

เอกสารอ้างอิง

1. Digico, Ltd. Micro 16 V Computer : Mannal.
2. Digico, Ltd. Multi-Drive, Single Channel Disc Controbler.
DF 331-0000.
3. Digico, Ltd. ASSEMBLER. A4- 5008-0-6
4. Digico, Ltd. Assembler Edit Program. SD-5010-0-6
5. Digico, Ltd. Assembler For Execntive And Disc Operating
System. SD -5305-5-1.
6. Digico, Ltd. Binary Relocotable Loader. SD- 5026-0-9
7. Digico, Ltd. Parallel Printer Interface. DF 389.
8. Digico, Ltd. Pack/ Extract Byte. A 2-5349-0-15.
9. Digico, Ltd. Text Type-out. A3- 5013-0-15.
10. Digico, Ltd. Introduction to Micro DOS. SA-5305-1-1.
11. Digico, Ltd. Overlay Controller. A1-5485-1-16.
12. Digico, Ltd. Binary Read Program. Sd-5290-0-2.
13. Digico, Ltd. Disc Multiread Load. A2-5350-11-15.

ภาคผนวก ก

Micro 16 V instruction Summary

ตัวอักษรย่อที่จะใช้ในการอธิบายคำสั่งต่าง ๆ :

S = Store คำที่อยู่ที่ address NNNN

A = Accumulator

C = Carry Register

P = Program address register

' = New contents of

- = the inverse of

f Am = floating point accumulator mantissa

f Ax = floating point accumulator exponent

f Aa = floating point accumulator a - word

f Ab = floating point accumulator b - word (M- register)

f Ac = floating point accumulator c - word

f A = floating point accumulator

นอกจากนี้ยังมีเครื่องหมายวงเล็บปิดเปิดที่สัญลักษณ์ใดหมายถึง indirect instruction คือนำคำที่อยู่ address ที่เป็นค่าของ address NNNN มาใช้

Central Processor

Mnemonic	Octal	Effect
INC	01 NNNN	$S' = S + 1$, skip next instruction if $S' = 0$
JPU	02 NNNN	$P' = NNNN$

Mnemonic	Octal	Effect
JPZ	03 NNNN	$P' = NNNN$ if $A = 0$
GET	04 NNNN	$A' = S$
STO	05 NNNN	$S' = A$
GTI	06 NNNN	$A' = (S)$
STI	07 NNNN	$(S)' = A$
AND	10 NNNN	$A' = A$ logical AND with S
DEC	11 NNNN	$S' = S - 1$, skip next instruction if $S' = 0$
JPS	12 NNNN	$P' = NNNN + 1$, $S' = P + 1$
JPN	13 NNNN	$P' = NNNN$ if A is negative, i.e. bit 15=1
ADD	14 NNNN	$A' = A + S$
SUB	15 NNNN	$A' = A - S$
ADI	16 NNNN	$A' = A + (S)$
JSI	17 NNNN	$P' = (S) + 1$, $(S)' = P + 1$
NOT	000000	Do nothing
CRY	000001	$A' = C$
SWB	000002	$A' =$ Switchbank
FIN	000020	Forbid interrupt
PIN	000030	Permit interrupt after next LKJ instruction
HLT	000040	Halt
CRU	000100	$C' = 0$
CRS	000200	$C' = 1$
LKJ	000400	$P' = (P + 1)$
CLA	001020	$A' = 0$
OCA	001060	$A' = \bar{A}$

Mnemonic	Octal	Effect
TCA	001061	$A' = \bar{A} + 1$
NCA	001421	$A' = -C$
SHR	001000+n	Shift right propagating zeros
RCI	001040+ n	Circulate right propagating inverse of least significant bit
CIR	001100+ n	Circulate right propagating least significant bit
RSS	001200+ n	Shift right propagating sign bit
SHL	001300+ n	Shift left propagating zeros
RSC	001400+ n	Shift right propagating carry

Multi-Level Interrupt

LEX	000031	Permit interrupt for current level after LKJ
SID	000032	Set interrupt detect register from accumulator
SIE	000033	Set interrupt enable register from accumulator
RID	000036	Read interrupt detect register into accumulator
RLP	000037	Read interrupt level register into accumulator

Mnemonic	Octal	Effect
<u>Memory Partition</u>		
SPL	004177	Set partition limits from accumulator
PEX	004277	Generate exit interrupt from restricted area
SPI	004377	Skip if no interrupt from program restrict

Real Time Clock

ECI	004477	Enable clock interrupts and start clock
ICI	004577	Unset clock interrupts and reset clock
SCI	004677	Skip if no clock interrupt and unset interrupt
SNS	004777	Skip if 'not serviced' interrupt and unset interrupt

Hardware Floating Point

MPY	002000	$[A' \& fAb'] = A \times S$
DIV	002001	$A' \left[\text{quot} \right] \& fAb' \left[\text{rem} \right] = \left[A \& fAb \right] \div S$
FNG	002150	$fA' = -fA$
SEX	002160	$fAX' = A$
GEX	002170	$A' = fAX$
IGT	002301	$fA' = (S)$
FGT	002305	$fA' = S$
IDV	002502	$fA' = fA \div (S)$
FDV	002506	$fA' = fA \div S$
IMY	002621	$fA' = fA \times (S)$
FMY	002625	$fA' = fA \times S$

Mnemonic	Octal	Effect
IAD	002761	$fA' = fA + (S)$
ISB	002763	$fA' = fA - (S)$
FAD	002765	$fA' = fA + S$
FSB	002767	$fA' = fA - S$
IAS	003010	$(S)' = fA + (S)$
ISS	003012	$(S)' = fA - (S)$
FAS	003014	$S' = fA + S$
FSS	003016	$S' = fA - S$
CLR	003020	$fA' = 0, A' = 0$
SWP	003260	$A' = fAb, fAb' = A$
IST	003421	$(S)' = fA$
FSW	003424	$fA' = S, S' = fA$
FST	003425	$S' = fA$
GMB	003460	$A' = fAb$
GMA	003461	$A' = fAa$
GMC	003463	$A' = fAc$
DLL	003520	$A = X$, shift contents of double word of store X bits to left, propagating zeros
DRL	003522	$A = X$, shift right X bits, propagating zeros
DRA	003524	$A = X$, shift right X bits, propagating sign bit
FLT	003521	$fA' \left[\text{floating} \right] = S \left[\text{fixed} \right]$

Mnemonic	Octal	Effect
FIX	003550	$S' \left[\text{fixed} \right] = fA \left[\text{floating} \right]$
ORM	003720	$A' = A \text{ logical OR with } fAb$
GFM	003770	$A' = \text{floating point mode/status register}$
SFM	003771	Floating point mode/status register = A

Console Teletype

REO	004000	Read a character using inclusive OR logic
RSO	004100	Start reader, read a character using inclusive OR logic
KBO	004200	Get keyboard character using inclusive OR logic
PRT	004300	Print punch or write a character from accumulator
MOF	004400	Switch motor off
MON	004500	Switch motor on
RED	005000	Clear accumulator and read a character
RST	005100	Start reader, clear accumulator and read a character
KBD	005200	Clear accumulator and get keyboard character
SAI	006100	Skip next instruction if AI is not set
SKI	006200	Skip next instruction if KI is no set
SRI	006400	Skip next instruction if RI is not set
TTI	007100	Skip next instruction if none of AI, RI, KI is set.

Mnemonic	Octal	Effect
SKB	007200	Skip next instruction if device is not busy
SRB	007400	Skip next instruction if reader is not busy

Magnetic Disc

005040	Write, accumulator contains start address
005140	Read, accumulator contains start address
005240	Qualifier 1, accumulator contains the qualifier
005340	Qualifier 2, accumulator contains the qualifier
005440	Zero seek
005540	Emergency unload
005640	Send status word to accumulator
005740	Skip if no interrupt and send status word
006740	Do nothing
007440	Skip if controlles not busy

Card Reader

004044	Get data, read data from buffer to accumu- lator (1 column)
004644	Get card, read card to buffer (80 columns)
006044	Re- read data
007444	Skip if no interrupt, and send status word to accumulator



Mnemonic Octal

Effect

Parallel Printer

004147	Transfer 1 character from accumulator to print buffer and skip if O.K.
004247	Transfer 2 characters from accumulator to print buffer and skip if O.K.
004347	Print contents of buffer and move paper and skip if O.K. accumulator contains paper movement format
007447	Transfer status word to accumulator and unset interrupt
007547	Skip if no interrupt, transfer status word to accumulator and unset interrupt
007647	Skip if not busy
007747	Reset buffer

Generalised Communication

0040XX	Transfer data (BCD) from accumulator bits 0-3 to GCIC
0043XX	Transfer data from accumulator bits 0-7 to GCIC
0044XX	Call request
0046XX	Load synchronous character
0050XX	Transfer data from GCIC to accumulator bits 0 - 7

Mnemonic	Octal	Effect
	006YXX	Mode control: I bit 6 = connection mode I bit 7 = transmission mode I bit 8 = receive mode
	0070XX	Skip if no interrupt
	0071XX	Skip if ready to go
	0072XX	No skip if transmit buffer interrupt
	0073XX	No skip if transmit buffer available
	0074XX	No skip if receive buffer is holding data
	0075XX	No skip if incoming call detected
	0076XX	Skip if any GCIC is interrupt

XX = 50, 51, 52, 53, 54, 55

Executive T203- 5301 - 1 - 43 for 28X Chiang Mai University

%REL	004001	Peripheral release
%ASS	004003	Peripheral assignment
%CL1	004005	Transfer no. of 10 mS. clock interrupt to usser program
%CL3	004007	"CL3" function
%DAT	004011	Read date
%T01	004013	Out character onto TTT and suspend
%T02	004015	Output character onto TTT, not suspend
%T03	004017	Output stream of characters onto TTT and suspend
%T04	004021	Output stream of characters onto TTT, not suspend

Mnemonic	Octal	Effect
%T06	004023	Output stream of characters until terminator, not suspend
%TI1	004025	Input teletype character with suspension
%TI3	004027	Input teletype characters stream with suspension
%TI6	004031	Input TTT character stream until terminator, not suspend
%P02	004033	" P02" function
%RI2	004035	Input a character from paper tape reader
%TR1	004037	Read a character from TTT reader with suspension
%TR2	004041	Read a character from TTT reader, not suspend
%MT	004043	Call magnetic tape package
%EDW	004045	Write sectors to disc with suspension
%EDR	004047	Read sectors from disc with suspension
%EDZ	004051	Disc zero seek with suspension
%EDG	004053	Get disc status with suspension
%EDU	004055	Disc emergency unload with suspension
%EJW	004057	Write sectors to disc, no suspension
%EJR	004061	Read sectors from disc, no suspension
%EJZ	004063	Disc zero seek, no suspension
%EJG	004065	Get disc status, no suspension
%EJU	004067	Disc emergency unload, no suspension

Mnemonic	Octal	Effect
% PP1	004071	Print on parallel printer with suspension
% PP2	004073	Print on parallel printer, not suspend
% CA2	004075	Read data from 80 column card reader
% MCD	004077	Call to communication (GCIC)
% SPD	004101	Suspend user program till end of data transfer
% SPC	004103	Suspend user program on clock
% CNC	004105	Cancel data transfer
% MOV	004107	Move block of store
% SUS	004111	Suspend console package
% DEL	004113	Delete user program via console package
% PER	004115	Remove peripheral via console package
% FIL	004117	Call disc file handling package
% FIM	004121	Special call disc file handling package
% FIX	004123	Exit from disc file handling package
% SME	004125	Suspend calling program til another program call via % RYU
% RYU	004127	Release program whose slot no. in Acc from suspension
% REM	004131	DOS and F/H special call

ตารางที่ 1

ภาคผนวก ข.

