the negative command is encountered. Its binary scale b must be in the range $0 \lessgtr b \lessgtr 77_8$.

Return is made to the command next following the negative command —16 nb.

The number is typed at the position at which the typewriter stands; any initial or final positioning commands for the typewriter must be provided in the main program.

If b is not within the stipulated range, a fixed point number can still be typed out by the procedure given in paragraph VI.

IV. **Command —17 N n**

where N is a two digit octal number which specifies the number of floating point binary numbers to be connected and typed, and n is a two digit octal number which specifies the number of digits to be typed for each characteristic.

This command must be immediately preceded by a command C L A P where P is the address of a word which contains the initial address at b 18; i.e., (P) = PZE (IA) ·0 PZE (zero) . 0 and IA is the address of the first of the floating point binary numbers to be outputted. The others must follow in sequence, two locations per number.

The numbers are typed out in a vertical column, one number per line, at the left of the page. It is not necessary to provide an initial carriage return or figure shift in the main program.

If the machine types EXP TOO HIGH and stops at LC 1176.0, touching START will cause the routine to proceed with the outputting of the next number.

V. **Closed Subroutine**

In this form, the routine converts and types a block of N binary floating point numbers, commencing at IA, and allows any desired number of them to be typed on each line.

The TAB DEFEAT SWITCH below the typewriter cover must be positioned to the REAR; and the TAP STOPS on the typewriter must be adjusted according to the spacing desired.

The calling sequence is:

2

		SLL		
α	TRA	1251.0		
	PZE	(IA) · 0		IA = address of first number
α + 1	PZE	(N) · 0		N = number of floating point numbers to be outputted
	PZE	(n) · 0		n = digits for each characteristic
α + 2	PZE	(Count) · 0		Count = number of numbers per line
	RETURN ADDRESS			

If the routine is relocated, address 1251.0 will be replaced by 1251.0 + Δ where Δ represents the amount by which the routine is advanced in memory.

If machine types EXP TOO HIGH and stops at LC 1176.0, touching START will cause the routine to proceed to output the next number.

VI. To output a single fixed point binary number at a binary scale outside the range $0 \leqq b \leqq 77_8$, use the following commands:

    CLA Loc (binary scale at b 39)

    XAR

    CLA Loc(Fixed Point Number)

    FNM

    -15 00 n

VII. The closed subroutine and the -17 N n command can each be used for outputting fixed point numbers, if each fixed point number is followed by a word containing its binary scale at b 39. The combination of the fixed point number and its next word constitute an unnormalized floating point number. A brief routine to normalize the numbers must then be used before entering AFIT 019.

Restriction: Negative commands cannot be utilised in the L loop.

Comparison with AN 036: The general effect of AFIT 019 is similar to that of AN 036. AN 019 is more flexible in that it allows a choice of the number of digits to be typed and provides several methods of use. AN 036 is somewhat faster for small exponents (for an equal number of typed digits) AN 019 is much faster for large exponents.

```
     C+0007740+1413251
     8

0774 +4210040+7200370          1060 +3077740+0711560
5    +7200100+0077610          1    +3577740+0077700
6    +3310440+4000060          2    +0311770+6077700
7    +4000000+4212460          3    +5710371+6410700
1000 +0077610+3310460          4    +5777600+4000000
1    +4212370+7200330          5    +0000000-0031000
2    +4000000+4000000          6    +0000000-0002400
3    +6612300+4000000          7    +0000000-0000200
4    +3002240+5012060          1070 +0077750+5011050
5    +4000000+3577740          1    +5111050+3077740
6    +4300000+5011050          2    +0577710+3577740
7    +5110331+4000000          3    +0077700+0113130
1010 +0310650+5212110          4    +6077700+5777600
1    +0077750+0310660          5    +0000000-0000000
2    +5210160+0077750          6    +0000000-0000620
3    +0310670+5210170          7    +6411000+5777600
4    +0077750+0310470          1100 +0277750+0377720
5    +5210270+5710631          1    +5111050+3077740
6    +6410200+5777600          2    +0777710+3577740
7    +6410200+5777631          3    +0077700+0313130
1020 +3077740+5011140          4    +6077700+5777600
1    +3577740+0077700          5    +0077750+4100250
2    +0210760+6077700          6    +4211070+0077740
3    +5710110+3077740          7    +4000020+6411200
4    +0511160+3577740          1110 +5211121+7200030
5    +0077700+0177730          1    +6011520+0211520
6    +6077700+5710121          2    +5777600+7200040
7    +6410300+5777600          3    +5777600+4000000
1030 +3077740+5011560          4    +4444651-4454561
1    +3577740+0077700          5    +0000000-0002461
2    +0111770+6077700          6    +4520131+4440000
3    +5710140+0110650          7    +0000000-0000210
4    +5112200+0077750          1120 +1177730+5011271
5    +0110660+5110411          1    +4100010+0113140
6    +0077750+0110670          2    +4277631+4000000
7    +5110421+0077750          3    +4000000+5700000
1040 +0110470+5110570          4    +0077770+0310450
1    +5710770+6410500          5    +6077700+5011450
2    +5777600+6410500          6    +4300000+1177730
3    +5777631+4000000          7    +5777610+0077700
4    -0077000-0000000          1130 +0313130+6077700
5    +0000010-0000000          1    +4300000+1177730
6    -0000770-0000000          2    +5777610+4000000
7    +0000000-0000101          3    +7200260+5777640
1050 +3077740+0711140          4    +7200270+5777640
1    +3577740+0077700          5    +7200230+5777640
2    +0310760+6077700          6    +7200010+5777640
3    +5710341+3077740          7    +7200120+5777640
4    +0711160+3577740          1140 +7200200+5777640
5    +0077700+0377730          1    +7200250+5777640
6    +6077700+5710360          2    +7200070+5777640
7    +6410600+5777600          3    +7200060+5777640
                               4    +7200300+5777640
                               5    +7200040+6411600
                               6    +0077700+5012470
                               7    +5277600+0277700
```

