

IDENTIFICATION: DECIMAL INPUT SUBROUTINE I

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ACCEPTED: January 1, 1961

PURPOSE: To input a decimal fixed or floating point number from the Flexowriter keyboard or from paper tape and convert it to a fixed point binary number at a given scale.

RESTRICTIONS:

1. The absolute value of the number must not exceed  $(2^{21} - 1)10^{255}$ .
2. The number, ignoring decimal point and exponent, must be less than 2,097,152.
3. The only keys which may be typed are: 0-9, lower case, space, ., +, -, tab, and carriage return. Typing other keys will cause an incorrect number to be entered. If an error is made, typing the lower case key will reset the computer and the number should be re-entered from the beginning.

SPACE:  
REQUIRED

1. One full long line, excluding sectors 003, 022, 041, 014, 070, 075, 100, 110, 151, 162, 200, 203, 205, 233, 237, 253, 255, 345, 353, 364, 366 and 370.
2. All of line 00.

TIMING: Numbers are accepted at Flexowriter speed (approximately 10 characters/second).

ACCURACY: 21 bits plus sign.

USE:

1. Calling Sequence:  
Set index with line number of subroutine.

LDC	return command
LDA	scale of number @ Q21
TRU	subroutine

The transfer is to sector 340)<sub>8</sub> if the decimal numbers are read from the keyboard, sector 211)<sub>8</sub> if read from tape, and sector 042)<sub>8</sub> if the reading mode was previously set.

USE (cont.):

2. This subroutine returns with the number in A and the scale of the number in C. If the overflow indicator is on, the number is scaled differently from the specified scaling; this happens if the specified scaling is insufficient.

3. A number has the format:

$$S_1 I.FS_2 ET$$

where

$S_1$  is the sign of the number

I is the integral part of the number

. is the decimal point

F is the fractional part of the number

$S_2$  is the sign of the decimal exponent

E is an integral decimal exponent

T is one of the termination characters - -  
space, tab or carriage return.

Not all of these seven parts are necessary; T is the only required part. Typing the lower case key before the termination character will reset the computer. The number may be reentered from the beginning.

The following numbers are all equivalent to +1:

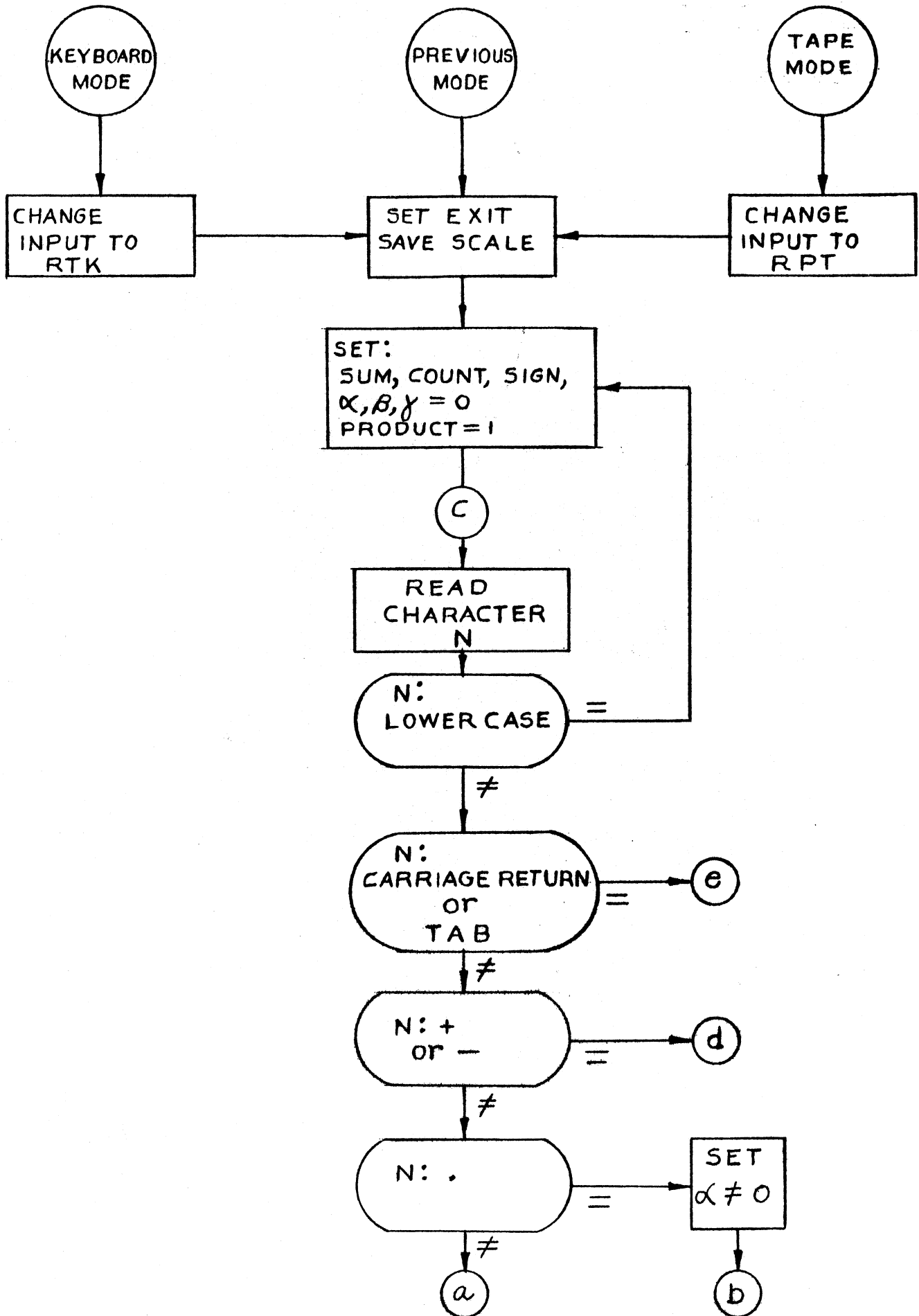
+10-1, 10-1, 1, +1, 1., .1+1, +.1+1, .001+3, etc.