#NAME=SYMBOLIC TABLE

	XSET	&TABLE=	
00 - 0000	144516	* 144516	(INC
00 - 0001	141640	* 141640	
00 - 0002	145120	* 145120	(JPU
00 - 0003	052640	* 052640	
00 - 0004	145120	* 145120	(JPZ
00 - 0005	055240	* 055240	
00 - 0006	043705	* 043705	(GET
00 - 0007	152240	* 152240	
00 - 0010	051724	* 051724	(STO
00 - 0011	147640	* 147640	
00 - 0012	043724	* 043724	(GTI
00 - 0013	144640	* 144640	
00 - 0014	051724	* 051724	(STI
00 - 0015	144640	* 144640	
00 - 0016	040516	* 040516	(AND
00 - 0017	042240	* 042240	
00 - 0020	042305	* 042305	(DEC
00 - 0021	141640	* 141640	
00 - 0022	145120	* 145120	(JPS
00 - 0023	051640	* 051640	
00 - 0024	145120	* 145120	(JPN
00 - 0025	047240	* 047240	
00 - 0026	040504	* 040504	(ADD
00 - 0027	042240	* 042240	
00 - 0030	051525	* 051525	(SUB
00 - 0031	041240	* 041240	
00 - 0032	040504	* 040504	(ADI
00 - 0033	144640	* 144640	
00 - 0034	145123	* 145123	(JSI
00 - 0035	144640	* 144640	

#END

ตาราง 2

#NAME=TABLE TWO

	XSET	&TETWO=	
00 - 0000	000000	*000000	(NOT
00 - 0001	000001	*000001	(CRT
00 - 0002	000002	*000002	(SWB
00 - 0003	000020	*000020	(FIN
00 - 0004	000030	*000030	(PIN
00 - 0005	000040	*000040	(HLT
00 - 0006	000100	*000100	(CRU
00 - 0007	000200	*000200	(CRS
00 - 0010	001020	*001020	(CLA
00 - 0011	001060	*001060	(OCA
00 - 0012	001061	*001061	(TCA
00 - 0013	001420	*001420	(NCA
00 - 0014	000031	*000031	(LEX
00 - 0015	000032	*000032	(SID
00 - 0016	000036	*000036	(RID
00 - 0017	000033	*000033	(SIE
00 - 0020	000037	*000037	(RLP
00 - 0021	004177	*004177	(SPL
00 - 0022	004277	*004277	(PEX
00 - 0023	004377	*004377	(SPI
00 - 0024	004477	*004477	(ECI
00 - 0025	004577	*004577	(ICI
00 - 0026	004677	*004677	(SCI
00 - 0027	004777	*004777	(SNS
00 - 0030	002150	*002150	(FNG
00 - 0031	002160	*002160	(SEX
00 - 0032	002170	*002170	(GEX
00 - 0033	003020	*003020	(CLR
00 - 0034	003260	*003260	(SWP
00 - 0035	003460	*003460	(GMB
00 - 0036	003461	*003461	(GMA
00 - 0037	003463	*003463	(GMC
00 - 0040	003770	*003770	(GFM
00 - 0041	003771	*003771	(SFM
00 - 0042	003720	*003720	(ORM

#END

ตารางที่ 3

#NAME=SYMBOLIC TWO

	XSET	&SIMB2=	
00 - 0000	047317	* 047317	(NOT
00 - 0001	152240	* 152240	
00 - 0002	141722	* 141722	(CRT
00 - 0003	054640	* 054640	
00 - 0004	051727	* 051727	(SWB
00 - 0005	041240	* 041240	
00 - 0006	143311	* 143311	(FIN
00 - 0007	047240	* 047240	
00 - 0010	050311	* 050311	(PIN
00 - 0011	047240	* 047240	
00 - 0012	044314	* 044314	(HLT
00 - 0013	152240	* 152240	
00 - 0014	141722	* 141722	(CRU
00 - 0015	052640	* 052640	
00 - 0016	141722	* 141722	(CRS
00 - 0017	051640	* 051640	
00 - 0020	141714	* 141714	(CLA
00 - 0021	040640	* 040640	
00 - 0022	147703	* 147703	(OCA
00 - 0023	040640	* 040640	
00 - 0024	152303	* 152303	(TCA
00 - 0025	040640	* 040640	
00 - 0026	047303	* 047303	(NCA
00 - 0027	040640	* 040640	
00 - 0030	146305	* 146305	(LEX
00 - 0031	154240	* 154240	
00 - 0032	051711	* 051711	(SID
00 - 0033	042240	* 042240	
00 - 0034	151311	* 151311	(RID
00 - 0035	042240	* 042240	
00 - 0036	051711	* 051711	(SIE
00 - 0037	142640	* 142640	
00 - 0040	151314	* 151314	(RLP
00 - 0041	050240	* 050240	
00 - 0042	051520	* 051520	(SPL
00 - 0043	146240	* 146240	
00 - 0044	050305	* 050305	(PEX
00 - 0045	154240	* 154240	
00 - 0046	051520	* 051520	(SPI
00 - 0047	144640	* 144640	

00 - 0050	142703	*142703	(ECI
00 - 0051	144640	*144640	
00 - 0052	144703	*144703	(ICI
00 - 0053	144640	*144640	
00 - 0054	051703	*051703	(SCI
00 - 0055	144640	*144640	
00 - 0056	051516	*051516	(SNS
00 - 0057	051640	*051640	
00 - 0060	143116	*143116	(FNG
00 - 0061	043640	*043640	
00 - 0062	051705	*051705	(SEX
00 - 0063	154240	*154240	
00 - 0064	043705	*043705	(GEX
00 - 0065	154240	*154240	
00 - 0066	141714	*141714	(CLR
00 - 0067	151240	*151240	
00 - 0070	051727	*051727	(SWP
00 - 0071	050240	*050240	
00 - 0072	043515	*043515	(GMB
00 - 0073	041240	*041240	
00 - 0074	043515	*043515	(GMA
00 - 0075	040640	*040640	
00 - 0076	043515	*043515	(GMC
00 - 0077	141640	*141640	
00 - 0100	043706	*043706	(GFM
00 - 0101	046640	*046640	
00 - 0102	051706	*051706	(SFM
00 - 0103	046640	*046640	
00 - 0104	147722	*147722	(ORM
00 - 0105	046640	*046640	

#END

ตารางที่ 4

#NAME=TABLE THREE

	XSET	&THREE=
00 - 0000	000400	* 000400
00 - 0001	002000	* 002000
00 - 0002	002001	* 002001
00 - 0003	002301	* 002301
00 - 0004	002305	* 002305
00 - 0005	002502	* 002502
00 - 0006	002506	* 002506
00 - 0007	002621	* 002621
00 - 0010	002625	* 002625
00 - 0011	002761	* 002761
00 - 0012	002763	* 002763
00 - 0013	002765	* 002765
00 - 0014	002767	* 002767
00 - 0015	003010	* 003010
00 - 0016	003012	* 003012
00 - 0017	003014	* 003014
00 - 0020	003016	* 003016
00 - 0021	003421	* 003421
00 - 0022	003424	* 003424
00 - 0023	003425	* 003425
00 - 0024	003520	* 003520
00 - 0025	003522	* 003522
00 - 0026	003524	* 003524
00 - 0027	003521	* 003521
00 - 0030	003550	* 003550
00 - 0031	004001	* 004001
00 - 0032	004003	* 004003
00 - 0033	004005	* 004005
00 - 0034	004007	* 004007
00 - 0035	004011	* 004011
00 - 0036	004013	* 004013
00 - 0037	004015	* 004015
00 - 0040	004017	* 004017
00 - 0041	004021	* 004021
00 - 0042	004023	* 004023
00 - 0043	004025	* 004025
00 - 0044	004027	* 004027
00 - 0045	004031	* 004031
00 - 0046	004033	* 004033
00 - 0047	004035	* 004035
00 - 0050	004037	* 004037
00 - 0051	004041	* 004041

00 - 0052	004043	*004043
00 - 0053	004045	*004045
00 - 0054	004047	*004047
00 - 0055	004051	*004051
00 - 0056	004053	*004053
00 - 0057	004055	*004055
00 - 0060	004057	*004057
00 - 0061	004061	*004061
00 - 0062	004063	*004063
00 - 0063	004065	*004065
00 - 0064	004067	*004067
00 - 0065	004071	*004071
00 - 0066	004073	*004073
00 - 0067	004075	*004075
00 - 0070	004077	*004077
00 - 0071	004101	*004101
00 - 0072	004103	*004103
00 - 0073	004105	*004105
00 - 0074	004107	*004107
00 - 0075	004111	*004111
00 - 0076	004113	*004113
00 - 0077	004115	*004115
00 - 0100	004117	*004117
00 - 0101	004121	*004121
00 - 0102	004123	*004123
00 - 0103	004125	*004125
00 - 0104	004127	*004127
00 - 0105	004131	*004131
00 - 0106	177777	*177777

#END

ตารางที่ 5

#NAME=SYMBOLIC THREE

	XSET	&SIMB3=	
00 - 0000	146113	*146113	(LKJ
00 - 0001	145240	*145240	
00 - 0002	046520	*046520	(MPY
00 - 0003	054640	*054640	
00 - 0004	042311	*042311	(DIV
00 - 0005	053240	*053240	
00 - 0006	144507	*144507	(IGT
00 - 0007	152240	*152240	
00 - 0010	143107	*143107	(FGT
00 - 0011	152240	*152240	
00 - 0012	144504	*144504	(IDV
00 - 0013	053240	*053240	
00 - 0014	143104	*143104	(FDV
00 - 0015	053240	*053240	
00 - 0016	144515	*144515	(IMY
00 - 0017	054640	*054640	
00 - 0020	143115	*143115	(FMY
00 - 0021	054640	*054640	
00 - 0022	144501	*144501	(IAD
00 - 0023	042240	*042240	
00 - 0024	144523	*144523	(ISB
00 - 0025	041240	*041240	
00 - 0026	143101	*143101	(FAD
00 - 0027	042240	*042240	
00 - 0030	143123	*143123	(FSB
00 - 0031	041240	*041240	
00 - 0032	144501	*144501	(IAS
00 - 0033	051640	*051640	
00 - 0034	144523	*144523	(ISS
00 - 0035	051640	*051640	
00 - 0036	143101	*143101	(FAS
00 - 0037	051640	*051640	
00 - 0040	143123	*143123	(FSS
00 - 0041	051640	*051640	
00 - 0042	144523	*144523	(IST
00 - 0043	152240	*152240	
00 - 0044	143123	*143123	(FSW
00 - 0045	153640	*153640	
00 - 0046	143123	*143123	(FST
00 - 0047	152240	*152240	

00 - 0050	042314	* 042314	(DLL
00 - 0051	146240	* 146240	
00 - 0052	042322	* 042322	(DRL
00 - 0053	146240	* 146240	
00 - 0054	042322	* 042322	(DRA
00 - 0055	040640	* 040640	
00 - 0056	143314	* 143314	(FLT
00 - 0057	152240	* 152240	
00 - 0060	143311	* 143311	(FIX
00 - 0061	154240	* 154240	
00 - 0062	122722	* 122722	(% REL
00 - 0063	142714	* 142714	
00 - 0064	122501	* 122501	(% ASS
00 - 0065	051523	* 051523	
00 - 0066	122703	* 122703	(% CL1
00 - 0067	146261	* 146261	
00 - 0070	122703	* 122703	(% CL3
00 - 0071	146063	* 146063	
00 - 0072	122504	* 122504	(% DAT
00 - 0073	040724	* 040724	
00 - 0074	122724	* 122724	(% TO1
00 - 0075	147661	* 147661	
00 - 0076	122724	* 122724	(% TO2
00 - 0077	147662	* 147662	
00 - 0100	122724	* 122724	(% TO3
00 - 0101	147463	* 147463	
00 - 0102	122724	* 122724	(% TO4
00 - 0103	147664	* 147664	
00 - 0104	122724	* 122724	(% TO6
00 - 0105	147466	* 147466	
00 - 0106	122724	* 122724	(% TI1
00 - 0107	144661	* 144661	
00 - 0110	122724	* 122724	(% TI3
00 - 0111	144463	* 144463	
00 - 0112	122724	* 122724	(% TI6
00 - 0113	144466	* 144466	
00 - 0114	122520	* 122520	(% PO2
00 - 0115	147662	* 147662	
00 - 0116	122722	* 122722	(% RI2
00 - 0117	144662	* 144662	
00 - 0120	122724	* 122724	(% TR1
00 - 0121	151261	* 151261	
00 - 0122	122724	* 122724	(% TR2
00 - 0123	151262	* 151262	
00 - 0124	122515	* 122515	(% MT
00 - 0125	152240	* 152240	
00 - 0126	122705	* 122705	(% EDW
00 - 0127	042327	* 042327	

