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**LISTIV: A FORTRAN IV
GENERALIZED INPUT ROUTINE**

MARCH 1965

<i>Extra</i>			
<i>W. V. DeMier</i>	<i>3106</i>	<i>321</i>	<i>APR 22 1965</i>

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LISTIV: A FORTRAN IV GENERALIZED INPUT ROUTINE

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March, 1965

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RICHLAND, WASHINGTON

Work performed under Contract No. AT(45-1) - 1830 between
the Atomic Energy Commission and Battelle Memorial Institute

Printed by/for the U. S. Atomic Energy Commission

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INTRODUCTION

The subroutine INPUT/LISTIN/UNIT* is incompatible with Fortran IV. Since the Fortran IV system differs from the Fortran II system in some basic respects, input routines based on different concepts will probably be developed after these concepts are clarified by experience with the new system. However, LISTIN's history of widespread use with scientific programs indicates that a routine of similar function is required.

The subroutine LISTIV was written to fill this need. Its objective is to make LISTIN-type input possible with two classes of programs: (1) those Fortran II codes which are being converted to Fortran IV without extensive revision and (2) new "quick-and-dirty" applications, in which programming time can be cut and data preparation simplified because of the familiarity of the input format.

The routine is written in Fortran IV language. Symbolic and binary decks are available from the Electronic Data Processing Operation Fortran Library.

*J. R. Lilley, A Generalized Fortran Input Routine, HW-70893. August, 1961.

THE LISTIN CONCEPT

Procedure

Each entry into the routine causes all cards of one case to be read. Each card is listed on the A3 output tape and data are placed in the COMMON area in a form and location specified by the data card. An error code is set and control is returned to the calling program.

Advantages

Utilization of a LISTIN-type input routine has four principal advantages:

1. The programmer is freed from the burden of writing input and format statements for each individual program by simply calling the generalized input routine.
2. Data preparation is simplified and data errors minimized by providing the user with a relatively simple, standardized format for many different codes. The input area may be easily cleared between cases. Repetitive data (such as large blocks of zeros) can be condensed onto a very few cards. Portions of data not applicable to a given case need not be punched.
3. Only input quantities which differ from the previous case need be punched. This overload feature cuts input card volume by a significant amount in the typical physics application.
4. A complete listing of input cards for a given case precedes the output of that case, simplifying location of input errors. Identifying comments, also printed, may be intermixed with the data.

DESCRIPTION OF INPUT CARDS

A card type is indicated by the entry in column 1 of each card. LISTIV recognizes four types of data-bearing cards, one type of control card, and one type of comment card.

Control Card

Card type 9 indicates end of case. Upon reading a card with 9 in column 1, LISTIV immediately returns control to the calling program. Columns 2-80 are ignored and may contain comments or identification.

Comment Card

Comments, data identification, additional heading material, or what-have-you may be entered on cards having C in column 1. The card is listed as punched, but is otherwise ignored by LISTIV.

Data Cards

An entry of 0, 1, 2, or blank* in column 1 indicates that data is to be transferred from the card to the COMMON storage area. All data-bearing cards are of the same general format:

<u>COLUMNS</u>	<u>ENTRY</u>			
1	Card type; indicates format of columns 11-70.			
2-3	N, the number of data words on this card.			
4-5	K, repetition control.			
6-10	LOC, the COMMON location to which the first data field on this card is addressed.			
11-70	Data (format given below).			
71-80	Printed, but otherwise ignored.			

<u>CARD TYPE</u> <u>(COL. 1)</u>	<u>FORMAT AND FIELD WIDTH</u>	<u>DATA TYPE</u>	<u>NMAX, NUMBER OF FIELDS PER CARD</u>	<u>FIELDS START IN COLUMNS</u>
0	E10.0	Real	6	11,21,31,41,51,61
1	I5	Integer	12	11,16,21,26,31,36,41,46,51,56,61,66
2	A6	BCD	10	11,17,23,29,35,41,47,53,59,65
Δ*	Same as preceding card.....			

