Varuvan Vadivelan Institute of Technology

Dharmapuri – 636 703

LAB MANUAL

Regulation : *2013*

Branch : *B.E. – CSE.*

Year & Semester : *II Year / IV Semester*

CS 6412 – MICROPROCESSOR AND MICROCONTROLLER LABORATORY

ANNA UNIVERSITY CHENNAI

Regulation 2013

CS6412- MICROPROCESSOR AND MICROCONTROLLER LABORATORY

SYLLABUS

LIST OF EXPERIMENTS:

8086 Programs using kits and MASM

1. Basic arithmetic and Logical operations
2. Move a data block without overlap
3. Code conversion, decimal arithmetic and Matrix operations.
4. Floating point operations, string manipulations, sorting and searching
5. Password checking, Print RAM size and system date
6. Counters and Time Delay

Peripherals and Interfacing Experiments

7. Traffic light control
8. Stepper motor control
9. Digital clock
10. Key board and Display
11. Printer status
12. Serial interface and Parallel interface
13. A/D and D/A interface and Waveform Generation 8051.

Experiments using kits and MASM

14. Basic arithmetic and Logical operations
15. Square and Cube program, Find 2's complement of a number
16. Unpacked BCD to ASCII

TOTAL: 45 PERIODS

INTRODUCTION TO MICROPROCESSORS & MICROCONTROLLERS:

Microprocessor and controller is digital and programmable device with highly reliable and secured modern architecture. Building blocks of the Digital computer CPU functions Memory types Input / Output Devices Stored program concept History of Microprocessors.

Intel 8085 microprocessor:

Internal architecture, Hardware description, Interrupts and interrupts servicing and Interfacing the memory. Assembly Language Programming: 8085- Addressing modes & Instruction set, Flow charts, Assembly language programming and assembler directives, Linker and its operation, Programming examples.

Interfacing the input / output devices:

8255 Programmable Peripheral Interface, i8253 Programmable Interval Timer, 8251 Universal Synchronous /Asynchronous Receiver Transmitter, 8259 Programmable Interrupt Controller and i8279 Programmable Keyboard / Display interface device.

Interfacing the data converters:

Digital-to-Analog Converters, Interfacing DAC with 8086 microprocessor, Analog-to-Digital Converters Interfacing ADC with 8086.

Microprocessors:

Intel 8086 family microprocessors, Programming model, Memory paging, Virtual memory concept, advanced features of 80386/486/Pentium Processors.

Microcontroller:

Introduction to Microcontrollers, Intel-8051: Architecture, Hardware description, Memory organization, Addressing Modes.

Programming the i8051:

Instruction set, Assembly language programming, Interrupt structure and interrupt priorities, Interfacing with external devices and Programming.

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EX. NO	DATE	NAME OF THE EXPERIMENT	STAFF SIGN	REMARKS
16		INTERFACING PRGRAMMABLE KEYBOARD ANDDISPLAY CONTROLLER- 8279		
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25		UNPACKED BCD TO ASCII		

EX. NO: 01

DATE :

BASIC ARITHMETIC AND LOGICAL OPERATIONS USING 8086 MICROPROCESSOR -16 BIT ADDITION

AIM:

To write an assembly language program to perform addition two 16 bit numbers by an 8 bit number using 8086**.**

APPARATUS REQUIRED:

S.NO	ITEM	SPECIFICATION	QUANTITY
1.	MICROPROCESSOR KIR	8086 KIT	1
2.	POWER SUPPLY	+ 5 V DC	1
3.	KEY BOARD	-	1

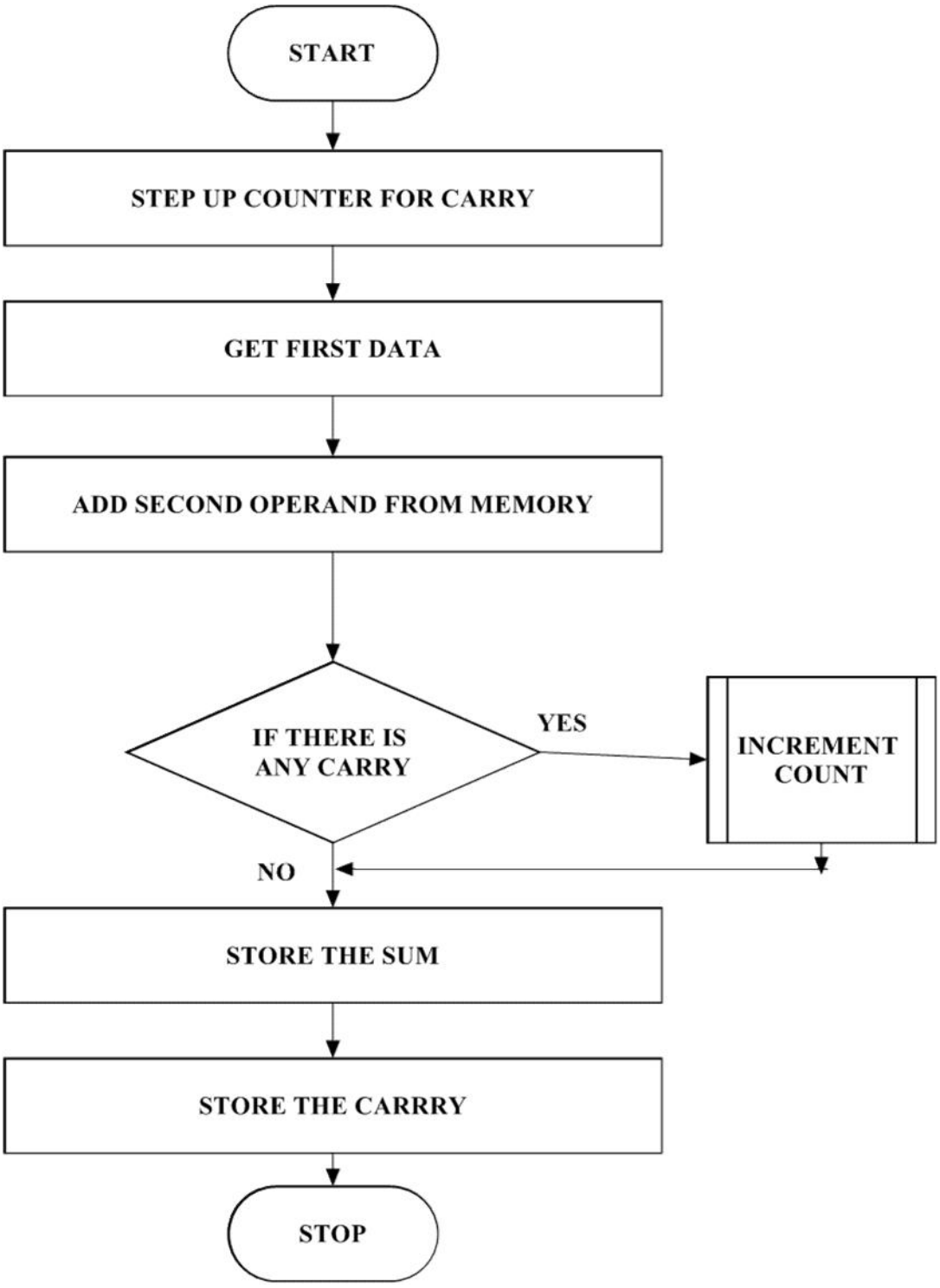
ALGORITHM:

16-bit addition

- Get the first number is specific address.
- Add the second number to the first number.
- Add the two values.
- Store the sum and carry.

FLOECHART:

ADDITION:



PROGRAM FOR ADDITION;

ADDRESS	OPCODE	LABEL	MNEMONICS	COMMENT
1000			MOV CX,0000H	Initialize counter CX
1003			MOV AX,[1200]	Get the first data in AX register.
1006			MOV BX, [1202]	Get the second data in BX register.
100A			ADD AX,BX	Add the contents of both the register AX & BX
100C			JNC L1	Check for carry
100E			INC CX	If carry exists, increment the CX
100F		LI	L1 : MOV [1206],CX	Store the carry
1013			MOV [1204], AX	Store the sum
1016		INT-3	HLT	Stop the program

OUTPUT FOR ADDITION:

	ADDRESS	DATA
INPUT	1200 1201 1202 1203	
OUTPUT	1204 1205	

RESULT:

Thus assembly language programs to perform addition two 16 bit numbers by an 8 bit number using 8086 Performed and the result is stored.

EX. NO: 02

DATE :

BASIC ARITHMETIC AND LOGICAL OPERATIONS USING 8086 MICROPROCESSOR - 16 BIT SUBTRACTION

AIM:

To write an assembly language program to perform subtraction two 16 bit numbers by an 8 bit number using 8086.

APPARATUS REQUIRED:

S.NO	ITEM	SPECIFICATION	QUANTITY
1.	MICROPROCESSOR KIR	8086 KIT	1
2.	POWER SUPPLY	+ 5 V DC	1
3.	KEY BOARD	-	1

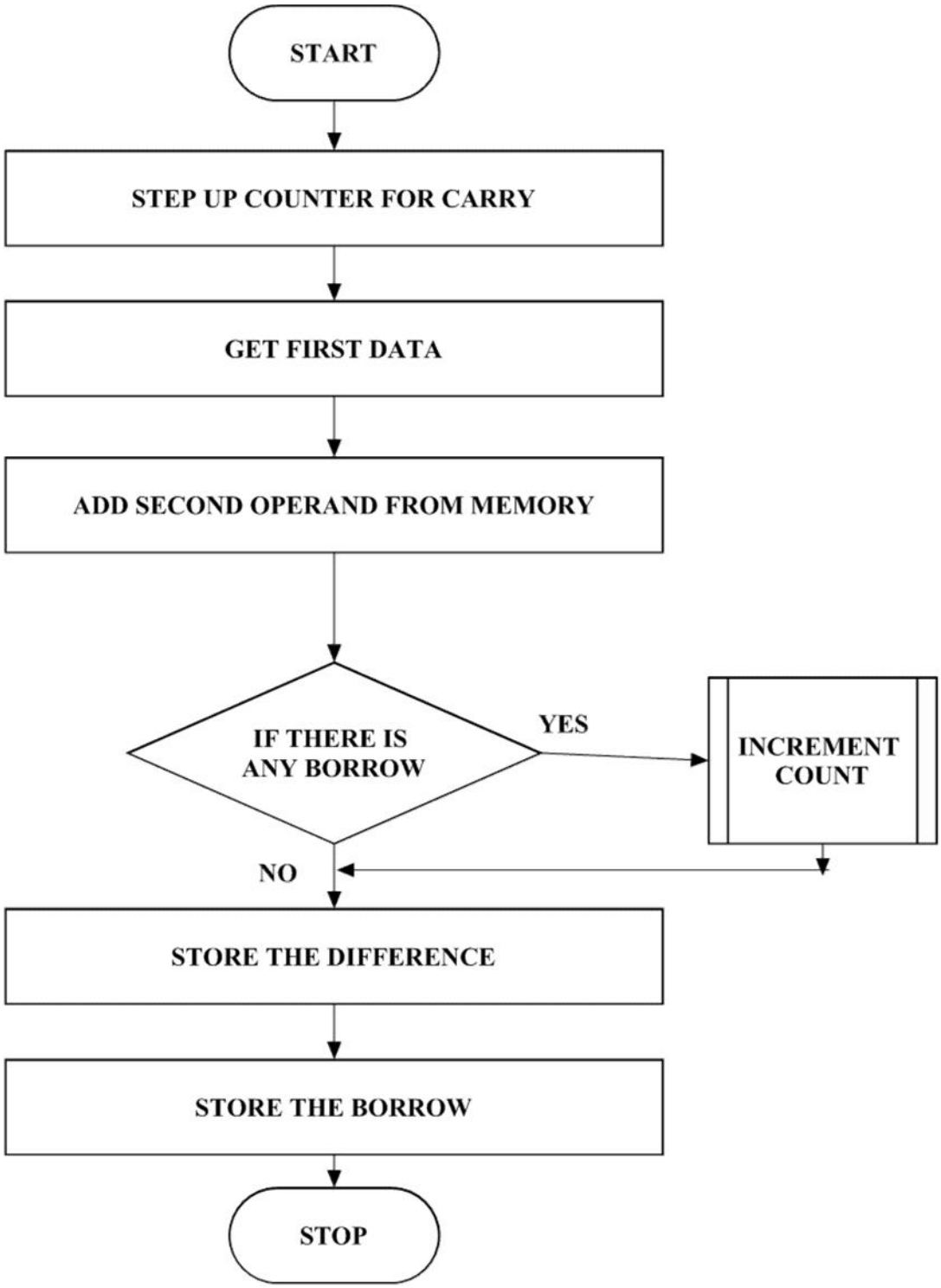
ALGORITHM:

16-bit SUBTRACTION:

- Initialize the MSBs of difference to 0
- Get the first number
- Subtract the second number from the first number.
- If there is any borrow, increment MSBs of difference by 1.
- Store LSBs of difference.
- Store MSBs of difference.

FLOECHART:

SUBTRACTION:



PROGRAM FOR SUBTRACTION:

ADDRESS	OPCODE	LABEL	MNEMONICS	COMMENT
1000			MOV CX,0000H	Initialize counter CX
1003			MOV AX,[1300]	Get the first data in AX register
1006			MOV BX, [1302]	Get the second data in BX register.
100A			SUB AX,BX	Subtract the contents of both the register AX & BX
100C			JNC A	Check the Borrow.
100E			INC CX	If carry exists, increment the CX
100F		LI	MOV [1306],CX	Store the Borrow.
1013			MOV [1304], AX	Store the difference.
1016		INT-3	HLT	Stop the program

OUTPUT FOR ADDITION:

	ADDRESS	DATA
INPUT	1300 1301 1302 1303	
OUTPUT	1304 1305	

RESULT:

Thus assembly language programs to perform subtraction two 16 bit numbers by an 8 bit number using 8086 Performed and the result is stored.

EX. NO: 03

DATE :

BASIC ARITHMETIC AND LOGICAL OPERATIONS USING 8086 MICROPROCESSOR - 16 BIT MULTIPLICATION

AIM:

To write an assembly language program to perform Multiplication two 16 bit numbers by an 8 bit number using 8086.