00 - 0130	122705	*122705	(%ERD
00 - 0131	042322	*042322	
00 - 0132	122705	*122705	(%EDZ
00 - 0133	042132	*042132	
00 - 0134	122705	*122705	(%EDG
00 - 0135	042107	*042107	
00 - 0136	122705	*122705	(%EDU
00 - 0137	042125	*042125	
00 - 0140	122705	*122705	(%EJW
00 - 0141	145327	*145327	
00 - 0142	122705	*122705	(%EJR
00 - 0143	145322	*145322	
00 - 0144	122705	*122705	(%EGZ
00 - 0145	145132	*145132	
00 - 0146	122705	*122705	(%EJG
00 - 0147	145107	*145107	
00 - 0150	122705	*122705	(%EJU
00 - 0151	145125	*145125	
00 - 0152	122520	*122520	(%PP 1
00 - 0153	050261	*050261	
00 - 0154	122520	*122520	(%PP 2
00 - 0155	050262	*050262	
00 - 0156	122703	*122703	(%CA 2
00 - 0157	040662	*040662	
00 - 0160	122515	*122515	(%MCD
00 - 0161	141504	*141504	
00 - 0162	122523	*122523	(%SPD
00 - 0163	050104	*050104	
00 - 0164	122523	*122523	(%SPC
00 - 0165	050303	*050303	
00 - 0166	122703	*122703	(%CNC
00 - 0167	047303	*047303	
00 - 0170	122515	*122515	(%MOV
00 - 0171	147526	*147526	
00 - 0172	122523	*122523	(%SUS
00 - 0173	052523	*052523	
00 - 0174	122504	*122504	(%DEL
00 - 0175	142714	*142714	
00 - 0176	122520	*122520	(%PER
00 - 0177	142722	*142722	
00 - 0200	122706	*122706	(%FIL
00 - 0201	144714	*144714	
00 - 0202	122706	*122706	(%FIM
00 - 0203	144515	*144515	
00 - 0204	122706	*122706	(%FIX
00 - 0205	144730	*144730	

00 - 0206	122523	*122523	(% SME
00 - 0207	046705	*046705	
00 - 0210	122722	*122722	(% RYU
00 - 0211	054525	*054525	
00 - 0212	122722	*122722	(% REM
00 - 0213	142515	*142515	
00 - 0214	000000	*000000	

END

ตารางที่ 6

#NAME=TABLE FOUR

	XSET	&TFOUR=
00 - 0000	001000	* 001000
00 - 0001	001040	* 001040
00 - 0002	001100	* 001100
00 - 0003	001200	* 001200
00 - 0004	001300	* 001300
00 - 0005	001400	* 001400
00 - 0006	177777	* 177777

#END

ตารางที่ 7

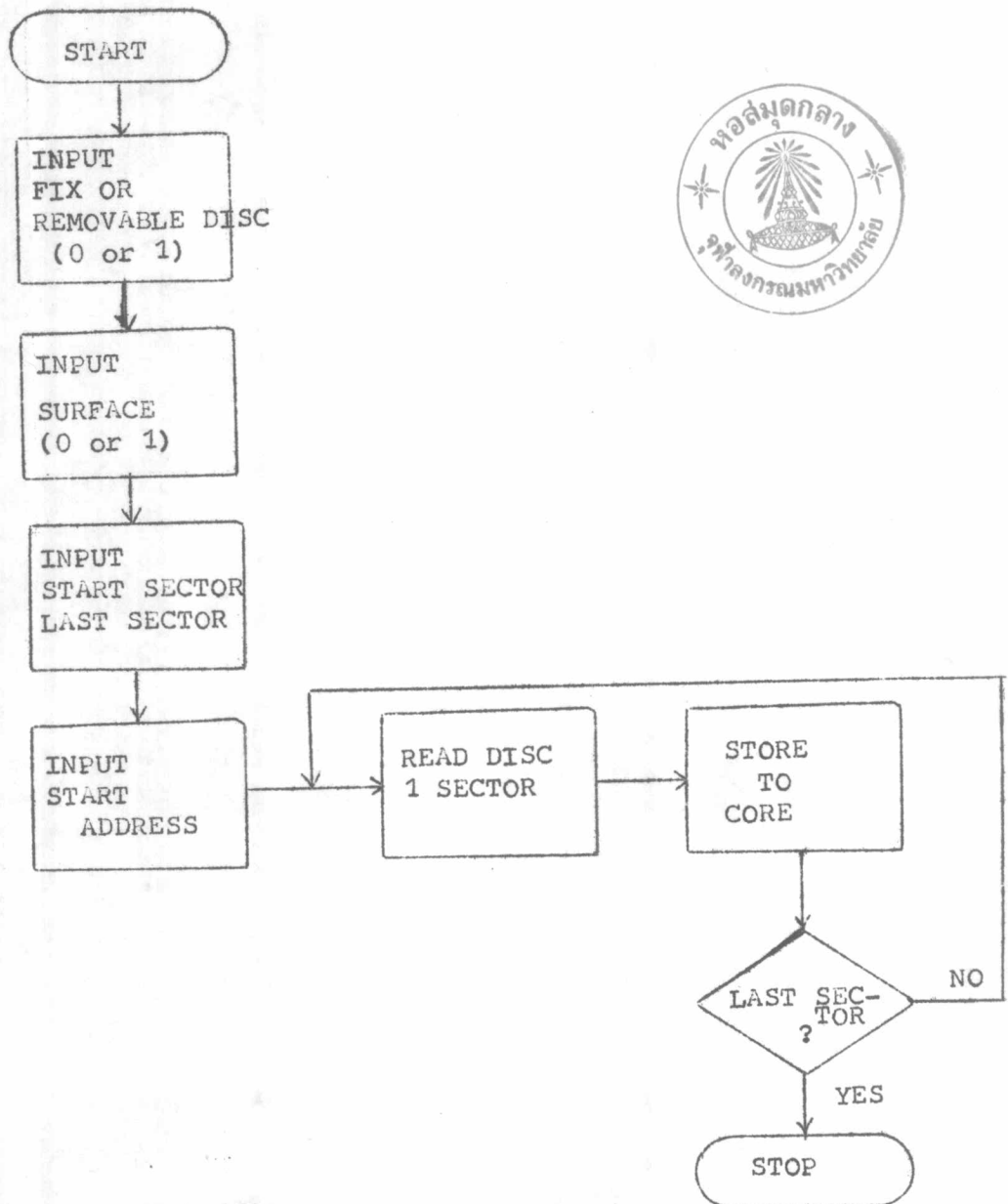
#NAME=SYMBOLIC FOUR

	XSET	& SIMB4=	
00 - 0000	051510	* 051510	(SHR
00 - 0001	151240	* 151240	
00 - 0002	151303	* 151303	(RCI
00 - 0003	144640	* 144640	
00 - 0004	141711	* 141711	(CIR
00 - 0005	151240	* 151240	
00 - 0006	151123	* 151123	(RSS
00 - 0007	051640	* 051640	
00 - 0010	051510	* 051510	(SHL
00 - 0011	146240	* 146240	
00 - 0012	151123	* 151123	(RSC
00 - 0013	141640	* 141640	
00 - 0014	177777	* 177777	