Reference to the above tables will be helpful during assimilation of the information given on the following page, where the functions of the data card control fields are explained.

*The symbol Δ indicates one blank throughout the following text and illustrations.

DESCRIPTION OF INPUT CARDS

Data Cards - cont'd.

Columns 6-10 contain LOC, the location in COMMON into which the data from the first field is to be placed. Normally, data from successive fields on the card are placed in successive COMMON locations. For Illustrations 1 through 6, assume the routine calling LISTIV contains the statement COMMON A(20), J(10), Q. Illustration 1: A card is read having LOC = 5 and data punched in the first 4 data fields. LISTIV places the data word from the first field into A(5), from the second into A(6), from the third into A(7), and from the fourth into A(8).

Columns 2-3 specify N, the number of data words on the card. If N is nonblank, data from the first N fields are placed in core and fields beyond the Nth are ignored. If N is blank, the entire card is examined and data from all nonblank fields are placed in core. EXCEPTION: For a type 2 card with blank N, all fields are placed in core.

Note that the treatment of blank data fields in columns 11-70 of card types 0 and 1 depends upon whether or not N is specified: If N is numeric, any blank data fields within the limit of N are placed in core as zeros. If N is blank, NMAX (as given in the table on page 3) fields are examined and data from all nonblank fields are placed; contents of locations corresponding to blank fields are unchanged. Illustration 2: A type 0 card has LOC = 5, N = 6, and is otherwise blank except for 7.0 in the third data field and 9.0 in the fifth data field. This sets A(5) = -0.0, A(6) = -0.0, A(7) = 7.0, A(8) = -0.0, A(9) = 9.0, and A(10) = -0.0. Illustration 3: A card is read which is identical to that in Illustration 2 except that N is blank. This sets A(7) = 7.0, A(9) = 9.0, and all other COMMON storage is unchanged.

Another secondary effect of N is the effective LOC computed when LOC is unspecified on the following card. The first data field on the card is always addressed to LOC for any card on which LOC is punched. If, however, LOC is blank, the location for the first data field is computed as

$$LOC(\text{this card}) = LOC(\text{previous card}) + N(\text{previous card}).$$

Now: if N was blank on the previous card, N(previous card) = NMAX when computing LOC(this card). Illustration 4: The following two cards are read by LISTIV in the order given.

```

      N      LOC
0A3AAAAA1.0
0A2AAAAAAAA4.0AAAAA5.0

```

These two cards will cause the following changes in the COMMON storage area: A(1) = 1.0, A(2) = -0.0, A(3) = -0.0, A(4) = 4.0, and A(5) = 5.0.

Illustration 5: Two cards are read which are identical to those in Illustration 4 except that columns 2-3 of the first card are blank. They will have the following effect: A(1) = 1.0, A(7) = 4.0, and A(8) = 5.0; all other COMMON storage is unchanged.

Columns 4-5 contain a repetition control, K. A nonblank K simply causes this card to be treated, as though it were K cards, all identical except for LOC, which is blank on the last (K-1) of these cards. Illustration 6: A card which is blank except for 11210 in columns 1-5 and 1 in column 10 (N = 12, K = 10, LOC = 1) zeros the first 120 locations of COMMON storage: there are 12 fields to be stored; they are repeated K-1 (= 9) times, with LOC increased by 12 each time. In this way, as many as 1188 locations can be cleared with one type 1 card.

SYSTEM OPTIONS

LISTIV uses the MODIFY(2) option of the local Fortran IV system, which modifies the system I/O routines .FI0H. and .FCNV. Before returning to the calling program, LISTIV restores .FI0H. and .FCNV. to their condition at entry time.