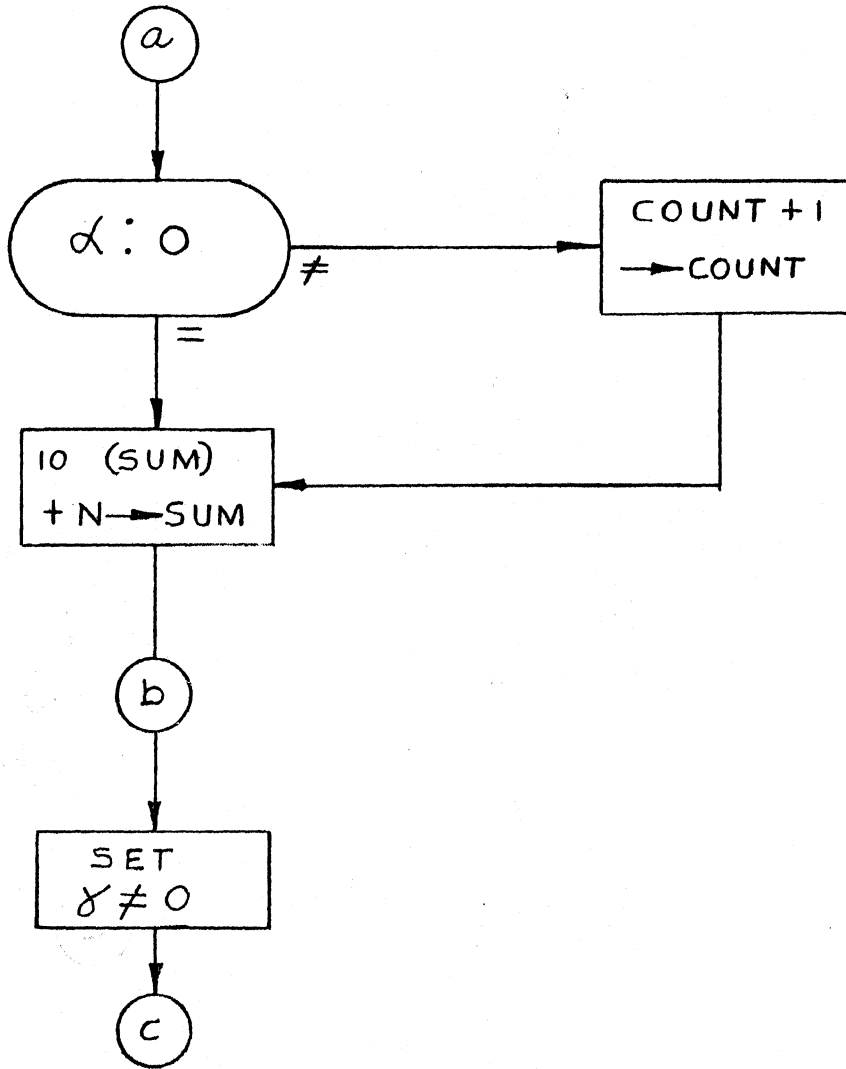
4. This program is line relocatable. When reading from tape, there should not be any space between numbers. The first number should be preceded by a stop code, which is used to manually position the tape by means of the START READ switch on the Flexowriter before the tape is read by the subroutine.