#END

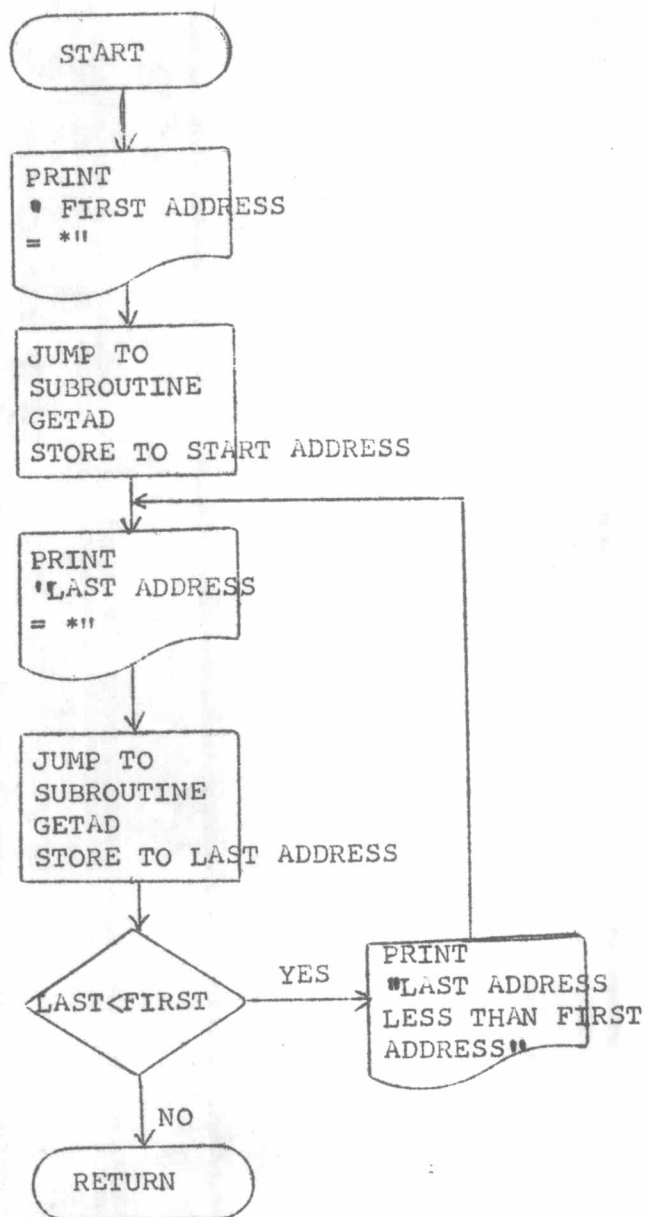
ผังงานที่ 1

Dump Disc To Core

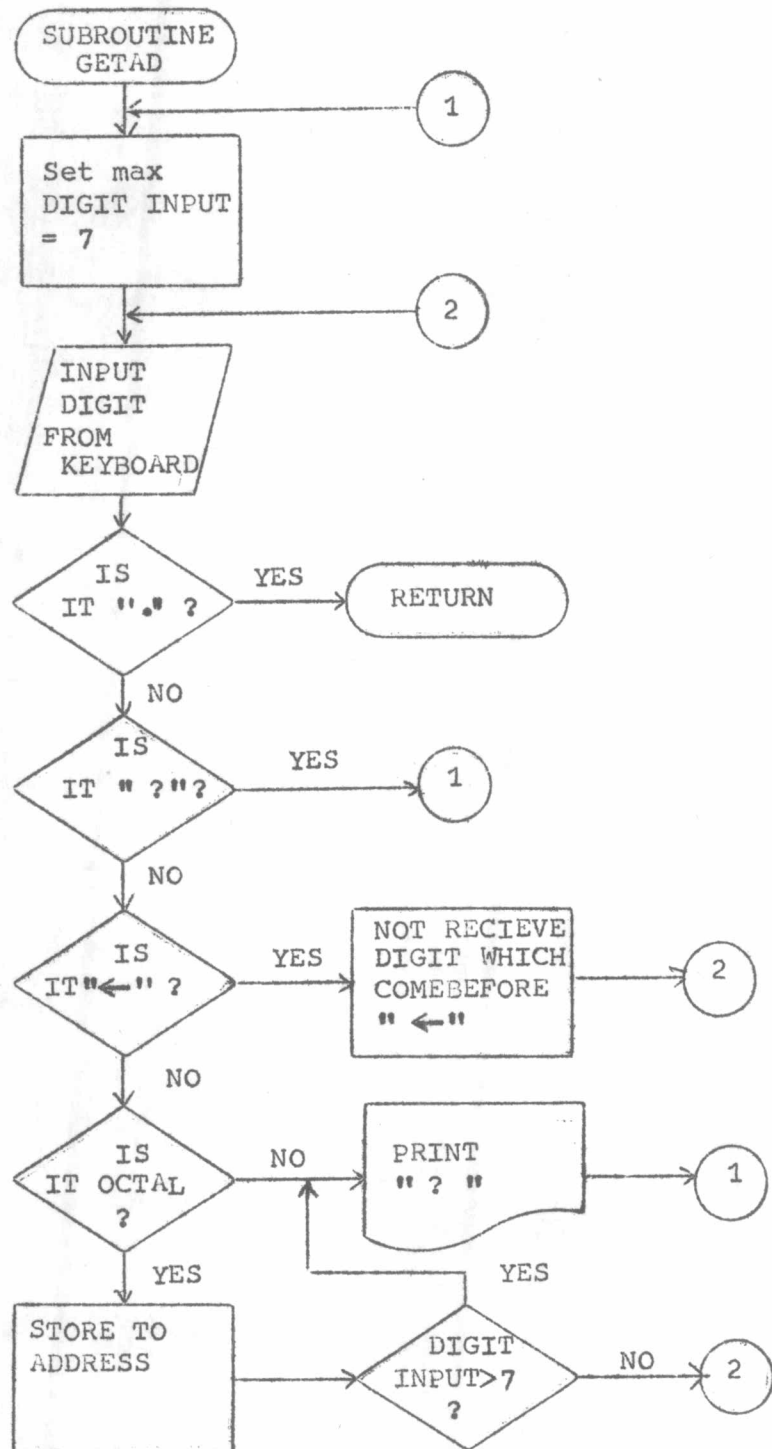


ผังงานที่ 2

Subroutine get address

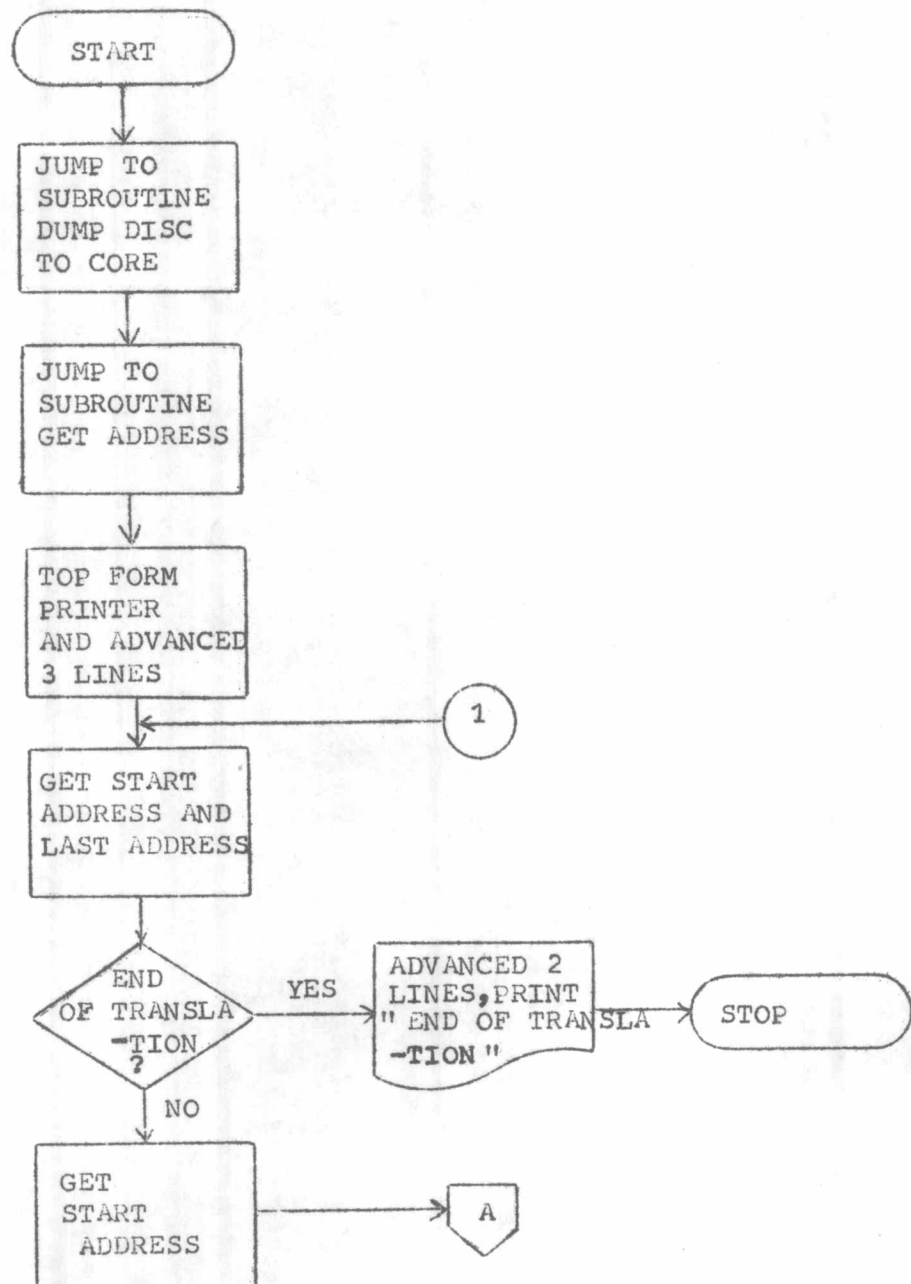


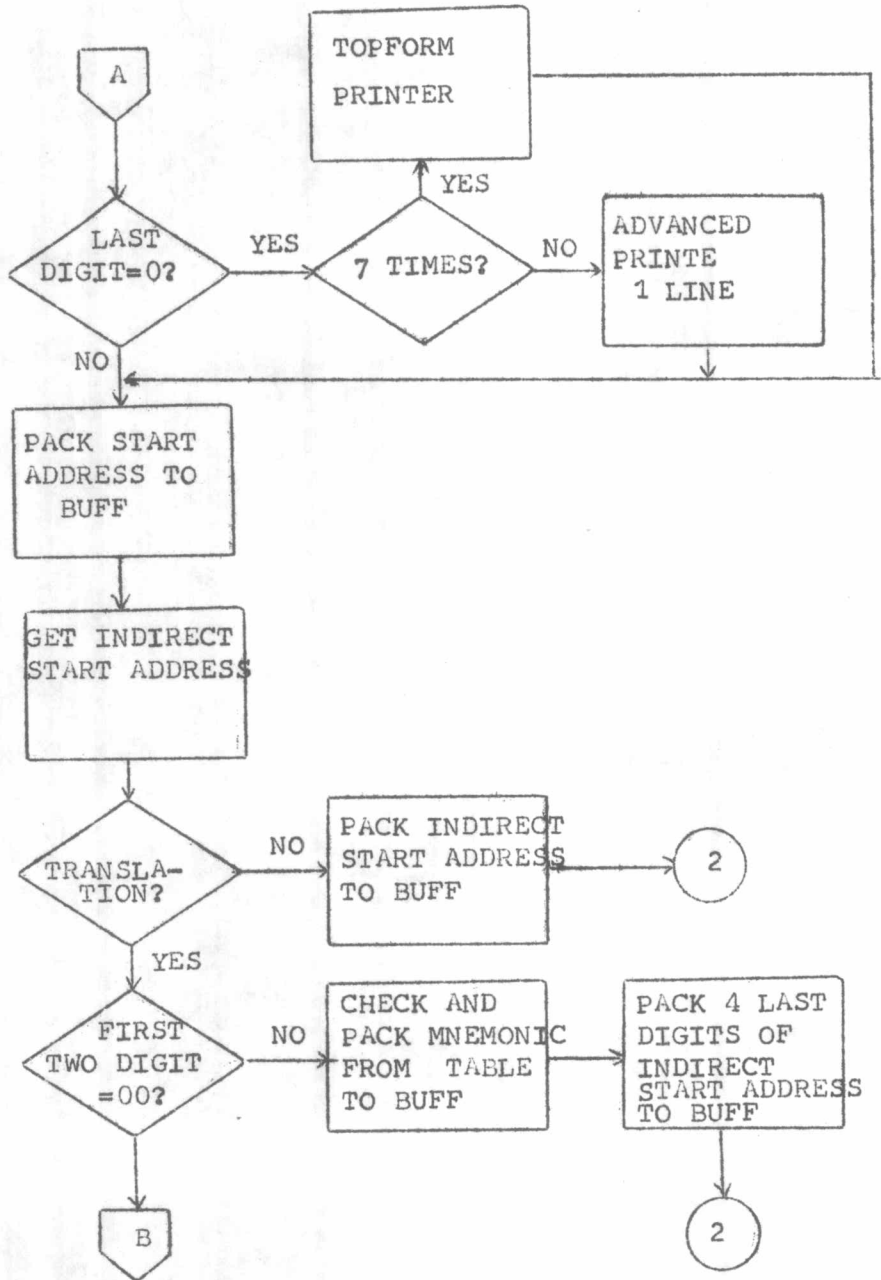
Subroutine get address (cont.)