The effects of Modification 2 on input conversion are identical to those produced in Fortran II by the use of 9I0H4, one of the local modifications of Fortran II (I0H). Modification 2 has no effect on LISTIV output. Its effects on the interpretation of input are:

1. Leading and trailing blanks in numeric (I, E, and F) fields are ignored rather than interpreted as zeros. An entirely blank I, E, or F field, however, is interpreted as a minus zero. Therefore integers and exponents need not be right-adjusted in the field. This applies to the control integers N, K, and I0C of all input cards, as well as data fields in columns 11-70 of card types 0 and 1. Note that this interpretation of numeric fields is compatible with standard usage except where intended zeros have been deliberately left blank.
2. When the decimal point is not punched in an E or F field, a decimal point is assumed immediately after the right-hand digit punched rather than at the right-hand edge of the field. Thus, a field specification of Ew.0 (as used by LISTIV) interprets integer information in the desired manner.

Input examples:

FORMAT	EXTERNAL	INTERNAL
E10.0*		5 (floating)
E10.0*	5	5 (floating)
E10.2	500	5 (floating)
E10.0*		50 (floating)
E10.0*	5+1	50 (floating)
E10.0*	5 -1	.5 (floating)
I10	5	5 (integer)
I5*	5	5 (integer)
I5*	50	50 (integer)

Further examples of input data interpretation may be seen in the sample problem, pages 10-13.

Any confusion regarding the functions of LISTIV and the Fortran system I/O routines with regard to the treatment of blanks should be resolved here. LISTIV determines from the control integers N and K whether a given field in columns 11-70 should cause a change in the COMMON storage area. How that field is interpreted before storing is a function of the system I/O routines, as modified by MODIFY(2).

*Format used by LISTIV.

PROGRAMMING FOR LISTIV

Call Sequence

Routines which call LISTIV should reserve some variable for an input-error code. The variable should be initialized before calling LISTIV and tested afterward. A heading should be written before calling LISTIV. Additional heading information for the listing of input may be entered on type C cards, if desired.

Sample coding section:

```
      WRITE (3, 101)
101  FORMAT (1H15X,21HLISTING OF INPUT DATA)
      KERRER = 0
      CALL LISTIV (KERRER)
      IF (KERRER) 120, 140, 120
120  Error procedure
      :
      GO TO .....
140  CONTINUE
      Remainder of program
      :
      END
```

An additional coding example is given with the sample problem, page 9.

Estimate of Core Space Required

In order to estimate the amount of core space which the use of LISTIV will add to a program, its space requirements and those of its associated routines are given here.

<u>DECK</u> <u>NAME</u>	<u>LENGTH*</u> <u>(BASE 10)</u>	<u>AVAILABILITY</u>
LST4	664	Fortran Library, 713 Building (cards).
MCHN	20	Included with LST4 deck in the Fortran Library.
.RERD.	111	Load from system tape at execute time.

In estimating required core space, the user should, of course, add in .RERD. (REREAD) only if it is not already included elsewhere in his program.

In addition to the routines given above, .FRDD., .FSLL., and .SLI. are required for BCD input. If the program has no other BCD input, a total of 82 core locations should be allowed for them, as well as 33 locations for input buffers and buffer control words.

*Figures given for core space required are accurate as of 02-25-65. Some variation with time is to be expected.

DIFFERENCES BETWEEN LISTIN AND LISTIV

The following summary of differences between INPUT/LISTIN/UNIT and LISTIV is given to aid the user who is familiar with the old Fortran II routine. Although there are a number of differences, they are such that virtually all old LISTIN input can be correctly interpreted by LISTIV. The outstanding exception is the LISTIN data card which is non-zero in column 4 (see Item 10 below). Other exceptions whose frequency is small are those given in Items 6 through 9. In general, the less widely used options have been replaced by others which give greater flexibility in areas of heavier use.