APPARATUS REQUIRED:

S.NO	ITEM	SPECIFICATION	QUANTITY
1.	MICROPROCESSOR KIR	8086 KIT	1
2.	POWER SUPPLY	+ 5 V DC	1
3.	KEY BOARD	-	1

ALGORITHM:

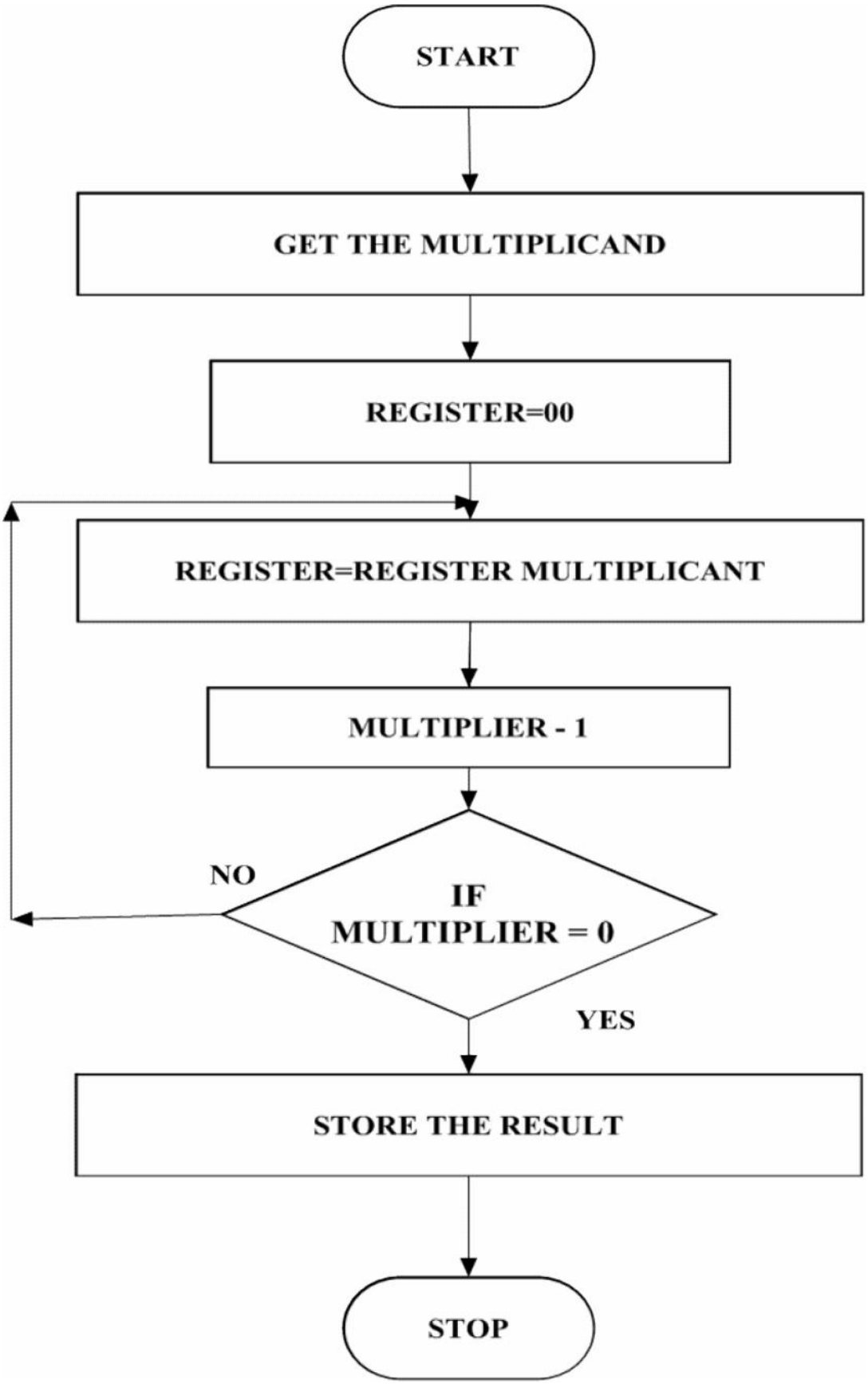
16-bit MULTIPLICATION

Multiplication of 16-bit numbers:

- Get the multiplier.
- Get the multiplicand
- Initialize the product to 0.
- Product = product + multiplicand
- Decrement the multiplier by 1.
- If multiplicand is not equal to 0, repeat from step (d) otherwise store the product.

FLOECHART:

MULTIPLICATION:



PROGRAM FOR MULTIPLICATION:

ADDRESS	OPCODE	LABEL	MNEMONICS	COMMENT
1000			MOV AX,1234H	Get the first data in AX register.
1003			MOV BX,[1300]	Get the second data in BX register.
1006			MUL BX	Multiply AX & BX data
1008			INT 3	Break point.

MULTIPLICATION OUTPUT:

INPUT		
OUTPUT		

RESULT:

Thus assembly language programs to perform multiplication two 16 bit numbers by an 8 bit number using 8086 Performed and the result is stored.

EX. NO: 04

DATE :

BASIC ARITHMETIC AND LOGICAL OPERATIONS USING 8086 MICROPROCESSOR - 16 BIT DIVISION:

AIM:

To write an assembly language program to perform division two 16 bit numbers by an 8 bit number using 8086.

APPARATUS REQUIRED:

S.NO	ITEM	SPECIFICATION	QUANTITY
1.	MICROPROCESSOR KIT	8086 KIT	1
2.	POWER SUPPLY	+ 5 V DC	1
3.	KEY BOARD	-	1

ALGORITHM:

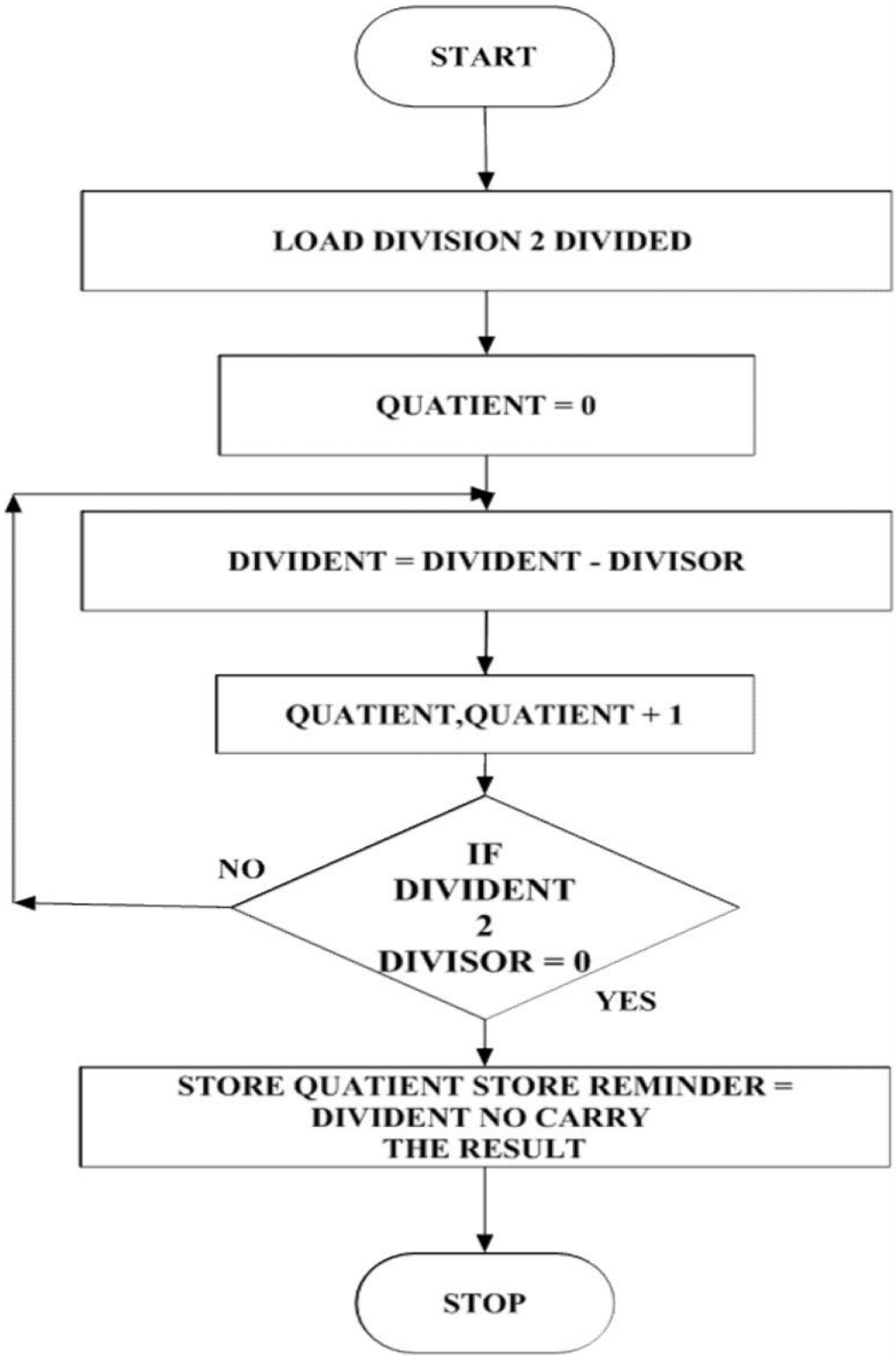
16-bit division

Division of 16-bit numbers:

- Get the dividend and divisor.
- Initialize the quotient to 0.
- Dividend = dividend–divisor
- If the divisor is greater, store the quotient
- Go to step 3
- If dividend is greater, quotient = quotient+ repeat from step 4.

FLOECHART:

DIVISION:



PROGRAM FOR DIVISION:

ADDRESS	OPCODE	LABEL	MNEMONICS	COMMENT
1000			MOV AX,[1200]	Get the first data in AX register,
1003			MOV DX,[1202]	Get the second data in DX register.
1007			MOV BX,[1204]	Move the higher order data.
100D			MOV [1206],AX	Move ax register into address
100B			DIV DX	Divide the dividend by divisor
1010			MOV AX,BX	Copy the lower order data
1012			MOV [1208],AX	Store the higher order data.
1015			INT 3	Stop the program.

OUTPUT FOR DIVISION:

INPUT	**AX=**	**DX=**
OUTPUT	**AX=**	**DX=**

RESULT:

Thus assembly language programs to perform division two 16 bit numbers by an 8 bit number using 8086 Performed and the result is stored.

EX. NO: 05

DATE :

MOVE A DATA BLOCK WITHOUT OVERLAP

AIM:

To move a data block without overlap

APPARATUS REQUIRED:

S.NO	ITEM	SPECIFICATION	QUANTITY
1.	MICROPROCESSOR KIR	8086 KIT	1
2.	POWER SUPPLY	+ 5 V DC	1
3.	KEY BOARD	-	1

ALGORITHM:

- Initialize the memory location to the data pointer.
- Increment B register.
- Increment accumulator by 1 and adjust it to decimal every time.
- Compare the given decimal number with accumulator value.
- When both match, the equivalent hexadecimal value is in B register.
- Store the resultant in memory location.

PROGRAM:

ADDRESS	OPCODES	PROGRAM	COMMENTS
1000		MOV CL, 05	Get the Data range
1002		MOV SI, 1400	Get the first data.
1005		MOV DI, 1450	Get the second data.
1008		LD DSB	Store the lower order product
1009		MOV [DI], AL	Store the result
100B		INC DI	Increment the pointer.
100C		DEC 1008	Counter 0
1010		INT 3	Break point

OUTPUT:

INPUT		OUTPUT	
1400		1450	
1401		1451	
1402		1452	
1403		1453	
1404		1454	

RESULT:

Thus the output for the Move a data block without overlap was executed successfully.

EX. NO: 06

DATE :

CODE CONVERSION, DECIMAL ARITHMETIC AND MATRIX OPERATIONS.

Code Conversions –Decimal to Hexadecimal:

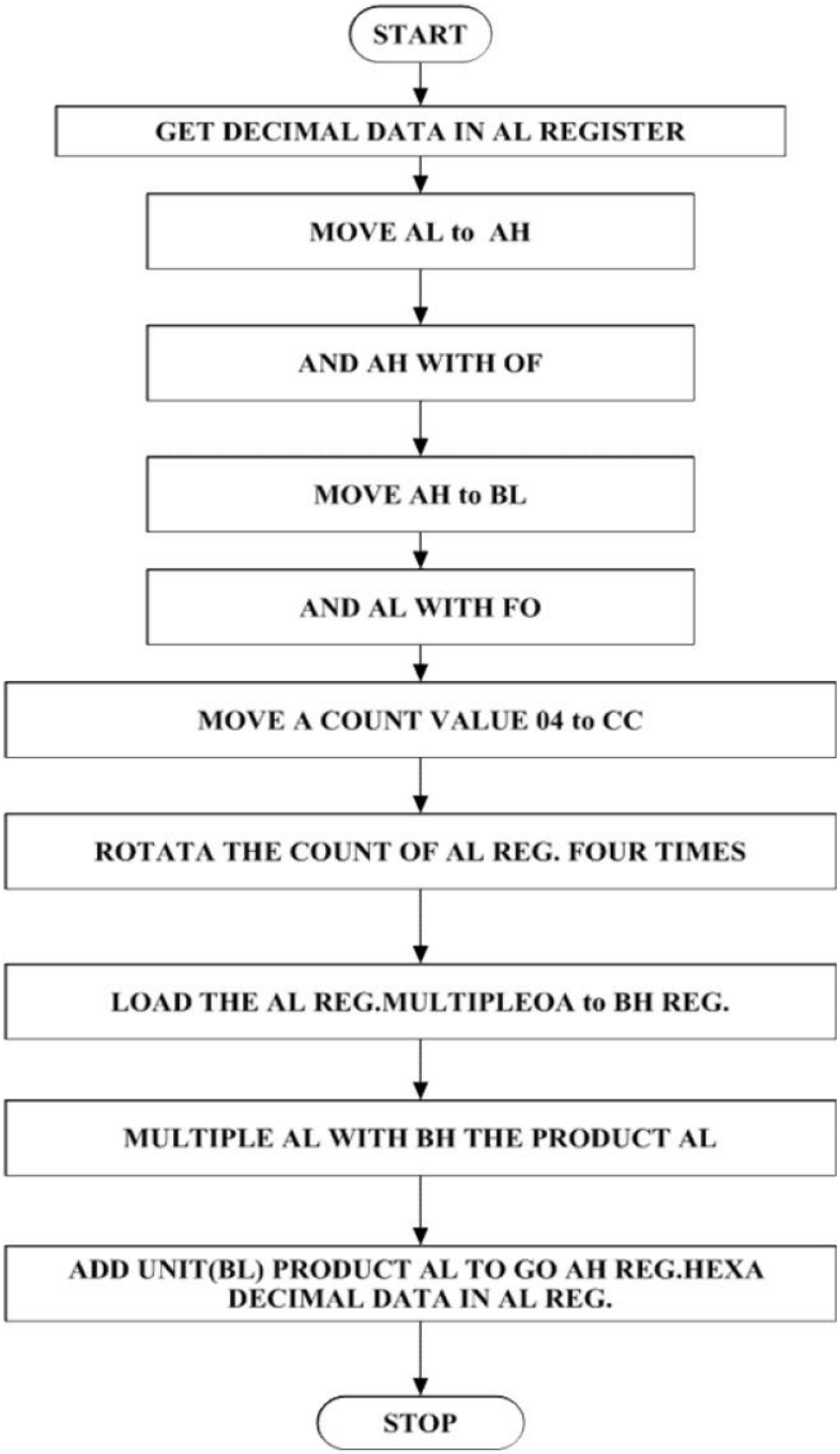
AIM:

To convert a given decimal number to hexadecimal.

ALGORITHM:

- Initialize the memory location to the data pointer.
- Increment B register.
- Increment accumulator by 1 and adjust it to decimal every time.
- Compare the given decimal number with accumulator value.
- When both match, the equivalent hexadecimal value is in B register.
- Store the resultant in memory location.

FLOWCHART:


START
GET DECIMAL DATA IN AL REGISTER
MOVE AL to AH
AND AH WITH OF
MOVE AH to BL
AND AL WITH FO
MOVE A COUNT VALUE 04 to CC
ROTATA THE COUNT OF AL REG. FOUR TIMES
LOAD THE AL REG.MULTIPLEOA to BH REG.
MULTIPLE AL WITH BH THE PRODUCT AL
ADD UNIT(BL) PRODUCT AL TO GO AH REG.HEXA DECIMAL DATA IN AL REG.
STOP

PROGRAM:

ADDRESS	OPCODE	LABEL	MNEMONICS	COMMENDS
1000			***MOV AL, [1100]***	Move data block AL
1003			***MOV AH, AL***	Move data lower to higher
1005			***MOV AH, OF***	Move data OF into AH
1008			***MOV BL, AH***	Move data BL into AH
100A			***AND AL, FO***	AND the data AL to FO
100C			***MOV CL, 04***	Move data 04 to CL block
100E			***ROR AL, CL***	Rotate functions CL and AL
1010			***MOV BH, OA***	Move data OA into BH
1012			***MUL BH***	Multiply BH
1014			***ADD AL, BL***	ADD the data AL And BL
1016			***MOV [2000], AL***	Move the store data
1019			***INT-3***	Halt program

OUTPUT:[DECIMAL TO HEXADECIMAL]

DATA	ADRESS	DATA
INPUT		
OUTPUT		

RESULT:

Thus the output for the code conversions –decimal to hex was executed successfully.

EX. NO: 07

DATE :

CODE CONVERSION –HEXADECIMAL TO DECIMAL

AIM:

To convert a given hexadecimal number to decimal.

ALGORITHM:

- Initialize the memory location to the data pointer.
- Increment B register.
- Increment accumulator by 1 and adjust it to decimal every time.
- Compare the given hexadecimal number with B register value.
- When both match, the equivalent decimal value is in A register.
- Store the resultant in memory location.

