AN/UYK-1

A "STORED LOGIC" MULTIPLE PURPOSE COMPUTER

AN/UYK-1 (TRW-130) BASIC LOGRAM PACKAGE

M250-2U21

Thompson Ramo Wooldridge Inc.

RW DIVISION

8433 FALLBROOK AVENUE • CANOGA PARK, CALIFORNIA • DIAMOND 6-6000

TABLE OF CONTENTS

TOPIC PAGE

Function Lograms

APPENDIX B

Assembled Listings

INTRODUCTION

The most effective method of translation from problem statement to program statement on the AN/UYK-1 (TRW-130) is by use of the interpretive mode of operation. The interpretive mode is the term used to describe the operational mode of the computer while executing instructions defined by a logram set. A primary advantage of this technique is that it provides the user with a logram set most useful to his purposes. He may augment or delete lograms from this set as required, and may develop special purpose lograms as the need arises. It is useful, however, to develop a common set of lograms which will fulfill the requirements of a wide variety of applications. Such a set is the "Basic Logram Set - TRW-130," described herein.

This Basic Logram Set is a part of the AN/UYK-1 (TRW-130) Logram Library. The Logram Library includes many more lograms and is constantly expanding as the TRW-130 is used in different applications. The Basic Logram Set merely represents those lograms that almost everyone using a TRW-130 will require.

The TRW-130 users will have a Software Library Catalog from which they may select lograms and other software useful to their applications.

As with all lograms, the Basic Logram Set has a consistent structure to allow simple, reliable extension and revision and to permit programmed diagnostic techniques. These programming standards and conventions along with detailed descriptions and program listings of each logram are presented in sections to follow. A descriptive summary is included as Appendix A.

LOGRAM LANGUAGE

The format of the programming language of the TRW-130 may resemble that of a one-address computer. For example, to add the contents of a memory cell, noted symbolically G, to the accumulator, the programmer would write:

```
ADl  G
```

In a conventional computer, the above statement would usually reside in a single memory cell. For the TRW-130, ADl refers to the symbolic address of the first cell of the machine code which will effect an Add, Single Length function. The address of the operand, denoted G, appears in the next cell in sequence after ADl. Therefore, the TRW-130 program code appears in a vertical multi-word format, where each word contains an address.

ADl
G

The design of the TRW-130 stored logic computer will allow the use of a programming language like the single address example or we may have one, two, three or more address instruction sets. The programmer may use any one set or select single address lograms for certain operations, a two address logram for another operation and a three address logram for yet another operation; all within the same TRW-130 program. Regardless of the number of parameters, the first word of a logram calling sequence refers to the logram starting address (LSA) followed in sequence by the address of the operand(s) required to perform the prescribed function. The following sequence illustrates the general method.

Instruction Sequence	Contents of Y or (Y)	Indirect Contents of Y or ((Y))
Y	LSA*	1st logand of logram 1
Y+1	Address of 1st Operand	1st Operand
Y+2	Address of 2nd Operand	2nd Operand
Y+3	LSA	1st logand of logram 2
...	...	...
etc.		

SYSTEM REGISTERS

The first 64 memory registers are described generally by the term "scratchpad." Notation for each scratchpad register begins with a dollar sign symbol ($). The allocation of scratchpad registers, and the symbolic

*Logram Starting Address

notation and usage of each scratchpad register is listed in Figure 1.

Accumulator and MQ

A pseudo-accumulator and MQ are included in scratchpad and are utilized as indicated below:

Single Length Accumulator	$AL	
Single Length M.Q.	$AR	
Double Length Accumulator	$AL	$AR
Double Length M.Q.	$QL	$QR

The Basic Logram Set provides for single, double, and in some cases, quadruple length operation. The third character of the instruction mnemonic (logram symbolic notation) is usually reserved to designate word length.

Instruction Counter

A pseudo-instruction counter, $IC, contains the logram calling sequence address corresponding to the logram currently operating. It therefore serves as a tracing indicator and provides a linkage between successive lograms.

LOGRAM STANDARDS

An indirect addressing technique is used to pass control from logram to logram and to access logram operands. In order to maintain this linkage, certain standards must be adhered to:

Standard 1

The E, M, and P registers must be loaded upon entry to each logram, as follows:

E Register:	The contents of the Logram Starting Address, contents of Y.
M Register:	The Logram Starting Address, Y.
P Register:	The next address in the logram calling sequence, Y+1.

Standard 2

Upon entry to a logram, the contents of the P register must be stored in the pseudo-instruction counter, $IC. To satisfy Standard 1, it is necessary to execute a logand upon exit from each logram to load the E, M, and P registers as prescribed. If the address of the next logram is in the P register, the logand to execute is:

LP/DP/C/NØ

If the address of the next Logram Starting Address (LSA) is in the pseudo-instruction counter $IC, the correct logand is:

LP/IL/$IC

UNIVERSAL SCRATCHPAD ALLOCATION FOR THE AN/UYK-1 (TRW-130)

Octal Location	Symbol	Use
00	$MIA	Interrupt Control registers for
01	$MIB	Type II (Miscellaneous) interrupts
02	$PFA	BR/DM/F/UN
03	$PFB	PZE 00002
04	$ØCA	Interrupt Control registers for Type 1
05	$ØCB	Output Channel Interrupts
06	$ICA	Interrupt Control registers for
07	$ICB	Input Channel interrupts.
10	$MIT	Miscellaneous interrupt temporary storage Type (II)
11	$ØCT	Output Channel interrupt temporary storage (Type I)
12	$ICT	Input Channel interrupt temporary storage (Type I)
13	$T1	Logram Temporary Storage
14	$T2	
15	$T3	
16	$T4	
17	$T5	
20	$T6	
21	$T7	
22	$T8	
23	$T9	
24	$T10	
25	$T11	
26	$T12	
27	$T13	
30	$T14	
31	$T15	
32	$T16	
33	$T17	
34	$T18	
35	$T19	
36	$T20	
37	$T21	
40	$T22	
41	$T23	
42	$T24	
43	$T25	
44	$C1	Common Storage for Operational Programs
45	$C2	
46	$C3	
47	$C4	

Figure 1

UNIVERSAL SCRATCHPAD ALLOCATION FOR THE AN/UYK-1 (TRW-130)

Octal Location	Symbol	Use
50	$C5	Common Storage for Operational Programs
51	$C6	
52	$C7	
53	$C8	
54	$C9	
55	$C10	
56	$C11	
57	$C12	
60	$C13	
61	$AE	Accumulator exponent for Floating Point
62	$AL	Accumulator
63	$AR	
64	$AT	Least Significant Part of Accumulator for Triple Precision
65	$QE	MQ exponent for Floating Point
66	$QL	MQ
67	$QR	
70	$QT	Least Significant Part of MQ for Triple Precision
71	$IC	Instruction Counter - Primary
72	$IC2	Instruction Counter - Second Level Lograms
73	$RET	Interpretive Return Address
74	$ØV	Pseudo Overflow Indicator
75	$DK	Divide Check Indicator
76	$ØNE	00001 (plus one)
77	$MØN	77777 (minus one)

Figure 1 (Continued)

STANDARD LOGRAM SET

AN/UYK-1 (TRW-130)

CALLING SEQUENCE	NAME	FUNCTION	CELLS	EXECUTION TIME (μs)
WORD TRANSFER				
LD1/G	Load Accumulator	(G)→($AL)	4	54
LD2/G		(G, G+1)→($AL, $AR)	6	78
LN1/G	Load Numeric	|(G)|→($AL)	8	If (G)+, 66; If (G)-, 78
LN2/G		|(G, G+1)|→($AL, $AR)	12	If (G)+, 96; If (G)-, 132.
LC1/G	Load Complement	-(G)→($AL)	6	66
LC2/G		-(G, G+1)→($AL, $AR)	10	120
IA1	Load Indirect	(($AL))→($AL)	4	60
IA2	Accumulator	(($AL, $AR))→($AL, $AR)	6	84
LQ1/G	Load MQ	(G)→($AR)	4	54
LQ2/G		(G, G+1)→($QL, $QR)	6	78
ST1/G	Store Accumulator	($AL)→(G)	4	54
ST2/G		($AL, $AR)→(G, G+1)	6	78
SQ1/G	Store MQ	($AR)→(G)	4	54
SQ2/G		($QL, $QR)→(G, G+1)	6	78
SZ1/G	Store Zero	Zero→(G)	3	42
SZ2/G		Zero→(G, G+1)	4	54
EX1	Exchange	($AL)←→($AR)	5	60
EX2		($AL, $AR)←→($QL, $QR)	8	96
ARITHMETIC				
AD1/G	Add	($AL) + (G) → ($AL)	5	66
AD2/G		($AL, $AR) + (G, G+1) → ($AL, $AR)	9	114
SB1/G	Subtract	($AL) - (G) → ($AL)	6	78
SB2/G		($AL, $AR) - (G, G+1) → ($AL, $AR)	9	120
MP1/G	Multiply	($AL) x (G)→ ($AL)	23	If (G)+, 168; If (G)-, and ($AL)+, 192; ($AL)-, 216.

MP2/G		($AL, $AR) x (G, G+1)→ ($AL, $AR)	73	If (G)+, and ($AL)+, 627
				If (G)+, and ($AL)-, 879
				If (G)-, and ($AL)+, 843
				If (G)-, and ($AL)-, 807

DV1/G	Divide	($AL, $AR) ÷ (G)→ ($AL)	46	If (G)+, and ($AL)+, 180
				If (G)+, and ($AL)-, 330
				If (G)-, and ($AL)+, 270
				If (G)-, and ($AL)-, 258

DV2/G		($AL, $AR, $QL, $QR) ÷ (G, G+1) →($AL, $AR)	148	1062 (Average time)
BRANCH				
BUN/G	Branch Unconditional	Branch to G	3	36
BPN/G	Branch on Positive Accumulator	Branch to G if sign of ($AL) is positive	5	If ($AL) is positive: 48 If ($AL) is negative: 66
BMN/G	Branch on Minus Accumulator	Branch to G if sign of ($AL) is negative	5	If ($AL) is negative: 48 If ($AL) is positive: 66
BAN	Branch to Accumulated Address	Branch to ($AL)	2	30
BVN/G	Branch to Overflow	If machine overflow = 1, branch to G	4	If overflow: 36 If no overflow: 48
BDK/G	Branch on Divide Check	Branch to G if $DK = 1	6	If divide check: 60 If no divide check: 78
BZ1/G	Branch on Accumulator Zero	If ($AL) = 0 branch to G	5	If ($AL) = 0: 48 If ($AL) ≠ 0: 66
BZ2/G		If ($AL, $AR) = 0 branch to G	6	If ($AL, $AR) = 0: 60 If ($AL, $AR) ≠ 0: 78
CE1/G/H	Compare Equal	If ($AL) = (G), branch to H	9	108
CE2/G/H		If ($AL, $AR) = (G, G+1), branch to H	13	If ($AL) = (G), 144 If ($AL) ≠ (G), 108
CG1/G/H	Compare Greater	If ($AL) ≥ (G) branch to H	9	108
CG2/G/H		If ($AL, $AR) ≥ (G, G+1), branch to H	14	150
CL1/G/H	Compare Less	If ($AL) < (G), branch to H	9	108
CL2/G/H		If ($AL, $AR) < (G, G+1), branch to H	14	150
TDN/G/H	Test and Decrement	(G) - 1 → (G); if resulting (G) = 0, branch to H	9	108
LJN/G/H	Link Jump	Next logand starting address → (G); branch to H	5	60
HPN/G	Halt and Proceed	If in flag mode, a halt occurs; when restarted branch to G	3	36
LVN/G/H	Leave Interpretive Mode	G → ($RET); branch to H	5	60

STANDARD LOGRAM SET
AN/UYK-1 (TRW-130)

CALLING SEQUENCE	NAME	FUNCTION		CELLS	EXECUTION TIME (μs)	AVG.
SHIFT						
NL1/n	Numeric Left Shift	Bits shifted from bit 14 of ($AL) lost; sign of ($AL) retained; zero → n low order bits of ($AL)	($AL) shifted left n places; 0 ≤ n ≤ 14	13	120 + 3n	141
NL2/n			($AL, $AR) shifted left n places; 0 ≤ n ≤ 29	24	If n ≤ 15, 168 + 3n If n > 15, 216 + 3(n-15)	213
NL4/n			($AL, $AR, $QL, $QR) shifted left n places; 0 ≤ n ≤ 29	60	If n < 15, 329 + 3n If n ≥ 15, 364 + 6(n-15)	373
NR1/n	Numeric Right Shift	Sign of ($AL) propagated; bits shifted from low order bits lost	($AL) shifted right n places; 0 ≤ n ≤ 14	21	If ($AL) +, 128 + 3n If ($AL) -, 162 + 3n	171
NR2/n			($AL, $AR) shifted right n places; 0 ≤ n ≤ 29	50	If n ≤ 15; ($AL) +, 252 +3n ($AL) -, 288 + 3n If n > 15; ($AL) +, 348 + 3(n-15) ($AL) -, 396 + 3(n-15)	345
NR4/n			($AL, $AR, $QL, $QR) shifted right n places; 0 ≤ n ≤ 29	51	If n ≤ 15, 330 + 9n If n > 15, 312 + 6(n-15)	374
LL1/n	Logical Left Shift	Bits shifted out of ($AL) lost. Zero→n low order bits of ($AL)	($AL) shifted left n places; 0 ≤ n ≤ 14	9	96 + 3n	117
LL2/n			($AL, $AR) shifted left n places; 0 ≤ n ≤ 29	21	If n ≤ 15, 144 + 3n If n > 15, 204 + 3(n-15)	197
LR1/n	Logical Right Shift	Bits shifted out of low order bits lost. Zero→n high order bits of ($AL)	($AL) shifted right n places; 0 ≤ n ≤ 14	9	96 + 3n	117
LR2/n			($AL, $AR) shifted right n places; 0 ≤ n ≤ 29	21	If n ≤ 15, 144 + 3n If n > 15, 204 + 3(n-15)	197
FL1	Float Left	Bits shifted left until bits 14 and 15 of ($AL) differ. Zero→vacated bits	($AL) shifted left; number of places shifted placed in $AR	8	84 + 3n	105
FL2			($AL, $AR) shifted left; number of places shifted placed in $QL.	18	198 + 3n	242
LOGICAL						
OC1	One's Complement	One's complement of ($AL) → ($AL)		5	60	
OC2		One's complement of ($AL, $AR) → ($AL, $AR)		8	96	
IN1/G/H	Insert	($AL) · (G) V ($\overline{G}$) · (H) → ($AL)		7	96	
IN2/G/H		($AL, $AR) · (G, G+1) V ($\overline{G, G+1}$) · (H, H+1) → ($AL, $AR)		17	222	
OR1/G	Inclusive OR	($AL) V (G) → ($AL)		4	54	
OR2/G		($AL, $AR) V (G, G+1) → ($AL, $AR)		7	90	
DG1/G	Dot G	($AL) · (G) → ($AL)		4	54	
DG2/G		($AL, $AR) · (G, G+1) → ($AL, $AR)		7	90	
CONVERSIONS						
BBD	Binary to BCD	Least significant 26 bits of ($AL, $AR) are converted to one 2-bit and seven 4-bit BCD characters and placed in ($AL, $AR)		43	983	
BBN	BCD to Binary	($AL, $AR) treated as one 2-bit and seven 4-bit BCD characters, are converted to a binary number; right adjusted and placed in ($AL, $AR)		67	945	
DATA PROCESSING						
MVN/G/H/n	Move	n 15-bit words, starting at G, are moved to locations H through H+n-1		8	108 + 12n	
TL1/G/n/ Condition	Table Look Up	($AL) compared with n words in table at G until specified condition satisfied. Address of matched word → ($AL). If no match, 0 → ($AL)		21	216 + 12n	

FUNCTIONS				SUBROUTINES AND TABLES USED	EXECUTION TIME Min.	Avg.	Max.
SN1	Sine	Sine of ($AL) → ($AL)	81		873	951	1029
SN2		Sine of ($AL, $AR) → ($AL, $AR)	219	MPS - 27 cells	4881	5085	5289
CS1	Cosine	Cosine of ($AL) → ($AL)	86		873	933	993
CS2		Cosine of ($AL, $AR) → ($AL, $AR)	79	SN2C - 148 cells MP2S - 27 cells	5013	5181	5385
AT1	Arc Tangent	Arc tangent of ($AL) → ($AL)	46	AT1TX - 66 cells	534	555	576
AT2		Arc tangent of ($AL, $AR) → ($AL, $AR)	82	AT1TX - 66 cells DV2S - 91 cells MP2S - 27 cells	2667	2979	3291
AS1	Arc Sine	Arc sine of ($AL) → ($AL)	62	SR1S - 50 AT1S - 36 AT1TX - 66	1407	1563	1719
AS2		Arc sine of ($AL, $AR) → ($AL, $AR)	95	MP2S - 27 cells DV2S - 91 cells SR2S - 75 cells SR1S - 50 cells AT2S - 107 cells AT1TX - 66 cells	6430	7598	8767
SR1	Square Root	Square root of ($AL) → ($AL)	49		477	606	734
SR2		Square root of ($AL, $AR) → ($AL, $AR)	72	SR1S - 50 cells DV2S - 91 cells	1800	2280	2760

AN/UYK-1 LOGRAM COVER SHEET

Thompson Ramo Wooldridge RW Division

LOGRAM NAME Load Accumulator - Single Length

MNEMONIC LD1

LIBRARY SERIAL NO.
1L AA 001

USAGE INFORMATION

NUMBER OF CELLS 4

EXECUTION TIME: 54μs

CALLING SEQUENCE LD1/G

SCRATCH PAD CELLS AFFECTED:
$IC
$AL

DATA TYPE Fixed Point

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of G are placed in $AL.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

LOGRAM NAME Load Accumulator - Double Length

MNEMONIC LD2

LIBRARY SERIAL NO. 1L AA 002

USAGE INFORMATION

NUMBER OF CELLS 6

EXECUTION TIME: 78μs

CALLING SEQUENCE LD2/G

SCRATCH PAD CELLS AFFECTED: $IC, $AL, $AR

DATA TYPE Fixed Point

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of G, G+1 are placed in $AL, $AR.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (X)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

DATE: November, 1961

AN/UYK-1 LOGRAM COVER SHEET

Thompson Ramo Wooldridge Inc
RW Division

LOGRAM NAME Load Numeric - Single Length

MNEMONIC LN1

LIBRARY SERIAL NO.
1L AA 003

USAGE INFORMATION

NUMBER OF CELLS 8

EXECUTION TIME: If (G) positive: 66μs
If (G) negative: 78μs

CALLING SEQUENCE LN1/G

SCRATCH PAD CELLS AFFECTED:
$IC
$AL

DATA TYPE Fixed Point

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The absolute value of the contents of G is placed in $AL.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

DATE: November, 1961

LOGRAM NAME Load Numeric - Double Length

MNEMONIC LN2

LIBRARY SERIAL NO.
1L AA 004

USAGE INFORMATION

NUMBER OF CELLS 12

EXECUTION TIME: If (G) positive: 96μs
If (G) negative: 132μs

CALLING SEQUENCE LN2/G

SCRATCH PAD CELLS AFFECTED:
$IC, $AL, $AR

DATA TYPE Fixed Point

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The absolute value of the contents of G, G+1 is placed in $AL, $AR.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

AN/UYK-1 LOGRAM COVER SHEET

Thompson Ramo Wooldridge Inc.
RW Division

LOGRAM NAME: Load Complement - Single Length

MNEMONIC: LC1

LIBRARY SERIAL NO.: 1L AA 005

USAGE INFORMATION

NUMBER OF CELLS: 6

EXECUTION TIME: 66μs

CALLING SEQUENCE: LC1/G

SCRATCH PAD CELLS AFFECTED:
$IC
$AL

DATA TYPE:

ACCURACY:

RESTRICTIONS:

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The two's complement of the contents of G is placed in $AL.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

LOGRAM NAME Load Complement - Double Length

MNEMONIC LC2

LIBRARY SERIAL NO. 1L AA 006

USAGE INFORMATION

NUMBER OF CELLS 10

EXECUTION TIME: 120μs

CALLING SEQUENCE LC2/G

SCRATCH PAD CELLS AFFECTED: $IC, $AL, $AR

DATA TYPE

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The two's complement of the contents of G, G+1 is placed in $AL, $AR.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

DATE: November, 1961

LOGRAM NAME Load Indirect AC - Single Length

MNEMONIC IA1

LIBRARY SERIAL NO.
1L AA 007

USAGE INFORMATION

NUMBER OF CELLS 4

EXECUTION TIME: 60μs

CALLING SEQUENCE IA1

SCRATCH PAD CELLS AFFECTED:
$IC
$AL

DATA TYPE Fixed Point

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of the address in $AL is placed in $AL.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

DATE: November, 1961

LOGRAM NAME Load Indirect AC - Double Length

MNEMONIC IA2

LIBRARY SERIAL NO. 1L AA 008

USAGE INFORMATION

NUMBER OF CELLS 6

EXECUTION TIME: 84μs

CALLING SEQUENCE IA2

SCRATCH PAD CELLS AFFECTED: $IC, $AL, $AR

DATA TYPE Fixed Point

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The content of $AL is used to address a double length word which is placed in $AL, $AR.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

DATE: November, 1961

LOGRAM NAME Load MQ - Single Length

MNEMONIC LQ1

LIBRARY SERIAL NO.
1L AA 009

USAGE INFORMATION

NUMBER OF CELLS 4

EXECUTION TIME: 54μs

CALLING SEQUENCE LQ1/G

SCRATCH PAD CELLS AFFECTED:
$IC
$AR

DATA TYPE Fixed Point

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of G are placed in $AR.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (X)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

DATE: November, 1961

Thompson Ramo Wooldridge Inc.
RW Division

LOGRAM NAME Load MQ - Double Length

MNEMONIC LQ2

LIBRARY SERIAL NO.
1L AA 010

USAGE INFORMATION

NUMBER OF CELLS 6

EXECUTION TIME: 78μs

CALLING SEQUENCE LQ2/G

SCRATCH PAD CELLS AFFECTED:
$IC, $QL, $QR

DATA TYPE Fixed Point

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of G, G+1 are placed in $QL, $QR.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

DATE: November, 1961

LOGRAM NAME Store Accumulator - Single Length

MNEMONIC ST1

LIBRARY SERIAL NO. 1L AB 011

USAGE INFORMATION

NUMBER OF CELLS 4

EXECUTION TIME: 54μs

CALLING SEQUENCE ST1/G

SCRATCH PAD CELLS AFFECTED:
$IC
$AL

DATA TYPE Fixed Point

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of $AL are stored at G.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING	( )
ASSEMBLED LISTING	(x)
FLOW CHART	( )
METHODOLOGICAL ANALYSIS	( )
OTHER	( )

AN/UYK-1 LOGRAM COVER SHEET

Thompson Ramo Wooldridge Inc
RW Division

LOGRAM NAME Store Accumulator - Double Length

MNEMONIC ST2

LIBRARY SERIAL NO.
1L AB 012

USAGE INFORMATION

NUMBER OF CELLS 6

EXECUTION TIME: 78μs

CALLING SEQUENCE ST2/G

SCRATCH PAD CELLS AFFECTED:
$IC
$AL
$AR

DATA TYPE Fixed Point

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of $AL, $AR are stored at G, G + 1.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

DATE: November, 1961

LOGRAM NAME Store MQ - Single Length

MNEMONIC SQ1

LIBRARY SERIAL NO.
1L AB 013

USAGE INFORMATION

NUMBER OF CELLS 4

EXECUTION TIME: 54μs

CALLING SEQUENCE SQ1/G

SCRATCH PAD CELLS AFFECTED:
$IC
$AR

DATA TYPE Fixed Point

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of $AR are stored at G.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

FORM 2215

AN/UYK-1 LOGRAM COVER SHEET

Thompson Ramo Wooldridge Inc.
RW Division

LOGRAM NAME Store MQ - Double Length

MNEMONIC SQ2

LIBRARY SERIAL NO.
1L AB 014

USAGE INFORMATION

NUMBER OF CELLS 6

EXECUTION TIME: 78μs

CALLING SEQUENCE SQ2/G

SCRATCH PAD CELLS AFFECTED:
$IC
$QL
$QR

DATA TYPE Fixed Point

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of $QL, $QR are stored at G, G + 1.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

FORM 2215

LOGRAM NAME Store Zero - Single Length

MNEMONIC SZ1

LIBRARY SERIAL NO. 1L AD 015

USAGE INFORMATION

NUMBER OF CELLS 3

EXECUTION TIME: 42μs

CALLING SEQUENCE SZ1/G

SCRATCH PAD CELLS AFFECTED: $IC

DATA TYPE Fixed Point

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: Location G is cleared to zero.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

DATE: November, 1961

LOGRAM NAME: Store Zero - Double Length

MNEMONIC: SZ2

LIBRARY SERIAL NO.: 1L AD 016

USAGE INFORMATION

NUMBER OF CELLS: 4

EXECUTION TIME: 54μs

CALLING SEQUENCE: SZ2/G

SCRATCH PAD CELLS AFFECTED: $IC

DATA TYPE: Fixed Point

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: Locations G, G+1 are cleared to zero.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

LOGRAM NAME Exchange - Single Length

MNEMONIC EX1

LIBRARY SERIAL NO.
1L AZ 017

USAGE INFORMATION

NUMBER OF CELLS 5

EXECUTION TIME: 60μs

CALLING SEQUENCE EX1

SCRATCH PAD CELLS AFFECTED:
$IC
$AL
$AR

DATA TYPE Fixed Point

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of $AL are exchanged with the contents of $AR.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

DATE: November, 1961

LOGRAM NAME Exchange - Double Length

MNEMONIC EX2

LIBRARY SERIAL NO.
1L AZ 018

USAGE INFORMATION

NUMBER OF CELLS 8

EXECUTION TIME: 96μs

CALLING SEQUENCE EX2

SCRATCH PAD CELLS AFFECTED:
$IC $QL
$AL $QR
$AR

DATA TYPE Fixed Point

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of $AL, $AR are exchanged with the contents of $QL, $QR.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

DATE: November, 1961

LOGRAM NAME Add - Single Length

MNEMONIC AD1

LIBRARY SERIAL NO.
1L BA 019

USAGE INFORMATION

NUMBER OF CELLS 5

EXECUTION TIME: 66μs

CALLING SEQUENCE AD1/G

SCRATCH PAD CELLS AFFECTED:
$IC, $AL

DATA TYPE Fixed Point

ACCURACY: 14 bits

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of G are added to $AL, and the sum is placed in $AL. Overflow is possible.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (X)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

LOGRAM NAME Add - Double Length

MNEMONIC AD2

LIBRARY SERIAL NO. 1L BA 020

USAGE INFORMATION

NUMBER OF CELLS 9

EXECUTION TIME: 114μs

CALLING SEQUENCE AD2/G

SCRATCH PAD CELLS AFFECTED: $IC, $AL, $AR

DATA TYPE Fixed Point

ACCURACY: 29 bits

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of G, G+1 are added to $AL, $AR. The sum is placed in $AL, $AR. Overflow is possible.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (X)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

DATE: November, 1961

LOGRAM NAME Subtract - Single Length

MNEMONIC SB1

LIBRARY SERIAL NO. 1L BB 021

USAGE INFORMATION

NUMBER OF CELLS 6

EXECUTION TIME: 78μs

CALLING SEQUENCE SB1/G

SCRATCH PAD CELLS AFFECTED: $IC, $AL

DATA TYPE Fixed Point

ACCURACY: 14 bits

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of G are subtracted from the contents of $AL and the difference is placed in $AL. Overflow is possible.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

DATE: November, 1961

LOGRAM NAME Subtract - Double Length

MNEMONIC SB2

LIBRARY SERIAL NO. 1L BB 022

USAGE INFORMATION

NUMBER OF CELLS 9

EXECUTION TIME: 120μs

CALLING SEQUENCE SB2/G

SCRATCH PAD CELLS AFFECTED: $IC, $AL, $AR

DATA TYPE Fixed Point

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The double length number located at G, G+1 will be subtracted from the contents of $AL, $AR and the difference is placed in $AL, $AR. Overflow is possible.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING	( )
ASSEMBLED LISTING	(X)
FLOW CHART	( )
METHODOLOGICAL ANALYSIS	( )
OTHER	( )

LOGRAM NAME Multiply - Single Length

MNEMONIC MP1

LIBRARY SERIAL NO.
1L BC 023

USAGE INFORMATION

NUMBER OF CELLS 23

EXECUTION TIME: 168μs

CALLING SEQUENCE MP1/G

SCRATCH PAD CELLS AFFECTED:
$IC, $AL, $AR

DATA TYPE Fixed Point

ACCURACY: 28 bits

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of G are multiplied by the contents of $AL. The high order portion of the signed 28-bit product is placed in $AL; the low portion in $AR. Bit 1 of $AR is always zero.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

DATE: November, 1961

LOGRAM NAME: Multiply - Double Length

MNEMONIC: MP2

LIBRARY SERIAL NO.: 1L BC 024

USAGE INFORMATION

NUMBER OF CELLS: 73

EXECUTION TIME: 627μs

CALLING SEQUENCE: MP2/G

SCRATCH PAD CELLS AFFECTED:

$IC	$QL	$T2
$AL	$QR	$T7
$AR	$T1	

DATA TYPE: Fixed Point

ACCURACY: 58 bits

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The double length number at G, G+1 is multiplied by the contents of $AL, $AR. The high order portion of the 58-bit product is placed in $AL, $AR; the low order portion in $QL, $QR. Bit 1 of SQR is always zero.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING	( )
ASSEMBLED LISTING	(X)
FLOW CHART	( )
METHODOLOGICAL ANALYSIS	( )
OTHER	( )

LOGRAM NAME Divide - Single Length

MNEMONIC DV1

LIBRARY SERIAL NO.
1L BD 025

USAGE INFORMATION

NUMBER OF CELLS 46

EXECUTION TIME: 180μs

CALLING SEQUENCE DV1/G

SCRATCH PAD CELLS AFFECTED:
$IC $AR
$AL $T1

DATA TYPE Fixed Point

ACCURACY: 14 bits

RESTRICTIONS The machine overflow indicator will be set if the absolute value of the divisor is less than the absolute value of the dividend.

