MICROPROCESSORS LAB MANUAL

Subject: Microprocessors Lab

Subject Code: ELPC 553

B.Tech V Semester

Department of Electrical Engineering
J. C. Bose University of Science and Technology
YMCA, Faridabad-121 006
DEPARTMENT OF ELECTRICAL ENGINEERING

VISION OF THE DEPARTMENT

Electrical Engineering Department congregates the challenges of new technological advancements to provide comprehensively trained, career-focused, morally strong accomplished graduates, cutting-edge researchers by experimental learning which contribute to ever-changing global society and serve as competent engineers.

MISSION OF THE DEPARTMENT

- To commit excellence in imparting knowledge through incubation and execution of high-quality innovative educational programs.
- To develop the Research-oriented culture to build national capabilities for excellent power management.
- To inculcate and harvest the moral values and ethical behavior in the students through exposure of self -discipline and personal integrity.
- To develop a Centre of Research and Education generating knowledge and technologies which lay ground work in shaping the future in the field of electrical engineering.

PROGRAM OUTCOMES (POs)

Graduates of the Electrical Engineering program at JCBUST, YMCA will be able to:

PO1. Apply knowledge of mathematics, science, engineering fundamentals, and electrical engineering specialization to the solution of engineering problems.

PO2. Identify, formulate, review literature, and analyze electrical engineering problems to design, conduct experiments, analyze data, and interpret data.

PO3. Design solutions for electrical engineering problems and design system components of processes that meet the desired needs with appropriate consideration for public health and safety and cultural, societal, and environmental considerations.

PO4. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions in electrical engineering.

PO5. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to electrical engineering activities with an understanding of the limitations.

PO6. Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to professional engineering practice.

PO7. Understand the impact of electrical engineering solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.

PO8. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communicate effectively on complex engineering activities with the engineering committee and with society at large, such as being able to comprehend and write effective reports and design documentation, and make effective presentations in electrical engineering.

PO11. Demonstrate knowledge and understanding of the engineering principles and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. Recognize the need for, and the preparation and ability to engage in independent research and lifelong learning in the broadest context of technological changes in electrical engineering.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1. To apply state-of-the-art knowledge in analysis design and complex problem solving with effective implementation in the multidisciplinary area of Electrical Engineering with due regard to environmental and social concerns.

PSO2. To prepare graduates for continuous self-learning to apply technical knowledge and pursue research in advanced areas in the field of Electrical Engineering for a successful professional career to serve society ethically.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1. To produce competent electrical engineering graduates with a strong foundation design, analytics and problem-solving skills for successful professional careers in industry, research and public service.

PEO2. To provide a stimulating research environment so as to motivate the students for higher studies and innovation in the specific and allied domains of electrical engineering.

PEO3. To encourage the graduates to practice the profession following ethical codes, social responsibility and accountability.

PEO4. To train students to communicate effectively in multidisciplinary environment.

PEO5. To imbibe an attitude in the graduates for life-long learning process.

Syllabus

Microprocessors Lab (ELPC553)

L-T-P **Internal Marks – 15**

0-0-2 **External Marks-15**

Total-50

List of Experiments

1. To study the architecture of microprocessor 8085 & 8086 and familiarization with their hardware, commands & operation of microprocessor kit.
2. Write a program using 8085 & verify for addition of two 8-bit numbers (with and without carry)
3. Write a program using 8085 & verify for:
    i) subtraction of two 8-bit numbers.
    ii) subtraction of two 16-bit numbers.
4. Write a program using using 8085 for multiplication of two 8-bit numbers by bit-rotation method.
5. Write a program using using 8085 for division of two 8-bit numbers by repeated subtraction method
6. Write a program using 8085 for finding square- root of a number & verify.
7. Write a program using 8085 to find out largest number in an array.
8. Write a program using 8085 to find out smallest number in an array
9. Write a program using 8085 to arrange the given numbers in ascending order.
10. Write a program using 8085 to find the sum of 8-bit numbers in series and display the result.
11. Write a program to interface ADC & DAC with 8085 & demonstrate generation of square wave.
12. Write a program using 8086 for arranging an array of numbers indescending order & verify.
13. Write a program using 8086 for copying 12 bytes of data fromsource to destination & verify.
14. Write a program using 8086 for division of a definedouble word by another word & verify.
15. Write a program to generate a square wave of 1 khz frequency on out 1 pin of 8253/54. assume clock frequency is 1Mhz and address for control register = 0BH, counter1 = 09H and counter 2 = 0AH.