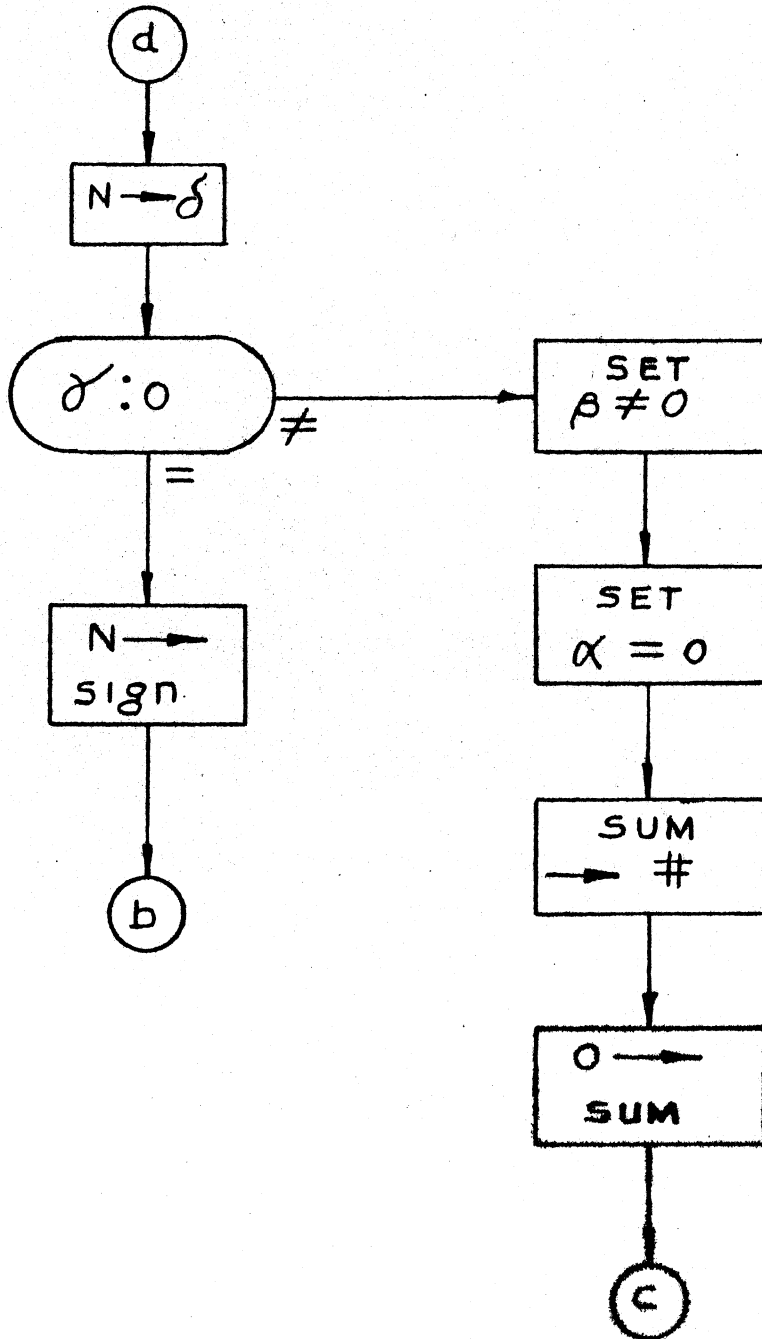
METHOD:

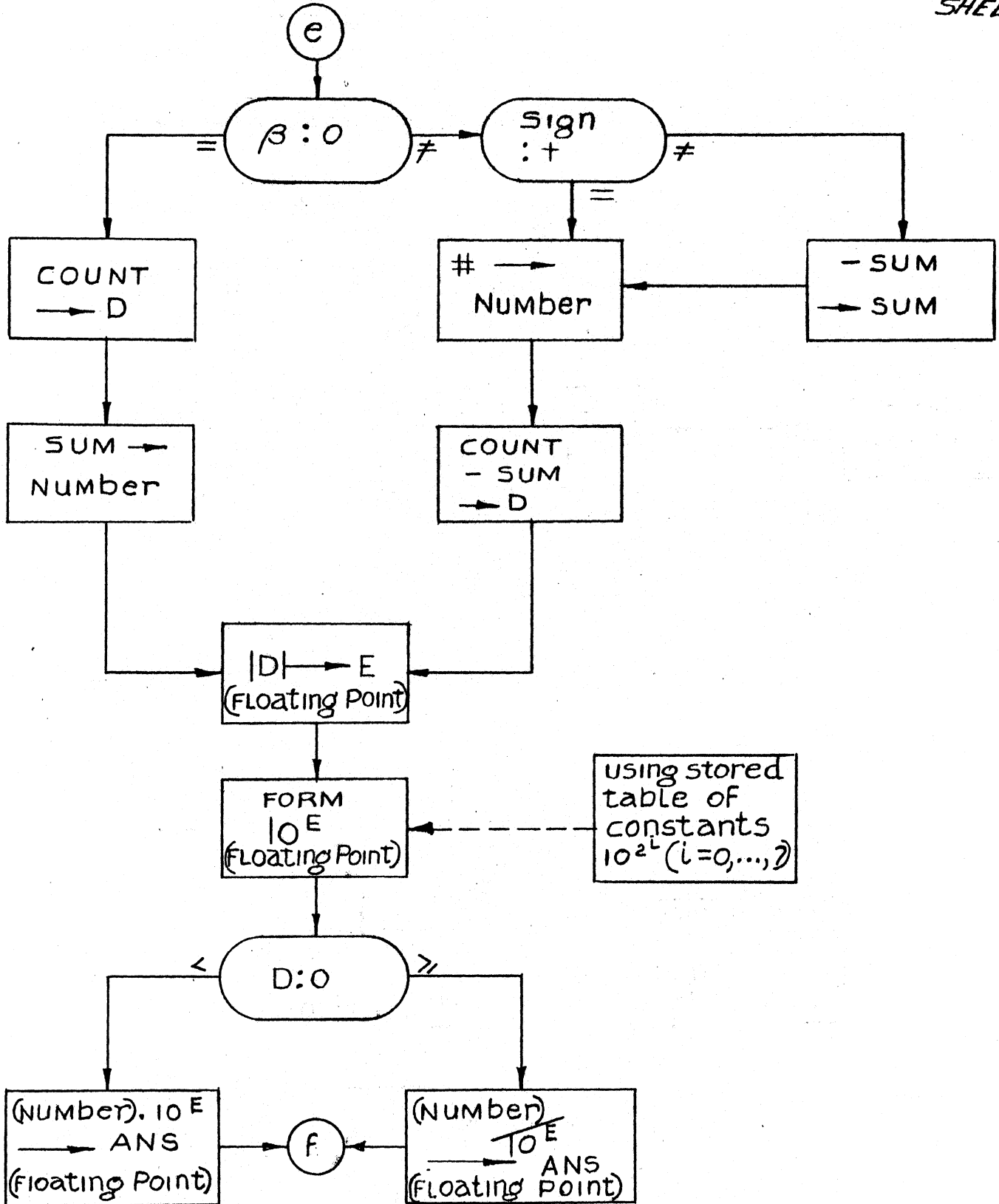
The given number is input in the form  $N \cdot 10^{-D}$ , where N and D are integers. D is the sum of the decimal exponent and the number of fractional digits.  $10^D$  is computed as a floating point number, and then divided into a floating point representation of N. The result is scaled right by the difference between the desired scaling and the initial scaling.