PROGRAM;

ADDRESS	OPCODE	LABEL	MNEMONICS	COMMENTS
1000			MOV AL, [1100]	Move date to AL REG
1003			MOV DX, AL	Move data AL TO DX
1006		HUND	MOV AL, 64	Move data to AX REG
1008			JC TEN	Jump carry
100A			SUB AL, 64	Subtract data
100C			INC DL	Increment DL
100E			JUP HUND	JUMP label data
1010		TEN	CMP AL, OA	Compare register
1012			JC UNIT	Jump carry
1014			SUB AL,OA	Subtract data
1016			INC DH	Increment DH
1018			JC TEN	JUMP carry
101A		UNIT	MOV [200],DL	Move data to DL
101E			MOV [200],DH	Move data to DH
1022			MOV [200],AL	Move data to AL
1025			MOV [200],AH	Move data to AH
1027			HLT	Stop the program

OUTPUT:[HEXADECIMAL NUMBER TO DECIMAL]:

	INPUT	OUTPUT
MEMORY		
DATA		

RESULT:

Thus the output for the addition code conversions –decimal to hex was executed successfully.

EX. NO: 08

DATE :

FLOATING POINT OPERATIONS- STRING MANIPULATIONS, SORTING AND SEARCHING

Copying a String:

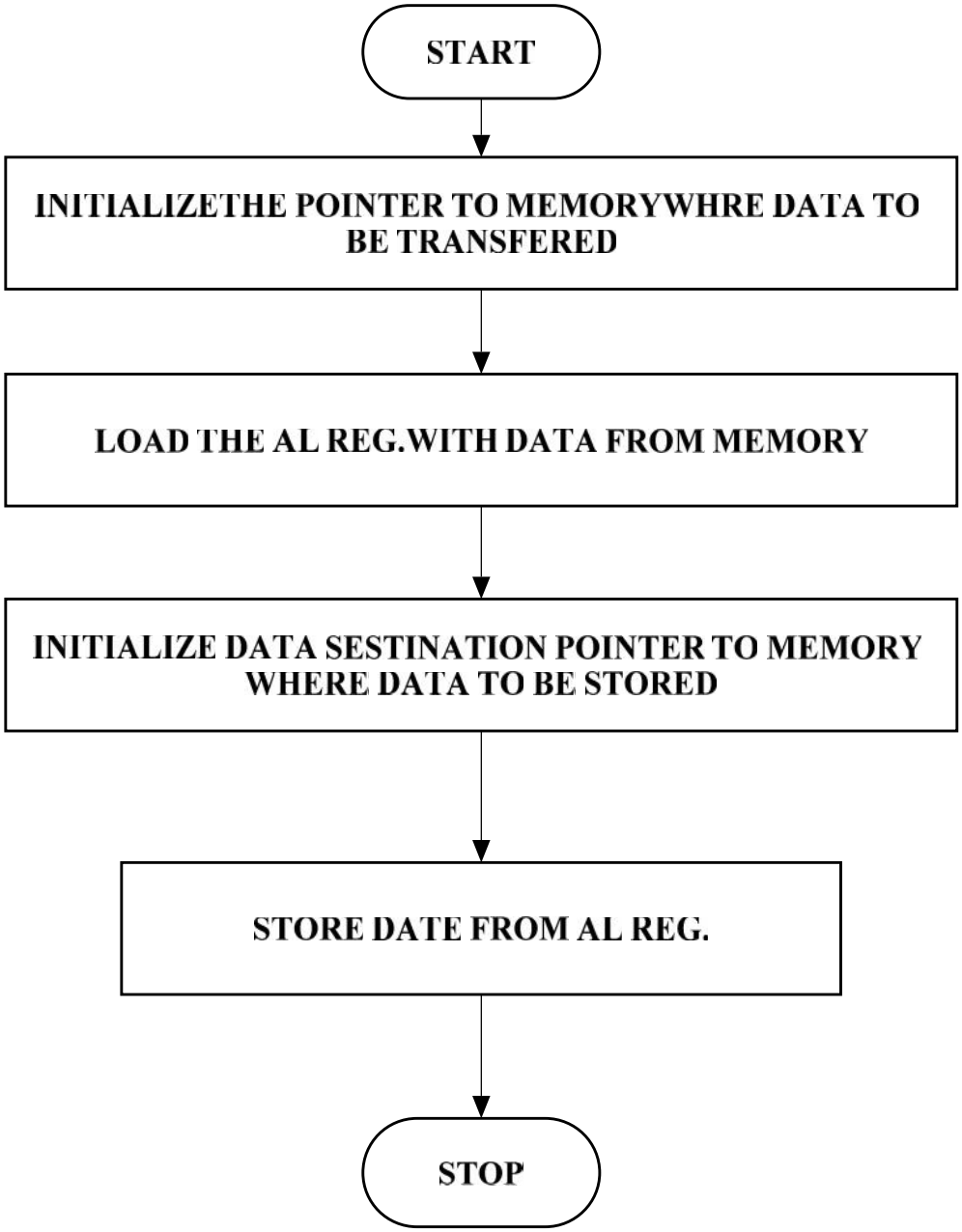
AIM:

To move a string of length FF from source to destination.

ALGORITHM:

- Initialize the data segment .(DS)
- Initialize the extra data segment .(ES)
- Initialize the start of string in the DS. (SI)
- Initialize the start of string in the ES. (DI)
- Move the length of the string (FF) in CX register.
- Move the byte from DS TO ES, till CX=0.

FLOECHART:


START
INITIALIZETHE POINTER TO MEMORYWHRE DATA TO BE TRANSFERED
LOAD THE AL REG.WITH DATA FROM MEMORY
INITIALIZE DATA SESTINATION POINTER TO MEMORY WHERE DATA TO BE STORED
STORE DATE FROM AL REG.
STOP

PROGRAM:

ADDRESS	OPCODES	PROGRAM	COMMENTS
1000		MOV SI,1200H	Initialize destination address
1003		MOV DI,1300H	Initialize starting address.
1006		MOV CX,0006H	Initialize array size
1008		CLD	Clear direction flag
100A		REP MOVSB	Copy the contents of source into destination until count reaches zero
100C		HLT	Stop

OUTPUT : [COPYING A STRING]:

INPUT		OUTPUT	
1400		1450	
1401		1451	
1402		1452	
1403		1453	
1404		1454	

RESULT:

Thus a string of a particular length is moved from source segment to destination segment.

EX. NO: 09

DATE :

ASCENDING & DESCENDING

AIM:

To write an Assembly Language Program (ALP) to sort a given array in ascending and descending order.

APPARATUS REQUIRED:

S.NO	ITEM	SPECIFICATION	QUANTITY
1.	MICROPROCESSOR KIR	8086 KIT	1
2.	POWER SUPPLY	+ 5 V DC	1
3.	KEY BOARD	-	1

PROBLEM STATEMENT:

An array of length 10 is given from the location. Sort it into descending and ascending order and store the result.

ALGORITHM:

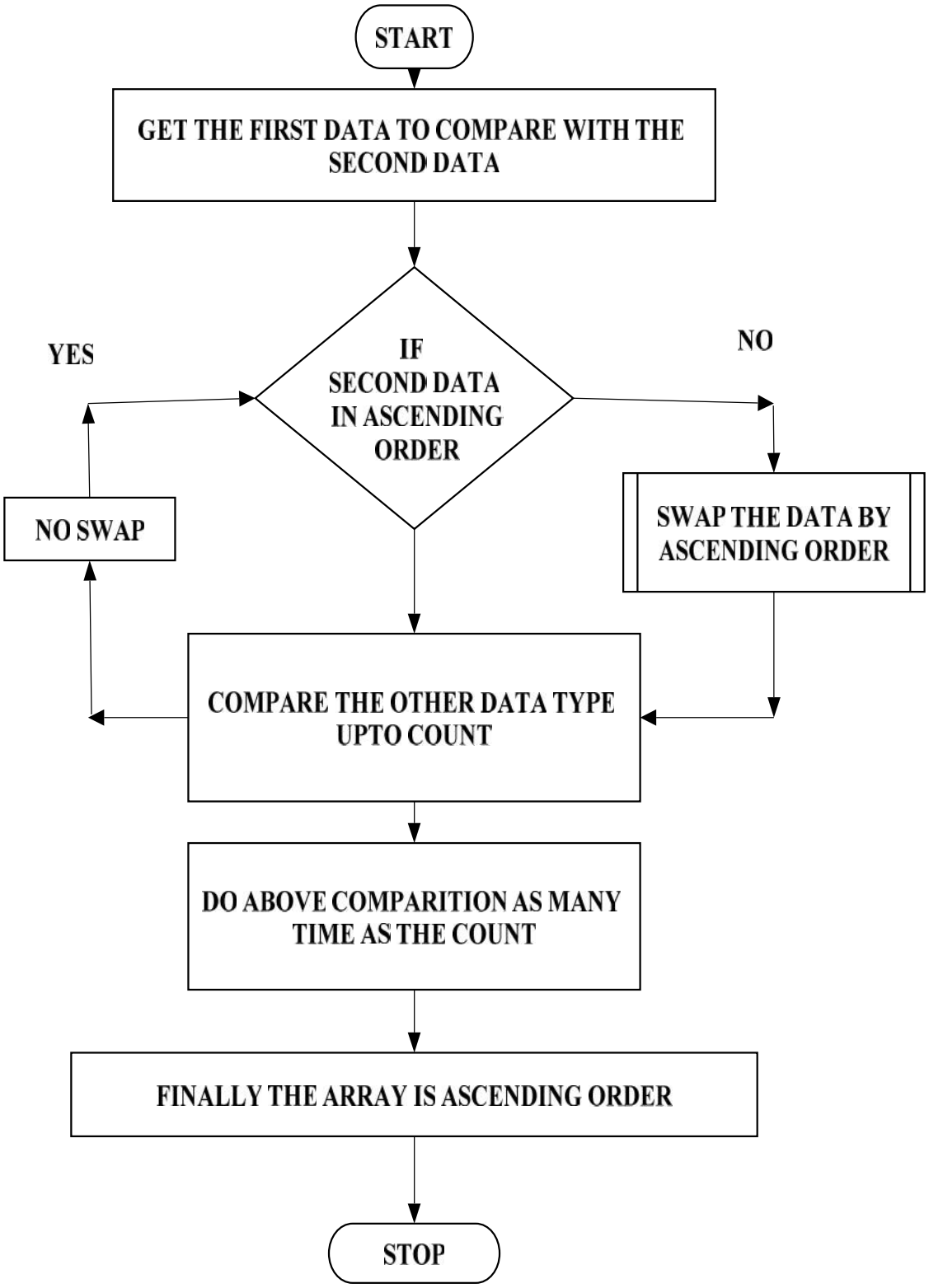
Sorting in ascending order:

- Load the array count in two registers C_1 and C_2.
- Get the first two numbers.
- Compare the numbers and exchange if necessary so that the two numbers are in ascending order.
- Decrement C_2.
- Get the third number from the array and repeat the process until C_2 is 0.
- Decrement C_1 and repeat the process until C_1 is 0.

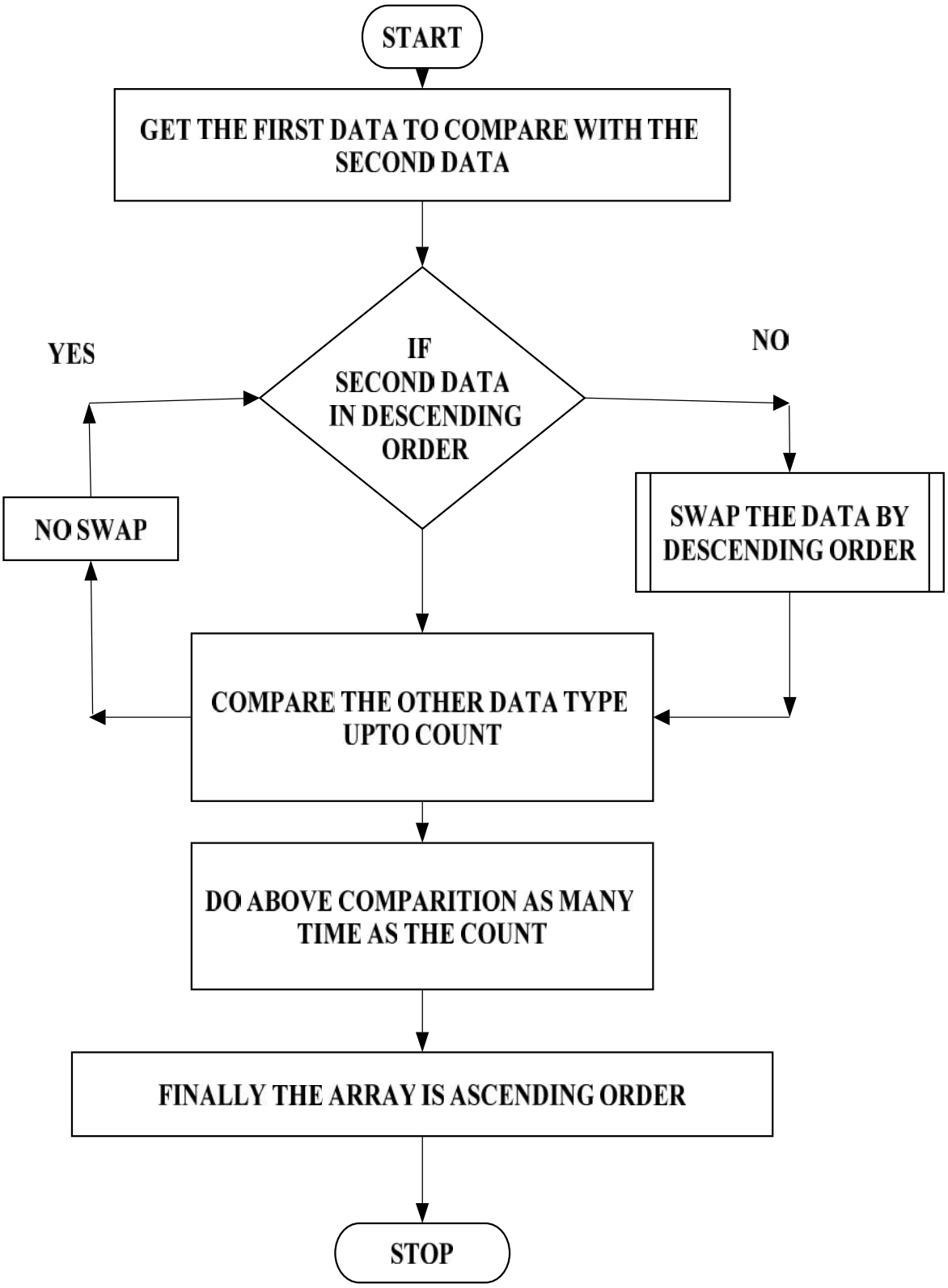
Sorting in descending order:

- Load the array count in two registers C_1 and C_2.
- Get the first two numbers.
- Compare the numbers and exchange if necessary so that the two numbers are in descending order.
- Decrement C_2.
- Get the third number from the array and repeat the process until C_2 is 0.
- Decrement C_1 and repeat the process until C_1 is 0.