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of $AL, $AR are divided by the contents of G. The signed quotient is placed in $AL and the unsigned undivided remainder is placed in $AR.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

LOGRAM NAME Divide - Double Length

MNEMONIC DV2

LIBRARY SERIAL NO. 1L BD 026

USAGE INFORMATION

NUMBER OF CELLS 148

EXECUTION TIME: 1062μs

CALLING SEQUENCE DV2/G

SCRATCH PAD CELLS AFFECTED:

$IC	$QL	$T2
$AL	$QR	$T3
$AR	$T1	$T7

DATA TYPE Fixed Point

ACCURACY: 28 bits

RESTRICTIONS The machine overflow indicator will be set if the absolute value of the divisor is less than the absolute value of the dividend.

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of $AL, $AR and $QL, $QR are divided by the contents of G, G+1. The quotient is placed in $AL, $AR. The value left in $QL, $QR is meaningless.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

AN/UYK-1 LOGRAM COVER SHEET

Thompson Ramo Wooldridge Inc.
RW Division

LOGRAM NAME Branch Unconditional

MNEMONIC BUN

LIBRARY SERIAL NO. 1L EG 027

USAGE INFORMATION

NUMBER OF CELLS 3

EXECUTION TIME: 36μs

CALLING SEQUENCE BUN/G

SCRATCH PAD CELLS AFFECTED: $IC

DATA TYPE

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: An unconditional branch to the address in location G is executed.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING	( )
ASSEMBLED LISTING	(x)
FLOW CHART	( )
METHODOLOGICAL ANALYSIS	( )
OTHER	( )

LOGRAM NAME Branch on Positive Accumulator

MNEMONIC BPN

LIBRARY SERIAL NO. 1L EB 028

USAGE INFORMATION

NUMBER OF CELLS 5

EXECUTION TIME: If ($AL) positive: 48μs
If ($AL) negative: 66μs

CALLING SEQUENCE BPN/G

SCRATCH PAD CELLS AFFECTED:
$IC
$AL

DATA TYPE

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: If the contents of $AL are positive a branch to the address in location G is executed.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

DATE: November, 1961

LOGRAM NAME Branch on Minus Accumulator

MNEMONIC BMN

LIBRARY SERIAL NO. 1L EB 029

USAGE INFORMATION

NUMBER OF CELLS 5

EXECUTION TIME: If ($AL) negative: 48μs
If ($AL) positive: 66μs

CALLING SEQUENCE BMN/G

SCRATCH PAD CELLS AFFECTED: $IC, $AL

DATA TYPE

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: If the contents of $AL are negative, a branch to the address in location G is executed.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

DATE: November, 1961

LOGRAM NAME Branch to Accumulated Address

MNEMONIC BAN

LIBRARY SERIAL NO.
1L EJ 030

USAGE INFORMATION

NUMBER OF CELLS 2

EXECUTION TIME: 30μs

CALLING SEQUENCE BAN

SCRATCH PAD CELLS AFFECTED:
$IC, $AL

DATA TYPE

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: An unconditional branch is made to the address in $AL.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

DATE: November, 1961

LOGRAM NAME Branch on Overflow

MNEMONIC BVN

LIBRARY SERIAL NO.
1L EB 031

USAGE INFORMATION

NUMBER OF CELLS 4

EXECUTION TIME: 36μs

CALLING SEQUENCE BVN/G

SCRATCH PAD CELLS AFFECTED:
$IC

DATA TYPE

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: If the overflow indicator is set a branch to the address in location G is executed. The overflow indicator is then reset to zero.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

LOGRAM NAME Branch on Divide Check

MNEMONIC BDK

LIBRARY SERIAL NO. 1L EB 032

USAGE INFORMATION

NUMBER OF CELLS 6

EXECUTION TIME: 60μs

CALLING SEQUENCE BDK/G

SCRATCH PAD CELLS AFFECTED: $IC, $DK

DATA TYPE

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: If the contents of $DK are one, a branch to the address in location G is executed and $DK is set to zero.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING	( )
ASSEMBLED LISTING	(x)
FLOW CHART	( )
METHODOLOGICAL ANALYSIS	( )
OTHER	( )

LOGRAM NAME Branch on Accumulator Zero - Single Length

MNEMONIC BZ1

LIBRARY SERIAL NO. 1L EC 033

USAGE INFORMATION

NUMBER OF CELLS 5

EXECUTION TIME: 48μs

CALLING SEQUENCE BZ1/G

SCRATCH PAD CELLS AFFECTED: $IC, $AL

DATA TYPE

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: If the contents of $AL are zero, a branch to the address in location G is executed.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (X)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

DATE: November, 1961

FORM 2218

LOGRAM NAME Branch on Accumulator Zero - Double Length

MNEMONIC BZ2

LIBRARY SERIAL NO. 1L EC 034

USAGE INFORMATION

NUMBER OF CELLS 6

EXECUTION TIME: 60μs

CALLING SEQUENCE BZ2/G

SCRATCH PAD CELLS AFFECTED: $IC, $AL, $AR

DATA TYPE

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: If the contents of $AL, $AR are zero, a branch to the address in location G is executed.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING	( )
ASSEMBLED LISTING	(x)
FLOW CHART	( )
METHODOLOGICAL ANALYSIS	( )
OTHER	( )

AN/UYK-1

LOGRAM COVER SHEET

Thompson Ramo Wooldridge Inc
RW Division

LOGRAM NAME Compare Equal - Single Length

MNEMONIC CE1

LIBRARY SERIAL NO.
1L EE 035

USAGE INFORMATION

NUMBER OF CELLS 9

EXECUTION TIME: 108μs

CALLING SEQUENCE CE1/G/H

SCRATCH PAD CELLS AFFECTED:
$IC, $AL, $T1

DATA TYPE

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: If the contents of $AL equal the contents of G, a branch to location H occurs.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING	( )
ASSEMBLED LISTING	(x)
FLOW CHART	( )
METHODOLOGICAL ANALYSIS	( )
OTHER	( )

LOGRAM NAME Compare Equal - Double Length

MNEMONIC CE2

LIBRARY SERIAL NO.
1L EE 036

USAGE INFORMATION

NUMBER OF CELLS 13

EXECUTION TIME: 144μs

CALLING SEQUENCE CE2/G/H

SCRATCH PAD CELLS AFFECTED:
$IC $AR
$AL $T1

DATA TYPE

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: If the contents of $AL, $AR equal the contents of G, G+1, a branch to location H occurs.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

LOGRAM NAME Compare Greater - Single Length

MNEMONIC CG1

LIBRARY SERIAL NO. 1L EE 037

USAGE INFORMATION

NUMBER OF CELLS 9

EXECUTION TIME: 108μs

CALLING SEQUENCE CG1/G/H

SCRATCH PAD CELLS AFFECTED: $IC, $AL, $T1

DATA TYPE

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: If the contents of $AL, are equal to or greater than the contents of G, a branch to location H occurs.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

DATE: November, 1961

AN/UYK-1 LOGRAM COVER SHEET

Thompson Ramo Wooldridge Inc.
RW Division

LOGRAM NAME Compare Greater - Double Length

MNEMONIC CG2

LIBRARY SERIAL NO.
1L EE 038

USAGE INFORMATION

NUMBER OF CELLS 14

EXECUTION TIME: 150μs

CALLING SEQUENCE CG2/G/H

SCRATCH PAD CELLS AFFECTED:
$IC, $AL, $AR, $T1

DATA TYPE

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: If the contents of $AL, $AR are greater than or equal to the contents of G, G+1 a branch to location H occurs.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING	( )
ASSEMBLED LISTING	(x)
FLOW CHART	( )
METHODOLOGICAL ANALYSIS	( )
OTHER	( )

LOGRAM NAME Compare Less - Single Length

MNEMONIC CL1

LIBRARY SERIAL NO. 1L EE 039

USAGE INFORMATION

NUMBER OF CELLS 9

EXECUTION TIME: 108μs

CALLING SEQUENCE CL1/G/H

SCRATCH PAD CELLS AFFECTED: $IC, $AL, $T1

DATA TYPE

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: If the contents of $AL are less than the contents of G, a branch to location H occurs.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

LOGRAM NAME Compare Less - Double Length

MNEMONIC CL2

LIBRARY SERIAL NO.
1L EE 040

USAGE INFORMATION

NUMBER OF CELLS 14

EXECUTION TIME: 150μs

CALLING SEQUENCE CL2/G/H

SCRATCH PAD CELLS AFFECTED:
$IC, $AL, $AR, $T1

DATA TYPE Fixed Point

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: If the contents of $AL, $AR are less than the contents of G, G+1, a branch to location H occurs.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

AN/UYK-1 LOGRAM COVER SHEET

Thompson Ramo Wooldridge Inc
RW Division

LOGRAM NAME Test and Decrement

MNEMONIC TDN

LIBRARY SERIAL NO.
1L EJ 041

USAGE INFORMATION

NUMBER OF CELLS 9

EXECUTION TIME: 108μs

CALLING SEQUENCE TDN/G/H

SCRATCH PAD CELLS AFFECTED:
$IC, $MØN

DATA TYPE Fixed Point

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of location G are decremented by one. If the contents of G then equal zero, a branch to location H occurs.

WRITTEN BY: ISL Staff

ATTACHMENTS

ORGANIZATION: RW

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

DATE: November, 1961

AN/UYK-1

LOGRAM COVER SHEET

Thompson Ramo Wooldridge Inc
RW Division

LOGRAM NAME: Link Jump

MNEMONIC: LJN

LIBRARY SERIAL NO.: 1L EH 042

USAGE INFORMATION

NUMBER OF CELLS: 5

EXECUTION TIME: 60μs

CALLING SEQUENCE: LJN/G/H

SCRATCH PAD CELLS AFFECTED: $IC

DATA TYPE:

ACCURACY:

RESTRICTIONS:

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The address of the next logram starting address is stored at G and a branch to the address in H is executed.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (X)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

LOGRAM NAME Halt and Proceed

MNEMONIC HPN

LIBRARY SERIAL NO.
1L EA 043

USAGE INFORMATION

NUMBER OF CELLS 3

EXECUTION TIME: 36μs

CALLING SEQUENCE HPN/G

SCRATCH PAD CELLS AFFECTED:
$IC

DATA TYPE

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: If the computer is running in the FLAG mode, a halt will occur. Upon restart it will branch to location G.

WRITTEN BY: ISD Staff

ATTACHMENTS

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

ORGANIZATION: RW

DATE: November, 1961

FORM 2218

LOGRAM NAME Leave Interpretive Mode

MNEMONIC LVN

LIBRARY SERIAL NO.
1L EH 044

USAGE INFORMATION

NUMBER OF CELLS 5

EXECUTION TIME: 60μs

CALLING SEQUENCE LVN/G/H

SCRATCH PAD CELLS AFFECTED:
$IC, $RET

DATA TYPE

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: An unconditional branch is made to location H which contains a subroutine written in logand language. The address G will be stored at $RET. When the logand subroutine is completed, the logand executed to return to the instruction at G will be LP/IL/$RET.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

AN/UYK-1

LOGRAM COVER SHEET

Thompson Ramo Wooldridge
RW Division

LOGRAM NAME Numeric Left Shift - Single Length

MNEMONIC NL1

LIBRARY SERIAL NO.
1L DB 045

USAGE INFORMATION

NUMBER OF CELLS 13

EXECUTION TIME: (120 + 3n) μs

CALLING SEQUENCE NL1/n

SCRATCH PAD CELLS AFFECTED:
$IC, $AL

DATA TYPE

ACCURACY:

RESTRICTIONS $0 \leq n \leq 14$

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of $AL are shifted left n places. Bits shifted out of bit position 14 are lost, and the vacated positions are filled with zeros. The sign of $AL is unchanged.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

FORM 2218

LOGRAM NAME Numeric Left Shift - Double Length

MNEMONIC NL2

LIBRARY SERIAL NO.
1L DB 046

USAGE INFORMATION

NUMBER OF CELLS 24

EXECUTION TIME: If $n \leq 15$: $(168+3n)\mu s$
If $n > 15$: $(216+3(n-15))\mu s$

CALLING SEQUENCE NL2/n

SCRATCH PAD CELLS AFFECTED:
$IC, $AL, $AR

DATA TYPE

ACCURACY:

RESTRICTIONS $0 \leq n \leq 29$

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of $AL, $AR are shifted left n places. Bits shifted out of bit position 14 of $AL are lost and the vacated positions are filled with zeros. The sign of $AL is unchanged.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

DATE: November, 1961

FORM 2215

LOGRAM NAME Numeric Left Shift - Quadruple Length

MNEMONIC NL4

LIBRARY SERIAL NO.
1L DD 047

USAGE INFORMATION

NUMBER OF CELLS 60

EXECUTION TIME: If $n < 15$: $(329+3n)\mu s$
If $n \geq 15$: $(364+6(n-15))\mu s$

CALLING SEQUENCE NL4/n

SCRATCH PAD CELLS AFFECTED:

$IC	$QR
$AL	$T1
$AR	$T2
$QL	

DATA TYPE

ACCURACY:

RESTRICTIONS $0 \leq n \leq 29$

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of $AL, $AR and $QL, $QR are shifted left n places. Bits shifted out of bit position 14 of $AL are lost and the vacated positions are filled with zeros. The sign of $AL is unchanged.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING	( )
ASSEMBLED LISTING	(x)
FLOW CHART	( )
METHODOLOGICAL ANALYSIS	( )
OTHER	( )

LOGRAM NAME Numeric Right Shift - Single Length

MNEMONIC NR1

LIBRARY SERIAL NO. IL DA 048

USAGE INFORMATION

NUMBER OF CELLS 21

EXECUTION TIME: (138 + 3n)μs

CALLING SEQUENCE NR1/n

SCRATCH PAD CELLS AFFECTED: $IC, $AL

DATA TYPE Fixed Point

ACCURACY:

RESTRICTIONS $0 \leq n \leq 14$

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of $AL are shifted right n places. The original sign of $AL is propagated.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

LOGRAM NAME Numeric Right Shift - Double Length

MNEMONIC NR2

LIBRARY SERIAL NO.
1L DA 049

USAGE INFORMATION

NUMBER OF CELLS 50

EXECUTION TIME: If $n \leq 15$: $252 + 3n$ μs
If $n > 15$: $348 + 3(n-15)$ μs

CALLING SEQUENCE NR2/n

SCRATCH PAD CELLS AFFECTED:
$IC, $AL, $AR

DATA TYPE Fixed Point

ACCURACY:

RESTRICTIONS $0 \leq n \leq 29$

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of $AL, $AR are shifted right n places. The original sign of $AL is propagated.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

LOGRAM NAME: Numeric Right Shift - Quadruple Length

MNEMONIC: NR4

LIBRARY SERIAL NO.: 1L DC 050

USAGE INFORMATION

NUMBER OF CELLS: 51

EXECUTION TIME: If $n \leq 15$: $(330+9n)\mu s$
If $n > 15$: $(312+6(n-15))\mu s$

CALLING SEQUENCE: NR4/n

SCRATCH PAD CELLS AFFECTED:

$IC	$QL	$T2
$AL	$QR	
$AR	$T1	

DATA TYPE: Fixed Point

ACCURACY:

RESTRICTIONS: $0 \leq n \leq 29$

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of $AL, $AR and $QL, $QR are shifted right n places. The original sign of $AL is propagated.

WRITTEN BY: ISD Staff

ATTACHMENTS

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

ORGANIZATION: RW

DATE: November, 1961

AN/UYK-1 LOGRAM COVER SHEET

Thompson Ramo Wooldridge Inc.
RW Division

LOGRAM NAME: Logical Left Shift - Single Length

MNEMONIC: LL1

LIBRARY SERIAL NO.: 1L DF 051

USAGE INFORMATION

NUMBER OF CELLS: 9

EXECUTION TIME: (96 +3n)μs

CALLING SEQUENCE: LL1/n

SCRATCH PAD CELLS AFFECTED: $IC, $AL

DATA TYPE: Fixed Point

ACCURACY:

RESTRICTIONS: $0 \leq n \leq 15$

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of $AL are shifted left n places. Bits shifted out of $AL are lost and zeros are inserted in the vacated positions.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING	( )
ASSEMBLED LISTING	(x)
FLOW CHART	( )
METHODOLOGICAL ANALYSIS	( )
OTHER	( )

FORM 2218

LOGRAM NAME Logical Left Shift - Double Length

MNEMONIC LL2

LIBRARY SERIAL NO.
1L DF 052

USAGE INFORMATION

NUMBER OF CELLS 21

CALLING SEQUENCE LL2/n

EXECUTION TIME: If $n \leq 15$: $(144+3n)\mu s$
If $n > 15$: $(204+3(n-15))\mu s$

SCRATCH PAD CELLS AFFECTED:
$IC, $AL, $AR

DATA TYPE Fixed Point

ACCURACY:

RESTRICTIONS $0 < n \leq 30$

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of $AL, $AR are shifted left n places. The bits vacated at the low order position of $AR are filled with zeros, and bits shifted out of the sign position are lost.

WRITTEN BY: IED Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (X)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

AN/UYK-1 LOGRAM COVER SHEET

Thompson Ramo Wooldridge Inc.
RW Division

LOGRAM NAME: Logical Right Shift - Single Precision

MNEMONIC: LR1

LIBRARY SERIAL NO.: 1L DE 053

USAGE INFORMATION

NUMBER OF CELLS: 9

EXECUTION TIME: $(96 + 3n)\mu s$

CALLING SEQUENCE: LR1/n

SCRATCH PAD CELLS AFFECTED: $IC, $AL

DATA TYPE: Fixed Point

ACCURACY:

RESTRICTIONS: $0 \leq n \leq 15$

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of $AL are shifted right n places. Bits shifted out of $AL are lost. Positions vacated are filled with zeros.

WRITTEN BY: ISD Staff

ORGANIZATION: RW

DATE: November, 1961

ATTACHMENTS

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (X)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

FORM 2218

LOGRAM NAME Logical Right Shift, Double Length

MNEMONIC LR2

LIBRARY SERIAL NO. 1L DE 054

USAGE INFORMATION

NUMBER OF CELLS 21

EXECUTION TIME: If $n \leq 15$; $(144+3n)\mu s$
If $n > 15$: $(204+3(n-15))\mu s$

CALLING SEQUENCE LR2/n

SCRATCH PAD CELLS AFFECTED:
$IC, $AR, $AL

DATA TYPE Fixed Point

ACCURACY:

RESTRICTIONS $0 \leq n \leq 30$

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of $AL, $AR are shifted right n places. Bits shifted out of $AL, $AR are lost. Vacated bits are filled with zeros.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING ( )
ASSEMBLED LISTING ( )
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

AN/UYK-1

LOGRAM COVER SHEET

Thompson Ramo Wooldridge Inc.
RW Division

LOGRAM NAME: Float Left - Single Length

MNEMONIC: FL1

LIBRARY SERIAL NO.: 1L DP 055

USAGE INFORMATION

NUMBER OF CELLS: 8

EXECUTION TIME: $(84 + 3n)\mu s$

CALLING SEQUENCE: FL1

SCRATCH PAD CELLS AFFECTED: $IC, $AL, $AR, $T1

DATA TYPE:

ACCURACY:

RESTRICTIONS:

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents $AL are shifted left until bits 14 and 15 differ. The number of positions shifted is placed in $AR.

WRITTEN BY: ICD Staff

ATTACHMENTS

SYMBOLIC LISTING ( )
ASSEMBLED LISTING ( )
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

ORGANIZATION: RW

DATE: November, 1961

FORM 2215

AN/UYK-1 LOGRAM COVER SHEET

Thompson Ramo Wooldridge Inc.
RW Division

LOGRAM NAME Float Left - Double Length

MNEMONIC FL2

LIBRARY SERIAL NO.
1L DP 056

USAGE INFORMATION

NUMBER OF CELLS 18

EXECUTION TIME: (198 + 3n)μs

CALLING SEQUENCE FL2

SCRATCH PAD CELLS AFFECTED:
$IC $QL
$AL $QR
$AR

DATA TYPE

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of $AL, $AR are shifted left until bits 14 and 15 of $AL differ. The number of positions shifted will be placed in $QR.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

DATE: November, 1961

FORM 2215

LOGRAM NAME: One's Complement of Accumulator - Single Length

MNEMONIC: OC1

LIBRARY SERIAL NO: 1L FE 057

USAGE INFORMATION

NUMBER OF CELLS: 5

EXECUTION TIME: 30 μs

CALLING SEQUENCE: OC1

SCRATCH PAD CELLS AFFECTED: $IC, $AL

DATA TYPE: Fixed Point

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The one's complement of $AL is placed in $AL.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

AN/UYK-1 LOGRAM COVER SHEET

Thompson Ramo Wooldridge Inc
RW Division

LOGRAM NAME: One's Complement of Accumulator - Double Length

MNEMONIC: OC2

LIBRARY SERIAL NO.: 1L FE 058

USAGE INFORMATION

NUMBER OF CELLS: 8

EXECUTION TIME: 96μs

CALLING SEQUENCE: OC2

SCRATCH PAD CELLS AFFECTED: $IC, $AL, $AR

DATA TYPE: Fixed Point

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The one's complement of the contents of $AL, $AR is placed in $AL, $AR.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING ( )
ASSEMBLED LISTING ( )
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

FORM 2215

LOGRAM NAME: Insert - Single Length

MNEMONIC: IN1

LIBRARY SERIAL NO.: 1L FD 059

USAGE INFORMATION

NUMBER OF CELLS: 7

EXECUTION TIME: 96μs

CALLING SEQUENCE: IN1/G/H

SCRATCH PAD CELLS AFFECTED: $IC, $AL

DATA TYPE: Fixed Point

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: This logram combines portions of two words into $AL. "One" bits in the mask located at G control the bits of $AL to be included. "Zero" bits of the mask control the portion of the contents of H to be included.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

AN/UYK-1 LOGRAM COVER SHEET

Thompson Ramo Wooldridge Inc.
RW Division

LOGRAM NAME Insert - Double Length

MNEMONIC IN2

LIBRARY SERIAL NO.
1L FD 060

USAGE INFORMATION

NUMBER OF CELLS 17

EXECUTION TIME: 222μs

CALLING SEQUENCE IN2/G/H

SCRATCH PAD CELLS AFFECTED:
$IC, $AL, $AR, $T1

DATA TYPE Fixed Point

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: This logram combines portions of two double length words into $AL, $AR. "One" bits of the mask located at G, G+1 control the bits of $AL, $AR to be included. "Zero" bits of the mask control the portion of the contents of H, H+1 to be inserted.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (X)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

FORM 2218

LOGRAM NAME Inclusive OR - Single Length

MNEMONIC OR1

LIBRARY SERIAL NO. 1L FB 061

USAGE INFORMATION

NUMBER OF CELLS 4

EXECUTION TIME: 54μs

CALLING SEQUENCE OR1/G

SCRATCH PAD CELLS AFFECTED: $IC, $AL

DATA TYPE

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of G are compared with the corresponding bits of $AL

a) if corresponding bits are zero, the result is zero.

b) if either of the corresponding bits is one, the result is one.

The results are placed in $AL.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (X)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

AN/UYK-1 LOGRAM COVER SHEET

Thompson Ramo Wooldridge Inc.
RW Division

LOGRAM NAME Inclusive OR - Double Length

MNEMONIC OR2

LIBRARY SERIAL NO. 1L FB 062

USAGE INFORMATION

NUMBER OF CELLS 7

EXECUTION TIME: 90μs

CALLING SEQUENCE OR2/G

SCRATCH PAD CELLS AFFECTED: $IC, $AL, $AR

DATA TYPE

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of G, G+1 are compared with the corresponding bits of $AL, $AR

a) if corresponding bits are zero, the result is zero.

b) if either of the corresponding bits is one the result is one.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

FORM 2215

LOGRAM NAME Dot G(AND) - Single Length

MNEMONIC DG1

LIBRARY SERIAL NO. 1L FA 063

USAGE INFORMATION

NUMBER OF CELLS 4

EXECUTION TIME: 54μs

CALLING SEQUENCE DG1/G

SCRATCH PAD CELLS AFFECTED: $IC, $AL

DATA TYPE Fixed Point

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of G are compared with the corresponding bits of $AL

a) if the corresponding bits are ones, the result is one.

b) if either of the corresponding bits is a zero, the result is a zero.

The results are placed in $AL.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

LOGRAM NAME Dot G(AND) - Double Length

MNEMONIC DG2

LIBRARY SERIAL NO. 1L FA 064

USAGE INFORMATION

NUMBER OF CELLS 7

EXECUTION TIME: 90μs

CALLING SEQUENCE DG2/G

SCRATCH PAD CELLS AFFECTED: $IC, $AL, $AR

DATA TYPE Fixed Point

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of G, G+1 are compared with the corresponding bits of $AL, $AR

a) if the corresponding bits are ones, the result is one.

b) if either of the corresponding bits is a zero, the result is zero.

The results are placed in $AL, $AR.

WRITTEN BY:

ORGANIZATION:

DATE:

ATTACHMENTS

SYMBOLIC LISTING ( )
ASSEMBLED LISTING ( )
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

AN/UYK-1 LOGRAM COVER SHEET

Thompson Ramo Wooldridge Inc
RW Division

LOGRAM NAME Binary to BCD

MNEMONIC BBD

LIBRARY SERIAL NO.
1L AE 065

USAGE INFORMATION

NUMBER OF CELLS 43

EXECUTION TIME: 983μs

CALLING SEQUENCE BBD

SCRATCH PAD CELLS AFFECTED:
$IC $T1
$AL $T2
$AR

DATA TYPE

ACCURACY:

RESTRICTIONS The number must be positive and not exceed $230,454,777_8$, (39,999,999).

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The least significant 26 bits of $AL, $AR are converted to one 2-bit and seven 4-bit BCD characters and placed in $AL, $AR right adjusted.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

DATE: November, 1961

FORM 2215

AN/UYK-1 LOGRAM COVER SHEET

Thompson Ramo Wooldridge Inc.
RW Division

LOGRAM NAME BCD to Binary

MNEMONIC BBN

LIBRARY SERIAL NO.
1L AE 066

USAGE INFORMATION

NUMBER OF CELLS 67

EXECUTION TIME: 945μs

CALLING SEQUENCE BBN

SCRATCH PAD CELLS AFFECTED:
$IC, $AL, $AR, $T1

DATA TYPE

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of $AL, $AR are treated as one 2-bit and seven 4-bit BCD characters and are converted to an unsigned binary number, right adjusted, and placed in $AL, $AR.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

FORM 2215

AN/UYK-1 LOGRAM COVER SHEET

Thompson Ramo Wooldridge Inc.
RW Division

LOGRAM NAME Move

MNEMONIC MVN

LIBRARY SERIAL NO.
1L AC 067

USAGE INFORMATION

NUMBER OF CELLS 8

EXECUTION TIME: (108 + 12n)μs

CALLING SEQUENCE MVN/G/H/n

SCRATCH PAD CELLS AFFECTED:
$IC

DATA TYPE

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: This instruction moves n 15-bit words, starting at G, to locations H through H+n-1.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

DATE: November, 1961

LOGRAM NAME Table Look Up

MNEMONIC TL1

LIBRARY SERIAL NO. 1L GA 068

USAGE INFORMATION

NUMBER OF CELLS 21

EXECUTION TIME: (216 + 12n)μs

CALLING SEQUENCE TL1/G/n/Condition

Condition	Octal Code
Equal	36606
Not Equal	36607
Numeric High	36616
Numeric Low	36617

SCRATCH PAD CELLS AFFECTED:
$IC $ØNE
$AL $T1
$MØN

DATA TYPE

ACCURACY:

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The contents of $AL are compared sequentially with n words in a table, starting at G, until the specified condition is satisfied. The address of the first word which satisfies the condition is placed in $AL. If no word is found, zero is placed in $AL.