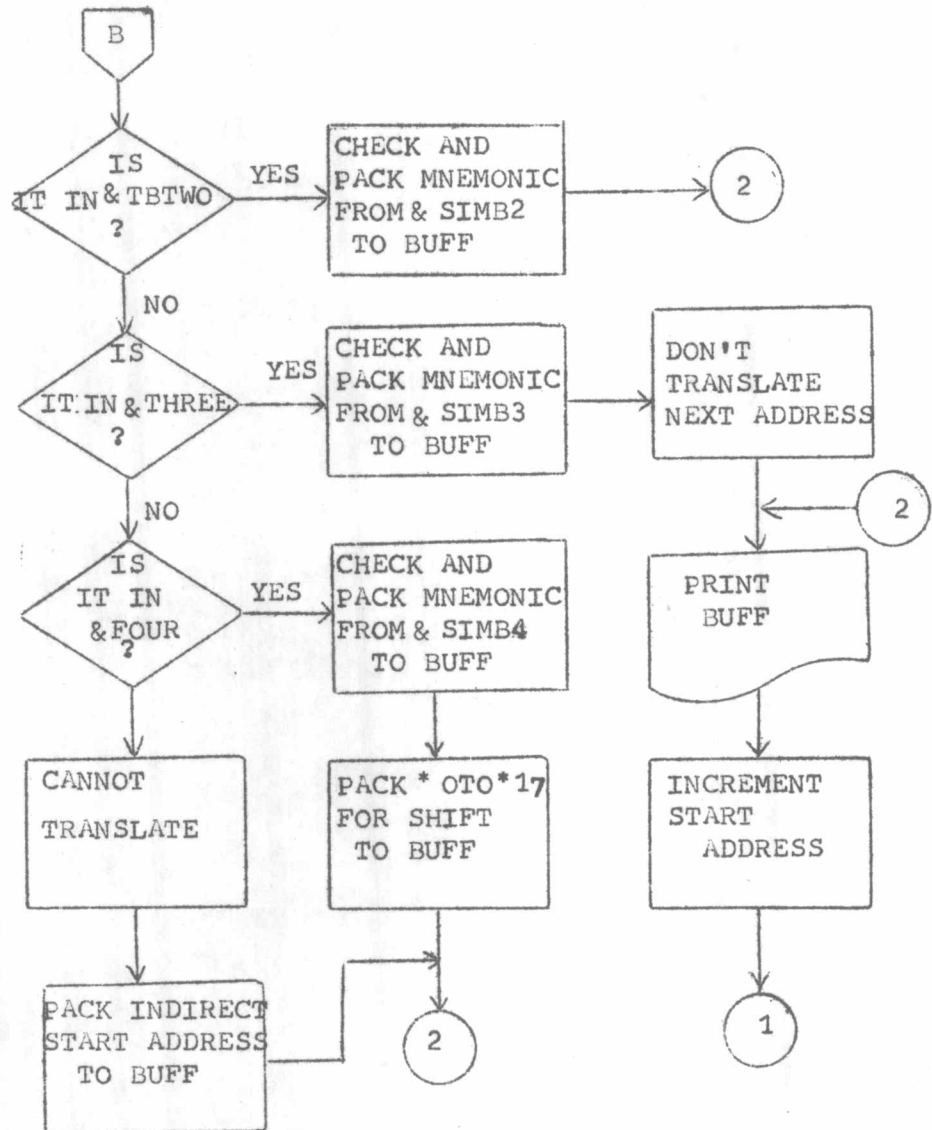


ผังงานที่ 3

1. Flowchart of TRANSLATION MASTER PROGRAM







00-0151	000400	LKJ
	XSET	&DUMP=
00-0152	000000	+0
		RN1=
00-0153	040013	GET MESS1
00-0154	050400	STO /MESSAGE
00-0155	120202	JPS GETAD
00-0156	050401	STO /DISC
		RN2=
00-0157	040045	GET MESS2
00-0160	050400	STO MESSAGE
00-0161	120202	JPS GETAD
00-0162	050402	STO /SURFA
		RN3=
00-0163	040073	GET MESS3
00-0164	050400	STO MESSAGE
00-0165	120202	JPS GETAD
00-0166	050403	STO /STSEC
		RN4=
00-0167	040102	GET MESS4
00-0170	050400	STO MESSAGE
00-0171	120202	JPS GETAD
00-0172	050505	STO /LTSEC
		RN5=
00-0173	040127	GET MESS5
00-0174	050400	STO MESSAGE
00-0175	120202	JPS GETAD
00-0176	050405	STO MEMADR
00-0177	020272	JPU READ
00-0200	040406	GET /ADDRES
00-0201	000400	LKJ
		GETAD=
00-0202	000000	+0
00-0203	040400	GET MESSAGE
00-0204	050206	STO T+2
00-0205	170150	JSI PRINT
00-0206	000000	+0
00-0207	040363	GET /7
00-0210	050407	STO COUNT
00-0211	001020	CLA
00-0212	050406	STO ADDRES
		GET1=
00-0213	007200	SKB
00-0214	020213	JPU T-1
00-0215	007200	SKB
00-0216	020220	JPU T+2
00-0217	020215	JPU T-2


```

00-0220 007200 SKB
00-0221 020220 JPU T-1
00-0222 005200 KBD
GET2=
00-0223 100364 AND /*177
00-0224 050410 STO /DIGIT
00-0225 150365 SUB /*56
00-0226 030200 JPZ GETAD-2
00-0227 150366 SUB /*77- *56
00-0230 030207 JPZ GETAD+5
00-0231 150367 SUB /*137- *77
00-0232 030264 JPZ CLEAR
GET3=
00-0233 040410 GET DIGIT
00-0234 150370 SUB /*60
00-0235 130257 JPN ERROR
00-0236 150371 SUB /*70- *60
00-0237 130241 JPN GET4
00-0240 020257 JPU ERROR
GET4=
00-0241 040406 GET ADDRES
00-0242 100372 AND /*60000
00-0243 030245 JPZ T+2
00-0244 020257 JPU ERROR
00-0245 040410 GET DIGIT
00-0246 150370 SUB /*60
00-0247 050410 STO DIGIT
00-0250 040406 GET ADDRES
00-0251 001303 SHL 3
00-0252 140410 ADD DIGIT
00-0253 050406 STO ADDRES
00-0254 110407 DEC /COUNT
00-0255 020213 JPU GET1
00-0256 020200 JPU GETAD-2
ERROR=
00-0257 040145 GET MESS6
00-0260 050262 STO T+2
00-0261 170150 JSI PRINT
00-0262 000000 +0
00-0263 020203 JPU GETAD+1
CLEAR=
00-0264 040406 GET ADDRES
00-0265 001003 SHR 3
00-0266 050406 STO ADDRES
00-0267 010407 INC COUNT
00-0270 020213 JPU GET1
00-0271 000040 HLT

```

```

                                READ=
00-0272  040403  GET  STSEC
00-0273  001103  CIR   3
00-0274  050411  STO  /PSTCY
00-0275  001015  SHR  13
00-0276  050412  STO  /SSECT2
00-0277  040411  GET  /PSTCY
00-0300  100373  AND  /*777
00-0301  050413  STO  /STCYL
00-0302  040404  GET  LTSEC
00-0303  150403  SUB  STSEC
00-0304  140374  ADD  /1
00-0305  050414  STO  /NUM
00-0306  040401  GET  DISC
00-0307  001313  SHL  11
00-0310  050415  STO  /QUAL1
00-0311  040402  GET  SURFA
00-0312  001312  SHL  10
00-0313  140415  ADD  QUAL1
00-0314  050415  STO  QUAL1
                                AAA=
00-0315  040412  GET  SSECT2
00-0316  001305  SHL  5
00-0317  140415  ADD  QUAL1
00-0320  140412  ADD  SSECT2
00-0321  050415  STO  QUAL1
00-0322  040413  GET  STCYL
00-0323  050416  STO  /QUAL2
00-0324  007440  *007440
00-0325  020324  JPU  T-1
00-0326  040415  GET  QUAL1
00-0327  005240  *005240
00-0330  040416  GET  QUAL2
00-0331  005340  *005340
00-0332  040405  GET  /MEMADR
00-0333  005140  *005140
00-0334  010412  INC  SSECT2
00-0335  040371  GET  /* 10
00-0336  150412  SUB  SSECT2
00-0337  030352  JPZ  CCC
                                BBB=
00-0340  040405  GET  MEMADR
00-0341  140375  ADD  /* 700
00-0342  050405  STO  MEMADR
00-0343  110414  DEC  NUM
00-0344  020346  JPU  DDD
00-0345  020356  JPU  END

```

```
DDD=
00-0346 040415 GET QUAL1
00-0347 100376 AND /*176000
00-0350 050415 STO QUAL1
00-0351 020315 JPU AAA
CCC=
00-0352 040377 GET /0
00-0353 050412 STO SSECT2
00-0354 010413 INC STCYL
00-0355 020340 JPU BBB
END=
00-0356 040000 GET MESS7
00-0357 050361 STO T+2
00-0360 170150 JSI PRINT
00-0361 000000 +0
00-0362 020151 JPU RN1-2
#END
```

โปรแกรมที่ 2

```

#NAME=GET ADDRESS

      XSET  &STADDR=      (RESULT OF FIRST INPUT ADDRESS
      STADR=
00-0000 000000 +0
      XSET  &LTADDR=      (RESULT OF SECOND INPUT
      LTADR=
00-0001 000000 +0

      MES1=
00-0002 000003 +T+1
#TEXT

FIRST ADDRESS= *←
      MES2=
00-0016 000017 +T+1
#TEXT

LAST ADDRESS = *←
      MES3=
00-0032 000033 +T+1
#TEXT

LAST ADDRESS LESS THAN FIRST ADDRESS !!!←
      MES4=
00-0061 000062 +T+1
#TEXT
?←

      PRINT=
00-0064 XREF  +&PRINT

00-0065 000400 LKJ
      XSET  &GETADD=      (ENTRY POINT
00-0066 000000 +0

      RN1=
00-0067 040002 GET MES1
00-0070 050220 STO /MESSAGE
00-0071 120121 JPS GETAD      (GET START ADDRESS
00-0072 050000 STO STADR

      RN2=
00-0073 040016 GET MES2
00-0074 050220 STO MESSAGE
00-0075 120121 JPS GETAD      (GET LAST ADDRESS

```

```

00-0076 050001 STO LTADR
00-0077 130110 JPN AAA
00-0100 150000 SUB STADR
00-0101 130103 JPN T+2
00-0102 020065 JPU RN1-2

```

(LAST <FIRST
(EXIT

```

RN3=
00-0103 040032 GET MES3
00-0104 050106 STO T+2
00-0105 170064 JSI PRINT
00-0106 000000 +0
00-0107 020073 JPU RN2
AAA=
00-0110 040000 GET STADR
00-0111 130113 JPN T+2
00-0112 020065 JPU RN1-2
00-0113 040001 GET LTADR
00-0114 150000 SUB STADR
00-0115 130103 JPN RN3
00-0116 020065 JPU RN1-2

```

(SUBROUTINE TO GET ADDRESS

```

00-0117 040221 GET /ADDRESS
00-0120 000400 LKJ
GETAD=
00-0121 000000 +0
00-0122 040220 GET MESSAGE
00-0123 050125 STO T+2
00-0124 170064 JSI PRINT
00-0125 000000 +0
00-0126 040210 GET /7
00-0127 050222 STO COUNT
00-0130 001020 CLA
00-0131 050221 STO ADDRESS

```

(SET MAX. DIGIT INPUT
(CLEAR RESULT

```

GET1=
00-0132 007200 SKB
00-0133 020132 JPU T-1
00-0134 007200 SKB
00-0135 020137 JPU T+2
00-0136 020134 JPU T-2
00-0137 007200 SKB
00-0140 020137 JPU T-1
00-0141 005200 KBD

```

(GET KEYBOARD INPUT

```

                                GET2=
00-0142 100211 AND /*177      (CLEAR PARITY
00-0143 050223 STO /DIGIT
00-0144 150212 SUB /*56      (IS IT PERIOD
00-0145 030117 JPZ GETAD-2   (YES, EXIT
00-0146 150213 SUB /*77-*56  (IS IT QUESTION MARK
00-0147 030126 JPZ GETAD+5   (YES, GET TOTALLY NEW INPUT
00-0150 150214 SUB /*137-*77 (IS IT LEFT ARROW
00-0151 030203 JPZ CLEAR

                                GET3=
00-0152 040223 GET DIGIT     (CHECK IS IT VALID OCTAL DIGIT
00-0153 150215 SUB /*60
00-0154 130176 JPN ERROR
00-0155 150216 SUB /*70-*60
00-0156 130160 JPN GET4
00-0157 020176 JPU ERROR

                                GET4=
00-0160 040221 GET ADDRES    (COUNT AND PACK INTO ONE WORD
00-0161 100217 AND /*60000  (CHECK, IT WILL BE > *177777
00-0162 030164 JPZ T+2
00-0163 020176 JPU ERROR
00-0164 040223 GET DIGIT
00-0165 150215 SUB /*60      (CLEAR ASCII CODE
00-0166 050223 STO DIGIT
00-0167 040221 GET ADDRES
00-0170 001303 SHL 3
00-0171 140223 ADD DIGIT
00-0172 050221 STO ADDRES
00-0173 110222 DEC /COUNT
00-0174 020132 JPU GET1
00-0175 020117 JPU GETAD-2

                                ERROR=
00-0176 040061 GET MES4
00-0177 050201 STO T+2
00-0200 170064 JSI PRINT
00-0201 000000 +0
00-0202 020122 JPU GETAD+1

                                CLEAR=
00-0203 040221 GET ADDRES
00-0204 001003 SHR 3
00-0205 050221 STO ADDRES
00-0206 010222 INC COUNT
00-0207 020132 JPU GET1