AFIT org Fl. Pt output   Page 4

+00 0774 6 + 14 1325 0

4 A

1150	+6077700+7200030
1	+5777600+4000000
2	+5777600+4000000
3	+0000000-0000000
4	+0000000-0000001
5	-7400000-0000000
6	+6065000-0000000
7	+0000000-0000101
1160	+4300000+0010750
1	+2277730+3511530
2	+4300000+4100270
3	+0177760+6077760
4	+0077620+0112270
5	+6077620+0011530
6	+5011670+5777600
7	+6411700+5777600
1170	+0077760+3311550
1	+5077621+1277761
2	+5711741+0077760
3	+4100040+6077760
4	+5777601+6412000
5	+5777600+4000000
6	+7200330+5711741
7	+0000000-0000021
1200	+0012460+0310450
1	+6012460+4000000
2	+5070111+0010040
3	+0112500+6010040
4	+7200370+7200100
5	+7200330+5710030
6	+7200370+7200210
7	+7200010+7200120
1210	+7200300+5711760
1	+7200370+7200010
2	+7200350+7200260
3	+7200640+7200200
4	+7200300+7200300
5	+7200040+7200240
6	+7200060+7200320
7	+7200240+5711760
1220	+7200370+7200360
1	+7200060+7200120
2	+7200200+7200070
3	+7200050+7200220
4	+7200040+7200210
5	+7200010+7200120
6	+7200300+5711760
7	+0000000-0000040
1230	+0000000-0000000
1	+5000000-0000000
2	+0000000-0000020
3	+0000000-0000050
4	+4000000-0000060
5	+0000000-0000010
6	+0000031+0000000
7	+0000070-0000000
1240	+6012350+0070120
1	+6012340+0077610
2	+3310460+4212370
3	+0010450+6012460
4	+7200330+3012340
5	+6612300+5710041
6	+0000000-0000000
7	+7200260+5711741
1250	+0000020-0000000
1	+1577600+4212551
2	+0113100+4212571
3	+0113100+4212621
4	+0113130+4270111
5	+4000000+0002360
6	+4100240+4210040
7	+4000000+0002370
1260	+4000000+4212460
1	+4100240+4212370
2	+4000000+0002400
3	+4213110+4213120
4	+7200370+7200100
5	+7200330+0013010
6	+6011740+0013020
7	+6012020+5710030
1270	+0013110+0310450
1	+6013110+5012740
2	+6412000+0013030
3	+6077640+5777600
4	+6412000+0013120
5	+6013110+5777600
6	+0013060+6012020
7	+0013070+6011740
1300	+5770111+4000000
1	+5777601+5712700
2	+5012760+0010040
3	+5713050+4000000
4	+4000000+4000000
5	+7200100+5710030
6	+5070111+0010040
7	+5777601+6412000
1310	+0000000-0000010
1	+0000010-0000000
2	+0000040-0000000
3	+0000000-0000001
4	+0000000-0011330
5	+6012340+0077610
6	+3310440+4000060
7	+4212370+0010450
1320	+6012460+7200330
1	+6612300+0077610
2	+3310460+6011500
3	+0211500+4000250
4	+4300000+0012340
5	+4500000+5710041
6	-2041020-2041020
7	-2041020-2041020
1330	-...060-2041020
1	-2041020-2041020
2	-2041020-2041020
3	-0734...-2041020
4	-6561220-2041020
5	-6454020-2041020

Page 2

AFIT 019 Fl.Pt output

+00 0774 0 +14 13250.

Key Words on next page

5A

```
1326    +4226110-3333361
   7    +4452060+1355571
1330    +2000221-4144541
   1    +0030200-4204111
   2    +5400010+0120401
   3    +0000000-2400001
   4    +0120261-2204231
   5    +4704040-0004001
   6    +0100000-0257341
   7    +2176040+2307771
1340    +6357071-0520011
   1    +5353450+2400001
```

AFIT 019-R

Fl. Pt. Output

Key Words

+00 0774 0 + 14 1325. 0

Pge 3