Conditions which terminate the logand are:

Equal - The contents of $AL equal to the table word.
Not Equal - The contents of $AL do not equal the table word.
Numeric High - The contents of $AL are algebraically greater than or equal to the table word.
Numeric Low - The contents of $AL are algebraically less than the table word.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (X)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

AN/UYK-1 LOGRAM COVER SHEET

Thompson Ramo Wooldridge Inc.
RW Division

LOGRAM NAME: Sine - Single Length

MNEMONIC: SN1

LIBRARY SERIAL NO.: 1L CB 069

USAGE INFORMATION

NUMBER OF CELLS: 81

EXECUTION TIME: 951μs

CALLING SEQUENCE: SN1

SCRATCH PAD CELLS AFFECTED: $IC, $AL, $T1, $T2

DATA TYPE: Fixed Point

ACCURACY: 11 bits

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The value in $AL is treated as a signed 14-bit argument in radians scaled 2^3. The signed result is placed in $AL, scaled 2^0.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING	( )
ASSEMBLED LISTING	(X)
FLOW CHART	( )
METHODOLOGICAL ANALYSIS	( )
OTHER	( )

FORM 2215

AN/UYK-1 LOGRAM COVER SHEET

Thompson Ramo Wooldridge Inc
RW Division

LOGRAM NAME Sine - Double Length

MNEMONIC SN2

LIBRARY SERIAL NO.
1L CB 070

USAGE INFORMATION

NUMBER OF CELLS 219 (See Restrictions)

EXECUTION TIME: 5085μs

CALLING SEQUENCE SN2

SCRATCH PAD CELLS AFFECTED:

$IC	$T1	$T4	$T9
$AL	$T2	$T5	
$AR	$T3	$T6	

DATA TYPE Fixed Point

ACCURACY: 24 bits

RESTRICTIONS Uses MP2S subroutine - 27 cells.

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The value in $AL, $AR is treated as a signed 29-bit argument in radians scaled 2^3. The signed result is placed in $AL, $AR, scaled 2^0.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (X)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

LOGRAM NAME Cosine - Single Length

MNEMONIC CS1

LIBRARY SERIAL NO.
1L CC 071

USAGE INFORMATION

NUMBER OF CELLS 86

EXECUTION TIME: 933μs

CALLING SEQUENCE CS1

SCRATCH PAD CELLS AFFECTED
$IC, $AL, $T1, $T2

DATA TYPE Fixed Point

ACCURACY: 11 bits

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The value in $AL is treated as a signed 14-bit argument in radians scaled 2^3. The signed fractional result is placed in $AL.

WRITTEN BY: ICD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (X)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

LOGRAM NAME Cosine - Double Length

MNEMONIC CS2

LIBRARY SERIAL NO.
1L CC 072

USAGE INFORMATION

NUMBER OF CELLS 79 (See Restrictions)

EXECUTION TIME: 5181μs

CALLING SEQUENCE CS2

SCRATCH PAD CELLS AFFECTED:

$IC	$T1
$AL	$T2
$AR	$T9

DATA TYPE Fixed Point

ACCURACY:

RESTRICTIONS Uses SN2C subroutines - 148 cells and MP2S subroutine - 27 cells.

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The value in $AL, $AR is treated as a signed 29-bit argument in radians scaled 2^3. The signed fractional result is placed in $AL, $AR.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (X)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

DATE: November, 1961

LOGRAM NAME Arc Tangent - Single Length

MNEMONIC AT1

LIBRARY SERIAL NO. 1L CE 073

USAGE INFORMATION

NUMBER OF CELLS 46 (See Restrictions)

EXECUTION TIME: 555μs

CALLING SEQUENCE AT1

SCRATCH PAD CELLS AFFECTED:
$IC, $T2
$AL $T3
$T1

DATA TYPE Fixed Point

ACCURACY: 13 bits

RESTRICTIONS Uses 66 cells of AT1TX Table.

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The value in $AL is treated as a signed 14_0-bit fractional argument. The signed result is placed in $AL in radians scaled 2^0.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

LOGRAM NAME Arc Tangent - Double Length

MNEMONIC AT2

LIBRARY SERIAL NO. 1L CE 074

USAGE INFORMATION

NUMBER OF CELLS 82 (See Restrictions)

EXECUTION TIME: 2979μs

CALLING SEQUENCE AT2

SCRATCH PAD CELLS AFFECTED:

$IC	$T1	$T4
$AL	$T2	
$AR	$T3	

DATA TYPE Fixed Point

ACCURACY: 24 bits

RESTRICTIONS Uses 66 cells of AT1TX Table
MP2S Subroutine - 27 cells
DV2S Subroutine - 91 cells

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The value in $AL, $AR is treated as a signed 29-bit fractional argument. The signed result is placed in $AL, $AR in radians scaled 2^0.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING	( )
ASSEMBLED LISTING	(x)
FLOW CHART	( )
METHODOLOGICAL ANALYSIS	( )
OTHER	( )

AN/UYK-1 LOGRAM COVER SHEET

Thompson Ramo Wooldridge Inc.
RW Division

LOGRAM NAME Arc - Sine - Single Length

MNEMONIC AS1

LIBRARY SERIAL NO. 1L CD 075

USAGE INFORMATION

NUMBER OF CELLS 62 (See Restrictions)

EXECUTION TIME: 1563μs

CALLING SEQUENCE AS1

SCRATCH PAD CELLS AFFECTED:
$IC $T5
$AL $T6
$AR $T7

DATA TYPE Fixed Point

ACCURACY: 13 bits

RESTRICTIONS Uses SR1S Subroutine - 50 cells
AT1S Subroutine - 36 cells
AT1TX Table - 66 cells

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The value in $AL is treated as a signed 14-bit fractional argument. The signed result is placed in $AL in radians scaled 2^{1}.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (x)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

FORM 2215

LOGRAM NAME Arc Sine - Double Length

MNEMONIC AS2

LIBRARY SERIAL NO. 1L CD 076

USAGE INFORMATION

NUMBER OF CELLS 95 (See Restrictions)

EXECUTION TIME: 7598μs

CALLING SEQUENCE AS2

SCRATCH PAD CELLS AFFECTED:

$IC	$QL	$T2
$AL	$QR	
$AR	$T1	

DATA TYPE Fixed Point

ACCURACY: 24 bits

RESTRICTIONS Uses subroutines MP2S - 27 cells, DV2S - 91 cells, AT2S - 107 cells, SR2S - 75 cells, SR1S - 50 cells and table AT1TX - 66 cells.

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The value in the accumulator $AL, $AR is treated as a signed 29-bit fractional argument. The signed result is placed in the accumulator $AL, $AR in radians scaled 2^{-1}.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

SYMBOLIC LISTING	( )
ASSEMBLED LISTING	(x)
FLOW CHART	( )
METHODOLOGICAL ANALYSIS	( )
OTHER	( )

AN/UYK-1 LOGRAM COVER SHEET

Thompson Ramo Wooldridge Inc.
RW Division

LOGRAM NAME Square Root - Single Length

MNEMONIC SR1

LIBRARY SERIAL NO.
1L CA 077

USAGE INFORMATION

NUMBER OF CELLS 49

EXECUTION TIME: 606μs

CALLING SEQUENCE SR1

SCRATCH PAD CELLS AFFECTED:
$IC $T1
$AL $T2
$AR $T3

DATA TYPE Fixed Point

ACCURACY: 13 bits

RESTRICTIONS

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The square root of $AL, $AR is placed in $AL, $AR. The scale of the root is one-half of the scale of the operand, which must be scaled evenly. The root is computed to 14 bits and other bits except leading zeros are meaningless.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

SYMBOLIC LISTING ( )
ASSEMBLED LISTING (X)
FLOW CHART ( )
METHODOLOGICAL ANALYSIS ( )
OTHER ( )

DATE: November, 1961

FORM 2215

LOGRAM NAME Square Root - Double Length

MNEMONIC SR2

LIBRARY SERIAL NO. 1L CA 078

USAGE INFORMATION

NUMBER OF CELLS 99 (See Restrictions)

EXECUTION TIME: 2280μs

CALLING SEQUENCE SR2

SCRATCH PAD CELLS AFFECTED:

$IC	$QR	$T3	$T8
$AL	$MØN	$T4	$T9
$AR	$T1	$T5	
$QL	$T2	$T7	

DATA TYPE

ACCURACY: 28 bits

RESTRICTIONS Uses subroutines SR1S - 50 cells, DV2S - 91 cells.

DESCRIPTIVE INFORMATION

DESCRIPTION AND FUNCTION: The square root of the signed 59-bit number in $AL, $AR, $QL, $QR is placed in $AL, $AR. The resulting contents of $QL, $QR are meaningless.

WRITTEN BY: ISD Staff

ATTACHMENTS

ORGANIZATION: RW

DATE: November, 1961

- SYMBOLIC LISTING ( )
- ASSEMBLED LISTING (X)
- FLOW CHART ( )
- METHODOLOGICAL ANALYSIS ( )
- OTHER ( )