```

#END

โปรแกรมที่ 3

```

#NAME=TRANSLATION MASTER PROGRAM
DUMPD=
00-0000 XREF +&DUMP
TTHREE=
00-0001 XREF +&THREE
SIMBO3=
00-0002 XREF +&SIMB3
SIMBO4=
00-0003 XREF +&SIMB4
TBFOUR=
00-0004 XREF +&TFOUR
TABTWO=
00-0005 XREF +&TBTWO
SIMBO2=
00-0006 XREF +&SIMB2

GETAD=
00-0007 XREF +&GETADD
STADR=
00-0010 XREF +&STADDR
LTADR=
00-0011 XREF +&LTADDR
SIB=
00-0012 XREF +&SIB
PRINT=
00-0013 XREF +&LNPRT
TABADD=
00-0014 XREF +&TABLE
FINMES=
00-0015 000016 +T+1
TEXT

END OR TRANSLATION !!!!!

←
BUFF=
00-0037 000041 +T+2
DISP=
00-0040 000000 +0
T=T+40

```

```

START=
00-0111 170000 JSI DUMPD      (JUMP TO SUBROUTINE DUMP DISC TO CORE

00-0112 170007 JSI GETAD      (JUMP TO SUBROUTING GET ADDRESS
00-0113 040530 GET /7
00-0114 050550 STO /INDEX     (SET INDEX = 7
00-0115 040531 GET /2
00-0116 050040 STO DISP
00-0117 040532 GET /*106414
00-0120 050041 STO DISP+1
00-0121 170013 JSI PRINT      (TOP FORM LINE PRINTER
00-0122 000040 +BUFF+1
00-0123 060010 GTI STADR
00-0124 050551 STO /STADDR    (START ADDRESS
00-0125 050552 STO /CRADR
00-0126 060011 GTI LTADR
00-0127 050553 STO /LTADDR    (LAST ADDRESS
00-0130 001020 CLA
00-0131 050040 STO DISP      (DISP = 0
00-0132 001020 CLA
00-0133 050554 STO /CHECK     (CHECK = 0

PATH1=
00-0134 120422 JPS LINFED
00-0135 120422 JPS LINFED
00-0136 120422 JPS LINFED    (SKIP LINE PRINTER 3 LINES

PATH2=
00-0137 040553 GET LTADDR
00-0140 150552 SUB CRADR
00-0141 140533 ADD /1
00-0142 030411 JPZ PATHEN    (JUMP TO END OF TRANSLATION:FINMES
00-0143 040552 GET CRADR
00-0144 100530 AND /7
00-0145 030147 JPZ T+2
00-0146 020151 JPU T+3
00-0147 120422 JPS LINFED
00-0150 120270 JPS TOPFRM    (PRINT 48 INSTRUCTIONS PER PAGE
00-0151 040552 GET CRADR
00-0152 001017 SHR 15
00-0153 140534 ADD /*60
00-0154 170012 JSI SIB      (SIB FIRST CHARACTER TO BUFF
00-0155 000037 +BUFF
00-0156 040552 GET CRADR
00-0157 001014 SHR 12
00-0160 100530 AND /7
00-0161 140534 ADD /*60

```


00-0162	170012	JSI SIB	(SIB SECOUND CHARACTER TO BUFF
00-0163	000037	+BUFF	
00-0164	040535	GET /*55	
00-0165	170012	JSI SIB	(SIB HYPHEN TO BUFF
00-0166	000037	+BUFF	
00-0167	040552	GET CRADR	
00-0170	100536	AND /*7777	
00-0171	120435	JPS PACK4	(JUMP SUBROUTINE FOR SIB 4 CH* TO BUFF
00-0172	120503	JPS SPACE	(JUMP SUBROUTINE FOR 4 SPACES
00-0173	060552	GTI CRADR	
00-0174	120455	JPS PACK6	(JUMP SUBROUTINE FOR CACK OCTAL CODE
00-0175	120503	JPS SPACE	(JUMP SUBROUTINE FOR 4 SPACES
00-0176	040554	GET CHECK	
00-0177	150536	SUB /*7777	
00-0200	030205	JPZ AAA	(IF CHECK= 7777 DON'T TRANSLATE IT
00-0201	060552	GTI CRADR	
00-0202	001014	SHR 12	
00-0203	030215	JPZ TTWO	(JUMP TO TTWO IF ZERO
00-0204	020236	JPU PATH3	
		AAA=	
00-0205	040537	GET /*52	
00-0206	170012	JSI SIB	(PACK * TO BUFF
00-0207	000037	+BUFF	
00-0210	060552	GTI CRADR	
00-0211	120455	JPS PACK6	
00-0212	001020	CLA	
00-0213	050554	STO CHECK	
00-0214	020257	JPU PATH4	
		TTWO=	
00-0215	000000	+0	(CHECK FOR TABTWO
00-0216	040540	GET /*43	
00-0217	050555	STO COUNT	
00-0220	040005	GET TABTWO	
00-0221	050556	STO /AREA	
00-0222	040006	GET SIMBO2	
00-0223	050557	STO /CODE	
00-0224	060552	GTI CRADR	
00-0225	001061	TCA	
00-0226	160556	ADI AREA	
00-0227	030254	JPZ PREPAC	
00-0230	010556	INC AREA	
00-0231	010557	INC CODE	
00-0232	010557	INC CODE	
00-0233	110555	DEC COUNT	
00-0234	020224	JPU TTWO+7	
00-0235	020306	JPU BBB	

PATH3=
 00-0236 150533 SUB /1 (CHECK FOR TABADD)
 00-0237 001301 SHL 1
 00-0240 140014 ADD TABADD
 00-0241 050557 STO /CODE
 00-0242 120515 JPS PCKCOD
 00-0243 010557 INC CODE
 00-0244 120515 JPS PCKCOD
 00-0245 040537 GET /*52
 00-0246 170012 JSI SIB
 00-0247 000037 +BUFF
 00-0250 060552 GTI CRADR
 00-0251 100536 AND /*7777
 00-0252 120435 JPS PACK4
 00-0253 020257 JPU PATH4
 PREPAC=
 00-0254 120515 JPS PCKCOD
 00-0255 010557 INC CODE
 00-0256 120515 JPS PCKCOD

PATH4=
 00-0257 170013 JSI PRINT (PRINT BUFF)
 00-0260 000040 +BUFF+1
 00-0261 001020 CLA
 00-0262 050040 STO DISP
 00-0263 120422 JPS LINFED
 00-0264 010552 INC CRADR
 00-0265 020137 JPU PATH2
 00-0266 000040 HLT
 00-0267 000400 LKJ
 TOPFRM=
 00-0270 000000 +0 (SUBROUTINE FOR TOPFORM LINE PRINTER)
 00-0271 110550 DEC INDEX
 00-0272 020267 JPU TOPFRM-1
 00-0273 040531 GET /2
 00-0274 050040 STO DISP
 00-0275 040532 GET /*106414
 00-0276 050041 STO DISP+1
 00-0277 170013 JSI PRINT
 00-0300 000040 +BUFF+1
 00-0301 001020 CLA
 00-0302 050040 STO DISP
 00-0303 040530 GET /7
 00-0304 050550 STO INDEX
 00-0305 020267 JPU TOPFRM-1
 BBB=
 00-0306 000000 +0 (CHECK FOR TTHREE)
 00-0307 040001 GET TTHREE

00-0310 050556 STO AREA
 00-0311 040002 GET SIMBO3
 00-0312 050557 STO CCDE
 00-0313 060556 GTI AREA
 00-0314 150541 SUB /*177777
 00-0315 030335 JPZ CCC
 00-0316 060552 GTI CRADR
 00-0317 001061 TCA
 00-0320 160556 ADI AREA
 00-0321 030327 JPZ PRE3
 00-0322 010556 INC AREA
 00-0323 010557 INC CODE
 00-0324 010557 INC CODE
 00-0325 020313 JPU BBB+5
 00-0326 000040 HLT
 PRE3=
 00-0327 120515 JPS PCKCOD (PREPACK FOR TTHREE
 00-0330 010557 INC CODE
 00-0331 120515 JPS PCKCOD
 00-0332 040536 GET /*7777
 00-0333 050554 STO CHECK
 00-0334 020257 JPU PATH4
 CCC=
 00-0335 000000 +0 (CHECK FOR TBFOUR
 00-0336 040004 GET TBFOUR
 00-0337 050556 STO AREA
 00-0340 040003 GET SIMBO4
 00-0341 050557 STO CODE
 00-0342 040542 GET /*17 (CAN SHIFT ONLY * 17
 00-0343 050560 STO /OCTAL
 00-0344 060556 GTI AREA
 00-0345 150541 SUB /*177777
 00-0346 030205 JPZ AAA
 DDD=
 00-0347 060556 GTI AREA
 00-0350 140560 ADD OCTAL
 00-0351 050561 STO /SAVE
 00-0352 060552 GTI CRADR
 00-0353 001061 TCA
 00-0354 140561 ADD SAVE
 00-0355 030365 JPZ PRE4
 00-0356 110560 DEC OCTAL
 00-0357 020347 JPU DDD
 00-0360 010556 INC AREA
 00-0361 010557 INC CODE
 00-0362 010557 INC CODE

00-0363 020342 JPU CCC+5
 00-0364 000040 HLT

PRE4=

00-0365 120515 JPS PCKCOD
 00-0366 010557 INC CODE
 00-0367 120515 JPS PCKCOD
 00-0370 040543 GET /*40
 00-0371 170012 JSI SIB
 00-0372 000037 +BUFF
 00-0373 040537 GET /*52
 00-0374 170012 JSI SIB
 00-0375 000037 +BUFF
 00-0376 040560 GET OCTAL
 00-0377 001003 SHR 3
 00-0400 140534 ADD /*60
 00-0401 170012 JSI SIB
 00-0402 000037 +BUFF
 00-0403 040560 GET OCTAL
 00-0404 100530 AND /*7
 00-0405 140534 ADD /*60
 00-0406 170012 JSI SIB
 00-0407 000037 +BUFF
 00-0410 020257 JPU PATH4

(CHANGE TO ASCII

PATHEN=

00-0411 120422 JPS LINFED
 00-0412 120422 JPS LINFED
 00-0413 040015 GET FINMES
 00-0414 050416 STO T+2
 00-0415 170013 JSI PRINT
 00-0416 000000 +0
 00-0417 000040 HLT
 00-0420 020111 JPU START

(END OF TRANSLATION

(*****

00-0421 000400 LKJ
 LINFED=
 00-0422 000000 +0
 00-0423 040531 GET /2
 00-0424 050040 STO DISP
 00-0425 040544 GET /*106412
 00-0426 050041 STO DISP+1
 00-0427 170013 JSI PRINT
 00-0430 000040 +BUFF+1
 00-0431 001020 CLA
 00-0432 050040 STO DISP
 00-0433 020421 JPU LINFED-1

(SUBROUTINE LINEFEED

```

00-0434 000400 LKJ
                PACK4=      (SUBROUTINE PACK 4 DIGITS)
00-0435 000000 +0
00-0436 001304 SHL 4
00-0437 050562 STO /WORD
00-0440 040545 GET /4
00-0441 050555 STO /COUNT
00-0442 040562 GET WORD
00-0443 001115 CIR 13
00-0444 050562 STO WORD
00-0445 100530 AND /7
00-0446 140534 ADD /*60
00-0447 1770012 JSI SIB
00-0450 000037 +BUFF
00-0451 110555 DEC COUNT
00-0452 020442 JPU T-8
00-0453 020434 JPU PACK4-1

```

```

00-0454 000400 LKJ
                PACK6=      (SUBROUTINE PACK 6 DIGITS)
00-0455 000000 +0
00-0456 050562 STO WORD
00-0457 040546 GET /5
00-0460 050555 STO COUNT
00-0461 040562 GET WORD
00-0462 001117 CIR 15
00-0463 050562 STO WORD
00-0464 100533 AND /1
00-0465 140534 ADD /*60
00-0466 170012 JSI SIB
00-0467 000037 +BUFF