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MISSION OF THE DEPARTMENT

To commit excellence in imparting knowledge through incubation and execution of high quality innovative educational programs.

To develop the Research oriented culture to build national capabilities for excellent power management.

To inculcate and harvest the moral values and ethical behaviour in the students through exposure of self -discipline and personal integrity.

To develop a Centre of Research and Education generating knowledge and technologies which lay ground work in shaping the future in the field of electrical engineering.

COURSE OBJECTIVES & OUTCOMES

Course objectives:

1. **Enhance analytical skills** to assess and study the basic architecture of 8085 and 8086 microprocessor.
2. **Gain practical expertise** in hardware, commands & operation of microprocessor kit.
3. **Develop an in-depth understanding** of assembly language programs in 8085 and 8086 to perform a given task.
4. **Obtain hands-on experience** in interfacing memory and I/O devices to 8085 using peripheral devices.

Course Outcomes:

CO1. Students will be able to explain the basic architecture of 8085 and 8086 microprocessor.
CO2. Students will be able to demonstrate knowledge in hardware, commands & operation of microprocessor kit.
CO3. Students will be able to write assembly language programs in 8085 and 8086 to perform a given task
CO4. Students will be able to perform interfacing of memory and I/O devices to 8085 using peripheral devices

Mapping of Course Outcomes (Cos) with POs and PSOs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	3	3	2	3	3	2	2	2	2	3	2
CO2	3	3	2	3	3	3	2	3	2	2	2	2	3	2
CO3	3	3	2	3	2	3	2	3	2	2	2	2	3	2
CO4	3	3	2	2	3	3	3	3	2	2	2	2	3	2

General Instructions

1. Be punctual and maintain discipline and silence in the lab.
2. Enter Laboratory with shoes
3. Handle instruments with utmost care and follow the procedure that has been instructed.
4. Strictly follow the written and verbal instructions given by the teacher / Lab Instructor. If you do not understand the instructions, the handouts and the procedures, ask the instructor or teacher.
5. Mobile phones should be switched off in the lab. Keep bags in the bag rack.
6. Keep the labs clean at all times, no food and drinks allowed inside the lab.
7. Do not insert connectors forcefully into the sockets.
8. Immediately report dangerous or exceptional conditions to the Lab instructor / teacher: Equipment that is not working as expected, wires or connectors are broken, the equipment that smells or “smokes”. If you are not sure what the problem is or what's going on, switch off the Emergency shutdown.
9. Never use damaged instruments, wires or connectors. Hand over these parts to the Lab instructor/Teacher.
10. Be sure of location of fire extinguishers and first aid kits in the laboratory.
11. After verification of program output, turn off power supply to the trainer kit. Do not take any item from the lab without permission.
12. Observation book and lab record should be carried to each lab. Programs of current lab session are to be written in Observation book and of previous lab session should be written in Lab record book. Both the books should be corrected by the faculty in each lab.
13. Handle the electronic devices as indicated by the handout, the specifications in the data sheet or other documentation.
14. Shut down the power supply after the experiment.

Microprocessors Lab
ELPC-553

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EXPERIMENT NO.1

Aim: Study the architecture of microprocessor 8085 & 8086 and familiarization with their hardware, commands & operation of microprocessor kit.

Apparatus used: 8085 microprocessor kit.

Theory:

Intel 8085 is an 8-bit microprocessor. It is 40-pin IC package fabricated on a single LSI chip. It uses asingle +5 V supply. Its clock speed is about 3 Mhz. It consists of three main sections:

1. **ALU (Arithmetic and logic unit):**

The ALU performs the arithmetic and logical operation, addition, subtraction, logical AND, OR, EX-OR, Complement, Increment, Decrement, shift, clear.

2. **Timing and Control Unit:-**

It generates timing and control signals, which are necessary for the execution of instruction.

3. **Registers: -**

These are used for temporary storage of data and instruction. INTEL 8085 has following registers:

a) One 8 bit accumulator
b) Six 8 bit registers (B, C, D, E, H, L)
c) One 16 bit stack pointer, SP
d) One 16 bit program counter, PC
e) Instruction register
f) Status register
a. Temporary registers

PC contains the address of next instruction.IR holds the instruction until it is decoded. SP holds the address of the stack top.
Accumulator is used during execution of program for temporary storage of data.