<u>INPUT/LISTIN/UNIT</u>	<u>LISTIV</u>
1. Variable length call list.	1. Call list always has one argument.
2. Listing of input data may be suppressed by calling INPUT instead of LISTIN.	2. Input data is always listed.
3. Data is read from A2 unless tape unit number is modified by calling UNIT.	3. Data is always read from A2 because the use of a variable tape unit soaks up an extra 2652 core spaces at load time. A version employing a variable tape unit can be prepared easily if requested.
4. Data errors (including illegal character in numeric field) indicated by sense light, and/or by one argument in call list.	4. Data errors indicated only by call list argument. Illegal characters in a numeric field are handled by the Fortran IV monitor and do not affect condition of the error code.
5. Comment cards not permitted.	5. C in column 1 indicates comment card.
6. L&C occupies columns 5-10.	6. L&C occupies columns 6-10.
7. A negative L&C specifies absolute core location.	7. Absolute core location cannot be specified.
8. Octal data is specified by 3 in column 1.	8. Octal data cannot be processed.
9. Data may be input to relocatable (non-COMMON) locations.	9. Relocatable data cannot be processed. This option is under consideration in order to permit input to labelled COMMON.
10. K occupies only column 4. Any non-blank, nonzero K causes the first data word on the card to be stored in N locations. Whether the word is stored in successive locations or at increments of K depends upon the version of LISTIN.	10. K occupies columns 4-5 and indicates that this card is to be treated as K cards, each containing N words; these N*K data words are to be placed in successive locations.

DIFFERENCES BETWEEN LISTIN AND LISTIV - cont'd.

<u>INPUT/LISTIN/UNIT</u>	<u>LISTIV</u>
11. Interpretation of blanks in a numeric field containing at least one non-blank character is dependent upon the version of (IØH) loaded with the program.	11. Blanks in a numeric field containing at least one nonblank character are always ignored.
12. Magnitude of the interpreted value of a number punched without a decimal point in a floating (E format) field is dependent upon both the version of INPUT/LISTIN/UNIT being used and upon the version of (IØH) loaded with the program.	12. A number punched without a decimal point in a floating field has an implied decimal point after the last character punched, exclusive of exponent.
13. N > NMAX undefined.	13. One or more words on a card may be placed in multiple locations at any desired increment by the use of N > NMAX (an elaboration of the INPUT/LISTIN/UNIT feature mentioned in Item 10). When N > NMAX, data words are placed K times at increments of N; all nonblank fields and only nonblank fields are placed, even when the card is type 2.

SIETIC TSTC FULIST,REF

C ILLUSTRATION OF LISTIV USE

02-26-65 DDM00000

Sample Code

APPENDIX

C		00010
C	COMMON A(20), J(10), Q, I	00020
		00030
	I = 1	00040
5	WRITE (3, 6) I	00050
6	FORMAT (I1,34X,21HLISTING OF INPUT DATA/1H 5X,20(4H....))	00060
	KERROR = 0	00070
	CALL LISTIV (KERROR)	00080
	IF (KERROR) 18, 10, 18	00090
10	WRITE (3, 12) (L, A(L), L, L, A(L+10), L, L, A(L+20), L, L=1,9),	00100
	X (L, A(L), L, A(L+10), A(L+20), A(L+21), L=10,10)	0110
12	FORMAT (1H03(9X,20HLOC CONTENTS NAME)/1H 3(9X,4(5H.....)))/9	00120
	X(1H 111,F10.4,3X,2HA(12,1H)9X,1H111,F10.4,3X,3HA(111,1H)9X,1H211,	00130
	X19,4X,2HJ(12,1H)/),1H 111,F10.4,3X,2HA(12,1H)9X,2H20,F10.4,3X,	00140
	X20A(20)9X,2H30I9,4X,2HJ(10)/1H 67X,2H31,4X,A6,3X,1HQ)	00150
	GO TO 5	00170
18	CALL EXIT	00180
	STOP	00190
	END	00200 -