FLOECHART:[ASCENDING]:



FLOWCHART :[DECENDING]:



PROGRAM FOR ASCENDING ORDER:

ADDRESS	OPCODES	PROGRAM	COMMENTS
1000		MOV SI,1200H	Initialize memory location for array size
1002		MOV CL,[SI]	Number of comparisons in CL
1004		L4 : MOVSI,1200H	Initialize memory location for array size
1006		MOV DL,[SI]	Get the count in DL
1007		INC SI	Go to next memory location
1009		MOV AL,[SI]	Get the first data in AL
100B		L3 : INC SI	Go to next memory location
100E		MOV BL,[SI]	Get the second data in BL
1010		CMP AL,BL	Compare two data's
1012		JNB L1	If AL < BL go to L1
1014		DEC SI	Else, Decrement the memory location
1016		MOV [SI],AL	Store the smallest data
1018		MOV AL,BL	Get the next data AL
1019		JMP L2	Jump to L2
101A		L1 : DEC SI	Decrement the memory location
101C		MOV [SI],BL	Store the greatest data in memory location
101E		L2 : INC SI	Go to next memory location
1020		DEC DL	Decrement the count
1022		JNZ L3	Jump to L3, if the count is not reached
1024		MOV [SI],AL	Store data in memory location
1026		DEC CL	Decrement the count
1028		JNZ L4	Jump to L4, if the count is not reached zero
1029		HLT	Stop

PROGRAM FOR DESCENDING ORDER:

ADDRESS	OPCODES	PROGRAM	COMMENTS
1000		***MOV SI,1200H***	Initialize memory location for array size
1002		***MOV CL,[SI]***	Number of comparisons in CL
1004		***L4 : MOVSI,1200H***	Initialize memory location for array size
1006		***MOV DL,[SI]***	Get the count in DL
1007		***INC SI***	Go to next memory location
1009		***MOV AL,[SI]***	Get the first data in AL
100B		***L3 : INC SI***	Go to next memory location

OUTPUT FOR ASCENDING:

	DATA					
INPUT						
OUTPUT						

OUTPUT FOR DESCENDING ORDER:

	DATA					
INPUT						
OUTPUT						

RESULT:

Thus given array of numbers are sorted in ascending & descending order.

EX. NO: 10

DATE :

LARGEST& SMALLEST

AIM:

To write an Assembly Language Program(ALP) to find the largest and smallest number in a given array.

APPARATUS REQUIRED:

S.NO	ITEM	SPECIFICATION	QUANTITY
1.	MICROPROCESSOR KIR	8086 KIT	1
2.	POWER SUPPLY	+ 5 V DC	1
3.	KEY BOARD	-	1

PROBLEM STATEMENT:

An array of length 5 is given from the location. Find the largest and smallest number and store the result.

ALGORITHM:

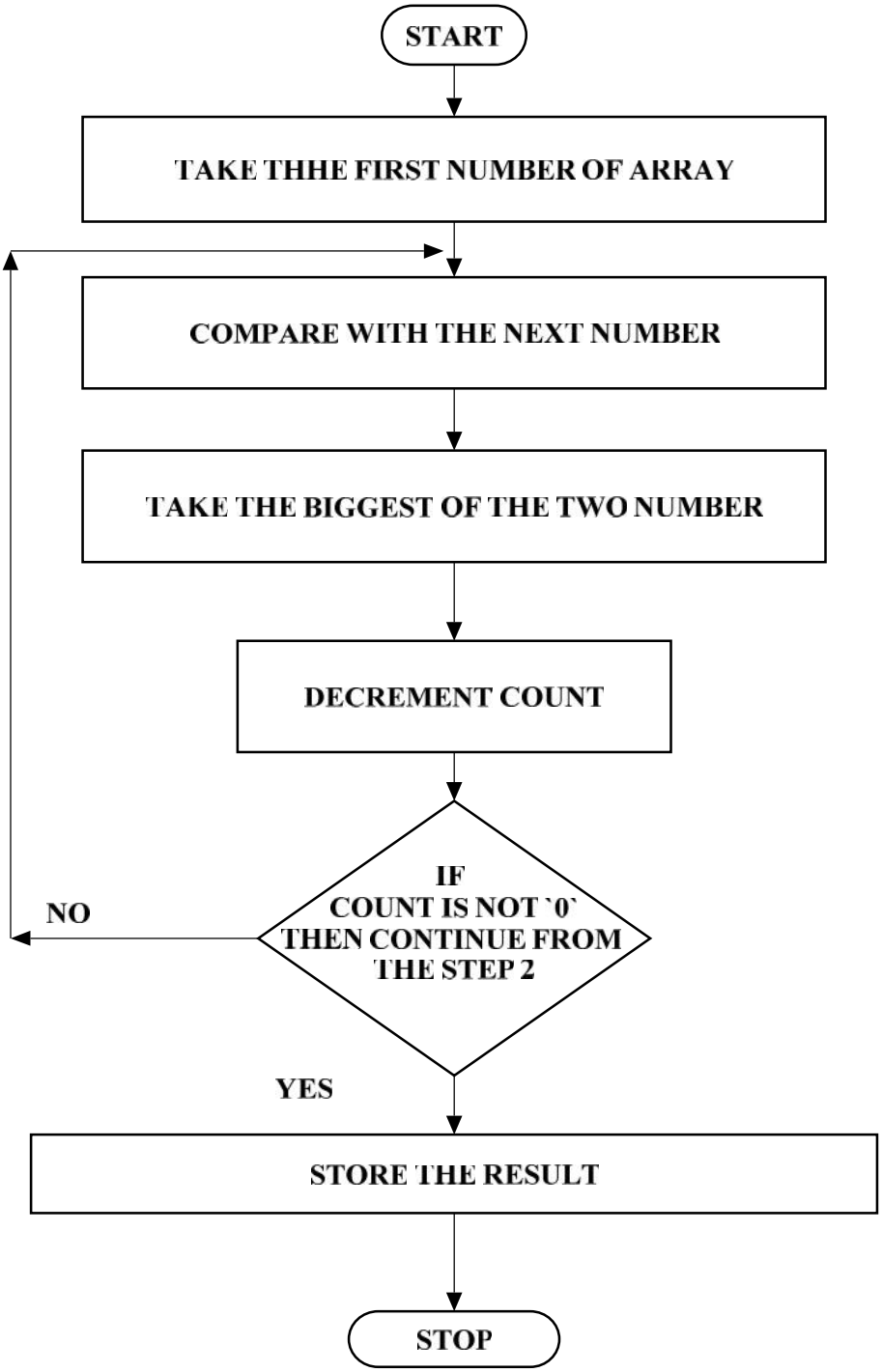
(i) Finding largest number:

- Load the array count in a register C_1.
- Get the first two numbers.
- Compare the numbers and exchange if the number is small.
- Get the third number from the array and repeat the process until C_1 is 0.

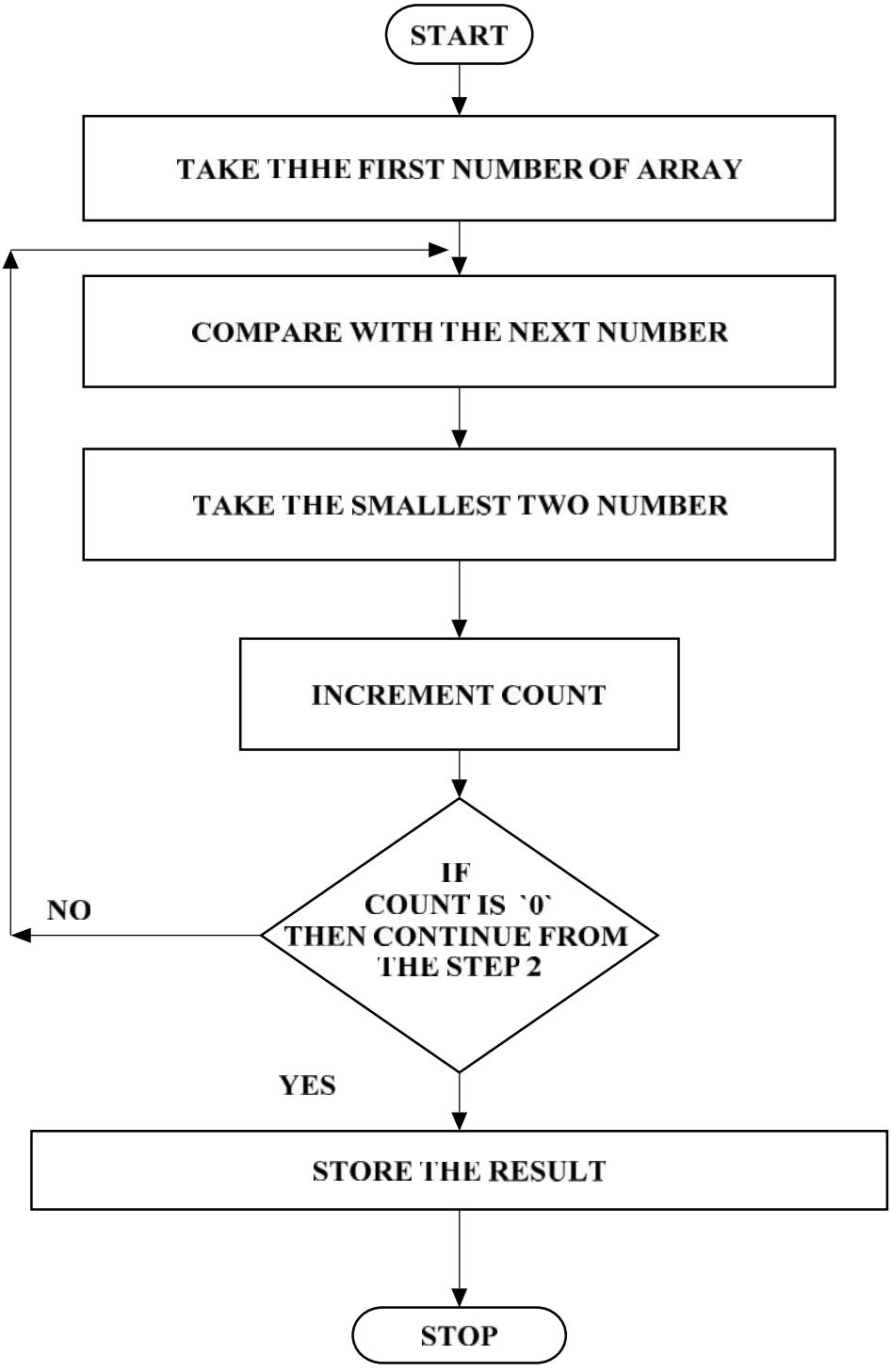
(ii) Finding smallest number:

- Load the array count in a register C1.
- Get the first two numbers.
- Compare the numbers and exchange if the number is large.
- Get the third number from the array and repeat the process until C1 is 0.

FLOECHART:[LARGEST]



FLOECHART:[SMALLEST]



PROGRAM FOR FINDING LARGEST NUMBER:

ADDRESS	OPCODES	PROGRAM	COMMENDS
1000		MOV SI,1200H	Initialize array size
1002		MOV CL,[SI]	Initialize the count
1004		INC SI	Go to next memory location
1006		MOV AL,[SI]	Move the first data in AL
1007		DEC CL	Reduce the count
1009		L2 : INC SI	Move the SI pointer to next data
100B		CMP AL,[SI]	Compare two data's
100E		JNB L1	If AL > [SI] then go to L1 (no swap)
1010		MOV AL,[SI]	Else move the large number to AL
1012		L1 : DEC CL	Decrement the count
1014		JNZ L2	If count is not zero go to L2
1016		MOV DI,1300H	Initialize DI with 1300H
1018		MOV [DI],AL	Else store the biggest number in 1300 location
1010		HLT	Stop

PROGRAM FOR FINDING SMALLEST NUMBER:

ADDRESS	OPCODES	PROGRAM	COMMENDS
1000		MOV SI,1200H	Initialize array size
1002		MOV CL,[SI]	Initialize the count
1004		INC SI	Go to next memory location
1006		MOV AL,[SI]	Move the first data in AL
1007		DEC CL	Reduce the count
1009		L2 : INC SI	Move the SI pointer to next data
100B		CMP AL,[SI]	Compare two data's
100E		JB L1	If AL < [SI] then go to L1 (no swap)
1010		MOV AL,[SI]	Else move the large number to AL
1012		L1 : DEC CL	Decrement the count
1014		JNZ L2	If count is not zero go to L2
1016		MOV DI,1300H	Initialize DI with 1300H
1018		MOV [DI],AL	Else store the biggest number in 1300 location
1010		HLT	Stop

OUTPUT FOR LARGESTNUMBER:

	DATA					
INPUT						
OUTPUT						

OUTPUT FOR SMALLEST NUMBER:

	DATA					
INPUT						
OUTPUT						

RESULT:

Thus largest and smallest number is found in a given array.

EX. NO: 11

DATE :

PASSWORD CHECKING

AIM:

To write an Assembly Language Program (ALP) for performing the Arithmetic operation of two byte numbers

APPARATUS REQUIRED:

SL .No	ITEM	SPECIFICATION	QUANTITY
1.	Microprocessor kit	8086 kit	1
2.	Power Supply	+5 V dc	1

PROGRAM:

```
; PASSWORD IS MASM1234
DATA SEGMENT
PASSWORD DB 'MASM1234'
LEN EQU ($-PASSWORD)
MSG1 DB 10, 13,'ENTER YOUR PASSWORD: $'
MSG2 DB 10, 13,' WELCOME TO ELECTRONICS WORLD!!$'
MSG3 DB 10, 13,'INCORRECT PASSWORD!$'
NEW DB 10, 13,'$'
INST DB 10 DUP (0)
DATA ENDS
CODE SEGMENT
```

```
ASSUME CS: CODE, DS: DATA
START:
MOV AX, DATA
MOV DS, AX

LEA DX, MSG1
MOV AH, 09H
INT 21H
MOV SI, 00
UP1:
MOV AH, 08H
INT 21H
CMP AL, 0DH
JE DOWN
MOV [INST+SI], AL
MOV DL,'*'
MOV AH, 02H
INT 21H
INC SI
JMP UP1
DOWN:
MOV BX, 00
MOV CX, LEN
CHECK:
MOV AL,[INST+BX]
MOV DL,[PASSWORD+BX]
CMP AL, DL
JNE FAIL
```

```
INC BX
LOOP CHECK
LEA DX, MSG2
MOV AH, 09H
INT 21H

JMP FINISH
FAIL:
LEA DX, MSG3
MOV AH, 009H
INT 21H
FINISH:
INT 3
CODE ENDS
END START
END
```

RESULT:

Thus the output for the Password checking, Print RAM size and system date was executed successfully

EX.NO: 12

DATE :

COUNTERS AND TIME DELAY

AIM:

To write an assembly language program in 8086 to Counters and Time Delay

APPARATUS REQUIRED:

SL .No	ITEM	SPECIFICATION	QUANTITY
1.	Microprocessor kit	8086 kit	1
2.	Power Supply	+5 V dc	1

PROGRAM:

```
.MODEL SMALL
.DATA

MSGIN DB 'Enter delay duration (0-50): $'
MSG1 DB 'This is Microprocessor! $'
DELAYTIME DW 0000H

.CODE
MOV DX,@DATA
MOV DS, DX
LEA DX, MSGIN
MOV AH, 09H
INT 21H



IN1:
```

```
MOV AH, 01H
INT 21H
CMP AL, 0DH           ;
JE NXT
SUB AL, 30H
MOV DL, AL
MOV AX, BX
MOV CL, 0AH
MUL CL
MOV BX, AX
AND DX, 00FFH
ADD BX, DX
MOV DELAYTIME, BX
LOOP IN1
NXT:
MOV CX, DELAYTIME
MOV DL, 10
MOV AH, 02H
INT 21H
LEA SI, MSG1
LP:          PUSH DX
MOV DL,[SI]
CMP DL,'$'
JE NXT2
MOV AH, 02H
INT 21H
ADD SI, 1
POP DX
MOV DI, DELAYTIME
MOV AH, 0
INT 1Ah
MOV BX, DX

Delay:
MOV AH, 0
INT 1Ah
```

```
SUB DX, BX
CMP DI, DX
JA Delay
LOOP LP

NXT2:
MOV AH, 4CH
INT 21H
END
```

RESULT:

Thus the output for the Counters and Time Delay was executed successfully

EXP.NO: 13

DATE :

TRAFFIC LIGHT CONTROL

AIM:

To write an assembly language program in 8086 to Traffic light control

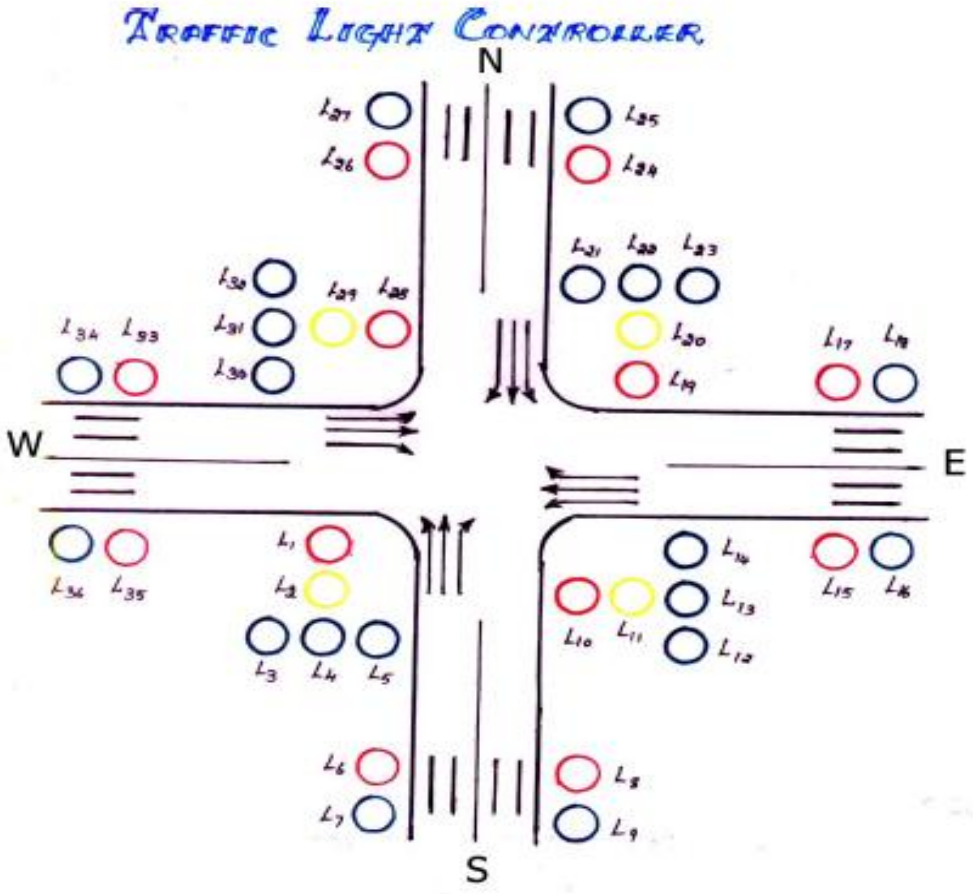
APPARATUS REQUIRED:

SL .No	ITEM	SPECIFICATION	QUANTITY
1.	Microprocessor kit	8086 kit	1
2.	Power Supply	+5 V dc	1

PROGRAM;

- Log into System.
- Select control type.
- If Automatic mode select then go to step 4th else go to step 8.
- If Automatic control activated.
- Assign time period for green, yellow signal.
- If emergency vehicle is over then go to step 4.
- If rally come then go to step 8.
- Manual control activated.
- Assign time period for green, yellow signal according to that particular road.
- If emergency over then go to step 4.

MODEL GRAPH FOR TRAFFIC LIGHT CONTROL:



ASSEMBLY LANGUAGE PROGRAM FOR TRAFFIC LIGHT CONTROL:

ADDRESS	OPCODE	LABEL	MNEMONICS
1000			MVI A,80
1002			OUT CWR
1004		REPEAT	MVI E, 03
1006			LXI H, C100
1007		NEXTSTAT	MOV A, M
1009			OUT PORRTA
100B			INX H
100E			MOV A, M
1010			OUT PORTB
1012			INX H
1014			MOV A,M
1016			OUT PORT C
1018			CALL DELAY
1019			INX H
101A			DCR E
101C			JNZ NEXTSTAT
101E			JMP REPEAT
1022		DELAY	LXI D, 3000
1024		L2	MVI C,FF
1026		L1	DCR C
1028			JNZ L1
1029			DCR D
1000			MOV A, D
1002			ORA E
1004			JNZ L2
1006			RET

▪

RESULT:

Thus the assembly language program for traffic light control is verified

EX. NO: 14

DATE :

STEPPER MOTOR INTERFACING

AIM:

To write an assembly language program in 8086 to rotate the motor at different speeds.

APPARATUS REQUIRED:

SL.NO	ITEM	SPECIFICATION	QUANTITY
1.	Microprocessor kit	8086	1
2.	Power Supply	+5 V, dc,+12 V dc	1
3.	Stepper Motor Interface board	-	1
4.	Stepper Motor	-	1

PROBLEM STATEMENT:

Write a code for achieving a specific angle of rotation in a given time and particular number of rotations in a specific time.

THEORY:

A motor in which the rotor is able to assume only discrete stationary angular position is a stepper motor. The rotary motion occurs in a stepwise manner from one equilibrium position to the next. Two-phase scheme: Any two adjacent stator windings are energized. There are two magnetic fields active in quadrature and none of the rotor pole faces can be in direct alignment with the stator poles. A partial but symmetric alignment of the rotor poles is of course possible.

ALGORITHM:

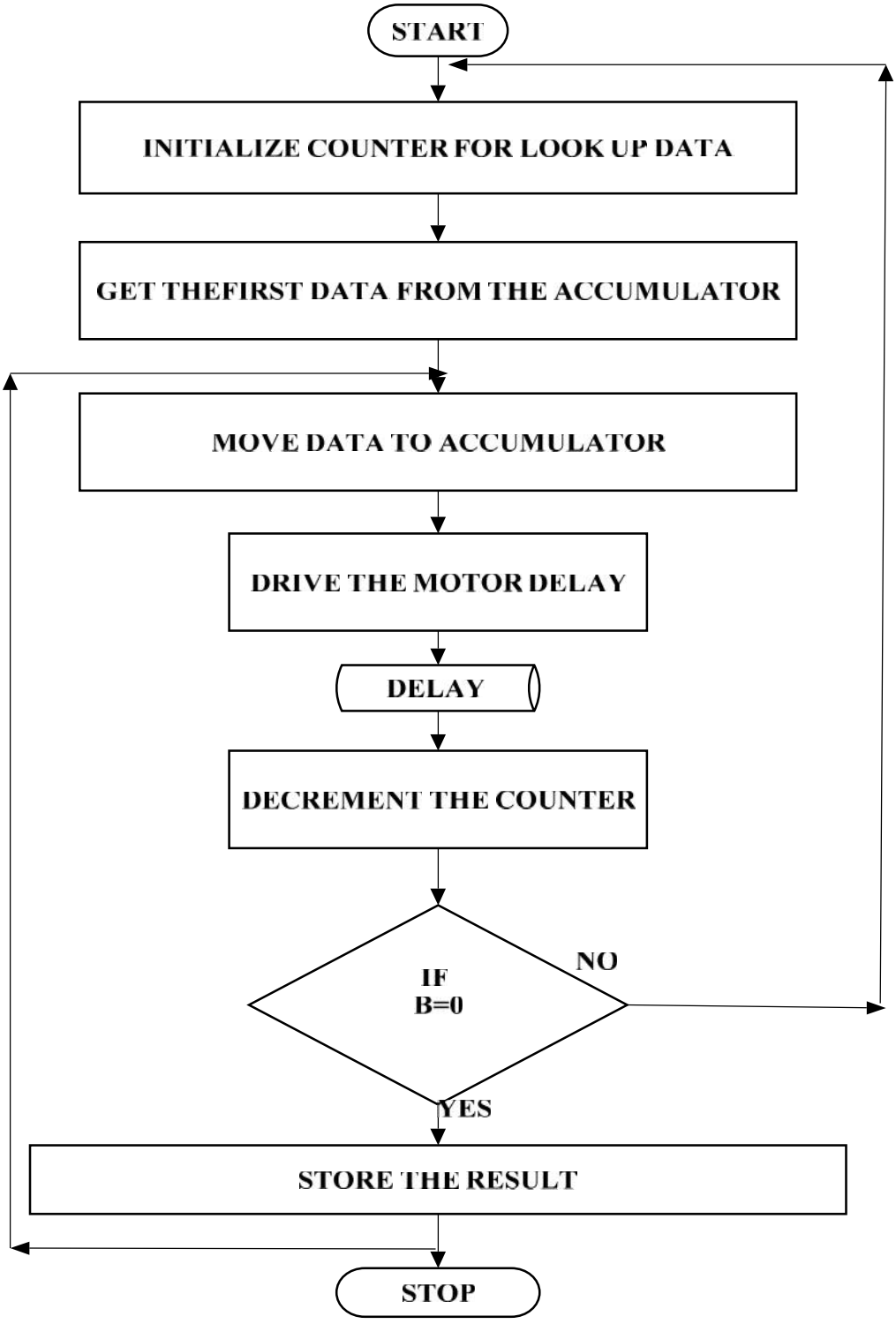
For running stepper motor clockwise and anticlockwise directions

- Get the first data from the lookup table.
- Initialize the counter and move data into accumulator.
- Drive the stepper motor circuitry and introduce delay
- Decrement the counter is not zero repeat from step(iii)
- Repeat the above procedure both for backward and forward directions.

SWITCHING SEQUENCE OF STEPPER MOTOR:

MEMORY LOCATION	A1	A2	B1	B2	HEX CODE
4500	1	0	0	0	09 H
4501	0	1	0	1	05 H
4502	0	1	1	0	06 H
4503	1	0	1	0	0A H

FLOWCHART:


START
INITIALIZE COUNTER FOR LOOK UP DATA
GET THEFIRST DATA FROM THE ACCUMULATOR
MOVE DATA TO ACCUMULATOR
DRIVE THE MOTOR DELAY
DELAY
DECREMENT THE COUNTER
IF
B=0
NO
YES
STORE THE RESULT
STOP

PROGRAM FOR STEPPER MOTOR CONTOL;

ADDRESS	OPCODE	PROGRAM	COMMENTS
1000		START : MOV DI, 1200H	Initialize memory location to store the array of number
1002		MOV CX, 0004H	Initialize array size
1004		LOOP 1 : MOV AL,[DI]	Copy the first data in AL
1006		OUT 0C0,AL	Send it through port address
1007		MOV DX, 1010H	Introduce delay
1009		L1 : DEC DX	Declare DX
100B		JNZ L1	JUNP no zero
100E		INC DI	Increment DI
1010		LOOP LOOP1	Go to next memory location
1012		JMP START	Loop until all the data's have been sent Go to start location for continuous rotation
1014		1200 : 09,05,06,0A	Array of data's

RESULT:

Thus the assembly language program for rotating stepper motor in both clockwise and anticlockwise directions is written and verified.

EX. NO: 15

DATE :

DIGITAL CLOCK

AIM:

To display the digital clock specifically by displaying the hours, minutes and seconds using 8086 kits

APPARATUS REQUIRED:

S.NO	ITEM	SPECIFICATION
1	Microprocessor kit	8086
2	Power Supply	5V

PRELIMINARY SETTINGS:

Store time value in memory location 1500- Seconds

1501- Minutes

1502- Hours

DIGITAL CLOCK PROGRAM:

MEMORY	OPCODE	LABEL	MNEMONICS
1000		START	
1000			***CALL CONVERT***
1003			***CALL DISPLAY***
1006		DELAY	***MOV AL, 0B0H***
1009			***OUT 16H, AL***
100B			***MOV CL, 07H***
100E		S2	***MOV AL, 88H***
1011			***OUT 14H, AL***
1013			***MOV AL, 80H***
1016			***OUT 14H, AL***
1018		S1	***MOV AL, 80H***
101B			***OUT 16H, AL***
101D			***NOP***
101E			***NOP***
101F			***NOP***
1020			***NOP***
1021			***IN AL, 14H***
1023			***MOV DL, AL***
1025			***IN AL, 14H***
1027			***OR AL,DL***
1029			***JNZ S1***
102B			***DEC CL***

102D			***JNZ S2***
102F			***MOV SI, 1500H***
1033			***MOV AL.[SI]***
1035			***INC AL***
1037			***MOV [SI],AL***
1039			***CMP AL, 3CH***
103C			***JNZ START***
103E			***MOV AL, 00H***
1041			***MOV[SI], AL***
1043			***INC AL***
1044			***MOV [SI],AL***
1046			***CMP AL,3CH***
1048			***JNZ START***
1041			***MOV AL, 0***
104D			***MOV AL, [SI]***
104F			***MOV AL, O***
1052			***MOV [SI],AL***
1054			***INC SI***
1055			***MOV AL, [SI]***
1057			***CMP AL, 18H***
1059			***JNZ START***
105B			***MOV AL, 0***
105E			***MOV SI,AL***
1060			***MOV AL,0***
1063			***MOV [SI],AL***

1065			***JMP START***
1068		DISPLAY	***MOV AH, 06H***
106B			***MOV DX, 1600H***
106F			***MOV CH, 01***
1072			***MOV CL , 01***
1075			***INT 5***
1077			***RET***
1078	CONVERT		***MOV SI, 1500H***
107C			***MOV BX, 1608H***
1080			***MOV AL, 24***
1080			***MOV [BX,] AL***
SECONDS			
1085			***MOV AL, SI***
1087			***MOV AH, 0***
108A			***MOV DH, 0AH***
108D			***DIV DH***
108F			***ADD AH, 30H***
1092			***DEC BX***
1093			***MOV [BX], AH***
1095			***DEC BX***
1096			***ADD AL, 30H***
1098			***HLT***

RESULT;

Thus the digital clock program has been written and executed using 8086 microprocessor kit and the output of digital clock was displayed as [hours: minutes: seconds] successfully.

EX. NO: 16

DATE :

INTERFACING PRGRAMMABLE KEYBOARD AND DISPLAY CONTROLLER- 8279

AIM :

To display the rolling message “HELP US “ in the display.

APPARATUS REQUIRED:

8086 Microprocessor kit, Power supply, interfacing board.

ALGORITHM :

- Display of rolling message “HELP US “
- Initialize the counter
- Set 8279 for 8 digit character display, right entry
- Set 8279 for clearing the display
- Write the command to display
- Load the character into accumulator and display it
- Introduce the delay
- Repeat from step 1.