APPENDIX B

(Assembled Listing)

```
                    T R W - 1 3 0   B A S I C   L O G R A M   P A C K A G E
        13135            ORG          5725
                          1PZZ0860 OON HSK130,HOUSEKEEPING ROUTINE                00042
  13135  75000   HSK130  LA    DM C   NO                 INITIALIZE
  13136  17166           PZE          AT1S               COMMON
  13137  50400           SA    IM C   NO                 SUBROUTINE
  13140  17163           PZE          AT1SR              ENTRY
  13141  75000           LA    DM C   NO                 POINTS
  13142  17232           PZE          AT2S
  13143  50400           SA    IM C   NO
  13144  17227           PZE          AT2SR
  13145  75000           LA    DM C   NO
  13146  17405           PZE          SR1S
  13147  50400           SA    IM C   NO
  13150  17402           PZE          SR1SR
  13151  75000           LA    DM C   NO
  13152  17467           PZE          SR2S
  13153  50400           SA    IM C   NO
  13154  17464           PZE          SR2SR
  13155  75000           LA    DM C   NO
  13156  17602           PZE          MP2S
  13157  50400           SA    IM C   NO
  13160  17577           PZE          MP2SR
  13161  75000           LA    DM C   NO
  13162  17635           PZE          DV2S
  13163  50400           SA    IM C   NO
  13164  17632           PZE          DV2SR
  13165  44175           ZE    DL     $DK                CLEAR DIVIDE CHECK INDICATOR
  13166  44174           ZE    DL     $OV                CLEAR $OV
  13167  44171           ZE    DL     $IC                CLEAR $IC
  13170  51067           HA    DM B   CC
  13171  50177           SA    DL     $MON               SET $MON TO 77777
  13172  75000           LA    DM C   NO
  13173  00001           OCT          1
  13174  50176           SA    DL     $ONE               SET $ONE TO 1
  13175  73176           AS    DL     $ONE
  13176  50100           SA    DL     $PFB               SET $PFB TO 2
  13177  75000           LA    DM C   NO
  13200  20060           BR    DM F   UN
  13201  50102           SA    DL     $PFA               SET $PFA TO BRANCH
  13202  25124           CF    DL     20                 CLEAR MOMENTARY INTERRUPT F. F.
  13203  20031           BR    DM     OV                 CLEAR OV
  13204  13205           PZE          *+1
  13205  20060           BR    DM F   UN
  13206  17776           OCT          17776
```

```
                    1LAA0010 01B1LD1   ,LOAD ACCUMULATOR S.L.              00004000054US  0010000
13207  60600  LD1   NO   IP C  NO              LOAD E WITH (G)MS                           0010001
13210  52162        SE   DL    $AL             STORE E IN AC                               0010002
13211  42171        SP   DL    $IC             STORE P IN IC                               0010003
13212  62200        LP   DP C  NO          R  EXIT                                        0010004
                    1LAA0020 01B2LD2   ,LOAD ACCUMULATOR D.L.              00006000078US  0020000
13213  60600  LD2   NO   IP C  NO              LOAD E WITH (G)MS                           0020001
13214  52162        SE   DL    $AL             STORE E IN AC                               0020002
13215  42171        SP   DL    $IC             STORE P IN IC                               0020003
13216  60300        NO   DA C  NO              LOAD E WITH (G)LS                           0020004
13217  52163        SE   DL    $AR             STORE E IN MQ(AR)                           0020005
13220  62300        LP   DA C  NO          R  EXIT                                        0020006
                    1LAA0030 01B1LN1   ,LOAD NUMERIC S.L.              00008000066US  0030000
13221  60615  LN1   NO   IP C  LA                                                        0030001
13222  42171        SP   DL    $IC                                                      0030002
13223  20035        BR   DM    AP                                                       0030003
13224  13227        PZE        LN1+6                                                    0030004
13225  65001        CS   DM C  AI                                                       0030005
13226  00000        PZE        0                                                        0030006
13227  50162        SA   DL    $AL                                                      0030007
13230  62200        LP   DP C  NO          R                                          0030008
                    1LAA0040 01B2LN2   ,LOAD NUMERIC D.L.              00012000096US  0040000
13231  60610  LN2   NO   IP C  LT              LOAD T WITH (G)MS                           0040001
13232  42171        SP   DL    $IC             STORE P IN $IC                              0040002
13233  75304        LA   DA C  AT              LOAD A WITH (G)LS, EXCHANGE A,T             0040003
13234  20035        BR   DM    AP              BRANCH IF A POSITIVE                        0040004
13235  13242        PZE        LN2A                                                       0040005
13236  67064        CC   DM B  AT              COMPLEMENT (G)MS, EXCHANGE A,T              0040006
13237  65001        CS   DM C  AI              COMPLEMENT (G+1)                            0040007
13240  00000        PZE        0                                                        0040008
13241  64061        AT   DM B  AI              ADD CARRY TO (G)                            0040009
13242  50162  LN2A  SA   DL    $AL             STORE                                       0040010
13243  40163        ST   DL    $AR             STORE                                       0040011
13244  62571        LP   IL    $IC         R  EXIT                                        0040012
                    1LAA0050 01B1LC1   ,LOAD COMPLEMENT S.L.              00006000066US  0050000
13245  60615  LC1   NO   IP C  LA              LOAD A WITH CONTENTS OF G                   0050001
13246  42171        SP   DL    $IC             STORE Y+2 IN $IC                            0050002
13247  65001        CS   DM C  AI              COMPLEMENT A                                0050003
13250  00000        PZE        0                                                        0050004
13251  50162        SA   DL    $AL             STORE A IN $AL                              0050005
13252  62200        LP   DP C  NO          R  EXIT                                        0050006
                    1LAA0060 01B2LC2   ,LOAD COMPLEMENT D.L.              00010000120US  0060000
13253  60600  LC2   NO   IP C  NO              LOAD A WITH CONTENTS OF G+1                 0060001
13254  52163        SE   DL    $AR             STORE G IN $AR                              0060002
13255  42171        SP   DL    $IC             STORE Y+2 IN $IC                            0060003
```

```
13256  75305          LA   DA C  CS              COMPLEMENT A                                         0060004
13257  44061          ZE   DM B  AI              COMPLEMENT A                                         0060005
13260  55163          RA   DL    $AR             STORE COMP IN $AR, LOAD (G)MS                        0060006
13261  77001          CH   DM C  AI              COMPLEMENT                                           0060007
13262  00000          PZE        0                                                                    0060008
13263  50162          SA   DL    $AL             STORE IN $AL                                         0060009
13264  62571          LP   IL    $IC           R   EXIT                                                 0060010
                       1LAA0070 00B1IA1   ,LOAD INDIRECT AC S.L.                   00004000060US      0070000
13265  42171   IA1    SP   DL    $IC             STORE Y+1 IN $IC                                     0070001
13266  75562          LA   IL    $AL             LOAD A WITH CONTENTS OF ADDRESS IN $AL               0070002
13267  50162          SA   DL    $AL             STORE IN $AL                                         0070003
13270  62571          LP   IL    $IC           R EXIT                                                 0070004
                       1LAA0080 00B2IA2   ,LOAD INDIRECT AC D.L.                   00006000084US      0080000
13271  42171   IA2    SP   DL    $IC             STORE Y+1 IN $IC                                     0080001
13272  75562          LA   IL    $AL             LOAD A WITH CONTENTS OF ADDRESS IN $AL               0080002
13273  50162          SA   DL    $AL             STORE IN $AL                                         0080003
13274  75200          LA   DP C  NO              LOAD SECOND HALF OF WORD                             0080004
13275  50163          SA   DL    $AR             STORE IN $AR                                         0080005
13276  62571          LP   IL    $IC           R EXIT                                                 0080006
                       1LAA0090 01B1LQ1   ,LOAD MQ S.L.                            00004000054US      0090000
13277  60600   LQ1    NO   IP C  NO              LOAD E WITH (G)                                      0090001
13300  52163          SE   DL    $AR             STORE E IN MQ(AR)                                    0090002
13301  42171          SP   DL    $IC             STORE P IN IC                                        0090003
13302  62200          LP   DP C  NO            R EXIT                                                 0090004
                       1LAA0100 01B2LQ2   ,LOAD MQ D.L.                            00006000078US      0100000
13303  60600   LQ2    NO   IP C  NO              LOAD E WITH (G)MS                                    0100001
13304  52166          SE   DL    $QL             STORE E IN QL(MQ)                                    0100002
13305  42171          SP   DL    $IC             STORE P IN IC                                        0100003
13306  60300          NO   DA C  NO              LOAD E WITH (G)LS                                    0100004
13307  52167          SE   DL    $QR             STORE E IN QL (MQ)                                   0100005
13310  62300          LP   DA C  NO            R EXIT                                                 0100006
                       1LAB0110 01B1ST1   ,STORE ACCUMULATOR S.L.                  00004000054US      0110000
13311  75162   ST1    LA   DL    $AL             LOAD A WITH AC                                       0110001
13312  52600          SE   IP C  NO              STORE A IN (G)                                       0110002
13313  42171          SP   DL    $IC             STORE P IN IC                                        0110003
13314  62200          LP   DP C  NO            R EXIT                                                 0110004
                       1LAB0120 01B2ST2   ,STORE ACCUMULATOR D.L.                  00006000078US      0120000
13315  75162   ST2    LA   DL    $AL             LOAD A WITH AC (MS)                                  0120001
13316  52600          SE   IP C  NO              STORE A IN (G)                                       0120002
13317  42171          SP   DL    $IC             STORE P IN IC                                        0120003
13320  60163          NO   DL    $AR             LOAD E WITH AC (LS)                                  0120004
13321  52300          SE   DA C  NO              STORE E IN (G+1)                                     0120005
13322  62300          LP   DA C  NO            R EXIT                                                 0120006
                       1LAB0130 01B1SQ1   ,STORE MQ S.L.                           00004000054US      0130000
13323  75163   SQ1    LA   DL    $AR             LOAD A WITH MQ (AR)                                  0130001
```

```
13324  52600          SE   IP C  NO              STORE A IN (G)                                    0130002
13325  42171          SP   DL    $IC             STORE P IN IC                                     0130003
13326  62200          LP   DP C  NO          R   EXIT                                            0130004
                      1LA80140 01B2SQ2   ,STORE MQ D.L.                  00006000078US           0140000
13327  75166   SQ2    LA   DL    $QL             LOAD A WITH MQ (MS)                               0140001
13330  52600          SE   IP C  NO              STORE A IN (G)                                    0140002
13331  42171          SP   DL    $IC             STORE P IN IC                                     0140003
13332  60167          NO   DL    $QR             LOAD E WITH MQ (LS)                               0140004
13333  52300          SE   DA C  NO              STORE E IN (G+1)                                  0140005
13334  62300          LP   DA C  NO          R   EXIT                                            0140006
                      1LAC0670 03L MVN   ,MOVE                                 00008108+12US       0670000
13335  75210   MVN    LA   DP C  LT              LOAD A AND T WITH G                               0670001
13336  60200          NO   DP C  NO              LOAD E WITH H                                     0670002
13337  52171          SE   DL    $IC             STORE H IN $IC TEMPORARILY                        0670003
13340  73200          AS   DP C  NO              ADD G AND N                                       0670004
13341  67064          CC   DM B  AT              COMPLEMENT G+N,EXCHANGE A AND T                   0670005
13342  47171          RP   DL    $IC             STORE Y+4 IN $IC,LOAD P WITH H                    0670006
13343  32603          MV   IP    NV                                                                0670007
13344  62571          LP   IL    $IC         R                                                     0670008
                      1LAD0150 01B2SZ1   ,STORE ZERO S.L.                  00003000042US           0150000
13345  44600   SZ1    ZE   IP C  NO              CLEAR (G)                                         0150001
13346  42171          SP   DL    $IC             STORE Y+2 IN $IC                                  0150002
13347  62200          LP   DP C  NO          R   EXIT                                            0150003
                      1LAD0160 01B1SZ2   ,STORE ZERO D.L.                  00004000054US           0160000
13350  44600   SZ2    ZE   IP C  NO              CLEAR (G)                                         0160001
13351  42171          SP   DL    $IC             STORE Y+2 IN $IC                                  0160002
13352  44300          ZE   DA C  NO              CLEAR (G+1)                                       0160003
13353  62300          LP   DA C  NO          R   EXIT                                            0160004
                      1LAE0650 0 D BBD   ,BINARY TO BCD                        00043000983US           0650000
13354  42171   BBD    SP   DL    $IC                                                               0650001
13355  75162          LA   DL    $AL                                                               0650002
13356  62163          LP   DL    $AR                                                               0650003
13357  67007          CC   DM    CC                                                                0650004
13360  54360          OCT        54360           DECIMAL 10,000                                    0650005
13361  05077          DV   DM D  15                                                               0650006
13362  11001          SO   DM S  R1                                                               0650007
13363  42113          SP   DL    $T1                                                               0650008
13364  47400          RP   IM    NO                                                                0650009
13365  13377          PZE        BBDR                                                              0650010
13366  50163          SA   DL    $AR                                                               0650011
13367  62114          LP   DL    $T2                                                               0650012
13370  42162          SP   DL    $AL                                                               0650013
13371  75113          LA   DL    $T1                                                               0650014
13372  47400          RP   IM    NO                                                                0650015
13373  13377          PZE        BBDR                                                              0650016
```

```
13374  11061          SO   DM D  L1                                          0650017
13375  54162          ME   DL    $AL                                         0650018
13376  62571          LP   IL    $IC          R  EXIT                        0650019
13377  13402  BBDR    PZE        BBDC                                        0650020
13400  47400  BBDX    RP   IM    NO                                          0650021
13401  13377          PZE        BBDR                                        0650022
13402  44062  BBDC    ZE   DM B  LP                                          0650023
13403  60000          NO   DM    NO                                          0650024
13404  54000          OCT        54000          -10 SCALED 4                 0650025
13405  05072          DV   DM D  10                                          0650026
13406  03024          SC   DM S  L4                                          0650027
13407  51114          HA   DL    $T2                                         0650028
13410  44060          ZE   DM B  NO                                          0650029
13411  55066          RA   DM B  AP                                          0650030
13412  05072          DV   DM D  10                                          0650031
13413  11007          SO   DM S  R7                                          0650032
13414  54114          ME   DL    $T2                                         0650033
13415  75006          LA   DM    AP                                          0650034
13416  54000          OCT        54000                                       0650035
13417  44060          ZE   DM B  NO                                          0650036
13420  43060          HP   DM B  NO                                          0650037
13421  05072          DV   DM D  10                                          0650038
13422  03043          SC   DM D  R3                                          0650039
13423  74114          MA   DL    $T2                                         0650040
13424  42114          SP   DL    $T2                                         0650041
13425  20020          BR   DM    UN                                          0650042
13426  13400          PZE        BBDX                                        0650043
                    1LAE0660 00B2BBN   ,BCD TO BINARY          00067000945US 0660000
13427  42171  BBN     SP   DL    $IC                                         0660001
13430  67015          CC   DM    LA                                          0660002
13431  77417          OCT        77417                                       0660003
13432  56163          DX   DL    $AR                                         0660004
13433  50062          SA   DM B  LP                                          0660005
13434  11043          SO   DM D  R3                                          0660006
13435  11022          SO   DM S  L2                                          0660007
13436  42073          SP   DM B  AS                                          0660008
13437  66015          AP   DM    LA                                          0660009
13440  77760          OCT        77760                                       0660010
13441  56163          DX   DL    $AR                                         0660011
13442  42073          SP   DM B  AS                                          0660012
13443  50113          SA   DL    $T1          2 L.S. CHAR                    0660013
13444  75162          LA   DL    $AL                                         0660014
13445  62163          LP   DL    $AR                                         0660015
13446  11041          SO   DM D  R1                                          0660016
13447  50162          SA   DL    $AL                                         0660017
```

```
13450  66060          AP    DM B  NO                                        0660018
13451  11007          SO    DM S  R7                                        0660019
13452  50163          SA    DL    $AR                                       0660020
13453  75000          LA    DM    NO                                        0660021
13454  00017          OCT         00017                                     0660022
13455  56163          DX    DL    $AR                                       0660023
13456  50062          SA    DM B  LP                                        0660024
13457  11043          SO    DM D  R3                                        0660025
13460  11022          SO    DM S  L2                                        0660026
13461  42073          SP    DM B  AS                                        0660027
13462  73163          AS    DL    $AR                                       0660028
13463  62000          LP    DM    NO                                        0660029
13464  00144          PZE         100                                       0660030
13465  55113          RA    DL    $T1                                       0660031
13466  15057          MP    DM D  15                                        0660032
13467  42163          SP    DL    $AR                                       0660033
13470  75000          LA    DM    NO          LAST THREE CHAR.              0660034
13471  77417          OCT         77417                                     0660035
13472  56162          DX    DL    $AL                                       0660036
13473  50062          SA    DM B  LP                                        0660037
13474  11043          SO    DM D  R3                                        0660038
13475  11022          SO    DM S  L2                                        0660039
13476  42073          SP    DM B  AS                                        0660040
13477  66015          AP    DM    LA                                        0660041
13500  77760          OCT         77760                                     0660042
13501  56162          DX    DL    $AL                                       0660043
13502  42073          SP    DM B  AS                                        0660044
13503  50113          SA    DL    $T1         2 MIDDLE CHAR.                0660045
13504  75162          LA    DL    $AL                                       0660046
13505  11010          SO    DM S  R8                                        0660047
13506  50162          SA    DL    $AL                                       0660048
13507  75000          LA    DM    NO                                        0660049
13510  00017          OCT         00017                                     0660050
13511  56162          DX    DL    $AL                                       0660051
13512  50062          SA    DM B  LP                                        0660052
13513  11043          SO    DM D  R3                                        0660053
13514  11022          SO    DM S  L2                                        0660054
13515  42073          SP    DM B  AS                                        0660055
13516  73162          AS    DL    $AL                                       0660056
13517  62000          LP    DM    NO                                        0660057
13520  00144          PZE         100                                       0660058
13521  55113          RA    DL    $T1                                       0660059
13522  15057          MP    DM D  15                                        0660060
13523  75000          LA    DM    NO                                        0660061
13524  23420          OCT         23420       DECIMAL 10,000                0660062
```

```
13525  55163          RA   DL     $AR                                                    0660063
13526  15057          MP   DM D   15                                                     0660064
13527  42163          SP   DL     $AR                                                    0660065
13530  50162          SA   DL     $AL                                                    0660066
13531  62571          LP   IL     $IC          R  EXIT                                   0660067
                    1LAZ0170 00B1EX1   ,EXCHANGE S.L.                 00005000060US     0170000
13532  42171   EX1    SP   DL     $IC               STORE Y+1 INTO $IC1                  0170001
13533  75162          LA   DL     $AL               LOAD $AL INTO A                      0170002
13534  55163          RA   DL     $AR               $AL TO $AR AND $AR TO A              0170003
13535  50162          SA   DL     $AL               STORE $AR INTO $AL                   0170004
13536  62200          LP   DP C   NO            R  EXIT TO Y+1                          0170005
                    1LAZ0180 00B2EX2   ,EXCHANGE D.L.                 00008000096US     0180000
13537  42171   EX2    SP   DL     $IC               STORE Y+1 INTO $IC1                  0180001
13540  75162          LA   DL     $AL               LOAD $AL INTO A                      0180002
13541  55166          RA   DL     $QL               $AL INTO $QL AND $QL TO A            0180003
13542  50162          SA   DL     $AL               STORE $QL INTO $AL                   0180004
13543  75163          LA   DL     $AR               LOAD A WITH $AR                      0180005
13544  55167          RA   DL     $QR               $AR INTO $QR AND $QR TO A            0180006
13545  50163          SA   DL     $AR               STORE $QR INTO $AR                   0180007
13546  62200          LP   DP C   NO            R  EIXT TO Y+1                          0180008
                    1LBA0190 01B1AD1   ,ADD S.L.                       00005000066US     0190000
13547  60615   AD1    NO   IP C   LA               LOAD A WITH (G)                      0190001
13550  42171          SP   DL     $IC               STORE P IN $IC                       0190002
13551  73162          AS   DL     $AL               ADD (G)+AC                           0190003
13552  50162          SA   DL     $AL               STORE A IN AC                        0190004
13553  62200          LP   DP C   NO            R  EXIT                                 0190005
                    1LBA0200 01B2AD2   ,ADD D.L.                       00009000114US     0200000
13554  60610   AD2    NO   IP C   LT               LOAD T WITH (G)MS                    0200001
13555  42171          SP   DL     $IC               STORE P IN IC                        0200002
13556  75300          LA   DA C   NO               LOAD A WITH (G)LS                    0200003
13557  63163          AL   DL     $AR               ADD (G)LS+AR                         0200004
13560  50163          SA   DL     $AR               STORE A IN AR                        0200005
13561  64411          AT   IM C   AM               (G)MS TO A, ADD AL                   0200006
13562  00062          PZE        $AL                                                    0200007
13563  50162          SA   DL     $AL               STORE A IN AL                        0200008
13564  62571          LP   IL     $IC          R  EXIT                                   0200009
                    1LBB0210 01B1SB1   ,SUBTRACT S.L.                  00006000078US     0210000
13565  60615   SB1    NO   IP C   LA               LOAD A WITH (G)                      0210001
13566  42171          SP   DL     $IC               STORE P IN $IC                       0210002
13567  65060          CS   DM B   NO               2S COMPLEMENT OF (G)                 0210003
13570  71162          AM   DL     $AL               ADD -(G)+AC                          0210004
13571  50162          SA   DL     $AL               STORE A IN AC                        0210005
13572  62200          LP   DP C   NO            R  EXIT                                 0210006
                    1LBB0220 01B2SB2   ,SUBTRACT D.L.                  00009000120US     0220000
13573  60610   SB2    NO   IP C   LT               LOAD T WITH (G)MS                    0220001
```

```
 13574  42171            SP    DL     $IC                   STORE P IN IC                              0220002
 13575  75305            LA    DA C   CS                    LOAD A WITH -(G)LS                         0220003
 13576  61163            AI    DL     $AR                   ADD (G)LS+AR                               0220004
 13577  50163            SA    DL     $AR                   STORE A IN AR                              0220005
 13600  64077            AT    DM B   CH                    LOAD A WITH (G)MS FROM T                   0220006
 13601  71162            AM    DL     $AL                   ADD (G)MS+AL                               0220007
 13602  50162            SA    DL     $AL                   STORE A IN AL                              0220008
 13603  62571            LP    IL     $IC                 R EXIT                                       0220009
                          1LBC0230 01B1MP1    ,MULTIPLY S.L.                          00023000168US    0230000
 13604  67215   MP1      CC    DP C   LA                    CLEAR CARRY, LOAD A WITH G                 0230001
 13605  42171            SP    DL     $IC                   STORE P IN $IC                             0230002
 13606  75300            LA    DA C   NO                    LOAD A WITH (G)                            0230003
 13607  44062            ZE    DM B   LP                    CLEAR P                                    0230004
 13610  20034            BR    DM     AN                    BRANCH IF (G) NEGATIVE                     0230005
 13611  13617            PZE          MP1B                                                             0230006
 13612  66162   MP1A     AP    DL     $AL                   LOAD $AL IN E, EXCHANGE A AND P            0230007
 13613  17056            MS    DM D   14                    MULTIPLY                                   0230008
 13614  50162            SA    DL     $AL                   STORE                                      0230009
 13615  42163            SP    DL     $AR                   STORE                                      0230010
 13616  62571            LP    IL     $IC                 R EXIT                                       0230011
 13617  55162   MP1B     RA    DL     $AL                   LOAD $AL IN A, STORE (G) IN $AL            0230012
 13620  20035            BR    DM     AP                    BRANCH IF $AL POSITIVE                     0230013
 13621  13612            PZE          MP1A                                                             0230014
 13622  67066            CC    DM B   AP                    LOAD (G PRIME) IN P ZERO IN A              0230015
 13623  55162            RA    DL     $AL                   LOAD $AL IN A, ZERO IN E                   0230016
 13624  65241            CS    DP N   AI                    LOAD + $AL IN A                            0230017
 13625  55060            RA    DM B   NO                    ZERO TO A, + $AL TO E                      0230018
 13626  15056            MP    DM D   14                    MULTIPLY                                   0230019
 13627  50162            SA    DL     $AL                   STORE                                      0230020
 13630  42163            SP    DL     $AR                   STORE                                      0230021
 13631  62571            LP    IL     $IC                 R EXIT                                       0230022
                          1LBC0240 01B2MP2    ,MULTIPLY D.L.                          00073000627US    0240000
 13632  60610   MP2      NO    IP C   LT                                                               0240001
 13633  52113            SE    DL     $T1                                                              0240002
 13634  42171            SP    DL     $IC                                                              0240003
 13635  60304            NO    DA C   AT                                                               0240004
 13636  52114            SE    DL     $T2                                                              0240005
 13637  50121            SA    DL     $T7                                                              0240006
 13640  20035            BR    DM     AP                                                               0240007
 13641  13651            PZE          MP2A                                                             0240008
 13642  75114            LA    DL     $T2                                                              0240009
 13643  65001            CS    DM C   AI                                                               0240010
 13644  00000            PZE          0                                                                0240011
 13645  51114            HA    DL     $T2                                                              0240012
 13646  55113            RA    DL     $T1                                                              0240013
```

```
13647  77061          CH    DM B  AI                    0240014
13650  50113          SA    DL    $T1                   0240015
13651  75162  MP2A    LA    DL    $AL                   0240016
13652  20035          BR    DM    AP                    0240017
13653  13667          PZE         MP2B                  0240018
13654  75000          LA    DM C  NO                    0240019
13655  40000          OCT         40000                 0240020
13656  73121          AS    DL    $T7                   0240021
13657  50121          SA    DL    $T7                   0240022
13660  75163          LA    DL    $AR                   0240023
13661  65001          CS    DM C  AI                    0240024
13662  00000          PZE         0                     0240025
13663  51163          HA    DL    $AR                   0240026
13664  55162          RA    DL    $AL                   0240027
13665  77061          CH    DM B  AI                    0240028
13666  50162          SA    DL    $AL                   0240029
13667  75113  MP2B    LA    DL    $T1                   0240030
13670  62114          LP    DL    $T2                   0240031
13671  11061          SO    DM D  L1                    0240032
13672  50113          SA    DL    $T1                   0240033
13673  42114          SP    DL    $T2                   0240034
13674  67015          CC    DM C  LA                    0240035
13675  00000          PZE         0                     0240036
13676  60163          NO    DL    $AR                   0240037
13677  15057          MP    DM D  15                    0240038
13700  42167          SP    DL    $QR                   0240039
13701  62113          LP    DL    $T1                   0240040
13702  60163          NO    DL    $AR                   0240041
13703  15057          MP    DM D  15                    0240042
13704  55114          RA    DL    $T2                   0240043
13705  66162          AP    DL    $AL                   0240044
13706  15057          MP    DM D  15                    0240045
13707  42166          SP    DL    $QL                   0240046
13710  62113          LP    DL    $T1                   0240047
13711  60162          NO    DL    $AL                   0240048
13712  15057          MP    DM D  15                    0240049
13713  66114          AP    DL    $T2                   0240050
13714  63060          AL    DM B  NO                    0240051
13715  66011          AP    DM C  AM                    0240052
13716  00000          PZE         0                     0240053
13717  50162          SA    DL    $AL                   0240054
13720  42163          SP    DL    $AR                   0240055
13721  75121          LA    DL    $T7                   0240056
13722  20034          BR    DM    AN                    0240057
13723  13725          PZE         MP2C                  0240058
```

```
13724  62571          LP   IL     $IC              R                                                 0240059
13725  75167   MP2C   LA   DL     $QR                                                                0240060
13726  65001          CS   DM C   AI                                                                 0240061
13727  00000          PZE         C                                                                  0240062
13730  51167          HA   DL     $QR                                                                0240063
13731  55166          RA   DL     $QL                                                                0240064
13732  77061          CH   DM B   AI                                                                 0240065
13733  51166          HA   DL     $QL                                                                0240066
13734  55163          RA   DL     $AR                                                                0240067
13735  77061          CH   DM B   AI                                                                 0240068
13736  51163          HA   DL     $AR                                                                0240069
13737  55162          RA   DL     $AL                                                                0240070
13740  77071          CH   DM B   AM                                                                 0240071
13741  50162          SA   DL     $AL                                                                0240072
13742  62571          LP   IL     $IC              R  EXIT                                           0240073
                       1LBD0250 01B1DV1    ,DIVIDE S.L.                            00046000180US    0250000
13743  60615   DV1    NO   IP C   LA                  LOAD A WITH (G)                               0250001
13744  42171          SP   DL     $IC                 STORE P IN IC                                 0250002
13745  20034          BR   DM     AN                  IF (G) NEGATIVE GO TO DV1B                    0250003
13746  13764          PZE         DV1B                                                              0250004
13747  65001          CS   DM C   AI                   FORM TWO,S COMPLEMENT                        0250005
13750  00000          PZE         0                                                                 0250006
13751  50113          SA   DL     $T1                 STORE (G) IN TEMP                             0250007
13752  75162          LA   DL     $AL                 LOAD A WITH AC                                0250008
13753  62163          LP   DL     $AR                 LOAD P WITH MQ(AR)                            0250009
13754  20034          BR   DM     AN                  IF AC NEGATIVE, GO TO DV1D                    0250010
13755  14013          PZE         DV1D                                                              0250011
13756  60113   DV1A   NO   DL     $T1                 LOAD E FROM TEMP                              0250012
13757  67067          CC   DM B   CC                     CLEAR CARRY                                0250013
13760  05076          DV   DM D   14                  DIVIDE                                        0250014
13761  42162          SP   DL     $AL                 STORE QUOTIENT IN AC                          0250015
13762  50163          SA   DL     $AR                 STORE REMAINDER IN MQ                         0250016
13763  62571          LP   IL     $IC              R  EXIT                                          0250017
13764  50113   DV1B   SA   DL     $T1                 STORE (G) IN TEMP, (G) NEGATIVE               0250018
13765  75162          LA   DL     $AL                 LOAD A WITH AC                                0250019
13766  20035          BR   DM     AP                  IF AC POSITIVE, GO TO DV1C                    0250020
13767  14000          PZE         DV1C                                                              0250021
13770  75163          LA   DL     $AR                 LOAD A WITH MQ                                0250022
13771  65001          CS   DM C   AI                   FORM TWO,S COMPLEMENT                        0250023
13772  00000          PZE         0                                                                 0250024
13773  66075          AP   DM B   LA                  EXCHANGE A AND P, CLEAR A                     0250025
13774  55162          RA   DL     $AL                  LOAD A WITH AC, CLEAR E                      0250026
13775  77071          CH   DM B   AM                  COMPLEMENT A, HOLD CARRY, ADD                 0250027
13776  20020          BR   DM     UN                  GO TO DV1A, (G) AND AC BOTH NEGATIVE          0250028
13777  13756          PZE         DV1A                                                              0250029
```

```
14000  62163  DV1C   LP   DL     $AR          LOAD P WITH MQ, (G) NEGATIVE, AC POSITIVE   0250030
14001  60113         NO   DL     $T1          LOAD E WITH (G)                             0250031
14002  67067         CC   DM B   CC             CLEAR CARRY                               0250032
14003  05076         DV   DM D   14           DIVIDE                                      0250033
14004  44065         ZE   DM B   CS           CLEAR E, COMPLEMENT A, SET CARRY            0250034
14005  61060         AI   DM B   NO           FORM TWOS COMPLEMENT                        0250035
14006  66065         AP   DM B   CS           EXCHANGE A AND P, COMP. A, SET CARRY        0250036
14007  71060         AM   DM B   NO           FORM TWOS COMPLEMENT                        0250037
14010  50162         SA   DL     $AL          STORE A IN AC                               0250038
14011  42163         SP   DL     $AR          STORE P IN MQ                               0250039
14012  62571         LP   IL     $IC        R EXIT                                       0250040
14013  66065  DV1D   AP   DM B   CS           EXCHANGE A AND P,COMP. A,SET CY,(G)+,AC-    0250041
14014  44061         ZE   DM B   AI           CLEAR E, FORM TWOS COMPLEMENT               0250042
14015  66077         AP   DM B   CH           EXCHANGE A AND P, COMP. A, HOLD CARRY       0250043
14016  71060         AM   DM B   NO           FORM TWOS COMPLEMENT                        0250044
14017  20020         BR   DM     UN           GO TO DV1C+1,(G)+,AC-                       0250045
14020  14001         PZE           DV1C+1                                                 0250046
                      1LBD0260 01B2DV2   ,DIVIDE D.L.                 00148001062US     0260000
14021  20031  DV2    BR   DM     OV           TURN OFF MACHINE OVFL.                      0260001
14022  14023         PZE           *+1                                                    0260002
14023  60610         NO   IP C   LT           LOAD T WITH (G)                             0260003
14024  42171         SP   DL     $IC          STORE P IN IC                               0260004
14025  60300         NO   DA     NO           LOAD E WITH (G+1)                           0260005
14026  62064         LP   DM B   AT           LOAD P WITH (G+1), LOAD A WITH (G)          0260006
14027  44121         ZE   DL     $T7          CLEAR T7                                    0260007
14030  20035         BR   DM     AP           BRANCH TO DV2A IF (G) POSITIVE              0260008
14031  14040         PZE           DV2A                                                   0260009
14032  60176         NO   DL     $ONE                                                     0260010
14033  52121         SE   DL     $T7          STORE 1 IN T7                               0260011
14034  66065         AP   DM B   CS           COMPLEMENT (G+1)                            0260012
14035  44061         ZE   DM B   AI                                                      0260013
14036  66077         AP   DM B   CH           COMPLEMENT (G)                              0260014
14037  71060         AM   DM B   NO                                                      0260015
14040  01077  DV2A   FL   DM D   L15          FLOAT THE DIVISOR-(G) AND (G+1)             0260016
14041  51113         HA   DL     $T1          FLOAT COMMAND TO A DIVISOR (MS) TO T1       0260017
14042  42114         SP   DL     $T2          STORE DIVISOR (LS)                          0260018
14043  67067         CC   DM B   CC                                                      0260019
14044  20427         BR   IM     NQ           BRANCH IF FLOATED LESS THAN 15              0260020
14045  76717         OCT           76717                                                  0260021
14046  14104         PZE           DV2F                                                   0260022
14047  75162         LA   DL     $AL          ACCUM TO A                                  0260023
14050  62163         LP   DL     $AR          ACCUM AND P                                 0260024
14051  01077         FL   DM D   L15          EXECUTE FLOAT                               0260025