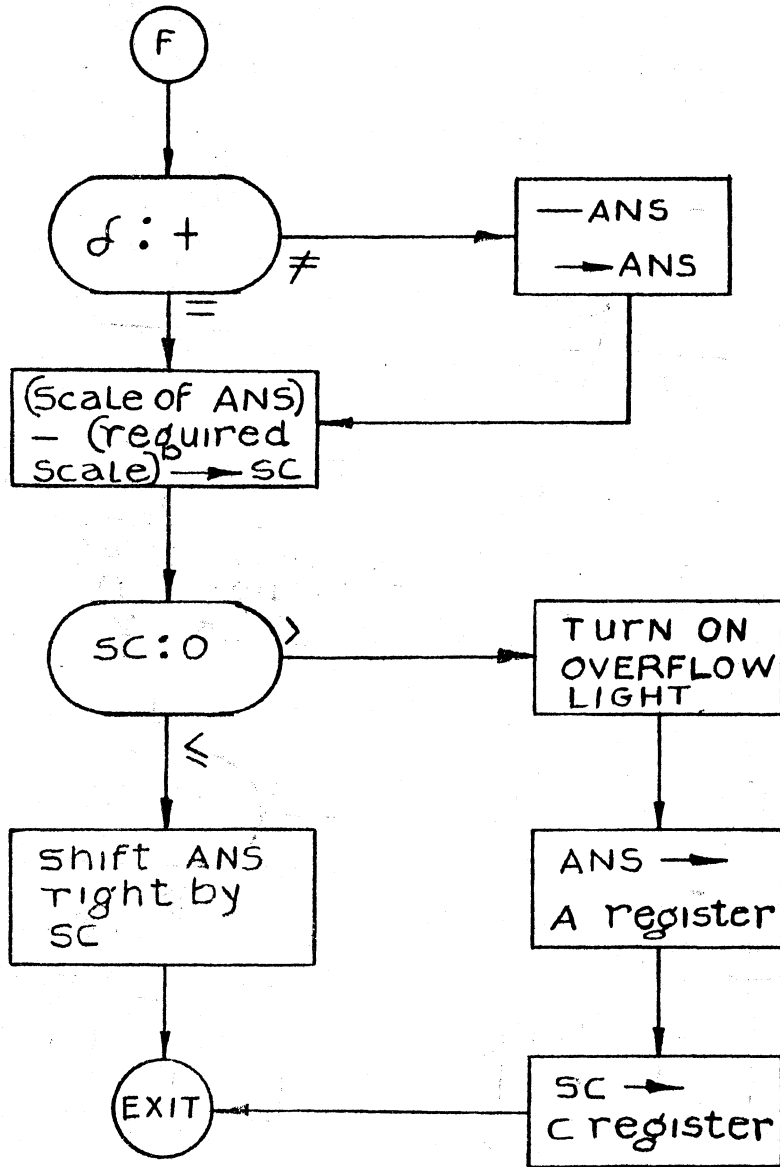
APPENDIX B  
DECIMAL INPUT SUBROUTINE I











PB 250 PROGRAM LISTING

PROBLEM DECIMAL INPUT, APPENDEX A

PAGE 1 OF 8

PROGRAMMER L. RAPHAEL

DATE 2-13-61

LOCATION	INSTRUCTION	SYMBOLIC OF CODE	REMARKS
000	001S4502I	CLA	$\beta : 0$
	031S3702I	TRU	
	003S5600;	CAM	
	<del>to 0</del>		
004	010 7502I	TOF	
	006S0500;	LDA	SIGN : +
	355S0400;	LDC	
	015S5602I	CAM	
010	013 0500;	LDA	SUM $\rightarrow$ NUMBER
	015 1100;	STA	
	073S4500;	CLA	COUNT $\rightarrow$ D
	034S1100;	STA	
	<del>to 0</del>		
015	000 0043;		
	054 7502I	TOF	
	020S4502I	CLA	$\leftarrow$ SUM $\rightarrow$ SUM
020	000 0013;		
	033S1500;	SUB	
023	000 0053I		
	020 5602I	CAM	L/C
	045 7502I	TOF	
	033 5602I	CAM	SPACE
	000 7502I	TOF	
030	046S5602I	CAM	C/R
	071 3502I	TAN	
	035S0500;	LDA	NUMBER / $10^E \rightarrow$ ANS
	000 0000;		
	053S1100;	STA	
	213S0400;	LDC	SUM $\rightarrow$ #
	037S0402I	LDC	
	000 0005I		