PROGRAM:

MEMORY LOCATION	OPCODES	PROGRAM	COMMENDS
1000		START : MOV SI,1200H	Initialize array
1000		MOV CX,000FH	Initialize array size
1003		MOV AL,10	Store the control word for display mode
1006		OUT C2,AL	Send through output port
1009		MOV AL,CC	Store the control word to clear display
100B		OUT C2,AL	Send through output port
100E		MOV AL,90	Store the control word to write display
1011		OUT C2,AL	Send through output port
1013		L1 : MOV AL,[SI]	Get the first data
1016		OUT C0,AL	Send through output port
1018		CALL DELAY	Give delay
101B		INC SI	Go & get next data
101D		LOOP L1	Loop until all the data's have been taken
101E		JMP START	Go to starting location
101F		DELAY : MOV DX,0A0FFH	Store 16bit count value
1020		LOOP1 : DEC DX	Decrement count value
1021		JNZ LOOP1	Loop until count values becomes zero
1023		RET	Return to main program

1. Display Mode Setup: Control word-10 H

0	0	0	1	0	0	0	0
0	0	0	D	D	K	K	K

DD-00- 8Bit character display left entry

01- 16Bit character display left entry

10- 8Bit character display right entry

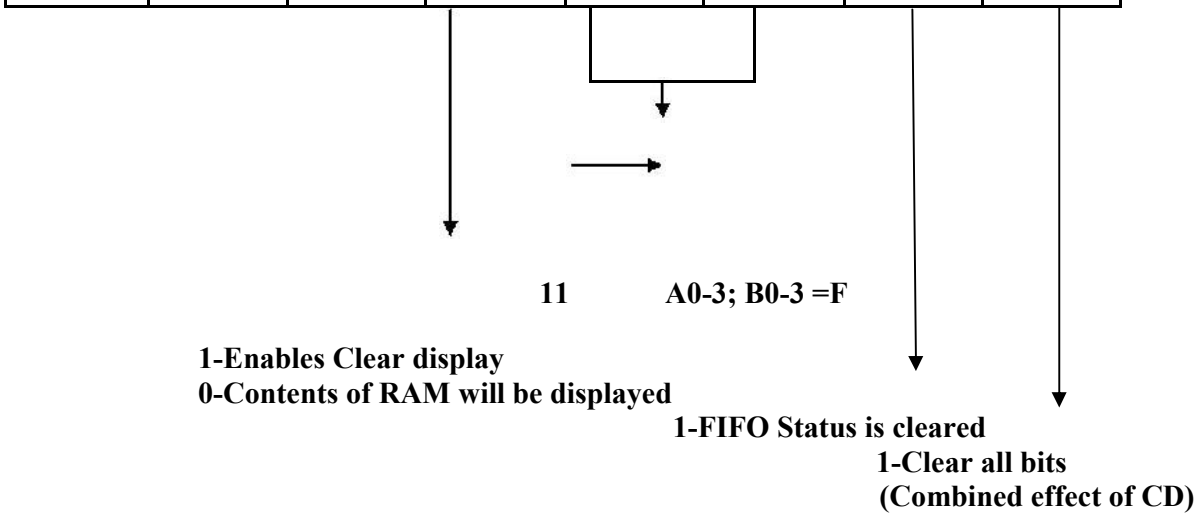
11- 16Bit character display right entry

KKK- Key Board Mode

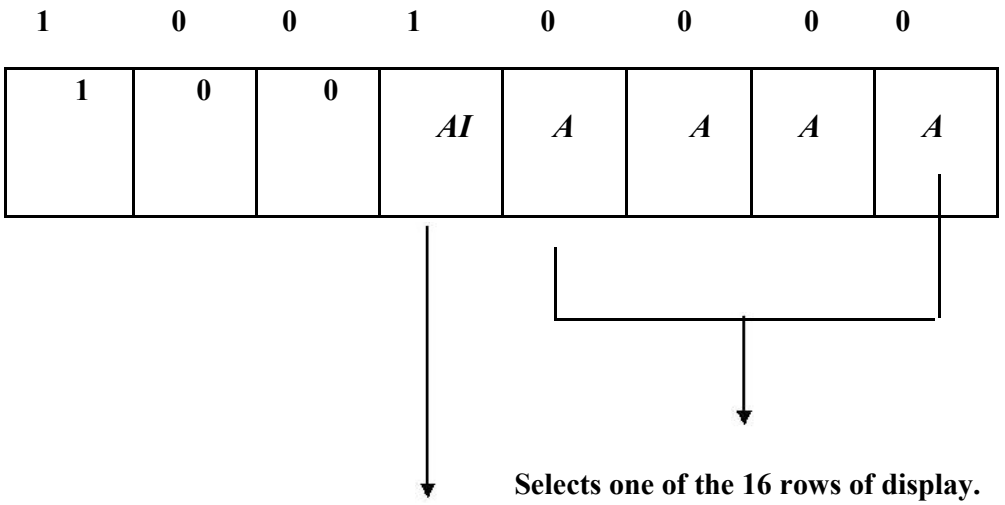
000-2Key lockout.

2.Clear Display: Control word-DC H

1	1	0	1	1	1	0	0
1	1	0	CD	CD	CD	CF	CA

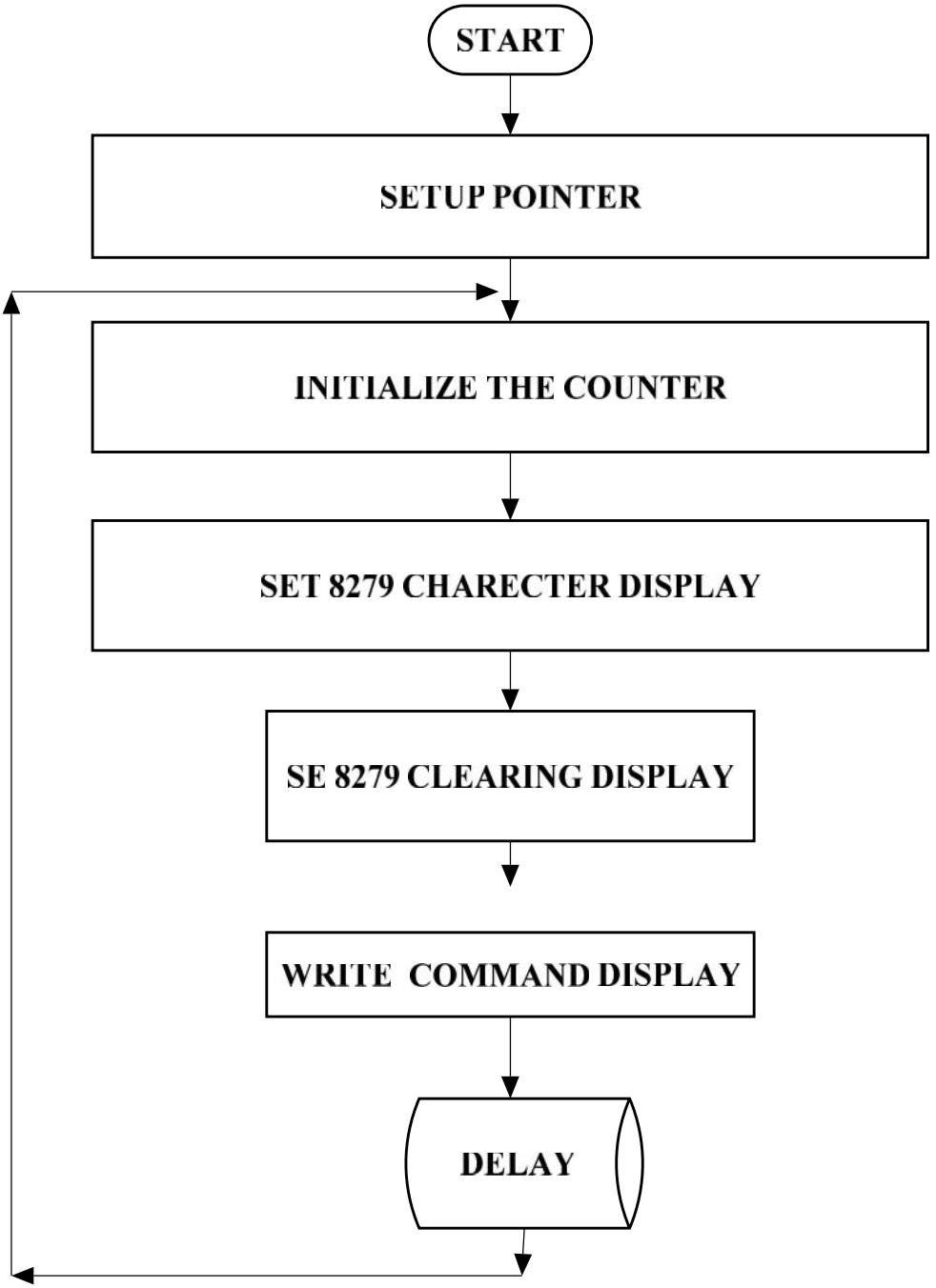


3. <u>Write Display:</u> Control word-90H



Auto increment = 1, the row address selected will be incremented after each of read and write operation of the display RAM.

FLOWCHART:


START
SETUP POINTER
INITIALIZE THE COUNTER
SET 8279 CHARECTER DISPLAY
SE 8279 CLEARING DISPLAY
WRITE COMMAND DISPLAY
DELAY

SEGMENT DEFINITION:

DATA BUS	D7	D6	D5	D4	D3	D2	D1	D0
SEGMENTS	d	c	b	a	d	g	f	e

RESULT:

Thus the rolling message “HELP US” is displayed using 8279 interface kit.

EX. NO: 17

DATE :

PRINTER STATUS

AIM:

To determine the printer status.

APPARATUS REQUIRED:

S.NO	ITEM	SPECIFICATION
1	Microprocessor kit	8086
2	Power Supply	5V

PROGRAM:

```
XOR AX, AX

XOR BX, BX

  ; This divides my 3digit number by 100 giving me
  my, hundredth digit

MOV AX, RES

MOV BX, 100

DIV BX

; prints the hundredth digit

ADD AL, '0'

MOV DL, AL

PUSH AX; save AX on the stack

MOV AH, 02h

INT 21h
```

```
POP AX; restore ax


 ; divides the remainder by 10 giving me my tens
 digit
MOV BX, 10
DIV BX
 ; prints my tens digit
ADD AL, '0'
MOV DL, AL
PUSH AX; save AX on the stack
MOV AH, 02h
INT 21h
POP AX; restore ax
 ; print my last remainder which is my ones
ADD AH, '0'
MOV DL, AH
MOV AH, 02h
INT 21h
```

RESULT:

Thus the output for the Move a data block without overlap was executed successfully.

EX. NO: 18

DATE :

A/D AND D/A INTERFACE AND WAVEFORM GENERATION.

ADC

AIM:

To write an assembly language program to convert an analog signal into a digital signal using an ADC interfacing.

APPARATUS REQUIRED:

SL.NO	ITEM	SPECIFICATION	QUANTITY
1.	Microprocessor kit	8086	1
2.	Power Supply	+5 V dc,+12 V dc	1
3.	ADC Interface board	-	1

THEORY:

An ADC usually has two additional control lines: the SOC input to tell the ADC when to start the conversion and the EOC output to announce when the conversion is complete.

ALGORITHM:

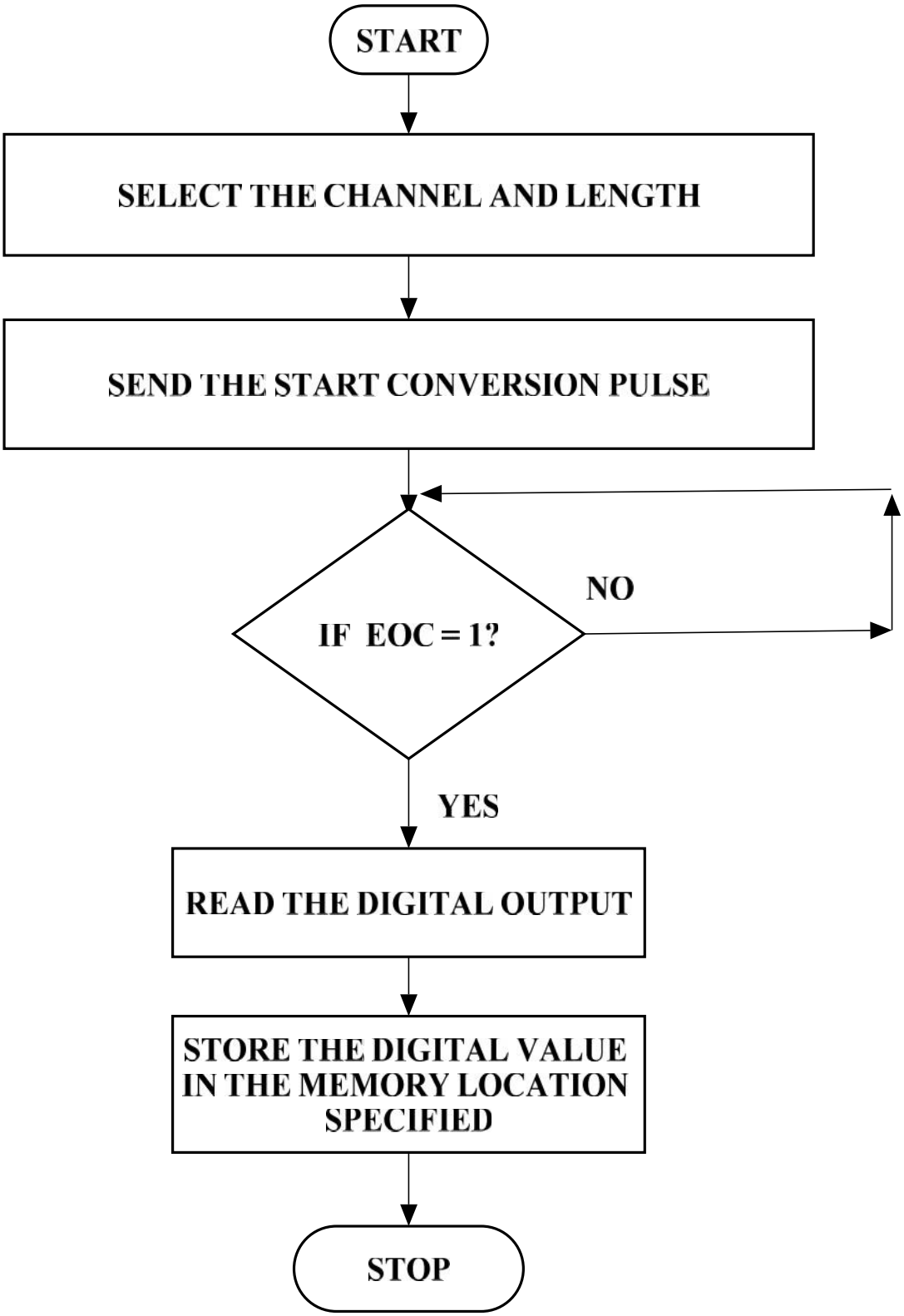
- Select the channel and latch the address.
- Send the start conversion pulse.
- Read EOC signal.
- If EOC = 1 continue else go to step (iii)
- Read the digital output.
- Store it in a memory location.

PROGRAM:

MEMORY LOCATION	OPCODES	PROGRAM	COMMENTS
1000		MOV AL,00	Load accumulator with value for ALE high
1000		OUT 0C8H,AL	Send through output port
1003		MOV AL,08	Load accumulator with value for ALE low
1006		OUT 0C8H,AL	Send through output port
1009		MOV AL,01	Store the value to make SOC high in the accumulator
100B		OUT 0D0H,AL	Send through output port
100E		MOV AL,00	Introduce delay
1011		MOV AL,00	
1013		MOV AL,00	
1016		MOV AL,00	
1018		OUT 0D0H,AL	Store the value to make SOC low the accumulator
101B		L1 : IN AL, 0D8H	Send through output port
101D		AND AL,01	Read the EOC signal from port & check for end of conversion
101E		CMP AL,01	
101F		JNZ L1	

1020		***IN AL,0C0H***	from port again
1021		***MOV BX,1100***	Read data from port
1023		***MOV [BX],AL***	Initialize the memory location to store data
1025		***HLT***	Store the data and halt program

FLOWCHART:


START
SELECT THE CHANNEL AND LENGTH
SEND THE START CONVERSION PULSE
IF EOC = 1?
NO
YES
READ THE DIGITAL OUTPUT
STORE THE DIGITAL VALUE IN THE MEMORY LOCATION SPECIFIED
STOP

OUTPUT:

ANALOG VOLTAGE	DIGITAL DATA ON LED DISPLAY	HEX CODE IN MEMORY LOCATION

RESULT:

Thus the ADC was interfaced with 8086 and the given analog inputs were converted into its digital equivalent.