14052  51162         HA   DL     $AL          FLOAT COMMAND TO A SHIFTED AC TO AL         0260026
14053  63000         AL   DM C   NO           ADD MAX POS MINUS FL/DM/D/LQ                0260027
```

```
14054  36717           OCT         36717                                                     0260028
14055  20034           BR    DM    AN                  EXIT IF OVERFLOW                      0260029
14056  14077           PZE         DV2X                                                      0260030
14057  60166           NO    DL    $QL                 QL GOES TO                            0260031
14060  52163           SE    DL    $AR                 AR                                    0260032
14061  60167           NO    DL    $QR                 QR GOES TO                            0260033
14062  52166           SE    DL    $QL                 QL                                    0260034
14063  44167           ZE    DL    $QR                 ZERO TO QR                            0260035
14064  75113           LA    DL    $T1                 DIVISOR TO A                          0260036
14065  62114           LP    DL    $T2                 AND P                                 0260037
14066  01077           FL    DM D  L15                 FLOAT DIVISOR                         0260038
14067  51113           HA    DL    $T1                 FLOAT COMMAND TO A DIVISOR (MS) TO T1 0260039
14070  42114           SP    DL    $T2                 STORE DIVISOR (LS)                    0260040
14071  65011           CS    DM C  AM                  FIND PLACES FLOATED                   0260041
14072  01077           OCT         1077                                                      0260042
14073  67067           CC    DM B  CC                                                        0260043
14074  20427           BR    IM    NO                  BRANCH IF NO DIVIDE CHECK             0260044
14075  77760           OCT         77760                                                     0260045
14076  14106           PZE         DV2I                                                      0260046
14077  60176    DV2X   NO    DL    $ONE                                                      0260047
14100  52175           SE    DL    $DK                 SET DIVIDE CHECK                      0260048
14101  20031           BR    DM    OV                                                        0260049
14102  14103           PZE         *+1                                                       0260050
14103  62571           LP    IL    $IC           R     EXIT                                  0260051
14104  65011    DV2F   CS    DM C  AM                  FIND PLACES FLOATED                   0260052
14105  01077           OCT         1077                                                      0260053
14106  20024    DV2I   BR    DM    AZ                                                        0260054
14107  14141           PZE         DV2AA                                                     0260055
14110  50115           SA    DL    $T3                 STORE IN T3                           0260056
14111  73000           AS    DM C  NO                  FORM FLOAT AND SHIFT COMMANDS         0260057
14112  01060           FL    DM D  L0                                                        0260058
14113  50400           SA    IM C  NO                  STORE FLOAT COMMAND                   0260059
14114  14125           PZE         DV2G                                                      0260060
14115  76000           XA    DM C  NO                  GET COMPLEMENT OF PLACES FLOATED      0260061
14116  00017           OCT         17                                                        0260062
14117  73000           AS    DM C  NO                                                        0260063
14120  11040           SO    DM D  R0                                                        0260064
14121  50400           SA    IM C  NO                  STORE SHIFT COMMAND                   0260065
14122  14136           PZE         DV2H                                                      0260066
14123  75162           LA    DL    $AL                 AC (MS) TO A                          0260067
14124  62163           LP    DL    $AR                 AC (LS) TO P                          0260068
14125  01060    DV2G   FL    DM D  L0                  EXECUTE FLOAT COMMAND                 0260069
14126  51162           HA    DL    $AL                 FLOAT COMMAND TO A SHIFTED AC TO AL   0260070
14127  42163           SP    DL    $AR                                                       0260071
14130  63000           AL    DM C  NO                  ADD MAX POS MINUS FL/DM/D/L0          0260072
```

```
14131  36717           OCT           36717                                                    0260073
14132  20034           BR    DM      AN         EXIT IF OVERFLOW                              0260074
14133  14077           PZE           DV2X                                                     0260075
14134  75166           LA    DL      $QL        MQ (MS) TO A                                  0260076
14135  62167           LP    DL      $QR        MQ (LS) TO P                                  0260077
14136  11040   DV2H    SO    DM D    R0         EXECUTE SHIFT COMMAND                         0260078
14137  54163           ME    DL      $AR        MERGE A AND AR                                0260079
14140  42166           SP    DL      $QL        STORE P IN QL                                 0260080
14141  75113   DV2AA   LA    DL      $T1        TAKE TWOS COMPLEMENT OF DIVISOR (MS)          0260081
14142  65011           CS    DM C    AM                                                       0260082
14143  00000           PZE           0                                                        0260083
14144  50113           SA    DL      $T1                                                      0260084
14145  75162           LA    DL      $AL                                                      0260085
14146  20035           BR    DM      AP         IF POSITIVE GO TO DV2B                        0260086
14147  14164           PZE           DV2B                                                     0260087
14150  75166           LA    DL      $QL                                                      0260088
14151  65001           CS    DM      AI                                                       0260089
14152  00000           PZE           0                                                        0260090
14153  51166           HA    DL      $QL                                                      0260091
14154  55163           RA    DL      $AR                                                      0260092
14155  77061           CH    DM B    AI                                                       0260093
14156  51163           HA    DL      $AR                                                      0260094
14157  55162           RA    DL      $AL                                                      0260095
14160  77071           CH    DM B    AM                                                       0260096
14161  55121           RA    DL      $T7                                                      0260097
14162  73176           AS    DL      $ONE                                                     0260098
14163  55121           RA    DL      $T7                                                      0260099
14164  62163   DV2B    LP    DL      $AR        LOAD P WITH AR                                0260100
14165  60113           NO    DL      $T1                                                      0260101
14166  67067           CC    DM B    CC         CLEAR CARRY                                   0260102
14167  05076           DV    DM D    14         DIVIDE BY DIVISOR (MS)                        0260103
14170  42162           SP    DL      $AL        STORE QUOT IN AL                              0260104
14171  62166           LP    DL      $QL        LOAD P WITH THIRD TERM                        0260105
14172  11041   DV2P    SO    DM D    R1         SHIFT BOTH RIGHT 1                            0260106
14173  60113           NO    DL      $T1                                                      0260107
14174  05077           DV    DM D    15         DIVIDE BY DIVISOR (MS)                        0260108
14175  42163           SP    DL      $AR        STORE QUOTIENT IN AR                          0260109
14176  75114           LA    DL      $T2        LOAD A WITH DIVISOR (LS)                      0260110
14177  20024           BR    DM      AZ         IF ZERO, GO TO DV2C, SKIP MIDDLE TERM         0260111
14200  14225           PZE           DV2C                                                     0260112
14201  44062           ZE    DM B    LP         CLEAR P                                       0260113
14202  11041           SO    DM D    R1         SHIFT DIVISOR (LS) RIGHT 1                    0260114
14203  60113           NO    DL      $T1                                                      0260115
14204  05076           DV    DM D    14         DIVIDE BY DIVISOR (MS)                        0260116
14205  44075           ZE    DM B    LA         ZERO A REGISTER                               0260117
```

```
14206  60162          NO   DL    $AL          LOAD E WITH FIRST TERM QUOTIENT                    0260118
14207  15057          MP   DM D  15           MULTIPLY MIDDLE TERMS                              0260119
14210  03062          SC   DM D  L2           SCALE                                              0260120
14211  66001          AP   DM C  AI                                                              0260121
14212  40000          OCT       40000                                                           0260122
14213  66001          AP   DM C  AI                                                              0260123
14214  00000          PZE       0                                                               0260124
14215  65060          CS   DM B  NO                                                            0260125
14216  61163          AI   DL    $AR          ADD LAST TERM                                      0260126
14217  50163          SA   DL    $AR          STORE RESULT                                       0260127
14220  66077          AP   DM B  CH           COMPLEMENT HIGH ORDER BIT                          0260128
14221  76017          XA   DM C  CH                                                            0260129
14222  00003          PZE       3                                                               0260130
14223  71162          AM   DL    $AL          FIRST TERM                                         0260131
14224  50162          SA   DL    $AL          STORE FINAL QUOT (MS)                              0260132
14225  75162  DV2C    LA   DL    $AL                                                            0260133
14226  20034          BR   DM    AN                                                             0260134
14227  14077          PZE       DV2X                                                           0260135
14230  75121          LA   DL    $T7                                                            0260136
14231  20021          BR   DM    AD           IF ODD SIGNS, BRANCH TO DV2D                       0260137
14232  14236          PZE       DV2D                                                           0260138
14233  20031          BR   DM    OV                                                             0260139
14234  14235          PZE       *+1                                                            0260140
14235  62571          LP   IL    $IC        R EXIT                                             0260141
14236  75163  DV2D    LA   DL    $AR          TAKE TWOS COMPLEMENT OF RESULT                     0260142
14237  65001          CS   DM C  AI                                                            0260143
14240  00000          PZE       0                                                              0260144
14241  51163          HA   DL    $AR                                                            0260145
14242  55162          RA   DL    $AL                                                            0260146
14243  77071          CH   DM B  AM                                                            0260147
14244  50162          SA   DL    $AL                                                            0260148
14245  20031          BR   DM    OV                                                             0260149
14246  14247          PZE       *+1                                                            0260150
14247  62571          LP   IL    $IC        R EXIT                                             0260151
                    1LCA0770 00B1SR1   ,SQUARE ROOT S.L.                 00049000606US          0770000
14250  42171  SR1     SP   DL    $IC          SAVE P-COUNTER                                     0770001
14251  44115          ZE   DL    $T3                                                            0770002
14252  75162          LA   DL    $AL          MOST SIGNIFICANT TO A                              0770003
14253  20024          BR   DM    AZ                                                             0770004
14254  14322          PZE       *+38                                                           0770005
14255  62163          LP   DL    $AR                                                            0770006
14256  01077          FL   DM D  L15                                                           0770007
14257  51113          HA   DL    $T1                                                            0770008
14260  20021          BR   DM    AD                                                             0770009
14261  14265          PZE       *+4                                                            0770010
```

```
14262 55113           RA  DL    $T1         HERE IF FLOATING SHIFT WERE ODD             0770011
14263 11041           SO  DM D  R1                                                      0770012
14264 55113           RA  DL    $T1                                                     0770013
14265 65011           CS  DM    AM                                                      0770014
14266 01077           OCT       01077       CONSTANT-- FL  DM D L15                     0770015
14267 11001           SO  DM S  R1                                                      0770016
14270 73000           AS  DM    NO          FORM FINAL SHIFT COMMAND                    0770017
14271 11041           OCT       11041                                                   0770018
14272 73115           AS  DL    $T3         COMMAND FORMED                              0770019
14273 50400           SA  IM    NO          STORE FINAL SHIFT COMMAND                   0770020
14274 14316           PZE       *+18                                                    0770021
14275 75113           LA  DL    $T1         MOST SIGNIFICANT FLOATED                    0770022
14276 13042           NR  DM D  R2          SCALE TO 2                                  0770023
14277 65011           CS  DM    AM          MAKE IT MINUS                               0770024
14300 63507           OCT       -14271      CONSTANT  -1.420756  SCALED 2.              0770025
14301 60000           NO  DM    NO          CONSTANT TO L                               0770026
14302 47642           OCT       47642       -B                                          0770027
14303 51067           HA  DM B  CC                                                      0770028
14304 05176           DV  DL D  14          B/C+X                                       0770029
14305 66011           AP  DM    AM          -Y1                                         0770030
14306 72050           OCT       72050       CONSTANT  -A SCALED -2                      0770031
14307 50114           SA  DL    $T2                                                     0770032
14310 67067           CC  DM B  CC                                                      0770033
14311 55113           RA  DL    $T1                                                     0770034
14312 05176           DV  DL D  14                                                      0770035
14313 66067           AP  DM B  CC          -X/Y                                        0770036
14314 61114           AI  DL    $T2         -Y2= -Y1-X/Y                                0770037
14315 67060           CC  DM B  NO                                                      0770038
14316 00000           PZE                   SHIFT COMMAND LOADED HERE                   0770039
14317 50162           SA  DL    $AL                                                     0770040
14320 42163           SP  DL    $AR                                                     0770041
14321 62571           LP  IL    $IC       R EXIT                                        0770042
14322 66000           AP  DM    NO                                                      0770043
14323 00006           PZE       6                                                       0770044
14324 52115           SE  DL    $T3         SET $T3 = 6                                 0770045
14325 55163           RA  DL    $AR                                                     0770046
14326 11042           SO  DM D  R2                                                      0770047
14327 20020           BR  DM    UN                                                      0770048
14330 14256           PZE       *-42                                                    0770049
                      1LCA0780 00B2SR2  ,SQUARE ROOT D.L.              00099002280US-   0780000
14331 42171     SR2   SP  DL    $IC         SAVE P-COUNTER                              0780001
14332 44123           ZE  DL    $T9                                                     0780002
14333 75162           LA  DL    $AL                                                     0780003
14334 20024           BR  DM    AZ          JUMP IF SCALING GREATER THAN 14             0780004
14335 14426           PZE       SR2A                                                    0780005
```

```
14336  62163          LP   DL    $AR                                        0780006
14337  01077  SR2C    FL   DM D  L15                                       0780007
14340  51162          HA   DL    $AL                                        0780008
14341  20021          BR   DM    AD      JUMP IF EVEN NU. SHIFTS            0780009
14342  14347          PZE        *+5                                        0780010
14343  73176          AS   DL    $ONE    COUNT-1 TO A                       0780011
14344  55162          RA   DL    $AL     SAVE COUNT, GET M.S. TO A          0780012
14345  11041          SO   DM D  R1                                         0780013
14346  55162          RA   DL    $AL                                        0780014
14347  65011          CS   DM    AM      2N                                 0780015
14350  01077          OCT        01077                                      0780016
14351  50113          SA   DL    $T1                                        0780017
14352  11001          SO   DM S  R1      N                                  0780018
14353  73123          AS   DL    $T9     N=FINAL SHIFTS                     0780019
14354  73000          AS   DM    NO      SHIFT COMMAND                      0780020
14355  11041          OCT        11041                                      0780021
14356  42163          SP   DL    $AR                                        0780022
14357  50400          SA   IM    NO      STORE SHIFT COMMAND                0780023
14360  14414          PZE        SR2B                                       0780024
14361  75113          LA   DL    $T1     2N                                 0780025
14362  65011          CS   DM    AM      SHIFT COMMAND                      0780026
14363  11057          OCT        11057                                      0780027
14364  55166          RA   DL    $QL                                        0780028
14365  52020          SE   DM H  NO      SAVE SHIFT COMMAND                 0780029
14366  00000          PZE                                                   0780030
14367  54163          ME   DL    $AR                                        0780031
14370  47400          RP   IM    NO                                         0780032
14371  17402          PZE        SR1SR                                      0780033
14372  50121          SA   DL    $T7                                        0780034
14373  75114          LA   DL    $T2                                        0780035
14374  50122          SA   DL    $T8                                        0780036
14375  47400          RP   IM    NO                                         0780037
14376  17632          PZE        DV2SR                                      0780038
14377  75162          LA   DL    $AL                                        0780039
14400  20035          BR   DM    AP                                         0780040
14401  14406          PZE        *+5                                        0780041
14402  75177          LA   DL    $MON                                       0780042
14403  62177          LP   DL    $MON                                       0780043
14404  20020          BR   DM    UN                                         0780044
14405  14413          PZE        SR2B-1                                     0780045
14406  75122          LA   DL    $T8                                        0780046
14407  63163          AL   DL    $AR                                        0780047
14410  66060          AP   DM B  NO                                         0780048
14411  75121          LA   DL    $T7                                        0780049
14412  61162          AI   DL    $AL                                        0780050
```

```
14413  42113          SP   DL    $T1                                           0780051
14414  00000   SR2B   PZE                                                      0780052
14415  50162          SA   DL    $AL                                           0780053
14416  42163          SP   DL    $AR                                           0780054
14417  75113          LA   DL    $T1                                           0780055
14420  60400          NO   IM    NO                                            0780056
14421  14414          PZE        *-5                                           0780057
14422  52020          SE   DM H  NO                                            0780058
14423  00000          PZE                                                      0780059
14424  42166          SP   DL    $QL                                           0780060
14425  62571          LP   IL    $IC           R                               0780061
14426  75000   SR2A   LA   DM    NO                                            0780062
14427  00007          OCT        7                                             0780063
14430  50123          SA   DL    $T9                                           0780064
14431  75166          LA   DL    $QL                                           0780065
14432  62167          LP   DL    $QR                                           0780066
14433  11041          SO   DM D  R1                                            0780067
14434  47166          RP   DL    $QL                                           0780068
14435  75163          LA   DL    $AR                                           0780069
14436  11041          SO   DM D  R1                                            0780070
14437  20020          BR   DM    UN                                            0780071
14440  14337          PZE        SR2C                                          0780072
                      1LCB0690 00B1SN1   ,SINE S.L.          0008100095lUS     0690000
14441  44113   SN1    ZE   DL    $T1            CLEAR T1                       0690001
14442  43171          HP   DL    $IC            CLEAR P,STORE P IN $IC         0690002
14443  75162          LA   DL    $AL            LOAD A WITH AC                 0690003
14444  20035          BR   DM    AP             IF POSITIVE, GO TO SN1A        0690004
14445  14452          PZE        SN1A                                          0690005
14446  50113          SA   DL    $T1            SET SIGN CONTROL.              0690006
14447  65011          CS   DM C  AM             COMPLEMENT AC                  0690007
14450  00000          PZE        0                                             0690008
14451  50162          SA   DL    $AL                                           0690009
14452  73000   SN1A   AS   DM C  NO             TEST FOR GREATER THAN PI.      0690010
14453  63336          OCT        63336           PI  3.1416                    0690011
14454  20034          BR   DM    AN             NO, GO TO SN1B                 0690012
14455  14463          PZE        SN1B                                          0690013
14456  50162          SA   DL    $AL            CHANGE SIGN OF INPUT           0690014
14457  75113          LA   DL    $T1                                           0690015
14460  63000          AL   DM C  NO                                            0690016
14461  40000          OCT        40000                                         0690017
14462  50113          SA   DL    $T1                                           0690018
14463  75162   SN1B   LA   DL    $AL            REDUCE TO PI/2.                0690019
14464  73000          AS   DM C  NO                                            0690020
14465  71557          OCT        71557          PI/2 SCALED 3                  0690021
14466  20034          BR   DM    AN             LESS THAN PI/2 IN -            0690022
```

```
14467 14475   PZE          *+6
14470 73000   AS   DM C    NO         REDUCE BY PI/2
14471 71557   OCT          71557      PI/2 SCALED 3
14472 65011   CS   DM C    AM
14473 00000   PZE          0
14474 50162   SA   DL      $AL
14475 75162   LA   DL      $AL
14476 67067   CC   DM B    CC         CLEAR CARRY
14477 66000   AP   DM C    NO         LOAD E WITH 2/PI
14500 24276   OCT          24276      2/PI
14501 15056   MP   DM D    14         MULTIPLY
14502 11063   SO   DM D    L3         SCALE TO 0.
14503 50162   SA   DL      $AL        NOW IN RADIANS X 2/PI
14504 44062   ZE   DM B    LP
14505 50066   SA   DM B    AP
14506 15056   MP   DM D    14
14507 50114   SA   DL      $T2        Y SQUARE
14510 62114   LP   DL      $T2
14511 44075   ZE   DM B    LA
14512 60000   NO   DM C    NO
14513 77720   DEC          -29804E-2   B7
14514 17056   MS   DM D    14         B7 X Y SQUARED
14515 73000   AS   DM C    NO         ADD B5
14516 01502   OCT          01502      B5  .05133
14517 44062   ZE   DM B    LP
14520 66114   AP   DL      $T2
14521 67067   CC   DM B    CC
14522 15056   MP   DM D    14         RESULT X Y SQUARED
14523 73000   AS   DM C    NO         ADD B3
14524 62657   DEC          -41123     B3
14525 66015   AP   DM C    LA
14526 00000   PZE          0
14527 47114   RP   DL      $T2
14530 67067   CC   DM B    CC
14531 17056   MS   DM D    14         RESULT X Y SQUARED
14532 73000   AS   DM C    NO         ADD ONE
14533 37777   OCT          37777
14534 44062   ZE   DM B    LP
14535 66162   AP   DL      $AL
14536 67067   CC   DM B    CC
14537 15056   MP   DM D    14         RESULT X Y
14540 67007   CC   DM C    CC
14541 53502   DEC          -63662
14542 05076   DV   DM D    14
14543 66162   AP   DL      $AL        EXCHANGE A P
```

```
14544  20035          BR   DM    AP
14545  14550          PZE        *+3                    IF RESULT IS NEGATIVE
14546  75000          LA   DM C  NO                     SET RESULT TO
14547  37777          OCT        37777                  ONE AND
14550  50162          SA   DL    $AL                    SAVE IN $AL
14551  75113          LA   DL    $T1
14552  20034          BR   DM    AN
14553  14555          PZE        *+2
14554  62571          LP   IL    $IC          R
14555  75162          LA   DL    $AL
14556  65011          CS   DM C  AM
14557  00000          PZE        0
14560  50162          SA   DL    $AL
14561  62571          LP   IL    $IC          R
                       1LCB0700 0082SN2   ,SINE D.L.                        00219005085US-
14562  44123   SN2    ZE   DL    $T9                    CLEAR T9
14563  42171          SP   DL    $IC                    STORE P IN IC
14564  75162          LA   DL    $AL                    LOAD A WITH AC
14565  20035          BR   DM    AP
14566  14577          PZE        SN2A
14567  50123          SA   DL    $T9                    SIGN CONTROL
14570  75163          LA   DL    $AR                    TAKE TWOS COMPLEMENT
14571  65001          CS   DM C  AI
14572  00000          PZE        0
14573  51163          HA   DL    $AR
14574  55162          RA   DL    $AL
14575  77071          CH   DM B  AM
14576  50162          SA   DL    $AL
14577  73000   SN2A   AS   DM C  NO                     TEST GREATER THAN PI
14600  63337          DEC        -31416E1B3
14601  20034          BR   DM    AN                     LESS THAN PI IF -
14602  14617          PZE        SN2B
14603  75123          LA   DL    $T9                     LESS THAN PI
14604  63000          AL   DM C  NO                     SIGN CONTROL
14605  40000          OCT        40000
14606  50123          SA   DL    $T9
14607  75163          LA   DL    $AR
14610  63000          AL   DM    NO                        LS PART OF -PI/
14611  01132          OCT        1132
14612  50163          SA   DL    $AR
14613  75162          LA   DL    $AL
14614  71000          AM   DM    NO                        MS PART OF -PI
14615  63336          OCT        63336
14616  50162          SA   DL    $AL
14617  75162   SN2B   LA   DL    $AL                    REDUCE TO PI/2
```

```
14620  73000          AS   DM C  NO                                          0700031
14621  71557          OCT       71557                                       0700032
14622  20034          BR   DM    AN        3RD QUAD. IF -                    0700033
14623  14641          PZE       SN2C                                        0700034
14624  75163          LA   DL    $AR                                         0700035
14625  63000          AL   DM    NO        LS PART OF -PI                    0700036
14626  01132          OCT       1132                                        0700037
14627  55162          RA   DL    $AL                                         0700038
14630  71000          AM   DM    NO        MS PART OF -PI                    0700039
14631  63336          OCT       63336                                       0700040
14632  55162          RA   DL    $AL                                         0700041
14633  65001          CS   DM C  AI        COMPLEMENT                        0700042
14634  00000          PZE       0                                           0700043
14635  51163          HA   DL    $AR                                         0700044
14636  55162          RA   DL    $AL                                         0700045
14637  77071          CH   DM B  AM                                          0700046
14640  50162          SA   DL    $AL                                         0700047
14641  75162  SN2C    LA   DL    $AL                                         0700048
14642  20035          BR   DM    AP                                          0700049
14643  14653          PZE       *+8                                         0700050
14644  75163          LA   DL    $AR                                         0700051
14645  65001          CS   DM C  AI                                          0700052
14646  00000          PZE       0                                           0700053
14647  51163          HA   DL    $AR                                         0700054
14650  55162          RA   DL    $AL                                         0700055
14651  77071          CH   DM B  AM                                          0700056
14652  50162          SA   DL    $AL                                         0700057
14653  75400          LA   IM C  NO                                          0700058
14654  15071          PZE       SC2PI     MS PART OF 2/PI                   0700059
14655  50113          SA   DL    $T1                                         0700060
14656  75200          LA   DP    NO        LS PART OF 2/PI                   0700061
14657  50114          SA   DL    $T2                                         0700062
14660  47400          RP   IM    NO        MULTIPLY TIMES 2/PI               0700063
14661  17577          PZE       MP2SR                                       0700064
14662  75162          LA   DL    $AL                                         0700065
14663  62163          LP   DL    $AR                                         0700066
14664  11063          SO   DM D  L3        SCALE TO 0                        0700067
14665  20035          BR   DM    AP                                          0700068
14666  14673          PZE       *+5                                         0700069
14667  62000          LP   DM    NO                                          0700070
14670  77777          OCT       77777                                       0700071
14671  75000          LA   DM    NO                                          0700072
14672  37777          OCT       37777                                       0700073
14673  50113          SA   DL    $T1                                         0700074
14674  50115          SA   DL    $T3       X MS                              0700075
```

```
14675  42114          SP   DL     $T2                                          0700076
14676  42116          SP   DL     $T4          X LS                            0700077
14677  50162          SA   DL     $AL                                          0700078
14700  42163          SP   DL     $AR                                          0700079
14701  47400          RP   IM     NO           FORM X SQUARE                   0700080
14702  17577          PZE         MP2SR                                        0700081
14703  75162          LA   DL     $AL                                          0700082
14704  50117          SA   DL     $T5          X2                              0700083
14705  75163          LA   DL     $AR                                          0700084
14706  50120          SA   DL     $T6          X2                              0700085
14707  75400          LA   IM     NO           MS PART OF C3                   0700086
14710  15073          PZE         SCC3                                         0700087
14711  50113          SA   DL     $T1                                          0700088
14712  75200          LA   DP     NO           LS PART OF C3                   0700089
14713  50114          SA   DL     $T2                                          0700090
14714  47400          RP   IM     NO                                           0700091
14715  17577          PZE         MP2SR        C3.X SQUARE                     0700092
14716  75163          LA   DL     $AR                                          0700093
14717  65001          CS   DM C   AI                                           0700094
14720  00000          PZE         0                                            0700095
14721  51163          HA   DL     $AR                                          0700096
14722  55162          RA   DL     $AL                                          0700097
14723  77071          CH   DM B   AM                                           0700098
14724  50162          SA   DL     $AL                                          0700099
14725  75000          LA   DM     NO            LS PART OF C1                  0700100
14726  73230          OCT         73230                                        0700101
14727  63163          AL   DL     $AR                                          0700102
14730  50400          SA   IM     NO                                           0700103
14731  15104          PZE         SCSL         LS PART OF SUM                  0700104
14732  75000          LA   DM     NO             MS PART OF C1                 0700105
14733  62207          OCT         62207                                        0700106
14734  61162          AI   DL     $AL                                          0700107
14735  50400          SA   IM     NO                                           0700108
14736  15103          PZE         SCSM         MS PART OF SUM                  0700109
14737  75117          LA   DL     $T5          X2                              0700110
14740  62120          LP   DL     $T6          X2                              0700111
14741  50113          SA   DL     $T1                                          0700112
14742  42114          SP   DL     $T2                                          0700113
14743  75400          LA   IM     NO                                           0700114
14744  15077          PZE         SCC7         MS PART OF C7                   0700115
14745  50162          SA   DL     $AL                                          0700116
14746  75200          LA   DP     NO           LS PART OF C7                   0700117
14747  50163          SA   DL     $AR                                          0700118
14750  47400          RP   IM     NO           C7 TIMES X SQUARE               0700119
14751  17577          PZE         MP2SR                                        0700120
```

```
14752  75163          LA    DL     $AR          COMPLEMENT                    0700121
14753  65001          CS    DM C   AI                                         0700122
14754  00000          PZE          0                                          0700123
14755  51163          HA    DL     $AR                                        0700124
14756  55162          RA    DL     $AL                                        0700125
14757  77071          CH    DM B   AM                                         0700126
14760  50162          SA    DL     $AL                                        0700127
14761  75000          LA    DM     NO           LS PART OF C5                 0700128
14762  50536          OCT          50536                                      0700129
14763  63163          AL    DL     $AR                                        0700130
14764  50400          SA    IM     NO           CS TEMP SUM                   0700131
14765  15106          PZE          SCTSL                                      0700132
14766  75000          LA    DM     NO              MS PART OF C5              0700133
14767  02431          OCT          02431                                      0700134
14770  71162          AM    DL     $AL                                        0700135
14771  50400          SA    IM     NO                                         0700136
14772  15105          PZE          SCTSM        MS TEMP SUM                   0700137
14773  75117          LA    DL     $T5                                        0700138
14774  50162          SA    DL     $AL                                        0700139
14775  50113          SA    DL     $T1                                        0700140
14776  75120          LA    DL     $T6                                        0700141
14777  50163          SA    DL     $AR                                        0700142
15000  50114          SA    DL     $T2                                        0700143
15001  47400          RP    IM     NO           FORM X FOURTH                 0700144
15002  17577          PZE          MP2SR                                      0700145
15003  75162          LA    DL     $AL                                        0700146
15004  50117          SA    DL     $T5                                        0700147
15005  75163          LA    DL     $AR                                        0700148
15006  50120          SA    DL     $T6                                        0700149
15007  75400          LA    IM     NO           MS PART OF C9                 0700150
15010  15101          PZE          SCC9                                       0700151
15011  50113          SA    DL     $T1                                        0700152
15012  75200          LA    DP     NO           LS PART OF C9                 0700153
15013  50114          SA    DL     $T2                                        0700154
15014  47400          RP    IM     NO           X 4TH TIMES C9                0700155
15015  17577          PZE          MP2SR                                      0700156
15016  75163          LA    DL     $AR                                        0700157
15017  63400          AL    IM     NO                                         0700158
15020  15106          PZE          SCTSL                                      0700159
15021  50114          SA    DL     $T2                                        0700160
15022  75162          LA    DL     $AL                                        0700161
15023  71400          AM    IM     NO                                         0700162
15024  15105          PZE          SCTSM                                      0700163
15025  50113          SA    DL     $T1                                        0700164
15026  75117          LA    DL     $T5                                        0700165
```

```
15027  50162          SA   DL     $AL                                          0700166
15030  75120          LA   DL     $T6                                          0700167
15031  50163          SA   DL     $AR                                          0700168
15032  47400          RP   IM     NO              X4TH TIMES LAST TERM         0700169
15033  17577          PZE         MP2SR                                        0700170
15034  75163          LA   DL     $AR                                          0700171
15035  63400          AL   IM     NO                                           0700172
15036  15104          PZE         SCSL                                         0700173
15037  50163          SA   DL     $AR                                          0700174
15040  75162          LA   DL     $AL                                          0700175
15041  71400          AM   IM     NO                                           0700176
15042  15103          PZE         SCSM                                         0700177
15043  50162          SA   DL     $AL                                          0700178
15044  75115          LA   DL     $T3                                          0700179
15045  50113          SA   DL     $T1                                          0700180
15046  75116          LA   DL     $T4                                          0700181
15047  50114          SA   DL     $T2                                          0700182
15050  47400          RP   IM     NO              TIMES X                      0700183
15051  17577          PZE         MP2SR                                        0700184
15052  75123          LA   DL     $T9             SIGN CONTROL                 0700185
15053  20035          BR   DM     AP                                           0700186
15054  15064          PZE         *+8                                          0700187
15055  75163          LA   DL     $AR                                          0700188
15056  65001          CS   DM C   AI                                           0700189
15057  00000          PZE         0                                            0700190
15060  51163          HA   DL     $AR                                          0700191
15061  55162          RA   DL     $AL                                          0700192
15062  77071          CH   DM B   AM                                           0700193
15063  50162          SA   DL     $AL                                          0700194
15064  62571          LP   IL     $IC             R  EXIT                      0700195
15065  63336  SCPI    DECD        -31415926E1B3      -PI                       0700196
15066  01132
15067  71557  SCPI2   DECD        -15707963E1B3                                0700197
15070  00455
15071  24276  SC2PI   DECD        636619772                                    0700198
15072  30155
15073  24527  SCC3    DECD        645963711          C3                        0700199
15074  36026
15075  02431  SCC5    DECD        079689679          C5                        0700200
15076  50536
15077  00114  SCC7    DECD        4673765E-2         C7                        0700201
15100  44630
15101  00002  SCC9    DECD        151484E-3          C9                        0700202
15102  36657
15103  00000  SCSM    PZE                                                      0700203
```

```
15104  00000  SCSL   PZE                                                                    0700204
15105  00000  SCTSM  PZE                                                                    0700205
15106  00000  SCTSL  PZE                                                                    0700206
15107  06220  SCPI2P DECD      157079626E1B3                                                 0700207
15110  77320
15111  55115  SC3PI  DECD      -4712389E1B3      -3PI OVER 2                                 0700208