```

```

00-0470 040562 GET WORD
00-0471 001115 CIR 13
00-0472 050562 STO WORD
00-0473 100530 AND /7
00-0474 140534 ADD /*60
00-0475 170012 JSI SIB
00-0476 000037 +BUFF
00-0477 110555 DEC COUNT
00-0500 020470 JPU T-8
00-0501 020454 JPU PACK6-1

```

```

00-0502 000400 LKJ
                SPACE=      (SUBROUTINE FOR 4 SPACES)
00-0503 000000 +0
00-0504 040545 GET /4
00-0505 050555 STO COUNT

```

00-0506 040543 GET /* 40
00-0507 170012 JSI SIB
00-0510 000037 +BUFF
00-0511 110555 DEC COUNT
00-0512 020506 JPU T-4
00-0513 020502 JPU SPACE-1

00-0514 000400 LKJ

PCKCOD=

(SUBROUTINE FOR PACK MNEMONIC CODE

00-0515 000000 +0
00-0516 060557 GTI CODE
00-0517 001010 SHR 8
00-0520 100547 AND /* 177
00-0521 170012 JSI SIB
00-0522 000037 +BUFF
00-0523 060557 GTI CODE
00-0524 100547 AND /* 177
00-0525 170012 JSI SIB
00-0526 000037 +BUFF
00-0527 020514 JPU PCKCOD-1
#END

โปรแกรมที่ 4

```

#NAME=LINE PRINTER SUBROUTINE
00-0000 000400 LKJ
      XSET &LNPRT=
      LINPRT=
00-0001 000000 +0
      YYY=
00-0002 060001 GTI T-1
00-0003 050044 STO /DISI
00-0004 060044 GTI DISI
00-0005 050045 STO /COUNT
      XXX=
00-0006 010044 INC DISI
00-0007 060044 GTI DISI
00-0010 001010 SHR 8
00-0011 100043 AND /*377
00-0012 120026 JPS PRIN
00-0013 110045 DEC COUNT
00-0014 020016 JPU T+2
00-0015 020023 JPU ZZZ
00-0016 060044 GTI DISI
00-0017 100043 AND /*377
00-0020 120026 JPS PRIN
00-0021 110045 DEC COUNT
00-0022 020006 JPU XXX
      ZZZ=
00-0023 010001 INC LINPRT
00-0024 020000 JPU LINPRT-1
00-0025 000400 LKJ
      PRIN=
00-0026 000000 +0
00-0027 007647 *007647
00-0030 020027 JPU T-1
00-0031 004147 *004147
00-0032 120035 JPS CHEC
00-0033 020025 JPU PRIN-1
00-0034 000400 LKJ
      CHEC=
00-0035 000000 +0
00-0036 007447 *007447
00-0037 130034 JPN CHEC-1
00-0040 001302 SHL 2
00-0041 130034 JPN CHEC-1
00-0042 000040 HLT

# END

```

โปรแกรมที่ 5โปรแกรม &GIB &SIB

```

#NAME = &GIB &SIB      5349 - 0 -1

EXITG =                (EXTRACT EXIT
INC  &GIB
LKJ
&GIB =
+0
GTI  &GIB              (GETADDR. OF CONTROL AREA
STO /A
GTI  A                  (GET BASE
STO /B                  (B = BASE
INC  A
GTI  A                  (GET DISPLACEMENT
SHR  1
ADD  B
STO  B                  (B = ADDR. OF WORD CONTAINING BYTE
GTI  A
ADD  /1                (INC DISPLACEMENT
STI  A
CIR  1                  (LH OR RH ?
JPN  T+4
GTI  B                  (RH
AND  /*377
JPU  EXITG             (EXIT
GTI  B                  (LH
SHR  8
JPU  EXITG             (EXIT
EXITB =                (PACK EXIT
INC  &SIB
GET  /C                (RESTORE ACC
LKJ
&SIB=
+0
STO  C                  (STORE ACC.
AND  /*377
STO  /D                (D = BYTE TO BE PACKED
GTI  &SIB
STO  A
GTI  A                  (GET BASE
STO  B                  (B = BASE
INC  A
GTI  A                  (GET DISPLACEMENT
SHR  1
ADD  B

```


STO B	(B = ADDR. OF WORD TO CONTAIN BYTE
GTI A	
ADD /1	(INC DISPLACEMENT
STI A	
CIR 1	(LH OR RH ?
JPN T+6	
GTI B	(RH
AND /* 177400	(MARK OUT BOTTOM BYTE
ADD D	
STI B	
JPU EXITB	(EXIT
GET D	(LH
SHL 8	
STO D	
GTI B	
AND /* 377	
ADD D	
STI B	
JPU EXITB	(EXIT
#END	



โปรแกรมที่ 6

โปรแกรม &PRINT

```

#NAME = &PRINT TEXT MESSAGE 5013-0-2
COUNT=
+0
ADDR=
+0
(EXIT FROM SUBROUTINE NOTE-TYPEWRITER STILL BUSY FOR 100 M.S.)
XIT=
INC T+2
LKJ
&PRINT= (ENTRY TO SUBROUTINE)
+0
GTI T-1 (GET START ADDR. OF TEXT AREA)
STO ADDR
GTI ADDR
JPZ XIT (NO CHARS. LEFT IN MESSAGE ?)
STO COUNT

LOOP=
INC ADDR
GTI ADDR
JPS PRIT (PRINT RIGHT HAND HALF OF WORD)
DEC COUNT
JPU T+2
JPU XIT (ALL CHARS. PRINTED)
JPS PRIT (PRINT LEFT HAND HALF OF WORD)
DEC COUNT
JPU LOOP
JPU XIT (ALL CHARS. PRINTED)
LXJ
PRIT= (PRINT A CHARACTER USING TELETYPE BUSY STATUS)
+0
CIR 8
SKB (WAIT KEYBOARD NOT BUSY)
JPU T-1
PRT (INITIAIE PRINT CYCLE)
JPU PRIT-1

#END

```

ภาคผนวก จ.

ผลของการแปลภาษาเครื่องเป็นภาษาแอสเซมบลีย์ จาก sector 0 cylinder 0

00-0000	007440	*007440
00-0001	020000	JPU *0000
00-0002	000040	HLT
00-0003	020212	JPU *0212
00-0004	020130	JPU *0130
00-0005	020400	JPU *0400
00-0006	000074	*000074
00-0007	000074	*000074
00-0010	000107	*000107
00-0011	001110	CIR *1.0
00-0012	020007	JPU *0007
00-0013	000047	*000047
00-0014	000136	*000136
00-0015	000400	LKJ
00-0016	000101	*000101
00-0017	100007	AND *0007
00-0020	050014	STO *0014
00-0021	140014	ADD *0014
00-0022	140012	ADD *0012
00-0023	050014	STO *0014
00-0024	150010	SUB *0010
00-0025	140001	ADD *0001
00-0026	050017	STO *0017
00-0027	000010	*000010
00-0030	060014	GTI *0014
00-0031	140004	ADD *0004
00-0032	050011	STO *0011
00-0033	010014	INC *0014
00-0034	000400	LKJ
00-0035	004101	*004101
00-0036	050127	STO *0127
00-0037	110036	DEC *0036

00-0040	007401	* 007401
00-0041	020040	JPU * 0040
00-0042	005101	* 005101
00-0043	030040	JPZ * 0040
00-0044	007401	* 007401
00-0045	020044	JPU * 0044
00-0046	001110	CIR * 10
00-0047	020035	JPU * 0035
00-0050	000522	* 000522
00-0051	037767	JPZ * 7767
00-0052	177571	JSI * 7571
00-0053	177775	JSI * 7775
00-0054	120121	JPS * 0121
00-0055	050050	STO * 0050
00-0056	050051	STO * 0051
00-0057	120121	JPS * 0121
00-0060	050127	STO * 0127
00-0061	120121	JPS * 0121
00-0062	070050	STI * 0050
00-0063	140051	ADD * 0051
00-0064	050051	STO * 0051
00-0065	010050	INC * 0050
00-0066	110127	DEC * 0127
00-0067	020061	JPU * 0061
00-0070	120121	JPS * 0121
00-0071	150051	SUB * 0051
00-0072	030103	JPZ * 0103
00-0073	020077	JPU * 0077
00-0074	177777	JSI * 7777
00-0075	000040	HLT
00-0076	020102	JPU * 0102
00-0077	000040	HLT
00-0100	020077	JPU * 0077
00-0101	050114	STO * 0114
00-0102	120113	JPS * 0113
00-0103	001020	CLA
00-0104	120113	JPS * 0113
00-0105	140052	ADD * 0052
00-0106	030054	JPZ * 0054
00-0107	150053	SUB * 0053

00-0110	030075	JPZ *0075
00-0111	020103	JPU *0103
00-0112	000400	LKJ
00-0113	000105	*000105
00-0114	007401	*007401
00-0115	020114	JPU *0114
00-0116	004101	%SPD
00-0117	020112	*020112
00-0120	000400	LKJ
00-0121	000071	*000071
00-0122	001020	CLA
00-0123	120113	JPS *0113
00-0124	001110	CIR *10
00-0125	120113	JPS *0113
00-0126	020120	JPU *0120
00-0127	000000	NOT
00-0130	007440	*007440
00-0131	020130	JPU *0130
00-0132	001020	CLA
00-0133	005240	*005240
00-0134	005340	*005340
00-0135	005040	*005040
00-0136	007440	*007440
00-0137	020136	JPU *0136
00-0140	005640	*005640
00-0141	130143	JPN *0143
00-0142	000040	HLT
00-0143	000040	HLT
00-0144	000700	*000700
00-0145	000010	*000010
00-0146	000067	*000067
00-0147	000001	CRY
00-0150	000400	LKJ
00-0151	000000	*000000
00-0152	001020	CLA
00-0153	050257	STO *0257
00-0154	050260	STO *0260
00-0155	040261	GET *0261
00-0156	150145	SUB *0145
00-0157	130162	JPN *0162

00-0160	010260	INC *0260
00-0161	020156	JPU *0156
00-0162	140145	ADD *0145
00-0163	050257	STO *0257
00-0164	001305	SHL *05
00-0165	140257	ADD *0257
00-0166	050257	STO *0257
00-0167	040262	GET *0262
00-0170	001312	SHL *12
00-0171	140257	ADD *0257
00-0172	050257	STO *0257
00-0173	007440	*007440
00-0174	020173	JPU *0173
00-0175	040257	GET *0257
00-0176	005040	*005240
00-0177	040260	GET *0260
00-0200	005340	*005340
00-0201	040263	GET *0263
00-0202	005140	*005140
00-0203	040264	GET *0264
00-0204	030000	JPZ *0000
00-0205	007440	*007440
00-0206	020205	JPU *0205
00-0207	005640	*005640
00-0210	130150	JPN *0150
00-0211	000040	HLT
00-0212	000002	SWB
00-0213	050264	STO *0264
00-0214	001013	SHR *13
00-0215	100254	AND *0254
00-0216	050262	STO *0262
00-0217	040264	GET *0264
00-0220	100254	AND *0254
00-0221	050264	STO *0264
00-0222	030227	JPZ *0227
00-0223	001020	CLA
00-0224	140146	ADD *0146
00-0225	110264	DEC *0264
00-0226	020224	JPU *0224
00-0227	140147	ADD *0147

00-0230	050261	STO *0261
00-0231	050265	STO *0265
00-0232	010261	INC *0261
00-0233	040146	GET *0146
00-0234	150255	SUB *0255
00-0235	050264	STO *0264
00-0236	040144	GET *0144
00-0237	050263	STO *0263
00-0240	120151	JPS *0151
00-0241	010261	INC *0261
00-0242	040263	GET *0263
00-0243	140144	ADD *0144
00-0244	110264	DEC *0264
00-0245	020237	JPU *0237
00-0246	040256	GET *0256
00-0247	050263	STO *0263
00-0250	040265	GET *0265
00-0251	050261	STO *0261
00-0252	120151	JPS *0151
00-0253	000040	HLT
00-0254	000017	*000017
00-0255	000001	CRY
00-0256	000000	NOT
00-0257	133247	JPN *3247
00-0260	040142	GET *0142
00-0261	134310	JPN *4310
00-0262	024307	JPU *4307
00-0263	121504	JPS *1504
00-0264	001110	CIR *10
00-0265	050114	STO *0114
00-0266	000000	NOT
00-0267	000000	NOT

ภาคผนวก ฉ.