**PB 250 PROGRAM LISTING**

PROBLEM DECIMAL INPUT

PAGE 2 OF 8

PROGRAMMER L. RAPHAEL

DATE 2-13-61

LOCATION	INSTRUCTION	SYMBOLIC OF CODE	REMARKS
040	056S4302I	CLB	
042	377 1002I	STC	ENTER, PREVIOUS MODE
	044S1100;	STA	
	377 1002I	STC	
	052S4502I	CLA	PRESET
	000 0053;		
	000 7502I	TOF	SPACE
050	060S0102I	IAC	
	013 1100;	STA	0 → SUM
	240S3702I	TRU	
	054S1100;	STA	
	212S0500;	LDA	* → NUMBER
	057S1100;	STA	
	073S1500;	SUB	
	104S2000;	NAD	
060	123S1100;	STA	
	062S4202I	AMC	
	000 0043I		
	015 1200;	STB	
	015 0500;	LDA	
	015 5602I	CAM	+ OR -
	134 7502I	TOF	
	112S5602I	CAM	
071	072S0502I	LDA	(NUMBER) . 10 <sup>E</sup> → ANS
	000 0005I		
	075S0400;	LDC	
	076S1400;	ADD	COUNT - SUM → D
076	110S1400;	ADD	
	100S1100;	STA	

PB 250 PROGRAM LISTING

PROBLEM DECIMAL INPUT

PAGE 3 OF 8

PROGRAMMER L. RAPHAEL

DATE 2-13-61

LOCATION	INSTRUCTION	SYMBOLIC OF CODE	REMARKS
101	103 35021	TAN	D  → E
	121537021	TRU	
	104S45021	CLA	
	106S2200;	RSI	
	120S1500;	SUB	
	121S01021	IAC	
	117S1100;	STA	
111	127S1100;	STA	
	000 00431		
	134 75021	TOF	α : 0 N : + FLOAT E
	115S56021	CAM	
	000 00421		
	235 75021	TOF	
	132S45021	CLA	
120	125S56021	CAM	
	122S43021	CLB	
	130S1500;	SUB	
	141S2100;	LSD	
	233S1100;	STA	
	000 0043;		SET FOR NEGATIVE
	240 75021	TOF	
	171S05021	LDA	
130	131S0600;	LDB	
	137S1100;	STA	
	161S3200;	MUP	
	134S5600;	CAM	
	146S1100;	STA	
	155 75021	TOF	
	016 0500;	LDA	
	153S14021	ADD	N → δ COUNT + 1 → COUNT

PB 250 PROGRAM LISTING

PROBLEM DECIMAL INPUT

PAGE 4 OF 8

PROGRAMMER L. RAPHAEL

DATE 2-13-61

LOCATION	INSTRUCTION	SYMBOLIC OF CODE	REMARKS
140	147S0102I	IAC	
	142S0402I	LDC	PREPARE TO FORM $10^E$
	000 0002;		
	144S5602I	CAM	CHECK IF DONE
	000 0000;		
	372 7502I	TOF	
	157S2000;	NAD	NEXT POWER OF TEN
	163S4502I	CLA	$\gamma : 0$
150	151S0400;	LDC	
152	201S3100;	DIV	
	000 0000I		
	016 1100;	STA	
	160 0602I	LDB	$10 (\text{SUM}) + N \rightarrow \text{SUM}$
	353S0400;	LDC	
	162S1100;	STA	
160	000 0042;		
	167S0400;	LDC	NORMALIZE ANS
163	201S1000;	STC	
	017 5600;	CAM	
	167 7502I	TOF	
	174S0502I	LDA	SET $\beta \neq 0$
	106S0500;	LDA	$N \rightarrow \text{SIGN}$
170	217S2000;	NAD	
	251S1500;	SUB	
	250 1102I	STA	
	240S3702I	TRU	
	176S0502I	LDA	$\gamma \neq 0$
	263S1100;	STA	
	173S1100;	STA	
	237S1100;	STA	



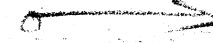
**PB 250 PROGRAM LISTING**

PROBLEM DECIMAL INPUT

PAGE 5 OF 8

PROGRAMMER L. RAPHAEL

DATE 2-13-61

LOCATION	INSTRUCTION	SYMBOLIC OF CODE	REMARKS
			
201	215S0202I	IBC	
	203S0102I	IAC	
			
204	206S2100;	LSD	FIND POWER IN TABLE
	325S0702I		
206	207S1402I	ADD	
	000 0156I		
210	221S2200;	RSI	
	004 1100;	STA	ENTER, TAPE MODE
	347S0702I	LDP	PRESET RPT
	323S3702I	TRU	
	012 1000;	STC	
	051S3702I	TRU	
	217S0500;	LDA	
	231S1100;	STA	
220	227S0102I	IAC	
	222S0402I	LDC	
	000 0702I	LDP	
	224S4602I	AOC	
	000S7737I		
	226 1202I	STB	
	[275 0702I]	LDP	PICK UP POWER OF TEN
	230S1400;	ADD	
230	167S4302I	CLB	
	250S1100;	STA	
	247S4502I	CLA	CORRECT SIGN ON ANS
			