15112  01600
15113  62207  SCC1   OCT       62207                                                         0700209
15114  73230         OCT       73230                                                         0700210
                     1LCC0710 00B1CS1   ,COSINE S.L.                    00086000873US      0710000
15115  44113  CS1    ZE   DL    $T1               CLEAR T1                                  0710001
15116  43171         HP   DL    $IC              STORE P IN IC, CLEAR P                    0710002
15117  75162         LA   DL    $AL              LOAD A WITH AC                            0710003
15120  20035         BR   DM    AP               IF POSITIVE, GO TO CS1A                   0710004
15121  15125         PZE       CS1A                                                        0710005
15122  65011         CS   DM C  AM               COMPLEMENT AC                             0710006
15123  00000         PZE       0                                                           0710007
15124  50162         SA   DL    $AL                                                         0710008
15125  73000  CS1A   AS   DM C  NO               TEST FOR 1ST QUADRANT                     0710009
15126  71557         OCT       71557                  -PI/2                                0710010
15127  20034         BR   DM    AN               IF YES, GO TO CS1B                        0710011
15130  15147         PZE       CS1B                                                        0710012
15131  75162         LA   DL    $AL                                                         0710013
15132  73000         AS   DM C  NO               TEST FOR 4TH QUADRANT                     0710014
15133  55115         OCT       55115             3PI/2                                     0710015
15134  20035         BR   DM    AP               YES, GO TO CS1C                           0710016
15135  15157         PZE       CS1D                                                        0710017
15136  50113         SA   DL    $T1              NEGATIVE SIGNED RESULT                    0710018
15137  73000         AS   DM C  NO                                                        0710019
15140  06221         OCT       06221               PI/2                                   0710020
15141  20035         BR   DM    AP               3RD QUADRANT IF +                         0710021
15142  15153         PZE       CS1C                                                        0710022
15143  73000         AS   DM C  NO                                                        0710023
15144  06221         OCT       06221                PI/2                                  0710024
15145  20020         BR   DM    UN                                                          0710025
15146  15157         PZE       CS1D                                                        0710026
15147  65001  CS1B   CS   DM C  AI               COMPLEMENT                                0710027
15150  00000         PZE       0                                                           0710028
15151  20020         BR   DM    UN                                                          0710029
15152  15157         PZE       CS1D                                                        0710030
15153  73000  CS1C   AS   DM C  NO               SUBTRACT PI/2                             0710031
15154  71557         OCT       71557                -PI/2                                  0710032
15155  65001         CS   DM C  AI               COMPLEMENT                                0710033
15156  00000         PZE       0                                                           0710034
15157  67067  CS1D   CC   DM B  CC               CLEAR CARRY                               0710035
```

```
15160 66000   AP   DM C  NO          LOAD E WITH 2/PI          0710036
15161 24276   OCT        24276       2/PI                      0710037
15162 15056   MP   DM D  14          MULTIPLY                  0710038
15163 11063   SO   DM D  L3                                    0710039
15164 50162   SA   DL    $AL         NOW IN RADIANS X 2/PI     0710040
15165 44062   ZE   DM B  LP                                    0710041
15166 50066   SA   DM B  AP                                    0710042
15167 15056   MP   DM D  14                                    0710043
15170 50114   SA   DL    $T2         Y SQUARE                  0710044
15171 62114   LP   DL    $T2                                   0710045
15172 44075   ZE   DM B  LA                                    0710046
15173 60000   NO   DM C  NO                                    0710047
15174 77720   DEC        -29804E-2    B7                       0710048
15175 17056   MS   DM D  14          B7 X Y SQUARED            0710049
15176 73000   AS   DM C  NO          ADD B5                    0710050
15177 01502   OCT        01502       B5  .05133                0710051
15200 44062   ZE   DM B  LP                                    0710052
15201 66114   AP   DL    $T2                                   0710053
15202 67067   CC   DM B  CC                                    0710054
15203 15056   MP   DM D  14          RESULT X Y SQUARED        0710055
15204 73000   AS   DM C  NO          ADD B3                    0710056
15205 62657   DEC        -41123      B3                        0710057
15206 66015   AP   DM C  LA                                    0710058
15207 00000   PZE        0                                     0710059
15210 47114   RP   DL    $T2                                   0710060
15211 67067   CC   DM B  CC                                    0710061
15212 17056   MS   DM D  14          RESULT X Y SQUARED        0710062
15213 73000   AS   DM C  NO          ADD ONE                   0710063
15214 37777   OCT        37777                                 0710064
15215 44062   ZE   DM B  LP                                    0710065
15216 66162   AP   DL    $AL                                   0710066
15217 67067   CC   DM B  CC                                    0710067
15220 15056   MP   DM D  14          RESULT X Y                0710068
15221 67007   CC   DM C  CC                                    0710069
15222 53502   DEC        -63662                                0710070
15223 05076   DV   DM D  14                                    0710071
15224 66162   AP   DL    $AL         EXCHANGE A P              0710072
15225 20035   BR   DM    AP                                    0710073
15226 15231   PZE        *+3         IF RESULT IS NEGATIVE     0710074
15227 75000   LA   DM C  NO          SET RESULT TO             0710075
15230 37777   OCT        37777       ONE AND                   0710076
15231 50162   SA   DL    $AL         SAVE IN $AL               0710077
15232 75113   LA   DL    $T1                                   0710078
15233 20034   BR   DM    AN          SIGN CONTROL              0710079
15234 15236   PZE        *+2                                   0710080
```

```
15235  62571          LP   IL    $IC       R  EXIT                                  0710081
15236  75162          LA   DL    $AL          NEGATIVE                              0710082
15237  65011          CS   DM C  AM                                                 0710083
15240  00000          PZE        0                                                  0710084
15241  50162          SA   DL    $AL                                                0710085
15242  62571          LP   IL    $IC       R  EXIT                                  0710086
                       1LCC0720 0082CS2  ,COSINE D.L.            0007900518IUS-    0720000
15243  44123   CS2    ZE   DL    $T9          SIGN CONTROL                          0720001
15244  43171          HP   DL    $IC          STORE P IN IC                         0720002
15245  75162          LA   DL    $AL          LOAD A WITH AC                        0720003
15246  20035          BR   DM    AP                                                 0720004
15247  15257          PZE        CS2A                                               0720005
15250  75163          LA   DL    $AR          COMPLEMENT                            0720006
15251  65001          CS   DM C  AI                                                 0720007
15252  00000          PZE        0                                                  0720008
15253  51163          HA   DL    $AR                                                0720009
15254  55162          RA   DL    $AL                                                0720010
15255  77071          CH   DM B  AM                                                 0720011
15256  50162          SA   DL    $AL                                                0720012
15257  73000   CS2A   AS   DM C  NO           TEST FOR 1ST QUADRANT                 0720013
15260  71557          OCT        71557        -PI/2                                 0720014
15261  20034          BR   DM    AN                                                 0720015
15262  15322          PZE        CS2B                                               0720016
15263  75163          LA   DL    $AR                                                0720017
15264  63000          AL   DM    NO              LS PART OF 3PI/2                   0720018
15265  01600          OCT        01600                                              0720019
15266  50114          SA   DL    $T2                                                0720020
15267  75162          LA   DL    $AL                                                0720021
15270  71000          AM   DM    NO             MS PART OF 3PI/2                    0720022
15271  55115          OCT        55115                                              0720023
15272  50113          SA   DL    $T1                                                0720024
15273  20035          BR   DM    AP           4TH QUAD IF +                         0720025
15274  15354          PZE        CS2D                                               0720026
15275  50123          SA   DL    $T9          SIGN CONTROL                          0720027
15276  75114          LA   DL    $T2                                                0720028
15277  63000          AL   DM    NO            LS PART OF PI/2                      0720029
15300  77323          OCT        77323                                              0720030
15301  50163          SA   DL    $AR                                                0720031
15302  75113          LA   DL    $T1                                                0720032
15303  71000          AM   DM    NO             MS PART OF PI/2                     0720033
15304  06220          OCT        06220                                              0720034
15305  50162          SA   DL    $AL                                                0720035
15306  20035          BR   DM    AP           3RD QUAD. IF +                        0720036
15307  15343          PZE        CS2C                                               0720037
15310  75163          LA   DL    $AR                                                0720038
```

```
15311 63000          AL   DM   NO              LS PART OF PI/2                      0720039
15312 77323          OCT       77323                                                0720040
15313 50163          SA   DL   $AR                                                  0720041
15314 75162          LA   DL   $AL                                                  0720042
15315 71000          AM   DM   NO               MS PART OF PI/2                     0720043
15316 06220          OCT       06220                                                0720044
15317 50162          SA   DL   $AL                                                  0720045
15320 20020          BR   DM   UN                                                   0720046
15321 14641          PZE       SN2C                                                 0720047
15322 75163   CS2B   LA   DL   $AR           1ST QUAD                               0720048
15323 63000          AL   DM   NO               LS PART OF -PI/2                    0720049
15324 00453          OCT       00453                                                0720050
15325 50163          SA   DL   $AR                                                  0720051
15326 75162          LA   DL   $AL                                                  0720052
15327 71000          AM   DM   NO              MS PART OF -PI/2                     0720053
15330 71557          OCT       71557                                                0720054
15331 50162          SA   DL   $AL                                                  0720055
15332 75163          LA   DL   $AR                                                  0720056
15333 65001          CS   DM C AI                                                   0720057
15334 00000          PZE       0                                                    0720058
15335 51163          HA   DL   $AR                                                  0720059
15336 55162          RA   DL   $AL                                                  0720060
15337 77071          CH   DM B AM                                                   0720061
15340 50162          SA   DL   $AL                                                  0720062
15341 20020          BR   DM   UN                                                   0720063
15342 14641          PZE       SN2C                                                 0720064
15343 75114   CS2C   LA   DL   $T2           3RD QUAD.                              0720065
15344 65001          CS   DM C AI                                                   0720066
15345 00000          PZE       0                                                    0720067
15346 51163          HA   DL   $AR                                                  0720068
15347 55113          RA   DL   $T1                                                  0720069
15350 77071          CH   DM B AM                                                   0720070
15351 50162          SA   DL   $AL                                                  0720071
15352 20020          BR   DM   UN                                                   0720072
15353 14641          PZE       SN2C                                                 0720073
15354 75113   CS2D   LA   DL   $T1                                                  0720074
15355 50162          SA   DL   $AL                                                  0720075
15356 75114          LA   DL   $T2                                                  0720076
15357 50163          SA   DL   $AR                                                  0720077
15360 20020          BR   DM   UN                                                   0720078
15361 14641          PZE       SN2C                                                 0720079
                       1LCD0750 0081AS1    ,ARC SINE              00062001563US-   0750000
15362 42171   AS1    SP   DL   $IC          R  STORE P IN IC                        0750001
15363 75162          LA   DL   $AL             LOAD A WITH AC                       0750002
15364 50121          SA   DL   $T7             SIGN CONTROL                         0750003
```

```
15365  20035          BR   DM     AP                                          0750004
15366  15372          PZE         *+4                                         0750005
15367  65011          CS   DM C   AM        COMPLEMENT                        0750006
15370  00000          PZE         0                                           0750007
15371  50162          SA   DL     $AL                                         0750008
15372  66067          AP   DM B   CC                                          0750009
15373  44075          ZE   DM B   LA                                          0750010
15374  60162          NO   DL     $AL                                         0750011
15375  15056          MP   DM D   14        FORM X SQUARE                     0750012
15376  65011          CS   DM C   AM          SUBTRACT FROM ONE               0750013
15377  37777          OCT         37777                                       0750014
15400  55162          RA   DL     $AL                                         0750015
15401  50120          SA   DL     $T6                                         0750016
15402  44163          ZE   DL     $AR                                         0750017
15403  47400          RP   IM     NO                                          0750018
15404  17402          PZE         SR1SR                                       0750019
15405  75005          LA   DM C   CS                                          0750020
15406  26501          DEC         70710     1/SQ. RT. 2                       0750021
15407  71120          AM   DL     $T6                                         0750022
15410  50117          SA   DL     $T5                                         0750023
15411  20034          BR   DM     AN        BRANCH IF LESS THAN ABOVE         0750024
15412  15425          PZE         AS1A                                        0750025
15413  44062          ZE   DM B   LP                                          0750026
15414  75120          LA   DL     $T6                                         0750027
15415  65001          CS   DM     AI                                          0750028
15416  00000          PZE         0                                           0750029
15417  55113          RA   DL     $T1                                         0750030
15420  67067          CC   DM B   CC                                          0750031
15421  05076          DV   DM D   14                                          0750032
15422  42162          SP   DL     $AL         SQ. RT. OX RESULT               0750033
15423  20020          BR   DM     UN                                          0750034
15424  15435          PZE         AS1B                                        0750035
15425  75113  AS1A    LA   DL     $T1                                         0750036
15426  44062          ZE   DM B   LP                                          0750037
15427  65001          CS   DM     AI                                          0750038
15430  00000          PZE         0                                           0750039
15431  55120          RA   DL     $T6                                         0750040
15432  67067          CC   DM B   CC                                          0750041
15433  05076          DV   DM D   14                                          0750042
15434  42162          SP   DL     $AL        X/SQ.RT. RESULT                  0750043
15435  47400  AS1B    RP   IM     NO        ARCTAN SUBROUTINE                 0750044
15436  17163          PZE         AT1SR                                       0750045
15437  75117          LA   DL     $T5                                         0750046
15440  20035          BR   DM     AP        GREATER THAN 1/SQ RT. 2 IF +      0750047
15441  15452          PZE         AS1D                                        0750048
```

```
15442 75121  AS1C  LA   DL    $T7            SIGN CONTROL                          0750049
15443 20035        BR   DM    AP                                                   0750050
15444 15451        PZE        *+5                                                  0750051
15445 75162        LA   DL    $AL                                                  0750052
15446 65011        CS   DM C  AM                                                   0750053
15447 00000        PZE        0                                                    0750054
15450 50162        SA   DL    $AL                                                  0750055
15451 62571        LP   IL    $IC          R EXIT                                  0750056
15452 75162  AS1D  LA   DL    $AL            GREATER THAN                          0750057
15453 65011        CS   DM    AM                                                   0750058
15454 31103        DEC        15708E1B1      PI/2                                  0750059
15455 50162        SA   DL    $AL                                                  0750060
15456 20020        BR   DM    UN                                                   0750061
15457 15442        PZE        AS1C                                                 0750062
                    1LCD0760 0082AS2    ,ARC SINE D.L.              00095007598US- 0760000
15460 42171  AS2   SP   DL    $IC            STORE P IN IC                         0760001
15461 44166        ZE   DL    $QL                                                  0760002
15462 44167        ZE   DL    $QR                                                  0760003
15463 75162        LA   DL    $AL            LOAD A WITH AC                        0760004
15464 50400        SA   IM    NO                                                   0760005
15465 15612        PZE        AS2SP          SIGN CONTROL                          0760006
15466 20035        BR   DM    AP                                                   0760007
15467 15477        PZE        *+8                                                  0760008
15470 75163        LA   DL    $AR            COMPLEMENT                            0760009
15471 65001        CS   DM C  AI                                                   0760010
15472 00000        PZE                                                             0760011
15473 51163        HA   DL    $AR                                                  0760012
15474 55162        RA   DL    $AL                                                  0760013
15475 77071        CH   DM B  AM                                                   0760014
15476 50162        SA   DL    $AL                                                  0760015
15477 50400        SA   IM    NO             X                                     0760016
15500 15613        PZE        AS2SP+1                                              0760017
15501 50113        SA   DL    $T1                                                  0760018
15502 75163        LA   DL    $AR                                                  0760019
15503 50200        SA   DP    NO             X-AS2SP+2                             0760020
15504 50114        SA   DL    $T2                                                  0760021
15505 47400        RP   IM    NO                                                   0760022
15506 17577        PZE        MP2SR          SQUARE X                              0760023
15507 75163        LA   DL    $AR                                                  0760024
15510 65001        CS   DM C  AI                                                   0760025
15511 77777        OCT        77777                                                0760026
15512 50163        SA   DL    $AR                                                  0760027
15513 75162        LA   DL    $AL                                                  0760028
15514 77011        CH   DM C  AM                                                   0760029
15515 37777        OCT        37777                                                0760030
```

```
15516  50162          SA   DL    $AL
15517  47400          RP   IM    NO          TAKE SQ ROOT
15520  17464          PZE        SR2SR
15521  75005          LA   DM    CS
15522  26501          DEC        70710       1/SQ RT 2
15523  71400          AM   IM    NO
15524  15613          PZE        AS2SP+1
15525  50400          SA   IM    NO
15526  15615          PZE        AS2SP+3
15527  20034          BR   DM    AN          BRANCH IF LESS THAN ABOVE
15530  15543          PZE        AS2A
15531  75400          LA   IM    NO
15532  15613          PZE        AS2SP+1
15533  50113          SA   DL    $T1
15534  75400          LA   IM    NO
15535  15614          PZE        AS2SP+2
15536  50114          SA   DL    $T2
15537  47400          RP   IM    NO          DIVIDE SUBR
15540  17632          PZE        DV2SR
15541  20020          BR   DM    UN
15542  15554          PZE        AS2B
15543  75400   AS2A   LA   IM    NO
15544  15613          PZE        AS2SP+1
15545  55162          RA   DL    $AL
15546  50113          SA   DL    $T1
15547  75200          LA   DP    NO          AS2SP+2
15550  55163          RA   DL    $AR
15551  50114          SA   DL    $T2
15552  47400          RP   IM    NO          DIVIDE
15553  17632          PZE        DV2SR
15554  47400   AS2B   RP   IM    NO          TAKE ARCTAN
15555  17227          PZE        AT2SR
15556  75400          LA   IM    NO
15557  15615          PZE        AS2SP+3
15560  20035          BR   DM    AP          GREATER THAN 1/SQ RT 2 IF X
15561  15576          PZE        AS2D
15562  75400   AS2C   LA   IM    NO
15563  15612          PZE        AS2SP       SIGN
15564  20035          BR   DM    AP
15565  15575          PZE        *+8
15566  75163          LA   DL    $AR
15567  65001          CS   DM C  AI
15570  00000          PZE        0
15571  51163          HA   DL    $AR
15572  55162          RA   DL    $AL
```

```
15573  77071          CH   DM B  AM                                                    0760076
15574  50162          SA   DL    $AL                                                   0760077
15575  62571          LP   IL    $IC            R  EXIT                                0760078
15576  75163  AS2D    LA   DL    $AR               SUBTRACT FROM PI/2                  0760079
15577  65401          CS   IM    AI                                                    0760080
15600  15611          PZE       ASPI2+1                                               0760081
15601  50163          SA   DL    $AR                                                   0760082
15602  75162          LA   DL    $AL                                                   0760083
15603  65411          CS   IM    AM                                                    0760084
15604  15610          PZE       ASPI2                                                 0760085
15605  50162          SA   DL    $AL                                                   0760086
15606  20020          BR   DM    UN                                                    0760087
15607  15562          PZE       AS2C                                                  0760088
15610  31103  ASPI2   OCT       31103             PI/2 SCALED 1                       0760089
15611  75500          OCT       75500                                                 0760090
       15612  AS2SP   RES       5                                                     0760091
                 1LCE0730 00B1AT1   ,ARC TANGENT                  00046000555US-     0730000
15617  42171  AT1     SP   DL    $IC                                                   0730001
15620  75162          LA   DL    $AL                                                   0730002
15621  50113          SA   DL    $T1               SIGN CONTROL                        0730003
15622  20035          BR   DM    AP                                                    0730004
15623  15627          PZE       *+4                                                   0730005
15624  65011          CS   DM C  AM                COMPLEMENT                          0730006
15625  00000          PZE       0                                                     0730007
15626  50162          SA   DL    $AL                                                   0730008
15627  67060          CC   DM B  NO                                                    0730009
15630  76006          XA   DM    AP                                                    0730010
15631  77000          OCT       77000                                                 0730011
15632  42114          SP   DL    $T2                                                   0730012
15633  44075          ZE   DM B  LA                                                    0730013
15634  11066          SO   DM D  L6                                                    0730014
15635  73000          AS   DM    NO                                                    0730015
15636  17061          PZE       AT1TX-2                                               0730016
15637  67315          CC   DA C  LA                CLEAR CARRY                         0730017
15640  50115          SA   DL    $T3               STORE XK                            0730018
15641  44075          ZE   DM B  LA                                                    0730019
15642  62114          LP   DL    $T2               ZK                                  0730020
15643  60162          NO   DL    $AL                                                   0730021
15644  15057          MP   DM D  15                                                    0730022
15645  74000          MA   DM C  NO                ADD ONE                             0730023
15646  20000          OCT       20000                                                 0730024
15647  65011          CS   DM C  AM                COMPLEMENT FOR DIVIDE               0730025
15650  00000          PZE       0                                                     0730026
15651  55114          RA   DL    $T2               1+Z*ZK TO $T2, ZK TO A              0730027
15652  65060          CS   DM B  NO                                                    0730028
```

```
15653  71162          AM   DL    $AL             Z-ZK                                         0730029
15654  44062          ZE   DM B  LP                                                           0730030
15655  60114          NO   DL    $T2             1+Z*ZK                                       0730031
15656  67067          CC   DM B  CC              CLEAR CARRY                                  0730032
15657  11041          SO   DM D  R1              SCALE TO ONE                                 0730033
15660  05076          DV   DM D  14                                                           0730034
15661  66060          AP   DM B  NO              T                                            0730035
15662  73115          AS   DL    $T3             ADD XK                                       0730036
15663  50162          SA   DL    $AL             STORE RESULT IN AC                           0730037
15664  75113          LA   DL    $T1             CHECK SIGN CONTROL                           0730038
15665  20034          BR   DM    AN                                                           0730039
15666  15670          PZE        *+2                                                          0730040
15667  62571          LP   IL    $IC          R  EXIT                                         0730041
15670  75162          LA   DL    $AL             SET RESULT NEGATIVE                          0730042
15671  65011          CS   DM C  AM                                                           0730043
15672  00000          PZE        0                                                            0730044
15673  50162          SA   DL    $AL                                                          0730045
15674  62571          LP   IL    $IC          R  EXIT                                         0730046
                       1LCE0740 00B2AT2    ,ARC TANGENT                  00082002979US-       0740000
15675  42171   AT2    SP   DL    $IC                                                          0740001
15676  44166          ZE   DL    $QL                                                          0740002
15677  44167          ZE   DL    $QR                                                          0740003
15700  75162          LA   DL    $AL                                                          0740004
15701  50122          SA   DL    $T8             SIGN CONTROL                                 0740005
15702  20035          BR   DM    AP                                                           0740006
15703  15713          PZE        AT2C                                                         0740007
15704  75163          LA   DL    $AR                                                          0740008
15705  65001          CS   DM    AI                                                           0740009
15706  00000          PZE        0                                                            0740010
15707  51163          HA   DL    $AR                                                          0740011
15710  55162          RA   DL    $AL                                                          0740012
15711  77071          CH   DM B  AM                                                           0740013
15712  50162          SA   DL    $AL                                                          0740014
15713  67060   AT2C   CC   DM B  NO                                                           0740015
15714  76006          XA   DM    AP                                                           0740016
15715  77000          OCT        77000                                                        0740017
15716  42115          SP   DL    $T3                                                          0740018
15717  44075          ZE   DM B  LA                                                           0740019
15720  11066          SO   DM D  L6                                                           0740020
15721  73000          AS   DM    NO                                                           0740021
15722  17061          PZE        AT1TX-2                                                      0740022
15723  75320          LA   DA H  NO                                                           0740023
15724  50120          SA   DL    $T6             $T6 = MSP OF XK                              0740024
15725  66013          AP   DM C  AS                                                           0740025
15726  00041          PZE        33                                                           0740026
```

```
15727  75320          LA    DA H   NO                                          0740027
15730  50121          SA    DL     $T7        $T7=LSP OF XK                    0740028
15731  62162          LP    DL     $AL        Z                                0740029
15732  44075          ZE    DM B   LA                                          0740030
15733  60115          NO    DL     $T3        ZK                               0740031
15734  15056          MP    DM D   14                                          0740032
15735  51113          HA    DL     $T1                                         0740033
15736  42114          SP    DL     $T2                                         0740034
15737  44062          ZE    DM B   LP                                          0740035
15740  66163          AP    DL     $AR                                         0740036
15741  15056          MP    DM D   14                                          0740037
15742  73114          AS    DL     $T2                                         0740038
15743  66060          AP    DM B   NO                                          0740039
15744  75113          LA    DL     $T1                                         0740040
15745  71000          AM    DM     NO                                          0740041
15746  00000          PZE          0                                           0740042
15747  11041          SO    DM D   R1                                          0740043
15750  74000          MA    DM     NO                                          0740044
15751  20000          OCT          20000                                       0740045
15752  42114          SP    DL     $T2                                         0740046
15753  50113          SA    DL     $T1        1+Z*ZK                           0740047
15754  75115          LA    DL     $T3                                         0740048
15755  65411          CS    IM C   AM                                          0740049
15756  00062          PZE          $AL                                         0740050
15757  62163          LP    DL     $AR                                         0740051
15760  11041          SO    DM D   R1                                          0740052
15761  50162          SA    DL     $AL        Z-ZK                             0740053
15762  42163          SP    DL     $AR                                         0740054
15763  47400          RP    IM     NO                                          0740055
15764  17632          PZE          DV2SR      T = (Z-ZK)/(1+Z*ZK)              0740056
15765  75162          LA    DL     $AL                                         0740057
15766  50113          SA    DL     $T1                                         0740058
15767  50116          SA    DL     $T4                                         0740059
15770  62163          LP    DL     $AR                                         0740060
15771  42114          SP    DL     $T2                                         0740061
15772  42117          SP    DL     $T5                                         0740062
15773  47400          RP    IM     NO         T**2                             0740063
15774  17577          PZE          MP2SR                                       0740064
15775  62162          LP    DL     $AL                                         0740065
15776  44075          ZE    DM B   LA                                          0740066
15777  67067          CC    DM B   CC                                          0740067
16000  60000          NO    DM     NO                                          0740068
16001  12525          DEC          33333                                       0740069
16002  15056          MP    DM D   14                                          0740070
16003  51162          HA    DL     $AL                                         0740071
```

```
16004 42114          SP   DL     $T2                                          0740072
16005 44062          ZE   DM B   LP                                          0740073
16006 66163          AP   DL     $AR                                          0740074
16007 15056          MP   DM D   14                                          0740075
16010 73114          AS   DL     $T2                                          0740076
16011 66060          AP   DM B   NO                                          0740077
16012 75162          LA   DL     $AL                                          0740078
16013 71000          AM   DM     NO                                           0740079
16014 00000          PZE         0                                            0740080
16015 50162          SA   DL     $AL                                          0740081
16016 66060          AP   DM B   NO                                          0740082
16017 65001          CS   DM     AI                                           0740083
16020 00000          PZE         0                                            0740084
16021 66075          AP   DM B   LA                                          0740085
16022 55162          RA   DL     $AL                                          0740086
16023 77071          CH   DM B   AM                                          0740087
16024 66003          AP   DM     AL                                           0740088
16025 77777          OCT         77777                                        0740089
16026 66011          AP   DM     AM                                           0740090
16027 37777          OCT         37777          1-1/3(T**2)                   0740091
16030 50162          SA   DL     $AL                                          0740092
16031 42163          SP   DL     $AR                                          0740093
16032 75116          LA   DL     $T4                                          0740094
16033 50113          SA   DL     $T1                                          0740095
16034 75117          LA   DL     $T5                                          0740096
16035 50114          SA   DL     $T2                                          0740097
16036 47400          RP   IM     NO                                           0740098
16037 17577          PZE         MP2SR          T(1-1/3(T**2))                0740099
16040 75163          LA   DL     $AR                                          0740100
16041 63121          AL   DL     $T7                                          0740101
16042 50163          SA   DL     $AR                                          0740102
16043 75162          LA   DL     $AL                                          0740103
16044 71120          AM   DL     $T6                                          0740104
16045 50162          SA   DL     $AL            XK+ARCTANT                    0740105
16046 75122          LA   DL     $T8            CHECK SIGN CONTROL            0740106
16047 20034          BR   DM     AN                                           0740107
16050 16052          PZE         *+2                                          0740108
16051 62571          LP   IL     $IC          R EXIT                         0740109
16052 75163          LA   DL     $AR                                          0740110
16053 65011          CS   DM C   AM                                           0740111
16054 00000          PZE         0                                            0740112
16055 50163          SA   DL     $AR                                          0740113
16056 75162          LA   DL     $AL                                          0740114
16057 67060          CC   DM B   NO                                           0740115
16060 50162          SA   DL     $AL                                          0740116
```

```
16061  62571              LP   IL    $IC         R     EXIT                                   0740117
                          1LDA0480 01B1NR1    ,NUMERIC RIGHT SHIFT S.L.        00021138+3NUS  0480000
16062  75200   NR1        LA   DP C  NO                 LOAD A WITH G                         0480001
16063  42171              SP   DL    $IC                STORE P IN IC                         0480002
16064  73000              AS   DM C  NO                 FORM SHIFT COMMAND                    0480003
16065  13000              NR   DM S  RO                                                       0480004
16066  50400              SA   IM C  NO                 STORE A IN NR1A AND NR1B              0480005
16067  16075              PZE        NR1A                                                     0480006
16070  50400              SA   IM C  NO                                                       0480007
16071  16102              PZE        NR1B                                                     0480008
16072  75162              LA   DL    $AL                LOAD A WITH AC                        0480009
16073  20034              BR   DM    AN                 IF NEGATIVE, BRANCH TO NR1A+3         0480010
16074  16100              PZE        *+4                                                      0480011
16075  13000   NR1A       NR   DM S  RO                 SHIFT                                 0480012
16076  50162              SA   DL    $AL                STORE A IN AC                         0480013
16077  62571              LP   IL    $IC         R      EXIT                                  0480014
16100  65001              CS   DM C  AI                 TAKE TWOS COMPLEMENT OF AC            0480015
16101  00000              PZE        0                                                        0480016
16102  13000   NR1B       NR   DM S  RO                 SHIFT                                 0480017
16103  65001              CS   DM C  AI                                                       0480018
16104  00000              PZE        0                                                        0480019
16105  50162              SA   DL    $AL                STORE A IN AC                         0480020
16106  62571              LP   IL    $IC         R      EXIT                                  0480021
                          1LDA0490 01B2NR2    ,NUMERIC RIGHT SHIFT D.L.        00050252+3NUS  0490000
16107  67215   NR2        CC   DP    LA                                                       0490001
16110  42171              SP   DL    $IC                                                      0490002
16111  20437              BR   IM    NL                                                       0490003
16112  77760              OCT        77760                                                    0490004
16113  16150              PZE        *+29                                                     0490005
16114  73000              AS   DM    NO                                                       0490006
16115  13040              OCT        13040                                                    0490007
16116  50400              SA   IM    NO                                                       0490008
16117  16126              PZE        *+7                                                      0490009
16120  50400              SA   IM    NO                                                       0490010
16121  16140              PZE        *+15                                                     0490011
16122  75162              LA   DL    $AL                                                      0490012
16123  20034              BR   DM    AN                                                       0490013