4. Status flags are as follows: -
   a) Carry (CS)
   b) Zero (Z)
   c) Sign (S)
   d) Parity (P)
   e) Auxiliary Carry (AC)

5. **Program Status Word (PSW)**

This 8-bit program status word includes status flags and three undefined bits.

6. **Data and Address bus**

Data bus is 8- bit wide and 8 bits of data can be transmitted in parallel. It has 16-bit address bus as the memory addresses are of 16 bits.
The pin description of Intel 8085 is shown below:

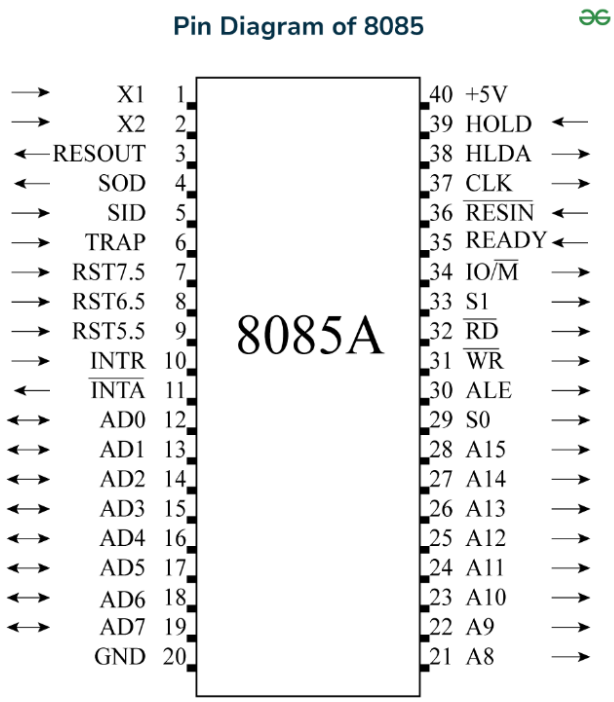

Fig 1. Pin Diagram of Intel 8085

ET-8085 has 28 keys and six-seven segment displays to communicate with the outside world. As ET-8085 is switched on, a message – EL 85 is displayed on the display and all keys are in command mode. The key board is as shown below:

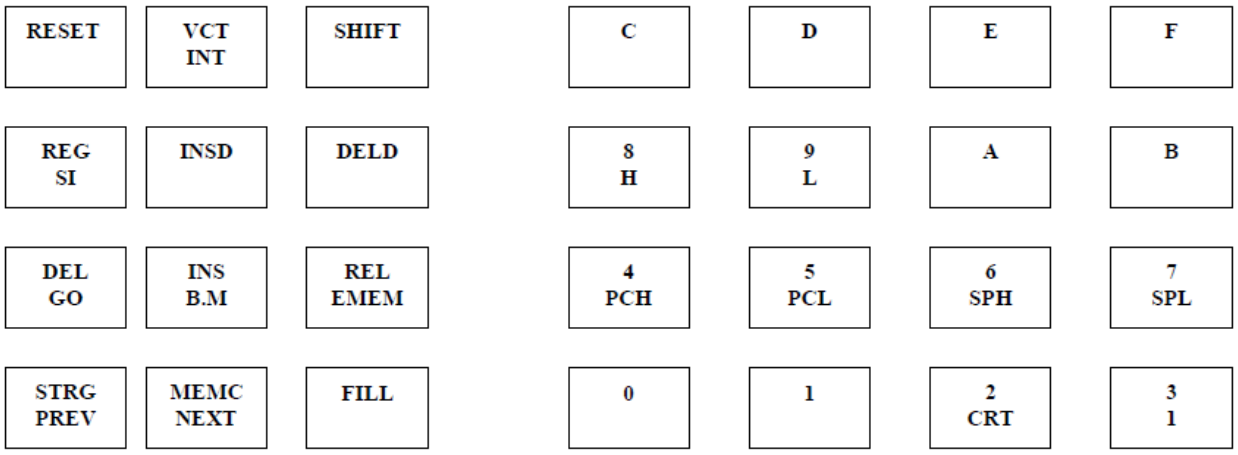

Fig 2. Keyboard

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The keyboard description is given below.