234	256S1100;	STA	
	014 1100;	STA	SET $\alpha \neq 0$
	237S1100;	STA	SET $\gamma \neq 0$

**PB 250 PROGRAM LISTING**

PROBLEM DECIMAL INPUT

PAGE 6 OF 8

PROGRAMMER L. RAPHAEL

DATE 2-13-61

LOCATION	INSTRUCTION	SYMBOLIC OF CODE	REMARKS
240	243S4500;	CLA	INPUT N
	247 7736;	TES	
	000 5700;	CIB	
	[ 240S5100; ]	RTK	
	[ 245 5100; ]	RTK	
	244 7736;	TES	
	242S5700;	CIB	
	023S5502I	LAI	
250	[ 251S1400; ]		
	271S0400;	LDC	
	253S0102I	IAC	FORM TEN PRODUCT
			SCALE ANS AS REQUIRED
254	255S1100;	STA	
256	264S1500;	SUB	
	260S0502I	LDA	PRESET FOR +
260	251S1400;	ADD	
	250 1102I	STA	
	273 0702I	LDP	
	330S1300;	SDP	
	012S4502I	CLA	SET $\alpha = 0$
	266S5602I	CAM	CHECK IF SCALE SET
	000 0000;		
	317 7502I	TOF	
270	320 3502I	TAN	CHECK IF SCALE POSSIBLE
	314S4502I	CLA	BAD SCALE
	321S3200;	MUP	
	000 0000I		
	100 0000;		
	120 0000;		POWERS OF TEN
	000 0001;		
	144 0000;		

**PB 250 PROGRAM LISTING**

PROBLEM DECIMAL INPUT

PAGE 7 OF 8

PROGRAMMER L. RAPHAEL

DATE 2-13-61

LOCATION	INSTRUCTION	SYMBOLIC OP CODE	REMARKS
300	000 0041 I		POWERS OF TEN
	116 2000;		
	000 0043;		
	137 5701;		
	000 0046 I		
	107 0636 I		
	000 0055;		
	116S6155;		
310	000 0072 I		
	141 3601;		
	000 0125 I		TURN ON OVER FLOW
	111S5622 I		
	000 0352;		SCALE SET
	316S5602 I	CAM	
	000 0000;		GOOD SCALE FORM EXPONENT
	333S0102 I	IAC	
320	321S1100;	STA	- SUM
	330S0400;	LDC	
	336S4502 I	CLA	
	015 1100;	STA	
	055S4500;	CLA	
	240S5100;		
326	245 5100;		GET SCALE
	243 1300 I	SDP	
330	044S3702 I	TRU	
	333S2000;	NAD	
	240S3702 I	TRU	
	334S0202 I	IBC	
	335S0400;	LDC	
	350S1300;	SDP	
	376S4302 I	CLB	
	341S1500;	SUB	

**PB 250 PROGRAM LISTING**

PROBLEM DECIMAL INPUT  
 PROGRAMMER L. RAPHAEL

PAGE 8 OF 8  
 DATE 2-13-61

LOCATION	INSTRUCTION	SYMBOLIC OP CODE	REMARKS
340	004 1100;	STA	ENTER, READ MODE  PRESET RTK
	325S0702I	LDP	
	343S1402I	ADD	
	000 0177I		
	345S1000;	STC	
346	357S2200;	RSI	FORM SHIFT  + N          D : 0          EXIT
	240S5200;		
350	245 5200;		
	327S3700I	TRU	
	361S0700;	LDP	
354	362 3200;	MUP	
	362S2100;	LSD	
	375S4302I	CLB	
	360S0402I	LDC	
360	000 2200;		
	373S4602I	AOC	
	175S1400;	ADD	
	364S0202I	IBC	
365	366S4302I	CLB	
367	371S2100;	LSD	
371	143S3702I	TRU	
	000S0500;	LDA	
	000S7777I		
	376 1202I	STB	
	005S0500;	LDA	
	[51 2200;]	RSI	
	[033S3704;]	TRU	