16124  16132              PZE        *+6                                                      0490014
16125  62163              LP   DL    $AR                                                      0490015
16126  00000              PZE                                                                 0490016
16127  42163              SP   DL    $AR                                                      0490017
16130  50162              SA   DL    $AL                                                      0490018
16131  62571              LP   IL    $IC         R      EXIT                                  0490019
16132  62162              LP   DL    $AL                                                      0490020
16133  75163              LA   DL    $AR                                                      0490021
```

```
16134  44065          ZE   DM B  CS                                                    0490022
16135  61060          AI   DM B  NO                                                    0490023
16136  66077          AP   DM B  CH                                                    0490024
16137  71060          AM   DM B  NO                                                    0490025
16140  00000          PZE                                                             0490026
16141  66065          AP   DM B  CS                                                    0490027
16142  44061          ZE   DM B  AI                                                    0490028
16143  50163          SA   DL    $AR                                                   0490029
16144  66077          AP   DM B  CH                                                    0490030
16145  44071          ZE   DM B  AM                                                    0490031
16146  50162          SA   DL    $AL                                                   0490032
16147  62571          LP   IL    $IC          R  EXIT                                  0490033
16150  55162          RA   DL    $AL                                                   0490034
16151  20034          BR   DM    AN                                                    0490035
16152  16163          PZE       *+9                                                   0490036
16153  55162          RA   DL    $AL                                                   0490037
16154  62162          LP   DL    $AL                                                   0490038
16155  44162          ZE   DL    $AL                                                   0490039
16156  42163          SP   DL    $AR                                                   0490040
16157  60013          NO   DM    AS                                                    0490041
16160  77761          OCT       77761                                                 0490042
16161  20020          BR   DM    UN                                                    0490043
16162  16114          PZE       *-38                                                  0490044
16163  62000          LP   DM    NO                                                    0490045
16164  77777          OCT       77777                                                 0490046
16165  55162          RA   DL    $AL                                                   0490047
16166  47162          RP   DL    $AL                                                   0490048
16167  20020          BR   DM    UN                                                    0490049
16170  16156          PZE       *-10                                                  0490050
                       1LDB0450 01B1NL1   ,NUMERIC LEFT SHIFT S.L.      00013120+3NUS  0450000
16171  75000  NL1     LA   DM C  NO            LOAD A WITH MASK                      0450001
16172  40000          OCT       40000                                                 0450002
16173  56162          DX   DL    $AL            SIGN OF AC TO AC, MAGNITUDE OF AC TO A 0450003
16174  64215          AT   DP C  LA            EXCHANGE A AND T, LOAD A WITH N       0450004
16175  42171          SP   DL    $IC            STORE P IN $IC                        0450005
16176  73000          AS   DM C  NO            FORM SHIFT COMMAND                    0450006
16177  11020          SO   DM S  LO                                                  0450007
16200  50024          SA   DM H  AT            STORE SHIFT, EXCHANGE A AND T         0450008
16201  11020          SO   DM S  LO            SHIFT                                 0450009
16202  67016          CC   DM C  XA            EXTRACT OFF SIGN POSITION             0450010
16203  37777          OCT       37777                                                 0450011
16204  54162          ME   DL    $AL            MERGE MAGNITUDE WITH INITIAL SIGN     0450012
16205  62200          LP   DP    NO         R  EXIT                                  0450013
                       1LDB0460 0182NL2   ,NUMERIC LEFT SHIFT D.L.      00024168+3NUS  0460000
16206  67015  NL2     CC   DM    LA                                                    0460001
```

```
16207  40000            OCT        40000                                                            0460002
16210  56162            DX    DL   $AL              EXTRACT SIGN OF NUMBER TO $AL                   0460003
16211  64215            AT    DP   LA               REST TO NUMBER TO T REGISTER                    0460004
16212  42171            SP    DL   $IC              SAVE INSTRUCTION COUNTER                        0460005
16213  20437            BR    IM   NL               JUMP IF NUMBER OF SHIFTS LARGER                 0460006
16214  77760            OCT        77760            THAN 17(8)                                      0460007
16215  16230            PZE        *+11                                                             0460008
16216  73000            AS    DM   NO               FORM SHIFT COMMAND                              0460009
16217  11060            OCT        11060                                                            0460010
16220  62163            LP    DL   $AR              NUMBER TO SHIFT (LS) TO P                       0460011
16221  50024            SA    DM H AT               NUMBER TO SHIFT MS) TO A                        0460012
16222  00000            PZE                         SHIFT COMMAND LOADED HERE                       0460013
16223  42163            SP    DL   $AR              SAVE SHIFTED NUMBER                             0460014
16224  67016            CC    DM   XA               MERGE SIGN WITH THE SHIFTED NUMBER (MS)         0460015
16225  37777            OCT        37777                                                            0460016
16226  54162            ME    DL   $AL                                                              0460017
16227  62571            LP    IL   $IC            R EXIT                                            0460018
16230  70163            LT    DL   $AR              HERE WHEN SHIFT LARGER THAN 17(8)               0460019
16231  44163            ZE    DL   $AR              ZERO TO $AR                                     0460020
16232  60013            NO    DM   AS               SET SHIFT COUNTER                               0460021
16233  77761            OCT        77761                                                            0460022
16234  20020            BR    DM   UN               RETURN TO MAIN CHAIN                            0460023
16235  16216            PZE        *-15                                                             0460024
                        1LDC0500 0182NR4     ,NUMERIC RIGHT SHIFT QUAD.L.          00051330+9NUS    0500000
16236  75200    NR4     LA    DP C NO                                                               0500001
16237  42171            SP    DL   $IC                                                              0500002
16240  50113            SA    DL   $T1                                                              0500003
16241  73000            AS    DM C NO                                                               0500004
16242  77761            OCT        77761                                                            0500005
16243  20035            BR    DM   AP                                                               0500006
16244  16276            PZE        NR4A                                                             0500007
16245  75113            LA    DL   $T1                                                              0500008
16246  73000            AS    DM C NO                                                               0500009
16247  11040            SO    DM D RO                                                               0500010
16250  50070            SA    DM B LT                                                               0500011
16251  73000            AS    DM C NO               UT SO SHIFT IN T                                0500012
16252  02000            OCT        02000            MAKE NR SHIFT                                   0500013
16253  44062            ZE    DM B LP                                                               0500014
16254  55162            RA    DL   $AL                                                              0500015
16255  52020            SE    DM H NO                                                               0500016
16256  13040            NR    DM D RO                                                               0500017
16257  50162            SA    DL   $AL                                                              0500018
16260  47163            RP    DL   $AR                                                              0500019
16261  66002            AP    DM C LP                                                               0500020
16262  00000            PZE        0                                                                0500021
```

```
16263  40020          ST   DM H  NO                                                  0500022
16264  11040          SO   DM D  RO                                                  0500023
16265  54163          ME   DL    $AR                                                 0500024
16266  64066          AT   DM B  AP                                                  0500025
16267  55166          RA   DL    $QL                                                 0500026
16270  47167          RP   DL    $QR                                                 0500027
16271  52020          SE   DM H  NO                                                  0500028
16272  11040          SO   DM D  RO                                                  0500029
16273  54166          ME   DL    $QL                                                 0500030
16274  42167          SP   DL    $QR                                                 0500031
16275  62571          LP   IL    $IC          R                                      0500032
16276  73000   NR4A   AS   DM C  NO                                                  0500033
16277  11040          SO   DM D  RO                                                  0500034
16300  50070          SA   DM B  LT                                                  0500035
16301  73000          AS   DM C  NO                                                  0500036
16302  02000          OCT       02000                                               0500037
16303  44062          ZE   DM B  LP                                                  0500038
16304  55162          RA   DL    $AL                                                 0500039
16305  52020          SE   DM H  NO                                                  0500040
16306  13040          NR   DM D  RO                                                  0500041
16307  55163          RA   DL    $AR                                                 0500042
16310  47166          RP   DL    $QL                                                 0500043
16311  40020          ST   DM H  NO                                                  0500044
16312  11040          SO   DM D  RO                                                  0500045
16313  54166          ME   DL    $QL                                                 0500046
16314  42167          SP   DL    $QR                                                 0500047
16315  75163          LA   DL    $AR                                                 0500048
16316  13016          NR   DM S  R14                                                 0500049
16317  50162          SA   DL    $AL                                                 0500050
16320  62571          LP   IL    $IC          R                                      0500051
                 1LDD0470 01B2NL4   ,NUMERIC LEFT SHIFT QUAD.L.      00060329+3NUS  0470000
16321  75200   NL4    LA   DP C  NO                                                  0470001
16322  42171          SP   DL    $IC                                                 0470002
16323  50113          SA   DL    $T1                                                 0470003
16324  73000          AS   DM C  NO                                                  0470004
16325  77761          OCT       77761                                               0470005
16326  20035          BR   DM    AP                                                  0470006
16327  16370          PZE       NL4A                                                0470007
16330  75000          LA   DM C  NO                                                  0470008
16331  11060          SO   DM D  LO                                                  0470009
16332  73113          AS   DL    $T1                                                 0470010
16333  51114          HA   DL    $T2          SHIFT LEFT COMMAND                     0470011
16334  76000          XA   DM C  NO                                                  0470012
16335  00017          OCT       00017                                               0470013
16336  73000          AS   DM C  NO                                                  0470014
```

```
16337  11040          SO   DM D  RO                                        0470015
16340  64015          AT   DM C  LA          SHIFT RIGHT COMMAND           0470016
16341  40000          OCT       40000                                      0470017
16342  56162          DX   DL    $AL                                        0470018
16343  62163          LP   DL    $AR                                        0470019
16344  60114          NO   DL    $T2                                        0470020
16345  52020          SE   DM H  NO                                        0470021
16346  11060          SO   DM D  LO                                        0470022
16347  42163          SP   DL    $AR                                        0470023
16350  67016          CC   DM C  XA                                        0470024
16351  37777          OCT       37777                                      0470025
16352  54162          ME   DL    $AL                                        0470026
16353  75166          LA   DL    $QL                                        0470027
16354  62167          LP   DL    $QR                                        0470028
16355  40020          ST   DM H  NO                                        0470029
16356  11040          SO   DM D  RO                                        0470030
16357  42166          SP   DL    $QL                                        0470031
16360  54163          ME   DL    $AR                                        0470032
16361  75167          LA   DL    $QR                                        0470033
16362  44062          ZE   DM B  LP                                        0470034
16363  60114          NO   DL    $T2                                        0470035
16364  52020          SE   DM H  NO                                        0470036
16365  11060          SO   DM D  LO                                        0470037
16366  50167          SA   DL    $QR                                        0470038
16367  62571          LP   IL    $IC         R                              0470039
16370  73000   NL4A   AS   DM C  NO                                        0470040
16371  11060          SO   DM D  LO                                        0470041
16372  64015          AT   DM C  LA                                        0470042
16373  40000          OCT       40000                                      0470043
16374  56162          DX   DL    $AL                                        0470044
16375  75163          LA   DL    $AR                                        0470045
16376  62166          LP   DL    $QL                                        0470046
16377  40020          ST   DM H  NO                                        0470047
16400  11060          SO   DM D  LO                                        0470048
16401  42163          SP   DL    $AR                                        0470049
16402  67016          CC   DM C  XA                                        0470050
16403  37777          OCT       37777                                      0470051
16404  54162          ME   DL    $AL                                        0470052
16405  44075          ZE   DM B  LA                                        0470053
16406  62167          LP   DL    $QR                                        0470054
16407  40020          ST   DM H  NO                                        0470055
16410  11060          SO   DM D  LO                                        0470056
16411  54163          ME   DL    $AR                                        0470057
16412  42166          SP   DL    $QL                                        0470058
16413  44167          ZE   DL    $QR                                        0470059
```

```
                                                                                              0470060
16414  62571            LP   IL    $IC              R
                         1LDE0530 01B1LR1    ,LOGICAL RIGHT SHIFT S.L.        00009096+3NUS   0530000
                                                                                              0530001
16415  75200   LR1      LA   DP C  NO                                                         0530002
16416  42171            SP   DL    $IC                                                        0530003
16417  73000            AS   DM C  NO                                                         0530004
16420  11000            SO   DM S  RO                                                         0530005
16421  55162            RA   DL    $AL                                                        0530006
16422  52020            SE   DM H  NO                                                         0530007
16423  11000            SO   DM S  RO                                                         0530008
16424  50162            SA   DL    $AL                                                        0530009
16425  62200            LP   DP C  NO               R
                         1LDE0540 01B2LR2    ,LOGICAL RIGHT SHIFT,D.L.        00021144+3NUS   0540000
16426  75207   LR2      LA   DP    CC                  SHIFT COUNT TO A REGISTER              0540001
16427  42171            SP   DL    $IC                 SAVE INSTRUCTION COUNTER               0540002
16430  20436            BR   IM    NH                  JUMP IF N LARGER THAN 17(8)            0540003
16431  00020            OCT        00020                                                      0540004
16432  16444            PZE        *+10                                                       0540005
16433  67013            CC   DM    AS                  FORM SHIFT INSTRUCTION                 0540006
16434  11040            OCT        11040                                                      0540007
16435  62163            LP   DL    $AR                 NUMBER TO SHIFT IN P (LS)              0540008
16436  55162            RA   DL    $AL                 NUMBER TO SHIFT IN A (MS)              0540009
16437  52020            SE   DM H  NO                  STORE SHIFT INSTRUCTION                0540010
16440  00000            PZE                            HERE                                   0540011
16441  42163            SP   DL    $AR                 SAVE SHIFTED NUMBER                    0540012
16442  50162            SA   DL    $AL                                                        0540013
16443  62571            LP   IL    $IC              R  EXIT                                   0540014
16444  62162            LP   DL    $AL                 N GREATER THAN 17(8)                   0540015
16445  44162            ZE   DL    $AL                 ZERO TO $AL                            0540016
16446  42163            SP   DL    $AR                 ($AL) TO $AR                           0540017
16447  60013            NO   DM    AS                  SET SHIFT COUNTER                      0540018
16450  00017            OCT        00017                                                      0540019
16451  20020            BR   DM    UN                  RETURN TO MAIN CHAIN                   0540020
16452  16433            PZE        *-15                                                       0540021
                         1LDF0510 01B1LL1    ,LOGICAL LEFT SHIFT S.L.         00009096+3NUS   0510000
                                                       LOAD A WITH N                          0510001
16453  75200   LL1      LA   DP C  NO                  STORE Y+2 IN $IC                       0510002
16454  42171            SP   DL    $IC                 ADD N AND SHIFT COMMAND                0510003
16455  73000            AS   DM C  NO                                                         0510004
16456  11020            SO   DM S  LO                  $AL TO A, SHIFT TO E                   0510005
16457  55162            RA   DL    $AL                 STORE SHIFT IN *+1                     0510006
16460  52020            SE   DM H  NO                  EXECUTE MODIFIED SHIFT                 0510007
16461  11020            SO   DM S  LO                  STORE RESULT                           0510008
16462  50162            SA   DL    $AL                                                        0510009
16463  62200            LP   DP C  NO               R  EXIT
                         1LDF0520 01B2LL2    ,LOGICAL LEFT SHIFT D.L.         00021144+3NUS   0520000
                                                                                              0520001
16464  75207   LL2      LA   DP    CC
```

```
16465  42171          SP   DL     $IC                                                    0520002
16466  20436          BR   IM     NH                                                     0520003
16467  00020          OCT         00020                                                  0520004
16470  16502          PZE         *+10                                                   0520005
16471  67013          CC   DM     AS                                                     0520006
16472  11060          OCT         11060                                                  0520007
16473  62163          LP   DL     $AR                                                    0520008
16474  55162          RA   DL     $AL                                                    0520009
16475  52020          SE   DM H   NO                                                     0520010
16476  00000          PZE                                                                0520011
16477  42163          SP   DL     $AR                                                    0520012
16500  50162          SA   DL     $AL                                                    0520013
16501  62571          LP   IL     $IC          R  EXIT                                   0520014
16502  62163          LP   DL     $AR                                                    0520015
16503  44163          ZE   DL     $AR                                                    0520016
16504  42162          SP   DL     $AL                                                    0520017
16505  60013          NO   DM     AS                                                     0520018
16506  00017          OCT         00017                                                  0520019
16507  20020          BR   DM     UN                                                     0520020
16510  16471          PZE         *-15                                                   0520021
                       1LDP0550 00B1FL1   ,FLOAT LEFT S.L.                 00008084+3NUS  0550000
16511  42171  FL1     SP   DL     $IC          STORE Y+1 IN $IC                          0550001
16512  75162          LA   DL     $AL          LOAD A WITH $AL                           0550002
16513  01036          FL   DM S   L14          FLOAT AL                                  0550003
16514  51162          HA   DL     $AL          STORE F(AL) IN $AL,LOAD A WITH COMMAND    0550004
16515  65001          CS   DM C   AI           CALCULATE PLACES FLOATED                  0550005
16516  01036          OCT         01036                                                  0550006
16517  50163          SA   DL     $AR          STORE IN $AR                              0550007
16520  62200          LP   DP C   NO        R  EXIT                                      0550008
                       1LDP0560 00B2FL2   ,FLOAT LEFT D.L.                 00018198+3NUS  0560000
16521  42171  FL2     SP   DL     $IC          STORE Y+1 IN $IC                          0560001
16522  75162          LA   DL     $AL          LOAD A WITH $AL                           0560002
16523  62163          LP   DL     $AR          LOAD P WITH $AR                           0560003
16524  01077          FL   DM D   L15          FLOAT A AND P                             0560004
16525  51162          HA   DL     $AL          STORE F($AL),LOAD A WITH COMMAND          0560005
16526  65001          CS   DM C   AI           CALCULATE PLACES FLOATED                  0560006
16527  01077          OCT         01077                                                  0560007
16530  50167          SA   DL     $QR          STORE IN $QR                              0560008
16531  75162          LA   DL     $AL          LOAD A WITH $AL                           0560009
16532  01076          FL   DM D   L14          FLOAT                                     0560010
16533  51162          HA   DL     $AL          STORE F($AL),LOAD A WITH COMMAND          0560011
16534  42163          SP   DL     $AR          STORE P IN $AR                            0560012
16535  65001          CS   DM C   AI           CALCULATE PLACES FLOATED                  0560013
16536  01076          OCT         01076                                                  0560014
16537  73167          AS   DL     $QR          SUM OF TWO FLOATS                         0560015
```

```
16540  50167          SA   DL    $QR                                                    0560016
16541  44166          ZE   DL    $QL              CLEAR $QL                             0560017
16542  62571          LP   IL    $IC          R   EXIT                                  0560018
                      1LEA0430 01L HPN    ,HALT AND PROCEED              00003000036US  0430000
16543  75200   HPN    LA   DP C  NO                                                     0430001
16544  42171          SP   DL    $IC                                                    0430002
16545  20360          BR   DA F  UN           R                                       0430003
                      1LEB0280 01B1BPN    ,BRANCH ON POSITIVE ACCUM.          00005000048US  0280000
16546  60200   BPN    NO   DP C  NO               LOAD E WITH G                       0280001
16547  43171          HP   DL    $IC              LOAD P WITH G, STORE P IN IC        0280002
16550  75162          LA   DL    $AL              LOAD A WITH AC                      0280003
16551  20235          BR   DP    AP           R   EXIT TO G IF POSITIVE              0280004
16552  62571          LP   IL    $IC          R   EXIT TO LSA IF NEGATIVE            0280005
                      1LEB0290 01B1BMN    ,BRANCH ON MINUS ACCUM.             00005000048US  0290000
16553  60200   BMN    NO   DP C  NO               LOAD E WITH G                       0290001
16554  43171          HP   DL    $IC              LOAD P WITH G, STORE P IN IC        0290002
16555  75162          LA   DL    $AL              LOAD A WITH AC                      0290003
16556  20234          BR   DP    AN           R   EXIT TO G, IF NEGATIVE             0290004
16557  62571          LP   IL    $IC          R   EXIT TO LSA IF POSITIVE            0290005
                      1LEB0310 01Z BVN    ,BRANCH ON OVERFLOW                 00004000036US  0310000
16560  75200   BVN    LA   DP C  NO               LOAD WITH CONDITIONAL ADDRESS G     0310001
16561  42171          SP   DL    $IC              STORE P IN $IC                      0310002
16562  20331          BR   DA    OV               BRANCH TO G IF OVERFLOW IND ON      0310003
16563  62300          LP   DA C  NO           R   EXIT TO NEXT LSA                    0310004
                      1LEB0320 01Z BDK    ,BRANCH ON DIVIDE CHECK             00007000060US  0320000
16564  60200   BDK    NO   DP C  NO               LOAD E WITH G                       0320001
16565  43171          HP   DL    $IC              LOAD P WITH G, STORE P IN IC        0320002
16566  75175          LA   DL    $DK              LOAD A WITH DK INDICATOR            0320003
16567  44175          ZE   DL    $DK                                                  0320004
16570  20221          BR   DP    AD           R   EXIT TO G IF ONE                    0320005
16571  62571          LP   IL    $IC          R   EXIT TO LSA IF ZERO                 0320006
                      1LEC0330 01B1BZ1    ,BRANCH ON ACCUMULATOR ZERO S.L.    00005000048US  0330000
16572  60200   BZ1    NO   DP C  NO               LOAD E WITH G                       0330001
16573  43171          HP   DL    $IC              LOAD P WITH G, STORE P IN IC        0330002
16574  75162          LA   DL    $AL              LOAD A WITH AC                      0330003
16575  20224          BR   DP    AZ           R   EXIT TO G, IF ZERO                 0330004
16576  62571          LP   IL    $IC          R   EXIT TO LSA IF NON-ZERO            0330005
                      1LEC0340 0182BZ2    ,BRANCH ON ACCUMULATOR ZERO D.L.    00006000060US  0340000
16577  60200   BZ2    NO   DP C  NO               LOAD E WITH G                       0340001
16600  43171          HP   DL    $IC              LOAD P WITH G, STORE P IN IC        0340002
16601  75162          LA   DL    $AL              LOAD A WITH AC(MS)                  0340003
16602  74163          MA   DL    $AR                                                  0340004
16603  20224          BR   DP    AZ           R   EXIT TO G IF ZERO                   0340005
16604  62571          LP   IL    $IC          R   EXIT TO LSA, NOT ZERO               0340006
                      1LEE0350 02B1CE1    ,COMPARE EQUAL S.L.                 00009000108US  0350000
```

```
16605 75200 CE1    LA   DP C  NO              LOAD A WITH G                                  0350001
16606 60200        NO   DP C  NO              LOAD E WITH H                                  0350002
16607 43171        HP   DL    $IC             STORE P IN $IC, H TO THE P REGISTER            0350003
16610 42113        SP   DL    $T1             STORE H IN $T1                                 0350004
16611 66162        AP   DL    $AL             EXCHANGE A AND P AND LOAD $AL INTO E           0350005
16612 75067        LA   DM B  CC              COMPLEMENT OF $AC TO A AND CLEAR CARRY         0350006
16613 24626        SK   IP    EQ              COMPARE G WITH $AC AND IF EQUAL SKIP ONE       0350007
16614 62571        LP   IL    $IC           R EXIT TO Y+3                                    0350008
16615 62513        LP   IL    $T1           R EXIT TO H                                      0350009
                   1LEE0360 02B2CE2   ,COMPARE EQUAL D.L.                  00013000144US     0360000
16616 75200 CE2    LA   DP C  NO              LOAD A WITH G                                  0360001
16617 60200        NO   DP C  NO              LOAD P WITH H                                  0360002
16620 43171        HP   DL    $IC             LOAD Y+3 INTO $IC                              0360003
16621 42113        SP   DL    $T1             LOAD H INTO $T1                                0360004
16622 62162        LP   DL    $AL             LOAD $AL INTO L                                0360005
16623 66067        AP   DM B  CC              EXCHANGE A+P COMPLEMENT A, CLEAR CARRY         0360006
16624 24626        SK   IP    EQ              IF $AC+G EQUAL SKIP ONE LOGAND, G+1 TO P       0360007
16625 62571        LP   IL    $IC           R EXIT TO Y+3 (NOT EQUAL)                        0360008
16626 75163        LA   DL    $AR             LOAD A WITH $AR                                0360009
16627 67060        CC   DM B  NO              COMPLEMENT A                                   0360010
16630 24626        SK   IP    EQ              COMPARE $AR WITH G+1, IF EQUAL SKIP ONE        0360011
16631 62571        LP   IL    $IC           R EXIT TO Y+3 (NOT EQUAL)                        0360012
16632 62513        LP   IL    $T1           R EXIT TO H                                      0360013
                   1LEE0370 02B1CG1   ,COMPARE GREATER S.L.                00009000108US     0370000
16633 75200 CG1    LA   DP C  NO              LOAD A WITH G                                  0370001
16634 60200        NO   DP C  NO              LOAD P WITH H                                  0370002
16635 43171        HP   DL    $IC                                                            0370003
16636 42113        SP   DL    $T1             LOAD $T1 WITH H                                0370004
16637 66162        AP   DL    $AL             EXCHANGE A+P LOAD $AL INTO E                   0370005
16640 75067        LA   DM B  CC              COMPLEMENT $AL IN A REGISTER                   0370006
16641 24636        SK   IP    NH              IF GREATER SKIP ONE LOGAND                     0370007
16642 62571        LP   IL    $IC           R EXIT TO Y+3 (NOT SATISFIED)                    0370008
16643 62513        LP   IL    $T1           R EXIT TO H                                      0370009
                   1LEE0380 02B2CG2   ,COMPARE GREATER D.L.                00014000150US     0380000
16644 60610 CG2    NO   IP C  LT              LOAD T WITH (G) MS                             0380001
16645 60200        NO   DP    NO                H TO E                                       0380002
16646 52113        SE   DL    $T1                H TO $T1                                    0380003
16647 42171        SP   DL    $IC             STORE P IN IC                                  0380004
16650 40400        ST   IM C  NO              STORE (G)MS                                    0380005
16651 16657        PZE        CG2A                                                           0380006
16652 62163        LP   DL    $AR             LOAD P WITH AR                                 0380007
16653 67301        CC   DA    AI              COMPLEMENT AR ADD (G)LS                        0380008
16654 75417        LA   IM C  CH              LOAD AND COMPLEMENT AL                         0380009
16655 00062        PZE        $AL                                                            0380010
16656 24436        SK   IM    NH                                                             0380011
```

```
16657  16657   CG2A   PZE          *                   SKIP TO CG2A+2 IF SATISFIED                     0380012
16660  62571          LP     IL    $IC             R      EXIT - NOT SATISFIED                         0380013
16661  62513          LP     IL    $T1             R   EXIT SATISFIED                                  0380014
                       1LEE0390 02B1CL1    ,COMPARE LESS S.L.                        00009000108US    0390000
16662  75200   CL1    LA     DP C  NO                  LOAD A WITH G                                   0390001
16663  60200          NO     DP C  NO                  LOAD P WITH H                                   0390002
16664  43171          HP     DL    $IC                 LOAD $IC WITH Y+3                               0390003
16665  42113          SP     DL    $T1                 LOAD $T1 WITH H                                 0390004
16666  66162          AP     DL    $AL                 EXCHANGE A+P LOAD $AL INTO E                    0390005
16667  75067          LA     DM B  CC                  COMPLEMENT OF $AL IN A                          0390006
16670  24637          SK     IP    NL                  SKIP ONE LOGAND IF LESS                         0390007
16671  62571          LP     IL    $IC             R   EXIT TO Y+3 (NOT SATISFIED)                     0390008
16672  62513          LP     IL    $T1             R   EXIT TO H                                       0390009
                       1LEE0400 02B2CL2    ,COMPARE LESS D.L.                        00014000150US    0400000
16673  60610   CL2    NO     IP C  LT                  LOAD T WITH (G) MS                              0400001
16674  60200          NO     DP    NO                    H TO E                                        0400002
16675  52113          SE     DL    $T1                    H TO $T1                                     0400003
16676  42171          SP     DL    $IC                 STORE P IN IC                                   0400004
16677  40400          ST     IM C  NO                  STORE (G)MS                                     0400005
16700  16706          PZE          CL2A                                                                0400006
16701  62163          LP     DL    $AR                 LOAD P WITH AR                                  0400007
16702  67301          CC     DA C  AI                  COMPLEMENT AR ADD (G)LS                         0400008
16703  75417          LA     IM C  CH                  LOAD AND COMPLEMENT AL                          0400009
16704  00062          PZE          $AL                                                                 0400010
16705  24437          SK     IM    NL                                                                  0400011
16706  16706   CL2A   PZE          *                                                                   0400012
16707  62571          LP     IL    $IC             R   EXIT-NOT SATISFIED                              0400013
16710  62513          LP     IL    $T1             R   EXIT-SATISFIED                                  0400014
                       1LEG0270 01Z BUN    ,BRANCH UNCONDITIONAL                     00003000036US    0270000
16711  75200   BUN    LA     DP C  NO                  LOAD A WITH BRANCH ADDRESS G                    0270001
16712  42171          SP     DL    $IC                 STORE P IN IC                                   0270002
16713  62300          LP     DA C  NO              R   EXIT TO G                                       0270003
                       1LEH0420 02L LJN    ,LINK JUMP                                00005000060US    0420000
16714  75200   LJN    LA     DP C  NO                  G TO A AND L, Y+2 IN P                          0420001
16715  60200          NO     DP C  NO                  H TO L, Y+3 IN P REGISTER                       0420002
16716  43171          HP     DL    $IC                 Y+3 TO P, H TO P REGISTER                       0420003
16717  52300          SE     DA C  NO                  H TO (G)                                        0420004
16720  62300          LP     DA    NO              R     EXIT                                          0420005
                       1LEH0440 02L LVN    ,LEAVE INTERPRETIVE MODE                  00005000060US    0440000
16721  75200   LVN    LA     DP C  NO                                                                  0440001
16722  60200          NO     DP C  NO                                                                  0440002
16723  43171          HP     DL    $IC                                                                 0440003
16724  50173          SA     DL    $RET                                                                0440004
16725  42072          SP     DM B  LM              R                                                   0440005
                       1LEJ0300 00L BAN    ,BRANCH TO ACCUM. ADDRESS                 00002000030US    0300000
```

```
16726  42171  BAN    SP   DL   $IC                                                    0300001
16727  62562         LP   IL   $AL          R                                         0300002
                     1LEJ0410 02L TDN   ,TEST AND DECREMENT          000090000108US  0410000
16730  60620  TDN    NO   IP H  NO            LOAD E WITH (G)                        0410001
16731  51171         HA   DL   $IC           G TO IC, (G) TO A                      0410002
16732  73177         AS   DL   $MON            DECREMENT                            0410003
16733  47171         RP   DL   $IC            H TO IC, G TO P                       0410004
16734  50200         SA   DP   NO            STORE (G)-1 IN G                       0410005
16735  60571         NO   IL   $IC            H TO E, LSA TO P                       0410006
16736  43171         HP   DL   $IC             H TO P, LSA TO $IC                    0410007
16737  20224         BR   DP   AZ          R   EXIT TO H IF ZERO                     0410008
16740  62571         LP   IL   $IC          R     EXIT  NON-ZERO                    0410009
                     1LFA0630 01B1DG1   ,DOT G(AND)-S.L.            000040000054US  0630000
16741  60615  DG1    NO   IP C  LA            LOAD A WITH (G)                        0630001
16742  42171         SP   DL   $IC           STORE P IN $IC                         0630002
16743  46162         XE   DL   $AL           EXTRACT (G) AND AC TO AC               0630003
16744  62200         LP   DP C  NO          R  EXIT                                  0630004
                     1LFA0640 01B2DG2   ,DOT G(AND)-D.L.            000070000090US  0640000
16745  60610  DG2    NO   IP C  LT            LOAD T WITH (G)                        0640001
16746  42171         SP   DL   $IC           STORE P IN IC                          0640002
16747  75300         LA   DA C  NO           LOAD A WITH (G+1)                      0640003
16750  46404         XE   IM   AT           EXTRACT (G+1) AND $AL TO $AL           0640004
16751  00063         PZE       $AR          EXCHANGE A AND T                       0640005
16752  46162         XE   DL   $AL           EXTRACT (G) AND AC(MS) TO AC(MS)       0640006
16753  62571         LP   IL   $IC          R  EXIT                                  0640007
                     1LFB0610 01  OR1B1  ,INCLUSIVE OR S.L.            000040000054US  0610000
16754  60615  OR1    NO   IP C  LA            LOAD A WITH (G)                        0610001
16755  42171         SP   DL   $IC           STORE P IN $IC                         0610002
16756  54162         ME   DL   $AL           MERGE (G) AND AC TO AC                 0610003
16757  62200         LP   DP C  NO          R  EXIT                                  0610004
                     1LFB0620 01B2OR2   ,INCLUSIVE OR D.L.            000070000090US  0620000
16760  60610  OR2    NO   IP C  LT            LOAD T WITH (G)                        0620001
16761  42171         SP   DL   $IC           STORE P IN IC                          0620002
16762  75300         LA   DA   NO           LOAD A WITH (G+1)                      0620003
16763  54404         ME   IM   AT           MERGE (G) AND AC(MS), EXCHANGE A AND T 0620004
16764  00063         PZE       $AR                                                  0620005
16765  54162         ME   DL   $AL           MERGE (G) AND AC(MS) TO AC(MS)         0620006
16766  62571         LP   IL   $IC          R    EXIT                                0620007
                     1LFD0590 02B1IN1   ,INSERT S.L.                 00007000096US   0590000
16767  70615  IN1    LT   IP C  LA            LOAD T WITH CONTENTS OF G, G TO A      0590001
16770  46162         XE   DL   $AL           EXTRACT WITH $AL                       0590002
16771  60604         NO   IP C  AT                                                  0590003
16772  76060         XA   DM B  NO                                                  0590004
16773  54162         ME   DL   $AL           MERGE WITH $AL                         0590005
16774  42171         SP   DL   $IC           Y+3 IN $IC                             0590006
```

```
16775 62200          LP   DP    NO          R  EXIT                                                  0590007
                     1LFD0600 02B2IN2    ,INSERT D.L.                                 00017000222US  0600000
16776 60610  IN2     NO   IP    LT             LOAD T WITH (G), (G) IN L, G+1 IN A                   0600001
16777 42171          SP   DL    $IC            STORE Y+2 IN $IC                                      0600002