EX. NO: 19

DATE :

INTERFACING DIGITAL – TO – ANALOG CONVERTER

AIM:

1. To write an assembly language program for digital to analog conversion
2. To convert digital inputs into analog outputs & To generate different waveforms

APPARATUS REQUIRED:

SL.NO	ITEM	SPECIFICATION	QUANTITY
1.	Microprocessor kit	8086 Vi Microsystems	1
2.	Power Supply	+5 V, dc,+12 V dc	1
3.	DAC Interface board	-	1

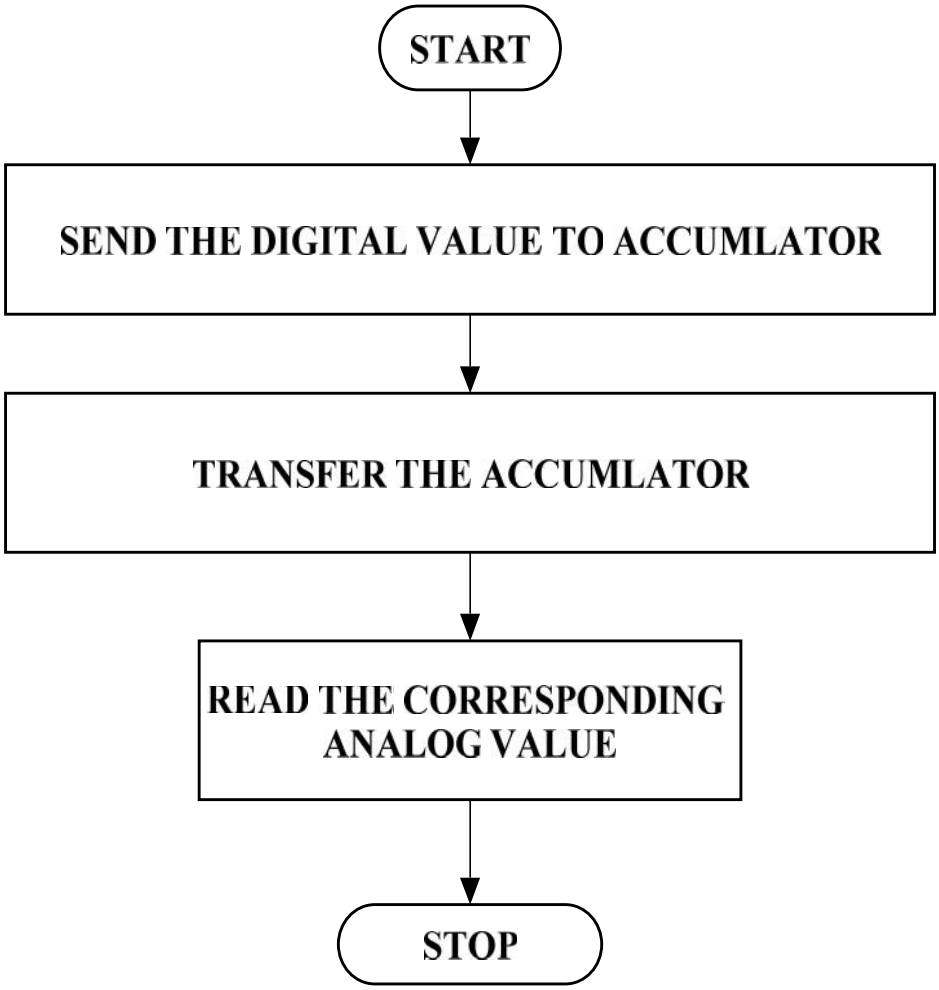
PROBLEM STATEMENT:

The program is executed for various digital values and equivalent analog voltages are measured and also the waveforms are measured at the output ports using CRO.

THEORY:

Since DAC 0800 is an 8 bit DAC and the output voltage variation is between –5v and +5v. The output voltage varies in steps of 10/256 = 0.04 (approximately). The digital data input and the corresponding output voltages are presented in the table. The basic idea behind the generation of waveforms is the continuous generation of analog output of DAC. With 00 (Hex) as input to DAC2 the analog output is –5v. Similarly with FF H as input, the output is +5v. Outputting digital data 00 and FF at regular intervals, to DAC2, results in a square wave of amplitude 5v.Output digital data from 00 to FF in constant steps of 01 to DAC2. Repeat this sequence again and again. As a result a saw-tooth wave will be generated at DAC2 output. Output digital data from 00 to FF in constant steps of 01 to DAC2. Output digital data from FF to 00 in constant steps of 01 to DAC2.

FLOECHART:


START
SEND THE DIGITAL VALUE TO ACCUMLATOR
TRANSFER THE ACCUMLATOR
READ THE CORRESPONDING ANALOG VALUE
STOP

ALGORITHM:

Measurement of analog voltage:

(i) Send the digital value of DAC.
(ii) Read the corresponding analog value of its output.

Waveform generation:

Square Waveform:

(i) Send low value (00) to the DAC.
(ii) Introduce suitable delay.
(iii) Send high value to DAC.
(iv) Introduce delay.
(v) Repeat the above procedure. Saw-tooth waveform:

(i) Load low value (00) to accumulator.
(ii) Send this value to DAC.
(iii) Increment the accumulator.
(iv) Repeat step (ii) and (iii) until accumulator value reaches FF.
(v) Repeat the above procedure from step 1.

Triangular waveform:

(i) Load the low value (00) in accumulator.
(ii) Send this accumulator content to DAC.
(iii) Increment the accumulator.
(iv) Repeat step 2 and 3 until the accumulator reaches FF, decrement the accumulator and send the accumulator contents to DAC.

MEASUREMENT OF ANALOG VOLTAGE:

PROGRAM	COMMENTS
MOV AL,7FH	Load digital value 00 in accumulator
OUT C0,AL	Send through output port
HLT	Stop

DIGITAL DATA	ANALOG VOLTAGE

PROGRAM TABLE: saw tooth wave

PROGRAM	COMMENTS
`L2: MOV AL,00H`	Load 00 in accumulator
`OUT C0,AL`	Send through output port
`CALL L1`	Give a delay
`MOV AL,FFH`	Load FF in accumulator
`OUT C0,AL`	Send through output port
`CALL L1`	Give a delay
`JMP L2`	Go to starting location
`L3: MOV CX,05FFH`	Load count value in CX register
`L1: LOOP L3`	Decrement until it reaches zero
`RET`	Return to main program

PROGRAM TABLE: Square Wave

PROGRAM	COMMENTS
`L2; OUT C0,AL`	Load 00 in accumulator
`CALL L1`	Send through output port
`MOV AL,FFH`	Give a delay
`OUT C0,AL`	Load FF in accumulator
`CALL L1`	Send through output port
`JMP L2`	Give a delay
`L1`	Load 00 in accumulator
`L3`	Send through output port
`RET`	return

PROGRAM TABLE: Triangular Wave

PROGRAM	COMMENTS
`L3`	Load 00 in accumulator
`L1`	Send through output port
`INC AL`	Increment contents of accumulator
`JNZ L1`	Send through output port until it reaches FF
`MOV AL,0FFH`	Load FF in accumulator
`L2`	Send through output port
`DEC AL`	Decrement contents of accumulator
`JNZ L2`	Send through output port until it reaches 00
`JMP L3`	Go to starting location
`L3`	Load 00 in accumulator

WAVEFORM GENERATION:

WAVEFORMS	AMPLITUDE	TIMEPERIOD
Square Waveform		
Saw-tooth waveform		
Triangular waveform		

RESULT

Thus the DAC was interfaced with 8085 and different waveforms have been generated.

EX. NO: 20

DATE :

BASIC ARITHMETIC AND LOGICAL OPERATIONS

8 BIT ADDITION

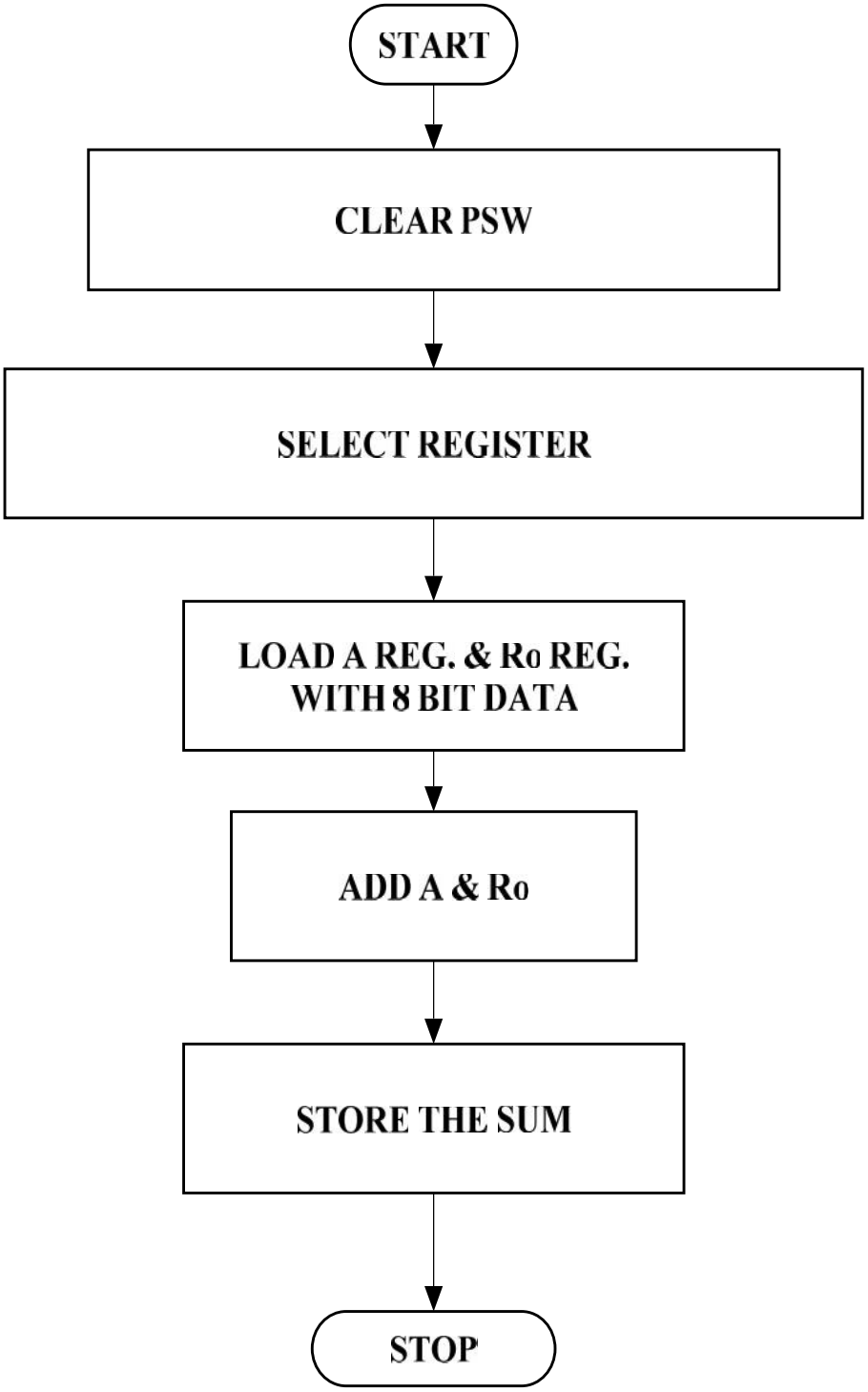
AIM:

To write a program to add two 8-bit numbers using 8051 microcontroller.

ALGORITHM:

- Clear Program Status Word.
- Select Register bank by giving proper values to RS1 & RS0 of PSW.
- Load accumulator A with any desired 8-bit data.
- Load the register R_0 with the second 8- bit data.
- Add these two 8-bit numbers.
- Store the result.
- Stop the program.

FLOW CHART:


START
CLEAR PSW
SELECT REGISTER
LOAD A REG. & R0 REG. WITH 8 BIT DATA
ADD A & R0
STORE THE SUM
STOP

PROGRAM:

ADDRESS	LABEL	MNEMONIC	OPERAND	HEX CODE	COMMENTS
4100		CLR	C	C3	Clear CY Flag
4101		MOV	A, data1	74,data1	Get the data1 in Accumulator
4103		ADDC	A, # data 2	24,data2	Add the data1 with data2
4105		MOV	DPTR, #4500H	90,45,00	Initialize the memory Location
4108		MOVX	@ DPTR, A	F0	Store the result in memory location
4109	L1	SJMP	L1	80,FE	Stop the program

OUTPUT:

INPUT		OUTPUT	
MEMORY DATA		MEMORY DATA	

RESULT:

Thus the 8051 ALP for addition of two 8 bit numbers is executed.

EX. NO: 21

DATE :

8 BIT SUBTRACTION

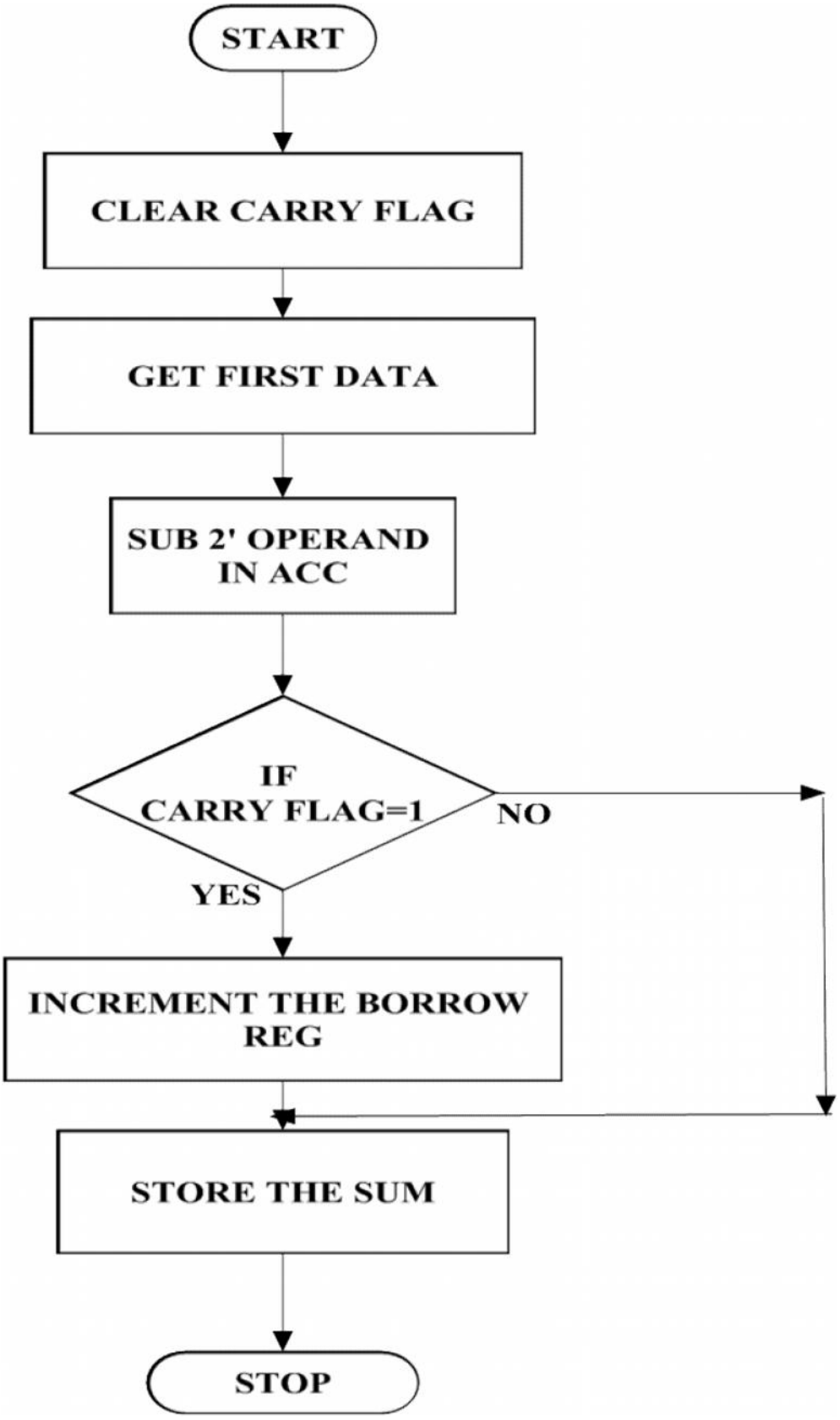
AIM:

To perform subtraction of two 8 bit data and store the result in memory.

ALGORITHM:

- Clear the carry flag.
- Initialize the register for borrow.
- Get the first operand into the accumulator.
- Subtract the second operand from the accumulator.
- If a borrow results increment the carry register.
- Store the result in memory.

FLOECHART:


START
CLEAR CARRY FLAG
GET FIRST DATA
SUB 2' OPERAND IN ACC
IF CARRY FLAG=1
NO
YES
INCREMENT THE BORROW REG
STORE THE SUM
STOP

8 BIT SUBTRACTION

ADDRESS	LABEL	MNEMONIC	OPERAND	HEX	COMMENTS
4100		CLR	C	CODE C3	Clear CY flag
4101		MOV	A, # data1	74, data1	Store data1 in accumulator
4103		SUBB	A, # data2	94,data2	Subtract data2 from data1
4105		MOV	DPTR, # 4500	90,45,00	Initialize memory Location
4108		MOVX	@ DPTR, A	F0	Store the difference in memory location
4109	L1	SJMP	L1	80,FE	Stop

OUTPUT:

INPUT		OUTPUT	
Memory Data		Memory Data	

RESULT:

Thus the 8051 ALP for subtraction of two 8 bit numbers is executed.