APPENDIX - cont'd.
Sample Output

LOC	CONTENTS	NAME	LOC	CONTENTS	NAME	LOC	CONTENTS	NAME
1	0.	A(1)	11	0.	A(11)	21	0	J(1)
2	0.	A(2)	12	0.	A(12)	22	0	J(2)
3	0.	A(3)	13	0.	A(13)	23	0	J(3)
4	0.	A(4)	14	0.	A(14)	24	0	J(4)
5	0.	A(5)	15	0.	A(15)	25	-0	J(5)
6	0.	A(6)	16	0.	A(16)	26	-0	J(6)
7	0.	A(7)	17	0.	A(17)	27	-0	J(7)
8	0.	A(8)	18	0.	A(18)	28	-0	J(8)
9	0.	A(9)	19	0.	A(19)	29	-0	J(9)
10	0.	A(10)	20	0.	A(20)	30	-0	J(10)
						31	-00000	Q

-10-

LOC	CONTENTS	NAME	LOC	CONTENTS	NAME	LOC	CONTENTS	NAME
1	1.0000	A(1)	11	11.0000	A(11)	21	21	J(1)
2	2.0000	A(2)	12	12.0000	A(12)	22	22	J(2)
3	3.0000	A(3)	13	13.0000	A(13)	23	23	J(3)
4	4.0000	A(4)	14	14.0000	A(14)	24	24	J(4)
5	5.0000	A(5)	15	15.0000	A(15)	25	25	J(5)
6	6.0000	A(6)	16	16.0000	A(16)	26	-26	J(6)
7	7.0000	A(7)	17	17.0000	A(17)	27	-27	J(7)
8	8.0000	A(8)	18	18.0000	A(18)	28	-28	J(8)
9	9.0000	A(9)	19	19.0000	A(19)	29	-29	J(9)
10	10.0000	A(10)	20	20.0000	A(20)	30	30	J(10)
						31	TEST01	Q

LISTING OF INPUT DATA

110 3 1
 1 2 32 COMMON LOCATIONS CLEARED
 9 CLEAR201
 CLEAR202
 CLEAR203

Sample Output
 cont'd.

LOC	CONTENTS	NAME	LOC	CONTENTS	NAME	LOC	CONTENTS	NAME
1	-0.	A(1)	11	-0.	A(11)	21	-0	J(1)
2	-0.	A(2)	12	-0.	A(12)	22	-0	J(2)
3	-0.	A(3)	13	-0.	A(13)	23	-0	J(3)
4	-0.	A(4)	14	-0.	A(14)	24	-0	J(4)
5	-0.	A(5)	15	-0.	A(15)	25	-0	J(5)
6	-0.	A(6)	16	-0.	A(16)	26	-0	J(6)
7	-0.	A(7)	17	-0.	A(17)	27	-0	J(7)
8	-0.	A(8)	18	-0.	A(18)	28	-0	J(3)
9	-0.	A(9)	19	-0.	A(19)	29	-0	J(9)
10	-0.	A(10)	20	-0.	A(20)	30	-0	J(10)
						31	-00000	0

LISTING OF INPUT DATA

0 TEST 12 SHOULD SET ALL OF A = PI, ALL OF J = 999, AND I = 1
 0 120 3 3.14159
 1 110 999
 2 1 31176102
 1
 9 TEST2 01
 TEST2 02
 TEST2 03
 TEST2 04
 TEST2 05
 TEST2 06

11

LOC	CONTENTS	NAME	LOC	CONTENTS	NAME	LOC	CONTENTS	NAME
1	3.1415	A(1)	11	3.1415	A(11)	21	999	J(1)
2	3.1415	A(2)	12	3.1415	A(12)	22	999	J(2)
3	3.1415	A(3)	13	3.1415	A(13)	23	999	J(3)
4	3.1415	A(4)	14	3.1415	A(14)	24	999	J(4)
5	3.1415	A(5)	15	3.1415	A(15)	25	999	J(5)
6	3.1415	A(6)	16	3.1415	A(16)	26	999	J(6)
7	3.1415	A(7)	17	3.1415	A(17)	27	999	J(7)
8	3.1415	A(8)	18	3.1415	A(18)	28	999	J(3)
9	3.1415	A(9)	19	3.1415	A(19)	29	999	J(9)
10	3.1415	A(10)	20	3.1415	A(20)	30	999	J(10)
						31	TEST02	0

LISTING OF INPUT DATA

APPENDIX

Sample Output - cont'd.