17000 75300          LA   DA    NO             (G+1) IN L REGISTER, (G+1) IN A, G+2 IN P             0600003
17001 46163          XE   DL    $AR            EXTRACT WITH $AR                                      0600004
17002 64060          AT   DM B  NO             G IN A REGISTER, (G+1) IN T                           0600005
17003 46162          XE   DL    $AL            EXTRACT WITH $AL                                      0600006
17004 50113          SA   DL    $T1            STORE (G) IN $T1                                      0600007
17005 62171          LP   DL    $IC            H TO P REGISTER                                       0600008
17006 60600          NO   IP C  NO             CONTENTS ON H TO E                                    0600009
17007 43171          HP   DL    $IC            Y+3 TO $IC, (H) TO P REGISTER                         0600010
17010 60300          NO   DA C  NO             (H+D TO L, (H) IN A                                   0600011
17011 64076          AT   DM B  XA             (G+1) TO A, EXTRACT                                   0600012
17012 54163          ME   DL    $AR            MERGE WITH $AR                                        0600013
17013 75113          LA   DL    $T1            LOAD RESULT FROM FIRST EXTRACT                        0600014
17014 47076          RP   DM B  XA             (H) TO L, EXTRACT                                     0600015
17015 54162          ME   DL    $AL            MERGE WITH $AL                                        0600016
17016 62571          LP   IL    $IC         R  EXIT                                                  0600017
                     1LFE0570 00B2OC1    ,ONE-S COMPLEMENT OF ACC. S.L.               00005000060US  0570000
17017 42171  OC1     SP   DL    $IC            STORE P IN IC                                         0570001
17020 75162          LA   DL    $AL            LOAD A WITH AC                                        0570002
17021 67060          CC   DM B  NO             ONES COMPLEMENT                                       0570003
17022 50162          SA   DL    $AL            STORE A IN AC                                         0570004
17023 62200          LP   DP C  NO          R  EXIT                                                  0570005
                     1LFE0580 00B2OC2    ,ONE-S COMPLEMENT OF ACC. D.L.               00008000096US  0580000
17024 42171  OC2     SP   DL    $IC            STORE P IN $IC                                        0580001
17025 75163          LA   DL    $AR            LOAD A WITH AC(LS)                                    0580002
17026 67060          CC   DM B  NO             ONES COMPLEMENT                                       0580003
17027 50163          SA   DL    $AR            STORE A IN AC(LS)                                     0580004
17030 75162          LA   DL    $AL            LOAD A WITH AC(MS)                                    0580005
17031 67060          CC   DM B  NO             ONES COMPLEMENT                                       0580006
17032 50162          SA   DL    $AL            STORE IN AC(MS)                                       0580007
17033 62200          LP   DP C  NO          R  EXIT                                                  0580008
                     1LGA0680 03L TL1    ,TABLE LOOK UP                               00021216+12US  0680000
17034 20031  TL1     BR   DM    OV                                                                   0680001
17035 17036          PZE        *+1                                                                  0680002
17036 75162          LA   DL    $AL                                                                  0680003
17037 67210          CC   DP C  LT                                                                   0680004
17040 64200          AT   DP C  NO                                                                   0680005
17041 55073          RA   DM B  AS                                                                   0680006
17042 52113          SE   DL    $T1                                                                  0680007
17043 73176          AS   DL    $ONE                                                                 0680008
17044 60200          NO   DP C  NO                                                                   0680009
17045 43171          HP   DL    $IC                                                                  0680010
```

```
17046  60113          NO   DL    $T1                                                   0680011
17047  67066          CC   DM B  AP                                                    0680012
17050  51020          HA   DM H  NO                                                    0680013
17051  00000          PZE        0            TABLE LOOK UP LOGAND                     0680014
17052  73177          AS   DL    $MON                                                  0680015
17053  50162          SA   DL    $AL                                                   0680016
17054  20031          BR   DM    OV                                                    0680017
17055  17057          PZE        *+2                                                   0680018
17056  62571          LP   IL    $IC          R                                        0680019
17057  44162          ZE   DL    $AL                                                   0680020
17060  62571          LP   IL    $IC          R                                        0680021
                       1PBZ0790 OON ATITX ,ARC TANGENT TABLE          00066     -      0790000
17061  00000          DEC        00000          ATAN ZK                                 0790001
17062  00777          DEC        03123                                                 0790002
17063  01776   AT1TX  DEC        06241                                                 0790003
17064  02773          DEC        09347                                                 0790004
17065  03765          DEC        12435                                                 0790005
17066  04753          DEC        15499                                                 0790006
17067  05734          DEC        18534                                                 0790007
17070  06710          DEC        21535                                                 0790008
17071  07655          DEC        24497                                                 0790009
17072  10613          DEC        27416                                                 0790010
17073  11542          DEC        30288                                                 0790011
17074  12460          DEC        33109                                                 0790012
17075  13366          DEC        35877                                                 0790013
17076  14262          DEC        38588                                                 0790014
17077  15144          DEC        41241                                                 0790015
17100  16015          DEC        43833                                                 0790016
17101  16654          DEC        46364                                                 0790017
17102  17500          DEC        48833                                                 0790018
17103  20312          DEC        51238                                                 0790019
17104  21112          DEC        53581                                                 0790020
17105  21700          OCT        21700                                                 0790021
17106  22453          DEC        58075                                                 0790022
17107  23213          DEC        60228                                                 0790023
17110  23742          DEC        62319                                                 0790024
17111  24457          DEC        64350                                                 0790025
17112  25161          DEC        66320                                                 0790026
17113  25653          OCT        25653                                                 0790027
17114  26332          DEC        70085                                                 0790028
17115  27001          DEC        71882                                                 0790029
17116  27436          DEC        73625                                                 0790030
17117  30063          DEC        75315                                                 0790031
17120  30477          DEC        76952                                                 0790032
17121  31103          DEC        78539                                                 0790033
```

```
17122  00000           OCT       00000                                                    0790034
17123  65255           OCT       65255                                                    0790035
17124  52673           OCT       52673                                                    0790036
17125  41404           OCT       41404                                                    0790037
17126  33523           OCT       33523                                                    0790038
17127  35671           OCT       35671                                                    0790039
17130  57322           OCT       57322                                                    0790040
17131  32724           OCT       32724                                                    0790041
17132  56575           OCT       56575                                                    0790042
17133  75321           OCT       75321                                                    0790043
17134  35632           OCT       35632                                                    0790044
17135  53314           OCT       53314                                                    0790045
17136  06240           OCT       06240                                                    0790046
17137  23233           OCT       23233                                                    0790047
17140  73541           OCT       73541                                                    0790048
17141  55144           OCT       55144                                                    0790049
17142  31602           OCT       31602                                                    0790050
17143  67205           OCT       67205                                                    0790051
17144  77224           OCT       77224                                                    0790052
17145  56633           OCT       56633                                                    0790053
17146  05653           OCT       05653                                                    0790054
17147  07131           OCT       07131                                                    0790055
17150  70034           OCT       70034                                                    0790056
17151  37670           OCT       37670                                                    0790057
17152  07643           OCT       07643                                                    0790058
17153  72573           OCT       72573                                                    0790059
17154  04606           OCT       04606                                                    0790060
17155  63070           OCT       63070                                                    0790061
17156  23705           OCT       23705                                                    0790062
17157  65675           OCT       65675                                                    0790063
17160  50266           OCT       50266                                                    0790064
17161  72776           OCT       72776                                                    0790065
17162  75524           OCT       75524                                                    0790066
                         1PBA0800 008IAT1SR ,ARC TANGENT, S.L.,SUBROUTINE        00036  -  0800000
17163  17166   AT1SR   PZE       AT1S                                                     0800001
17164  47400           RP    IM  NO                                                       0800002
17165  17163           PZE       AT1SR                                                    0800003
17166  75162   AT1S    LA    DL  $AL                                                      0800004
17167  67060           CC  DM B  NO                                                       0800005
17170  76006           XA    DM  AP                                                       0800006
17171  77000           OCT       77000                                                    0800007
17172  42114           SP    DL  $T2                                                      0800008
17173  44075           ZE  DM B  LA                                                       0800009
17174  11066           SO  DM D  L6                                                       0800010
17175  73000           AS    DM  NO                                                       0800011
```

```
17176 17061              PZE           AT1TX-2                                          0800012
17177 67315              CC    DA C    LA              CLEAR CARRY                      0800013
17200 50115              SA    DL      $T3             STORE XK                         0800014
17201 44075              ZE    DM B    LA                                               0800015
17202 62114              LP    DL      $T2             ZK                               0800016
17203 60162              NO    DL      $AL                                              0800017
17204 15057              MP    DM D    15                                               0800018
17205 74000              MA    DM C    NO              ADD ONE                          0800019
17206 20000              OCT           20000                                            0800020
17207 65011              CS    DM C    AM              COMPLEMENT FOR DIVIDE            0800021
17210 00000              PZE           0                                                0800022
17211 55114              RA    DL      $T2             1+Z*ZK TO $T2, ZK TO A           0800023
17212 65060              CS    DM B    NO                                               0800024
17213 71162              AM    DL      $AL             Z-ZK                             0800025
17214 44062              ZE    DM B    LP                                               0800026
17215 60114              NO    DL      $T2             1+Z*ZK                           0800027
17216 67067              CC    DM B    CC              CLEAR CARRY                      0800028
17217 11041              SO    DM D    R1              SCALE TO ONE                     0800029
17220 05076              DV    DM D    14                                               0800030
17221 66060              AP    DM B    NO              T                                0800031
17222 73115              AS    DL      $T3             ADD XK                           0800032
17223 11001              SO    DM S    R1                                               0800033
17224 50162              SA    DL      $AL             STORE RESULT IN AC               0800034
17225 20020              BR    DM      UN              EXIT                             0800035
17226 17164              PZE           AT1SR+1                                          0800036
                           1PBA0810 00B2AT2SR ,ARCTANGENT,DL(SUBROUTINE        00107    0810000
17227 17232     AT2SR    PZE           AT2S                                             0810001
17230 47400              RP    IM      NO                                               0810002
17231 17227              PZE           AT2SR                                            0810003
17232 75162     AT2S     LA    DL      $AL                                              0810004
17233 44166              ZE    DL      $QL                                              0810005
17234 44167              ZE    DL      $QR                                              0810006
17235 67060              CC    DM B    NO                                               0810007
17236 76006              XA    DM      AP                                               0810008
17237 77000              OCT           77000                                            0810009
17240 42115              SP    DL      $T3                                              0810010
17241 44075              ZE    DM B    LA                                               0810011
17242 11066              SO    DM D    L6                                               0810012
17243 73000              AS    DM      NO                                               0810013
17244 17061              PZE           AT1TX-2                                          0810014
17245 75320              LA    DA H    NO                                               0810015
17246 50120              SA    DL      $T6             $T6 = MSP OF XK                  0810016
17247 66013              AP    DM C    AS                                               0810017
17250 00041              PZE           33                                               0810018
17251 75320              LA    DA H    NO                                               0810019
```

```
17252  50121          SA   DL     $T7          $T7 = LSP OF XK                    0810020
17253  66060          AP   DM B   NO                                              0810021
17254  75120          LA   DL     $T6                                             0810022
17255  11041          SO   DM D   R1                                             0810023
17256  50120          SA   DL     $T6                                             0810024
17257  42121          SP   DL     $T7                                             0810025
17260  62162          LP   DL     $AL          Z                                  0810026
17261  44075          ZE   DM B   LA                                             0810027
17262  60115          NO   DL     $T3          ZK                                 0810028
17263  15056          MP   DM D   14                                             0810029
17264  51113          HA   DL     $T1                                             0810030
17265  42114          SP   DL     $T2                                             0810031
17266  44062          ZE   DM B   LP                                             0810032
17267  66163          AP   DL     $AR                                             0810033
17270  15056          MP   DM D   14                                             0810034
17271  73114          AS   DL     $T2                                             0810035
17272  66060          AP   DM B   NO                                             0810036
17273  75113          LA   DL     $T1                                             0810037
17274  71000          AM   DM     NO                                             0810038
17275  00000          PZE         0                                              0810039
17276  11041          SO   DM D   R1                                             0810040
17277  74000          MA   DM     NO                                             0810041
17300  20000          OCT         20000                                          0810042
17301  42114          SP   DL     $T2                                             0810043
17302  50113          SA   DL     $T1          1+Z*ZK                             0810044
17303  75115          LA   DL     $T3                                             0810045
17304  65411          CS   IM C   AM                                             0810046
17305  00062          PZE         $AL                                            0810047
17306  62163          LP   DL     $AR                                             0810048
17307  11041          SO   DM D   R1                                             0810049
17310  50162          SA   DL     $AL          Z-ZK                               0810050
17311  42163          SP   DL     $AR                                             0810051
17312  47400          RP   IM     NO                                             0810052
17313  17632          PZE         DV2SR        T = (Z-ZK)/(1+Z*ZK)                0810053
17314  75162          LA   DL     $AL                                             0810054
17315  50113          SA   DL     $T1                                             0810055
17316  50116          SA   DL     $T4                                             0810056
17317  62163          LP   DL     $AR                                             0810057
17320  42114          SP   DL     $T2                                             0810058
17321  42117          SP   DL     $T5                                             0810059
17322  47400          RP   IM     NO           T**2                               0810060
17323  17577          PZE         MP2SR                                          0810061
17324  62162          LP   DL     $AL                                             0810062
17325  44075          ZE   DM B   LA                                             0810063
17326  67067          CC   DM B   CC                                             0810064
```

```
17327  60000          NO   DM     NO                                          0810065
17330  12525          DEC         33333                                        0810066
17331  15056          MP   DM D   14              1/3T**2                      0810067
17332  51162          HA   DL     $AL                                          0810068
17333  42114          SP   DL     $T2                                          0810069
17334  44062          ZE   DM B   LP                                           0810070
17335  66163          AP   DL     $AR                                          0810071
17336  15056          MP   DM D   14                                           0810072
17337  73114          AS   DL     $T2                                          0810073
17340  66060          AP   DM B   NO                                           0810074
17341  75162          LA   DL     $AL                                          0810075
17342  71000          AM   DM     NO                                           0810076
17343  00000          PZE         0                                            0810077
17344  50162          SA   DL     $AL                                          0810078
17345  66060          AP   DM B   NO                                           0810079
17346  65001          CS   DM     AI                                           0810080
17347  00000          PZE         0                                            0810081
17350  66075          AP   DM B   LA                                           0810082
17351  55162          RA   DL     $AL                                          0810083
17352  77071          CH   DM B   AM                                           0810084
17353  66003          AP   DM     AL                                           0810085
17354  77777          OCT         77777                                        0810086
17355  66011          AP   DM     AM                                           0810087
17356  37777          OCT         37777           1-1/3(T**2)                  0810088
17357  50162          SA   DL     $AL                                          0810089
17360  42163          SP   DL     $AR                                          0810090
17361  75116          LA   DL     $T4                                          0810091
17362  50113          SA   DL     $T1                                          0810092
17363  75117          LA   DL     $T5                                          0810093
17364  50114          SA   DL     $T2                                          0810094
17365  47400          RP   IM     NO                                           0810095
17366  17577          PZE         MP2SR           T(1-1/3(T**2))               0810096
17367  75162          LA   DL     $AL                                          0810097
17370  62163          LP   DL     $AR                                          0810098
17371  11041          SO   DM D   R1                                           0810099
17372  66060          AP   DM B   NO                                           0810100
17373  63121          AL   DL     $T7                                          0810101
17374  50163          SA   DL     $AR                                          0810102
17375  66060          AP   DM B   NO                                           0810103
17376  71120          AM   DL     $T6                                          0810104
17377  50162          SA   DL     $AL                                          0810105
17400  20020          BR   DM     UN              EXIT                         0810106
17401  17230          PZE         AT2SR+1                                      0810107
                1PBD0820 OOB2SR1SR ,SQUARE ROOT SUBROUTINE,S.L.     00050   -  0820000
17402  17405   SR1SR  PZE         SR1S                                         0820001
```

```
17403  47400          RP   IM    NO                                                  0820002
17404  17402          PZE        SR1SR                                               0820003
17405  75162  SR1S    LA   DL    $AL                                                 0820004
17406  62163          LP   DL    $AR        LOAD P WITH MQ                           0820005
17407  01076          FL   DM D  L14                                                 0820006
17410  51162          HA   DL    $AL        STORE A IN AC                            0820007
17411  42163          SP   DL    $AR        STORE P IN MQ                            0820008
17412  67013          CC   DM C  AS         FIND NO. PLACES FLOATED                  0820009
17413  01077          OCT        01077                                               0820010
17414  20021          BR   DM    AD         BRANCH IF NO. OF PLACES SHIFTED IS ODD   0820011
17415  17455          PZE        SR1SC                                               0820012
17416  11001  SR1SB   SO   DM S  R1           DIVIDE NO. OF PLACES SHIFTED          0820013
17417  50114          SA   DL    $T2        STORE N/2 IN $T2                         0820014
17420  75162          LA   DL    $AL                                                 0820015
17421  13042          NR   DM D  R2         SCALE TO 2.                              0820016
17422  65011          CS   DM    AM                                                  0820017
17423  63507          OCT        -14271     CONSTANT=-1.4270756 SCALED 2             0820018
17424  60000          NO   DM    NO         B TO L                                   0820019
17425  47642          OCT        47642      -B                                       0820020
17426  51067          HA   DM B  CC                                                  0820021
17427  05176          DV   DL D  14         B/C=X                                    0820022
17430  66011          AP   DM    AM         B/X=C                                    0820023
17431  72050          OCT        72050      -2.1366045 SCALED -2                     0820024
17432  50113          SA   DL    $T1        STORE -Y1                                0820025
17433  67407          CC   IM    CC                                                  0820026
17434  00062          PZE        $AL                                                 0820027
17435  51060          HA   DM B  NO                                                  0820028
17436  05176          DV   DL D  14         X/Y                                      0820029
17437  66067          AP   DM B  CC         -X/Y                                     0820030
17440  61113          AI   DL    $T1        -Y2                                      0820031
17441  67060          CC   DM B  NO                                                  0820032
17442  11041          SO   DM D  R1                                                  0820033
17443  55114          RA   DL    $T2        LOAD A WITH PLACES SHIFTED               0820034
17444  73000          AS   DM C  NO         FORM SHIFT COMMAND                       0820035
17445  11040          SO   DM D  RO                                                  0820036
17446  55114          RA   DL    $T2        LOAD A WITH RESULT                       0820037
17447  52020          SE   DM H  NO         STORE SHIFT                              0820038
17450  11040          SO   DM D  RO         SHIFT                                    0820039
17451  50113          SA   DL    $T1                                                 0820040
17452  42114          SP   DL    $T2                                                 0820041
17453  20020          BR   DM    UN                                                  0820042
17454  17403          PZE        SR1SR+1                                             0820043
17455  55162  SR1SC   RA   DL    $AL                                                 0820044
17456  62163          LP   DL    $AR                                                 0820045
17457  11041          SO   DM D  R1         SHIFT ONE PLACE RIGHT                    0820046
```

```
17460  42163          SP   DL   $AR                                                    0820047
17461  55162          RA   DL   $AL          STORE BACK, NO. OF PLACES IN A REGISTER    0820048
17462  20020          BR   DM   UN                                                     0820049
17463  17416          PZE       SR1SB                                                  0820050
                    1PBD0830 00B2SR2SR ,SQUARE ROOT SUBROUTINE,D.L.      00075   -  0830000
17464  17467  SR2SR   PZE       SR2S                                                   0830001
17465  47400          RP   IM   NO                                                     0830002
17466  17464          PZE       SR2SR                                                  0830003
17467  44123  SR2S    ZE   DL   $T9                                                   0830004
17470  75162          LA   DL   $AL                                                   0830005
17471  20024          BR   DM   AZ          JUMP IF SCALING GREATER THAN 14           0830006
17472  17564          PZE       SR2SA                                                  0830007
17473  62163          LP   DL   $AR                                                   0830008
17474  01077  SR2SC   FL   DM D L15                                                   0830009
17475  51162          HA   DL   $AL                                                   0830010
17476  20021          BR   DM   AD          JUMP IF EVEN NU. SHIFTS                  0830011
17477  17504          PZE       *+5                                                    0830012
17500  73176          AS   DL   $ONE        COUNT-1 TO A                             0830013
17501  55162          RA   DL   $AL         SAVE COUNT, GET M.S. TO A                 0830014
17502  11041          SO   DM D R1                                                    0830015
17503  55162          RA   DL   $AL                                                   0830016
17504  65011          CS   DM   AM          2N                                       0830017
17505  01077          OCT       01077                                                  0830018
17506  50113          SA   DL   $T1                                                   0830019
17507  11001          SO   DM S R1          N                                        0830020
17510  73123          AS   DL   $T9         N=FINAL SHIFTS                           0830021
17511  73000          AS   DM   NO          SHIFT COMMAND                            0830022
17512  11041          OCT       11041                                                  0830023
17513  42163          SP   DL   $AR                                                   0830024
17514  50400          SA   IM   NO          STORE SHIFT COMMAND                      0830025
17515  17551          PZE       SR2SB                                                  0830026
17516  75113          LA   DL   $T1         2N                                       0830027
17517  65011          CS   DM   AM          SHIFT COMMAND                            0830028
17520  11057          OCT       11057                                                  0830029
17521  55166          RA   DL   $QL                                                   0830030
17522  52020          SE   DM H NO          SAVE SHIFT COMMAND                       0830031
17523  00000          PZE                                                            0830032
17524  54163          NE   DL   $AR                                                   0830033
17525  47400          RP   IM   NO                                                     0830034
17526  17402          PZE       SR1SR                                                  0830035
17527  50121          SA   DL   $T7                                                   0830036
17530  75114          LA   DL   $T2                                                   0830037
17531  50122          SA   DL   $T8                                                   0830038
17532  47400          RP   IM   NO                                                     0830039
17533  17632          PZE       DV2SR                                                  0830040
```

```
17534  75162          LA   DL    $AL                                          0830041
17535  20035          BR   DM    AP                                           0830042
17536  17543          PZE        *+5                                          0830043
17537  75177          LA   DL    $MON                                         0830044
17540  62177          LP   DL    $MON                                         0830045
17541  20020          BR   DM    UN                                           0830046
17542  17550          PZE        SR2SB-1                                      0830047
17543  75122          LA   DL    $T8                                          0830048
17544  63163          AL   DL    $AR                                          0830049
17545  66060          AP   DM B  NO                                           0830050
17546  75121          LA   DL    $T7                                          0830051
17547  61162          AI   DL    $AL                                          0830052
17550  42113          SP   DL    $T1                                          0830053
17551  00000   SR2SB  PZE                                                     0830054
17552  50162          SA   DL    $AL                                          0830055
17553  42163          SP   DL    $AR                                          0830056
17554  75113          LA   DL    $T1                                          0830057
17555  60400          NO   IM    NO                                           0830058
17556  17551          PZE        *-5                                          0830059
17557  52020          SE   DM H  NO                                           0830060
17560  00000          PZE                                                     0830061
17561  42166          SP   DL    $QL                                          0830062
17562  20020          BR   DM    UN                                           0830063
17563  17465          PZE        SR2S-2                                       0830064
17564  75000   SR2SA  LA   DM    NO                                           0830065
17565  00007          OCT        00007                                        0830066
17566  50123          SA   DL    $T9                                          0830067
17567  75166          LA   DL    $QL                                          0830068
17570  62167          LP   DL    $QR                                          0830069
17571  11041          SO   DM D  R1                                           0830070
17572  47166          RP   DL    $QL                                          0830071
17573  75163          LA   DL    $AR                                          0830072
17574  11041          SO   DM D  R1                                           0830073
17575  20020          BR   DM    UN                                           0830074
17576  17474          PZE        SR2SC                                        0830075
                    1PAA0840 0082MP2SR ,MULTIPLY,D.L.,SUBROUTINE      00027  -  0840000
17577  17602   MP2SR  PZE        MP2S                                         0840001
17600  47400          RP   IM    NO                                           0840002
17601  17577          PZE        MP2SR                                        0840003
17602  75113   MP2S   LA   DL    $T1                                          0840004
17603  62114          LP   DL    $T2                                          0840005
17604  11061          SO   DM D  L1                                           0840006
17605  50113          SA   DL    $T1                                          0840007
17606  42114          SP   DL    $T2                                          0840008
17607  44075          ZE   DM B  LA                                           0840009
```

```
17610  62113          LP   DL    $T1                                          0840010
17611  60163          NO   DL    $AR                                          0840011
17612  67067          CC   DM B  CC              CLEAR CARRY                  0840012
17613  15057          MP   DM D  15                                          0840013
17614  55114          RA   DL    $T2                                          0840014
17615  66162          AP   DL    $AL                                          0840015
17616  15057          MP   DM D  15                                          0840016
17617  62113          LP   DL    $T1                                          0840017
17620  60162          NO   DL    $AL                                          0840018
17621  15057          MP   DM D  15                                          0840019
17622  66114          AP   DL    $T2                                          0840020
17623  63060          AL   DM B  NO                                          0840021
17624  66011          AP   DM C  AM                                          0840022
17625  00000          PZE       0                                           0840023
17626  50162          SA   DL    $AL                                          0840024
17627  42163          SP   DL    $AR                                          0840025
17630  20020          BR   DM    UN                                           0840026
17631  17600          PZE       MP2SR+1                                      0840027
                    1PAA0850 00B2DV2SR ,DIVIDE SUBROUTINE,D.L.      00091   -  0850000
17632  17635  DV2SR   PZE       DV2S                                         0850001
17633  47400          RP   IM    NO                                           0850002
17634  17632          PZE       DV2SR                                        0850003
17635  62114  DV2S    LP   DL    $T2                                          0850004
17636  75113          LA   DL    $T1                                          0850005
17637  01077          FL   DM D  L15                                         0850006
17640  51113          HA   DL    $T1                                          0850007
17641  42114          SP   DL    $T2                                          0850008
17642  67067          CC   DM B  CC                                          0850009
17643  20427          BR   IM    NQ                                           0850010
17644  76717          OCT       76717                                        0850011
17645  17662          PZE       DV2FS                                        0850012
17646  60163          NO   DL    $AR                                          0850013
17647  52162          SE   DL    $AL                                          0850014
17650  60166          NO   DL    $QL                                          0850015
17651  52163          SE   DL    $AR                                          0850016
17652  60167          NO   DL    $QR                                          0850017
17653  52166          SE   DL    $QL                                          0850018
17654  44167          ZE   DL    $QR                                          0850019
17655  75113          LA   DL    $T1                                          0850020
17656  62114          LP   DL    $T2                                          0850021
17657  01077          FL   DM D  L15                                         0850022
17660  51113          HA   DL    $T1                                          0850023
17661  42114          SP   DL    $T2                                          0850024
17662  65011  DV2FS   CS   DM C  AM                                          0850025
17663  01077          OCT       1077                                         0850026
```

```
17664  20024          BR   DM     AZ                    0850027
17665  17713          PZE         DV2AAS                0850028
17666  50115          SA   DL     $T3                   0850029
17667  73000          AS   DM C   NO                    0850030
17670  11060          SO   DM D   LO                    0850031
17671  50400          SA   IM C   NO                    0850032
17672  17703          PZE         DV2GS                 0850033
17673  76000          XA   DM C   NO                    0850034
17674  00017          OCT         17                    0850035
17675  73000          AS   DM C   NO                    0850036
17676  11040          SO   DM D   RO                    0850037
17677  50400          SA   IM C   NO                    0850038
17700  17710          PZE         DV2HS                 0850039
17701  75162          LA   DL     $AL                   0850040
17702  62163          LP   DL     $AR                   0850041
17703  11060  DV2GS   SO   DM D   LO                    0850042
17704  50162          SA   DL     $AL                   0850043
17705  42163          SP   DL     $AR                   0850044
17706  75166          LA   DL     $QL                   0850045
17707  62167          LP   DL     $QR                   0850046
17710  11040  DV2HS   SO   DM D   RO                    0850047
17711  54163          ME   DL     $AR                   0850048
17712  42166          SP   DL     $QL                   0850049
17713  75113  DV2AAS  LA   DL     $T1                   0850050
17714  65011          CS   DM C   AM                    0850051
17715  00000          PZE         0                     0850052
17716  50113          SA   DL     $T1                   0850053
17717  75162          LA   DL     $AL                   0850054
17720  62163          LP   DL     $AR                   0850055
17721  60113          NO   DL     $T1                   0850056
17722  67067          CC   DM B   CC                    0850057
17723  05076          DV   DM D   14                    0850058
17724  42162          SP   DL     $AL                   0850059
17725  62166          LP   DL     $QL                   0850060
17726  11041          SO   DM D   R1                    0850061
17727  60113          NO   DL     $T1                   0850062
17730  05077          DV   DM D   15                    0850063
17731  42163          SP   DL     $AR                   0850064
17732  75114          LA   DL     $T2                   0850065
17733  20024          BR   DM     AZ                    0850066
17734  17761          PZE         DV2CS                 0850067
17735  44062          ZE   DM B   LP                    0850068
17736  11041          SO   DM D   R1                    0850069
17737  60113          NO   DL     $T1                   0850070
17740  05076          DV   DM D   14                    0850071
```

```
17741  44075          ZE    DM B  LA          0850072
17742  60162          NO    DL    $AL         0850073
17743  15057          MP    DM D  15          0850074
17744  03062          SC    DM D  L2          0850075
17745  66001          AP    DM C  AI          0850076
17746  40000          OCT         40000       0850077
17747  66001          AP    DM C  AI          0850078
17750  00000          PZE         0           0850079
17751  65060          CS    DM B  NO          0850080
17752  61163          AI    DL    $AR         0850081
17753  50163          SA    DL    $AR         0850082
17754  66077          AP    DM B  CH          0850083
17755  76017          XA    DM C  CH          0850084
17756  00003          PZE         3           0850085
17757  71162          AM    DL    $AL         0850086
17760  50162          SA    DL    $AL         0850087
17761  20031  DV2CS   BR    DM    OV          0850088
17762  17763          PZE         *+1         0850089
17763  20020          BR    DM    UN          0850090
17764  17633          PZE         DV2SR+1     0850091
17765  13135          END         5725
```