EX. NO: 22

DATE :

8 BIT MULTIPLICATION

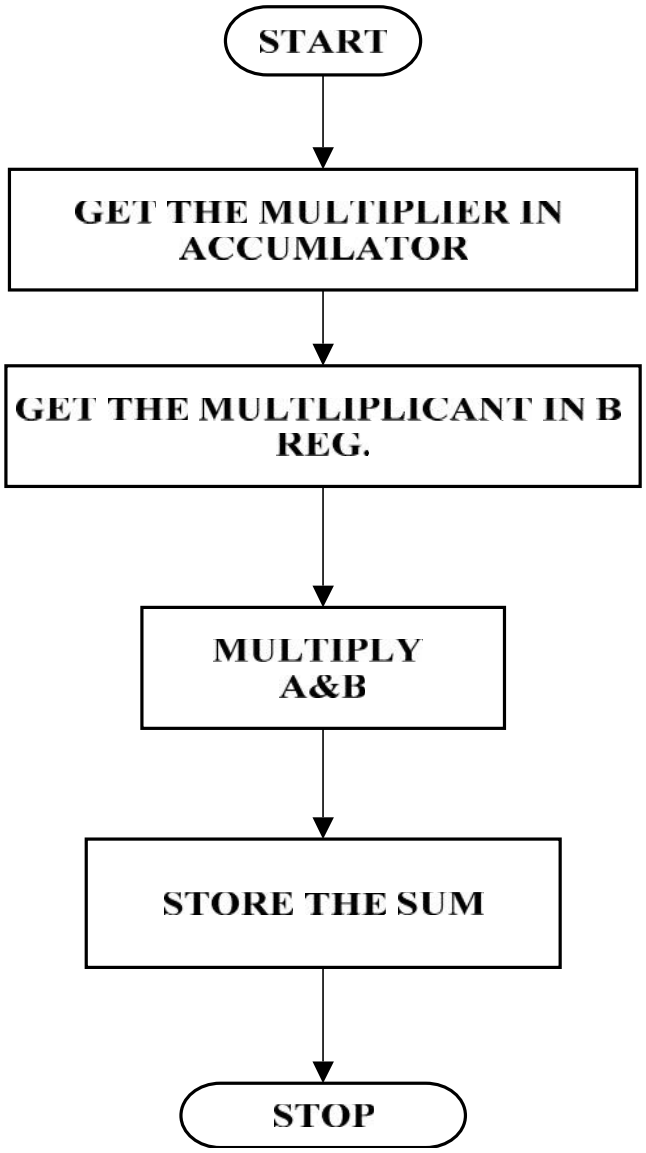
AIM:

To perform multiplication of two 8 bit data and store the result in memory.

ALGORITHM:

- Get the multiplier in the accumulator.
- Get the multiplicand in the B register.
- Multiply A with B.
- Store the product in memory.

FLOWCHART:


START
GET THE MULTIPLIER IN ACCUMLATOR
GET THE MULTLIPLICANT IN B REG.
MULTIPLY A&B
STORE THE SUM
STOP

8 BIT MULTIPLICATION:

ADDRESS	LABEL	MNEMONIC	OPERAND	HEX CODE	COMMENTS
4100		MOV	A ,#data1	74, data1	Store data1 in accumulator
4102		MOV	B, #data2	75,data2	Store data2 in B register.
4104		MUL	A,B	F5,F0	Multiply both
4106		MOV	DPTR, # 4500H	90,45,00	Initialize memory location
4109		MOVX	@ DPTR, A	F0	Store lower order result
401A		INC	DPTR	A3	Go to next memory location
410B		MOV	A,B	E5,F0	Store higher order
410D		MOV	@ DPTR, A	F0	result
410E	STOP	SJMP	STOP	80,FE	Stop

OUTPUT:

INPUT		OUTPUT	
Memory Location	Data	Memory location	Data
4500		4502	
4501		4503	

RESULT:

Thus the 8051 ALP for multiplication of two 8 bit numbers is executed.

EX. NO: 23

DATE :

8 BIT DIVISION

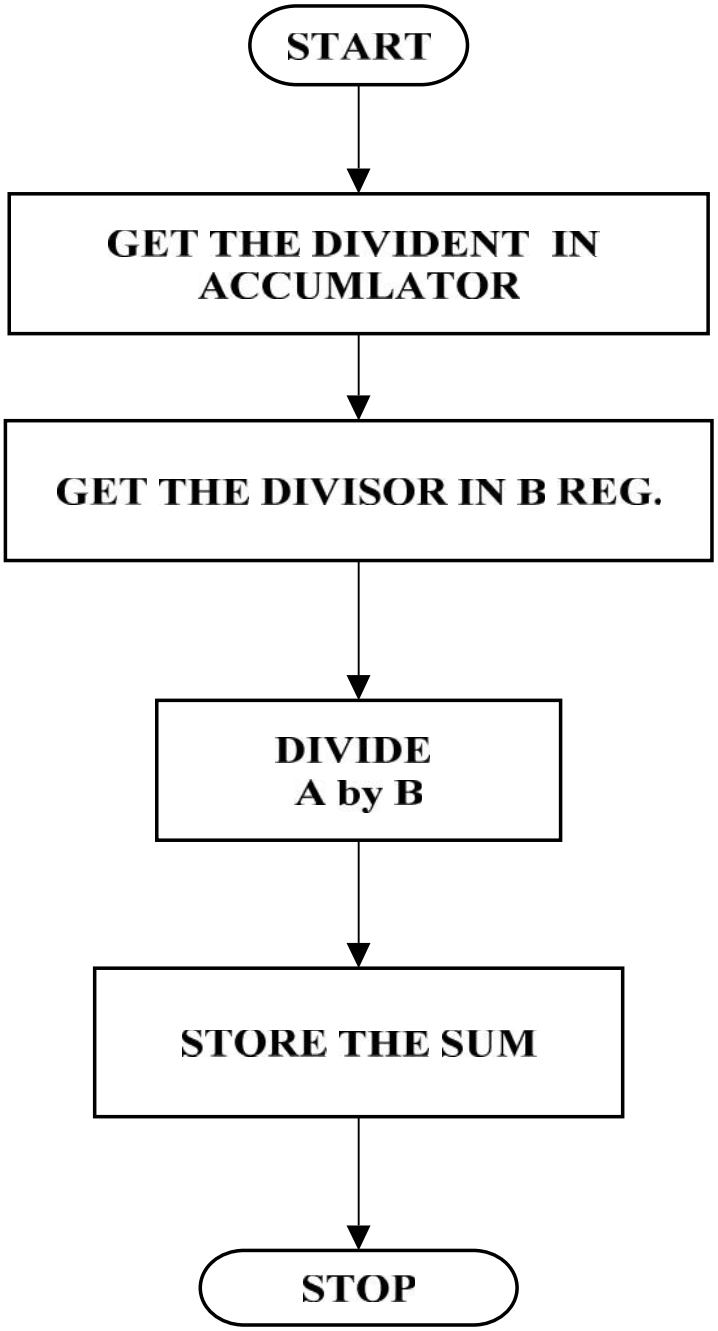
AIM:

To perform division of two 8 bit data and store the result in memory.

ALGORITHM:

- Get the Dividend in the accumulator.
- Get the Divisor in the B register.
- Divide A by B.
- Store the Quotient and Remainder in memory.

FLOWCHART:


START
GET THE DIVIDENT IN ACCUMLATOR
GET THE DIVISOR IN B REG.
DIVIDE A by B
STORE THE SUM
STOP

8 BIT DIVISION

ADDRESS	LABEL	MNEMONIC	OPERAND	HEX CODE	COMMENTS
4100		MOV	A, # data1	74,data1	Store data1 in accumulator
4102		MOV	B, # data2	75,data2	Store data2 in B register.
4104		DIV	A,B	84	Divide
4015		MOV	DPTR, # 4500H	90,45,00	Initialize memory location
4018		MOVX	@ DPTR, A	F0	Store remainder
4109		INC	DPTR	A3	Go to next memory location
410A		MOV	A,B	E5,F0	Store quotient
410C		MOV	@ DPTR, A	F0	Move stored data
410D	STOP	SJMP	STOP	80,FE	Stop

OUTPUT:

INPUT		OUTPUT	
Memory Location	Data	Memory location	Data
4500		4502	
4501		4503	

RESULT:

Thus the 8051 ALP for division of two 8 bit numbers is executed.

EX. NO: 24

DATE :

SQUARE AND CUBE PROGRAM, FIND 2'S COMPLEMENT OF A NUMBER

AIM:

To convert Square and Cube program, Find 2's complement of a number using 8051 micro controller

RESOURCES REQUIERED:

- 8051 microcontroller kit
- Keyboard
- Power supply

PROGRAM:

```
SQUARE PGM USING 8051

01 ORG 00h

02 LJMP MAIN

03 DELAYS:

04; MOV R0,#2

05 MOV TMOD, #01H

06 MOV TH0, #HIGH (-50000)

7 MOV TL0, #LOW (-50000)

8 SETB TR0

9 JNB TF0,

10CLR TF0

12; DJNZ R0,DELAY

13RET

14MAIN:

15MOV DPTR,#300H

16MOV A,#0FFH

17MOV P1,A

18BACK:

19LCALL DELAY

20MOV A,P1

21MOVC A,@A+DPTR
```

```
22;MOV P2,#00H
23;LCALL DELAY
24MOV P2,A
25SJMP BACK
26ORG 300H
27XSQR_TABLE:
28DB 0,1,4,9,16,25,36,49,64,81
29END
```

OUTPUT

INPUT DATA	OUTPUT DATA

RESULT;

Thus the Square and Cube program, Find 2's complement of a number is done in 8051 microcontroller

EX. NO: 25

DATE :

UNPACKED BCD TO ASCII

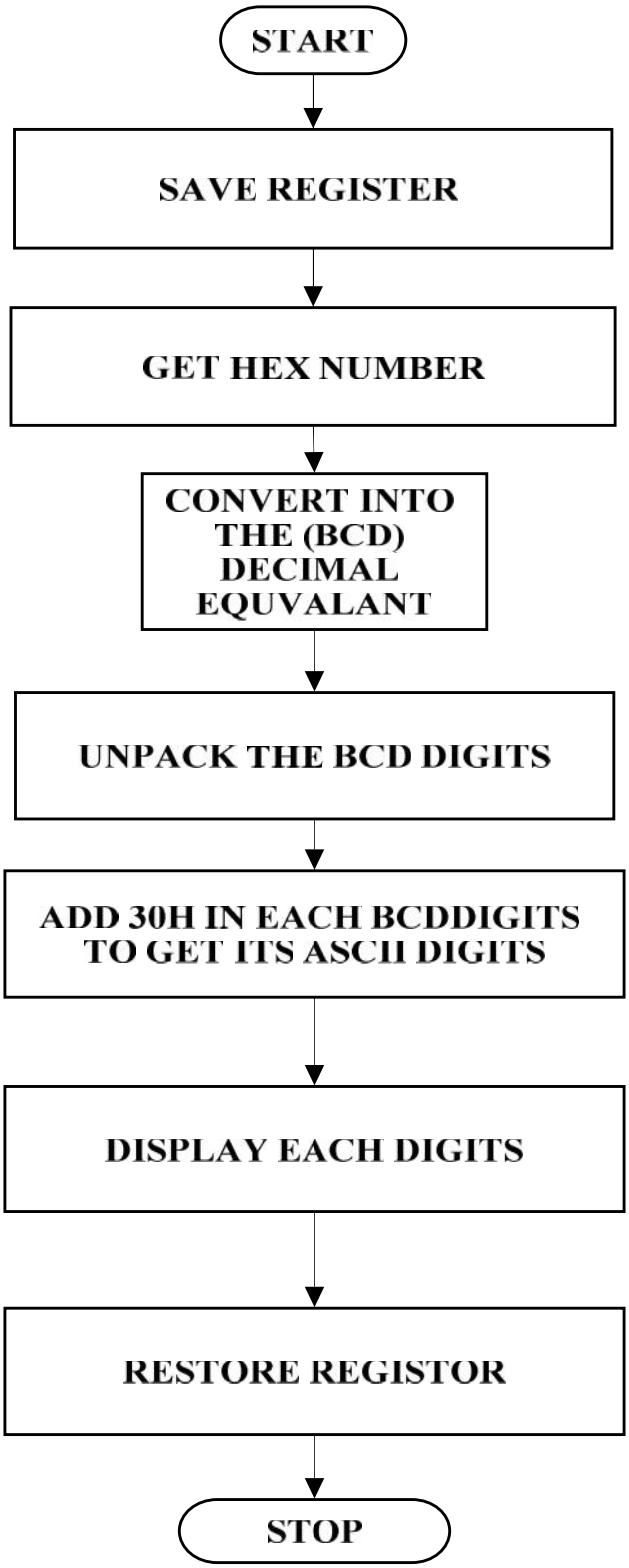
AIM:

To convert BCD number into ASCII by using 8051 micro controller.

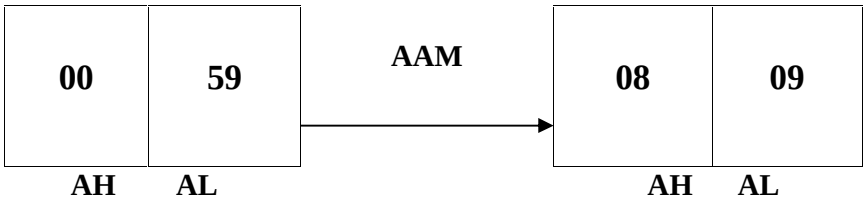
RESOURCES REQUIERED:

- 8051 microcontroller kit
- Keyboard
- Power supply

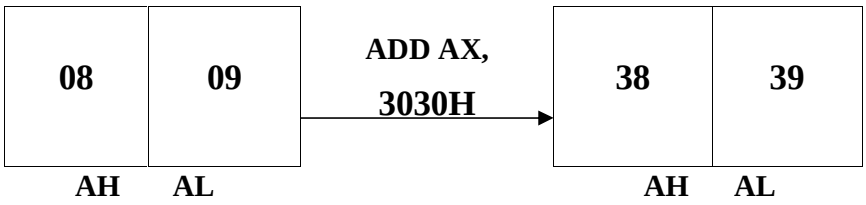
FLOWCHART:


START
SAVE REGISTER
GET HEX NUMBER
CONVERT INTO THE (BCD) DECIMAL EQUVALANT
UNPACK THE BCD DIGITS
ADD 30H IN EACH BCDDIGITS TO GET ITS ASCII DIGITS
DISPLAY EACH DIGITS
RESTORE REGISTOR
STOP

ALGORITHM:



NOTE; 59H TO 89 DECIMAL



NOTE; 38h and 39h are the ASCII equivalents of 8 and 9 respectively

- Save contents of all registers which are used in the routine
- Get the data in al register and make AH equal to 00.
- Use AAM instruction to convert number in its decimal equivalent in the unpacked format.
- Add 30h in each digit to get its ASCII equivalent.
- Display one by one using function 2 of INT 21h.
- Routine content of register.

PROGRAM;

ROUTINE: convert binary for number less than 100 passing parameter

; Hex number in al register.

; Routine to convert binary number into its

; Decimal and then ASCII equivalent, and display the number

```
BTA  PROC  NEAR
     PUSH DX
     PUSH BX
     PUSH AX

     MOV AX, 00H

     AAM
     ADD AX, 3030H
     MOV BX, AX
     MOV DL,   BH
     MOV AH, 02
     INT 21H
MOV DL, BL
INT 21H

POP AX
POP BX
POP DX
RET
END P
```

RESULT:

The given number is converted into ASCII using 8051 microcontroller kit.