.....
C TEST THREE SHOULD OVERLOAD L IFF ODD LOCATIONS TESTS 00
C X X X X X X X X X X X X X X TESTS 01
0 1 1 3 5 7 9 11 TESTS 02
TESTS 03
COMMENT CARDS MAY BE INSERTED AT ANY POINT, BUT LOOK NEATER IF PLACED TESTS 04
C AT THE BEGINNING OR END OF THE CASE. TESTS 05
13 15 17 TESTS 06
19 TESTS 07
1 21 23 25 27 29 TESTS 08
2 31 TESTS 09
C X X X X X X X X X X X X X X TESTS 10
900 CARDS MAY APPEAR ON D-CARD, ALSO. TESTS 11

LOC	CONTENTS	NAME	LOC	CONTENTS	NAME	LOC	CONTENTS	NAME
1	1.0000	A(1)	11	11.0000	A(11)	21	21	J(1)
2	3.1416	A(2)	12	3.1416	A(12)	22	999	J(2)
3	3.1400	A(3)	13	13.0000	A(13)	23	23	J(3)
4	3.1416	A(4)	14	3.1416	A(14)	24	999	J(4)
5	5.0000	A(5)	15	15.0000	A(15)	25	25	J(5)
6	3.1416	A(6)	16	3.1416	A(16)	26	999	J(6)
7	7.0000	A(7)	17	17.0000	A(17)	27	27	J(7)
8	3.1416	A(8)	18	3.1416	A(18)	28	999	J(8)
9	9.0000	A(9)	19	19.0000	A(19)	29	29	J(9)
10	3.1416	A(10)	20	3.1416	A(20)	30	999	J(10)
						31	TEST03	Q

LISTING OF INPUT DATA

APPENDIX

Sample Output - cont'd.

TEST 4 SHOULD SET EVEN LOCATIONS TO 777 AND CLEAR ODD LOCS

210 1 777
5 777 777
2 2 777
777

TEST4 01
TEST4 02
TEST4 03
TEST4 04
TEST4 05
TEST4 06
TEST4 07
TEST4 08
TEST4 09
TEST4 10

31TEST04

THE CARD LABELLED TEST4 02 LOADS LOCATIONS 1-20, CARD TEST4 03 LOADS
LOCS 21-25, TEST4 04 LOADS 26-29, AND TEST4 05 LOADS ONLY LOC 30.

2 1 31TEST04

LOC	CONTENTS	NAME	LOC	CONTENTS	NAME	LOC	CONTENTS	NAME
1	-0.	A(1)	11	-0.	A(11)	21	-0	J(1)
2	777.0000	A(2)	12	777.0000	A(12)	22	777	J(2)
3	-0.	A(3)	13	-0.	A(13)	23	-0	J(3)
4	777.0000	A(4)	14	777.0000	A(14)	24	777	J(4)
5	-0.	A(5)	15	-0.	A(15)	25	-0	J(5)
6	777.0000	A(6)	16	777.0000	A(16)	26	777	J(5)
7	-0.	A(7)	17	-0.	A(17)	27	-0	J(7)
8	777.0000	A(8)	18	777.0000	A(18)	28	777	J(8)
9	-0.	A(9)	19	-0.	A(19)	29	-0	J(9)
10	777.0000	A(10)	20	777.0000	A(20)	30	777	J(10)
						31	TEST04	0

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