ผลของการแปลภาษาเครื่องเป็นภาษาแอสเซมบลีจากกลุ่มโปรแกรมชื่อHWASMB

ที่อยู่แฟลชไอซี ชื่อ PANUSN คอสด์ไฟลด์ ชื่อ SORTPR

03-0000	024442	JPU *4442
03-0001	023134	JPU *3134
03-0002	023104	JPU *3104
03-0003	022777	JPU *2777
03-0004	001020	CLA
03-0005	055601	STO *5601
03-0006	024442	JPU *4442
03-0007	000000	NOT
03-0010	000001	CRY
03-0011	000765	*000765
03-0012	030152	JPZ *0152
03-0013	000713	*000713
03-0014	034512	JPZ *4512
03-0015	007777	*007777
03-0016	001313	SHL *13
03-0017	001313	SHL *13
03-0020	100334	AND *0334
03-0021	100676	AND *0676
03-0022	000006	*000006
03-0023	000000	NOT
03-0024	030060	JPZ *0060
03-0025	030060	JPZ *0060
03-0026	030261	JPZ *0261
03-0027	051531	STO *1531
03-0030	051724	STO *1724
03-0031	142515	ADD *2515
03-0032	051531	STO *1531
03-0033	051724	STO *1724
03-0034	142515	ADD *2515
03-0035	177776	JSI *7776
03-0036	154000	SUB *4000
03-0037	103443	AND *3443

03-0040	000000	NOT
03-0041	000001	CRY
03-0042	000713	*000713
03-0043	031052	JPZ *1052
03-0044	000713	*000713
03-0045	000010	*000010
03-0046	000714	*000714
03-0047	001313	SHL *13
03-0050	000714	*000714
03-0051	100334	AND *0334
03-0052	100344	AND *0344
03-0053	000002	SWB
03-0054	000000	NOT
03-0055	030060	JPZ *0060
03-0056	030060	JPZ *0060
03-0057	030261	JPZ *0261
03-0060	051531	STO *1531
03-0061	051724	STO *1724
03-0062	142515	ADD *2515
03-0063	051531	STO *1531
03-0064	051724	STO *1724
03-0065	142515	ADD *2515
03-0066	031052	JPZ *1052
03-0067	000712	*000712
03-0070	177773	JSI *7773
03-0071	154000	SUB *4000
03-0072	102643	AND *2643
03-0073	000000	NOT
03-0074	000001	CRY
03-0075	000553	*000553
03-0076	031752	JPZ *1752
03-0077	000452	*000452
03-0100	000200	CRS
03-0101	000553	*000553
03-0102	000553	*000553
03-0103	000553	*000553
03-0104	000471	*000471
03-0105	100676	AND *0676
03-0106	000005	*000005
03-0107	000000	NOT

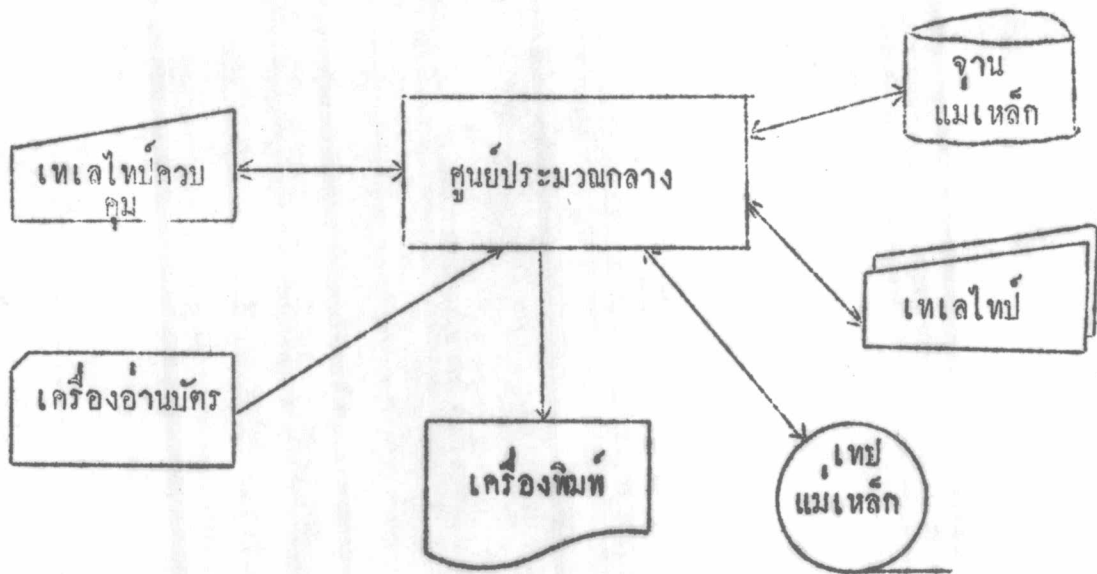
03-0110	042115	GET *2115
03-0111	120240	JPS *0240
03-0112	120240	JPS *0240
03-0113	151305	SUB *1305
03-0114	146317	ADD *6317
03-0115	141640	ADD *1640
03-0116	051531	STO *1531
03-0117	051724	STO *1724
03-0120	142515	ADD *2515
03-0121	031752	JPZ *1752
03-0122	001163	*001163
03-0123	000067	*000067
03-0124	024661	JPU *4661
03-0125	000051	*000051
03-0126	000261	*000261
03-0127	070000	STI *0000
03-0130	035650	JPZ *5650
03-0131	035714	JPZ *5714
03-0132	035652	JPZ *5652
03-0133	037135	JPZ *7135
03-0134	000001	CRY
03-0135	000000	NOT
03-0136	000000	NOT
03-0137	000000	NOT
03-0140	050140	STO *0140
03-0141	000000	NOT
03-0142	000000	NOT
03-0143	000000	NOT
03-0144	000000	NOT
03-0145	000000	NOT
03-0146	000245	*000245
03-0147	030150	JPZ *0150
03-0150	000001	CRY
03-0151	000061	*000061
03-0152	024456	JPU *4456
03-0153	000040	HLT
03-0154	000040	HLT
03-0155	000027	*000027
03-0156	000017	*000017
03-0157	000003	*000003

03-0160	000004	*000004
03-0161	000000	NOT
03-0162	000001	CRY
03-0163	000002	SWB
03-0164	000076	*000076
03-0165	024556	JPU *4556
03-0166	000700	*000700
03-0167	000010	*000010
03-0170	000067	*000067
03-0171	000001	CRY
03-0172	001020	CLA
03-0173	054643	STO *4643
03-0174	054644	STO *4644
03-0175	044645	GET *4645
03-0176	154415	SUB *4415
03-0177	134430	JPN *4430
03-0200	014644	INC *4644
03-0201	024424	JPU *4424
03-0202	144415	ADD *4415
03-0203	054643	STO *4643
03-0204	001305	SHL *05
03-0205	144643	ADD *4643
03-0206	054643	STO *4643
03-0207	044646	GET *4646
03-0210	001313	SHL *13
03-0211	144643	ADD *4643
03-0212	054643	STO *4643
03-0213	007440	*007440
03-0214	024441	JPU *4441
03-0215	044643	GET *4643
03-0216	000010	*000010
03-0217	136657	JPN *6657
03-0220	052516	STO *2516
03-0221	051705	STO *1705
03-0222	152041	SUB *2041
03-0223	030224	JPZ *0224
03-0224	120330	JPS *0330
03-0225	151305	SUB *1305
03-0226	143240	ADD *3240
03-0227	030230	JPZ *0230

03-0230	120330	JPS *0330
03-0231	051705	STO *1705
03-0232	152240	SUB *2240
03-0233	106412	AND *6412
03-0234	040523	GET *0523
03-0235	046502	GET *6502
03-0236	120306	JPS *0306
03-0237	040711	GET *0711
03-0240	146012	ADD *6012
03-0241	142550	ADD *2550
03-0242	000001	CRY
03-0243	000002	SWB
03-0244	177777	JSI *7777
03-0245	000001	CRY
03-0246	000002	SWB
03-0247	000004	*000004
03-0250	000010	*000010
03-0251	000020	FIN
03-0252	000040	HLT
03-0253	000100	CRU
03-0254	000200	CRS
03-0255	000400	LKJ
03-0256	001000	*001000
03-0257	002000	MPY
03-0260	004000	*004000
03-0261	010000	INC *0000
03-0262	020000	JPU *0000
03-0263	040000	GET *0000
03-0264	100000	AND *0000
03-0265	010000	INC *0000
03-0266	100000	AND *0000
03-0267	110000	DEC *0000

ภาคผนวก ข.

ระบบเครื่องคอมพิวเตอร์ดิจิทัล ไมโคร 16 บิต ที่ติดตั้งที่คณะวิทยาศาสตร์ มหาวิทยาลัยเชียงใหม่ มีเครื่องประกอบต่างๆ ดังนี้



รูปที่ 4 แสดง Hardware Configuration

เครื่องเทเลไทป์ (teletype) มี 3 เครื่องเป็นเครื่องที่ใช้สำหรับควบคุมการทำงาน 1 เครื่อง และอีก 2 เครื่องใช้สำหรับผู้ใช้ ซึ่งสามารถพิมพ์ได้ 72 ตัวอักษรต่อบรรทัด มีความเร็วในการพิมพ์ประมาณ 10 ตัวอักษรต่อวินาที ที่เครื่องเทเลไทป์ยังมีเครื่องอ่านและเจาะเทปกระดาษ ชนิด 8 ช่อง ซึ่งมีความเร็วในการอ่าน 25 ตัวอักษรต่อวินาที และความเร็วในการเจาะ 10 ตัวอักษรต่อวินาที

เครื่องอ่านบัตร (Card reader) มี 1 เครื่อง ใช้กับบัตรชนิด 80 คอลัมน์ สามารถอ่านบัตรด้วยความเร็วประมาณ 400 บัตรต่อ นาที

เครื่องพิมพ์ (Printer) มี 1 เครื่อง เป็นเครื่องพิมพ์แบบใช้กระดาษต่อเนื่อง สามารถพิมพ์ได้ถึง 136 ตัวอักษรต่อบรรทัด ความเร็วในการพิมพ์ประมาณ 300 บรรทัดต่อ นาที

เครื่องอ่านและบันทึกเทปแม่เหล็ก (Magnetic tape unit) มี 1 เครื่อง ใช้เทปชนิด 9 แทรค (track) ขนาดยาวประมาณ 1200 ฟุต สามารถบันทึกได้ 1600 bpi

เครื่องอ่านและบันทึกจานแม่เหล็ก (Disc unit) มี 1 เครื่อง ซึ่งมีจานแม่เหล็ก 2 แผ่น แผ่นหนึ่งอยู่ติดกับตัวเครื่อง อีกแผ่นหนึ่งถอดเข้าออกได้ สามารถบันทึกได้ 2 หน้า

แผ่นจานแม่เหล็กแบ่งออกเป็นหน้าละ 203 กระจบอก (cylinder) โดยแบ่งกระจบอกละ 16 เซกเตอร์ (sector) เซกเตอร์ละ 448 คำ (word) ซึ่งจะสามารถบันทึกข้อมูลได้ประมาณ 3 ล้านตัวอักษรต่อแผ่น

ประวัติการศึกษา

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วิทยาลัยเชียงใหม่ ปี พ.ศ. 2513 ปัจจุบันรับราชการในตำแหน่งอาจารย์ ที่ภาควิชา
คณิตศาสตร์ คณะวิทยาศาสตร์ มหาวิทยาลัยเชียงใหม่.

