ELLIOTT 903

Volume   2:   PROGRAMMING INFORMATION

Part   4:   LIBRARY ROUTINES

Section   1:   INPUT/OUTPUT ROUTINES FOR REAL NUMBERS: QFIN & QFOUT

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(Issue 2)

Chapter 1: INTRODUCTION

1.1 Purpose.

These programs provide routines for general number input and output.   The format conventions are those of Elliott Algol.

1.2 Method of Use.

The routines are entered via QF.

1.3 Summary.

The number input or output may be stored as a floating-point number or as an integer.   Input media may be paper-tape reader or teleprinter; output media may be paper-tape punch or teleprinter.

1.4 Accuracy and Range.

The maximum error is of the order of 10^{-8}.

The range of a floating-point number, x, is given approximately by

$$-9.2 \times 10^{18} < x < 9.2 \times 10^{18}$$

The range of an integer, n, is given by

$$-131072 \leq n \leq +131071$$

1.5 Form of Distribution.

The programs are distributed as a SIR mnemonic tape. The tape contains both input and output routines: it must be assembled after QF but may be preceded by floating point mathematical routines: no other programs may be assembled between QF and the input/output routines.

Chapter   2:   FUNCTIONS

2. 1   Entry and Exit.

The routines are entered by interpretation by QF of a pseudo-instruction. If the instruction is 6 8191 QF interprets the next but one instruction after execution; otherwise return is made to the next pseudo-instruction.

The functions available and the corresponding call are listed below.   Input/output instructions are assumed to refer to real numbers until a 6 7 instruction is interpreted.

Function	Pseudo-Instruction	Remarks
Input a number	15 2048	input via tape-reader; format as described in 2. 2.
	15 2052	input via teleprinter; format as described in 2. 2.
Output a number	15 6144	output via tape-punch; format as currently set
	15 6148	output via teleprinter; format as currently set
Following input/ output instructions refer to integers	6 7	see note 1; the effect of this instruction is not destroyed by exit from QF.
Following input/ output instructions refer to real numbers	6 8	
Reset presumed settings	6 0	See 2. 3 for description of presumed settings
Set new parameters	6 8191	This instruction must be followed by a parameter word; See 2. 3.

Notes

1. An integer is input to the location whose address is in QF+4
An integer is output from the location whose address is in QF+3.
Real numbers are input to or output from the Floating Point Accumulator.

2. An impermissible address gives an error indication (See para. 3).

3. A number is treated as <u>real</u> or <u>integer</u> depending on the entry used, not on the format.

<u>Example</u>

The following section of program inputs an integer, -n, followed by n real numbers. Their sum is output to the teleprinter in freepoint (8) format.

```
SUM       +0
          +0
COUNT     +0
PSI1      0    COUNT

ENTRY     4    PSI1              (HOUSEKEEPING)
          5    QF+4
          4    +0
          5    SUM
          5    SUM+1
          11   QF
          8    QF+1
          6    0
          6    7
          15   2048              (COUNT:= -n)
          6    8

LOOP      15   2048
          1    SUM
          5    SUM
          10   COUNT
          4    COUNT
          9    LOOP
          4    SUM
          15   6148
          8    ;+0
```

2. 2   Input Formats.

The character set accepted is as follows

0 1 2 3 4 5 6. 7 8 9 + - . $_{10}$

<null> <delete> <carriage return>
<halt>
<space> <newline> all other even-parity
                characters except (acute)

Characters on the first line may appear in a number.

Characters on the second line are always ignored.

If <halt> is read during execution of an input instruction the program waits.   On re-entry at 9 the program continues input.

Characters on the fourth line are treated as separators between numbers and are otherwise ignored.

Odd-parity characters cause an error indication to be output (see para. 3 of this document).

Numbers may be signed or unsigned and may be punched in any of the conventions of 903 Algol.   Note that + or - cannot terminate a number.

The number input is treated as integer or floating-point according to the entry-point used and not according to the format input.   An integer must not exceed 131071 in magnitude (fractional parts are rounded to the nearest integer).

Example of numbers that may be input by this program as real numbers

104	+500	-2	500000
1002	10234. 56		200. 0
$4_{10}1$	$5_{10}-5$		$+2. 75_{10}+10$
$_{10}2$	$_{-10}{}^{+}05$		

2.3   Output Formats.

In the following description the presumed settings after initial assembly are given in square-brackets. These settings apply to all output unless changed by a 6   8191 instruction and are reset by a 6   0 instruction. The formats satisfy the conventions of Elliott Algol.

The parameter word after a 6   8191 instruction is a pseudo-instruction

B   F   N

2.3.1   Lay-Out.   [newline]

This affects both real and integer format.

For newline   B=1
For sameline   B=0

2.3.2   Real Format   [freepoint(8)]

For freepoint(n) format F=0   N=n
  " aligned(m, n)   "   F=1   N=16m+n
  " scaled(n)   "   F=2   N=n

For aligned format $m+n \leq 15$
For freepoint and scaled format $n \leq 8$

The integer format is not changed by change of the real format.

2.3.3   Integer Format   [digits(6)]

For digits(n) format   F=4   N=n $;n \leq 6$

The real format is not changed by change of the integer format.

An impermissible parameter word causes an error indication to be output. (See para 3).

2.4   Accumulators for Input and Output.

Real numbers are input to and output from the Floating-Point Accumulator of QF.

Integers are input to and output from store locations: these operations are related to the floating-point operations

6   3 and 6   4.

Chapter 3: ERROR INDICATIONS

3.1 Standard Indication.

If an error occurs a message is displayed on a newline on the teleprinter, followed by 6 inches of blank tape on the punch. Recovery can be made and the program continued by re-entry at 9.

3.2 Errors Detected.

Message	Significance	Effect of re-entry at 9
QF!	Impermissible instruction or parameter	Dynamic-stop at 9
*EE2	FPA not standardised on output	Output +0
*EE3	Integer overflow on input	The largest number of correct sign is substituted
*EE4	Contextual error on input	Recommence input of the ~~Ignore the incorrect~~ number. ~~character~~
*EE5	Attempt to input string	Ignore the incorrect character
*EE6	Parity error in input	Ignore the incorrect character
*EE7	Floating-point over-flow on input (see Note 1) *	Substitute the largest number of correct sign that can be held in packed format.

3.3 Alarm Printing.

If the number to be output is too large for the format specified, alarm printing occurs. This is in scaled format and uses the same number of characters as the format demanded. If this is impossible H is output.

e.g. 1. format demanded: aligned (4, 3)
          numbers to be output: $- 35286.741$

          output obtained: $- 3.53_{10}+04$

e.g. 2. format demanded: aligned (2, 1)
          number to be output: 123.45

          output obtained: H

* Note 1. If the number being input has a value greater than 10^{+100} approximately, floating point overflow occurs. This error will most probably be caused by a wrongly punched data tape.

Chapter   4:   METHOD USED

The routines are based on the 903 ALGOL compiler.

Additions to this are
1)   the FPA is preserved by real output and by integer working;
2)   organisational material.

Chapter   5:   STORE USED

Input Routines	approximately	250	locations
Output Routines	"	250	"
Common Material	"	200	"
Total	"	700	"