RESET	Reset the system
VCT INT	Hardware interrupt via keyboard, RST 7.5.
SHIFT	Provides a second level command to all keys.
GO	To execute the program.
SI	To execute the program in single step mode.
REG	Examine Register; allows you to examine and modify the contents of different registers.
EMEM	Examine memory; allows user to examine any memory Location and modify any RAM location.
PRE	Previous is used as an intermediate terminator in case of Examine Memory. It decrements the PC contents and writes the contents of data field to the address displayed in the address location.
NEXT	Increments is used as a intermediate terminator in case of Examine Memory, Examine Register etc. It increments the PC Contents and writes the data field at the location displayed in address field.
"."	Terminator is used to terminate the command and write the data in data field at the location displayed in address field.
DEL	Delete the part of program or data, with relocation, by one or more bytes.
INS	Inserts the part of the program or data with relocation, by One or more bytes.
BLOCK MOVE	Allows user to move a block of memory to any RAM area.
FILL	Allows user to fill RAM area with a constant.
REL	Relocate a program written for some memory area and to Be transferred to other memory area.
INSD	Insert one or more data bytes in the user's program/data area.
DELD	Deletes one or more data bytes from the user's program / data area.
STRG	Finds out the string of data lying at a particular address /addresses.
MEMC	Memory compare: Compares two blocks of memory for equality.
0-F	Hexadecimal Keys.

All commands are followed by a set of numeric parameters separated by PREV, NEXT & ' . ' (Execute) to work as delimiters.

A '-'on the MSD of address display indicates the system is waiting for a command. If, instead of a valid command, the user gives a data, the system display '-Err'. A dot on the LSD of address field indicates that the system expects an address. Whenever the data of any memory location is changed, a dot is displayed on the LSD of DATA Field.

The ET-8085 accepts all data and address in hexadecimal form.

EXPERIMENT NO. 2(A)

Aim: Write a program using 8085 & verify for addition of two 8-bit numbers (without carry)

Apparatus : 8085 microprocessor kit, 5V power supply.

Theory (Program)

Memory address	Machine code	Mnemonics	Operands	Commands
2000	21,01,25	LXI	H,2501	Get address of 1st no. in HL pair
2003	7E	MOV	A,M	Move Ist no. in accumulator
2004	23	INX	H	HL points the address 2502H
2005	86	ADD	M	Add the 2nd no.
2006	23	INX	H	HL points 2503H
2007	77	MOV	M,A	Store result in 2503H.
2008	CF	RST 1		Terminate the program

Flow Chart:

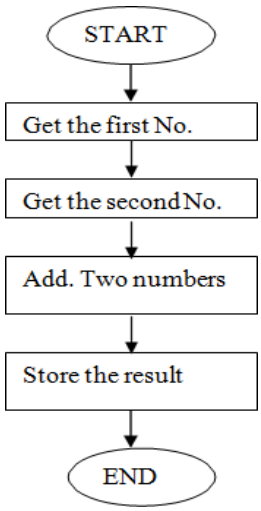

Fig 3. Flowchart for addition of two 8-bit numbers(without carry)

Input Data		Output	
2501	**13H**	**2503**	**25H**
2502	**12H**		

Precautions:

Make sure that all the machine codes should be as per specified in the program.

EXPERIMENT NO. 2(B)

Aim: Write a program using 8085 & verify for addition of two 8-bit numbers (with carry)

Apparatus : 8085 microprocessor kit, 5V power supply, Keyboard.

Theory (Program)

Memory address	Label	Machine code	Mnemonics	Operands	Commands
2000		2A,01,26	LHLD	2601H	Get 1st no. in HL pair from memory (2601)
2003		EB	XCHG		Exchange cont. of DE and HL
2004		2A,03,26	LHLD	2603H	Get 2st no. in HL pair from location 2603
2007		0E,00	MVI	C,00H	Clear reg. C.
2009		19	DAD	D	Get HL+DE & store result in HL
200A		D2,12,20	JNC	2012(loop)	If no carry move to loop/if carry then move to next step.
200D		0C	INR	C	Increment reg C
200E		79	MOV	A,C	Move carry from reg. C to reg. A
2011		32,02,25	STA	2502	Store carry at 2502H
2012	Loop	22,00,25	SHLD	2500	Store result in 2500H.
2015		CF	RST1		Terminate the program

Flow Chart:

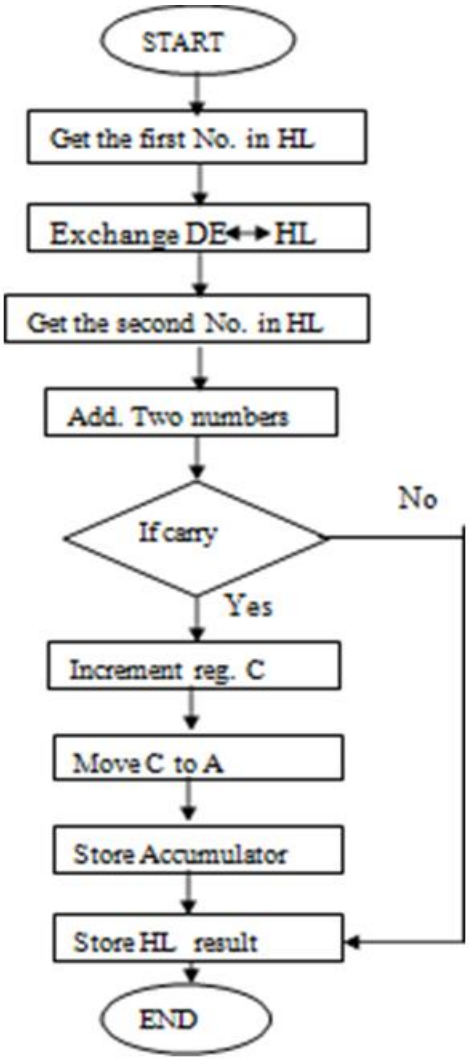

Fig 4. Flowchart for addition of two 8-bit numbers(with carry)

Input Data

2601:13H
2602:31H
2603:12H
2604:10H

Output Data

2500: 25H
2501: 41H
2502: 00H

Precautions:-

Make sure that all the machine codes should be as per specified in the program.

EXPERIMENT NO. 3(A)

Aim: Write a program using 8085 & verify for subtraction of two 8-bit numbers. (display of borrow).

Apparatus : 8085 microprocessor kit, 5V power supply, Keyboard.

Theory(program) :

Memory address	Opcode	Mnemonics	Operands	Comments
2000	21,01,25	LXI	H, 2501	Get address of 1st no. in HL pair
2003	7E	MOV	A, M	Move 1st no. in accumulator
2004	23	INX	H	HL points 2502H.
2005	96	SUB	M	Subtract 2nd no. from 1st no.
2006	23	INX	H	HL points 2503 H.
2007	77	MOV	M, A	Move contents of acc. to memory
2008	76	HLT		Terminate the program

Flowchart:-

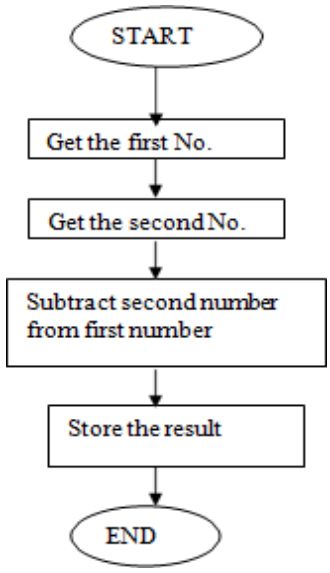

Fig 5. Flowchart for subtraction of two 8-bit numbers

Input data

2501: 20H
2502: 10H

Output data :

2503: 10H

Precautions :

Make sure that all the machine codes should be as per specified in the program.

EXPERIMENT NO. 3(B)

Aim: Write a program using 8085 & verify for subtraction of two 16-bit numbers (display of borrow)

Apparatus : 8085 microprocessor kit, 5V power supply, Keyboard.

Theory (Program) :

Memory Address	Machine Code	Mnemonics	Operands	Comments
2000	2A, 01,25	LHLD	2501 H	Get 1st 16 bit no. in HL pair
2003	EB	XCHG		Exchange HL pair with DE.
2004	2A, 03,25	LHLD	2503 H	Get 2nd 16 bit no. in HL pair
2007	7B	MOV	A, E	Get lower byte of 1st no.
2008	95	SUB	L	Subtract lower byte of 2nd no.
2009	6F	MOV	L, A	Store the result in reg. L
200A	7A	MOV	A, D	Get higher byte of 1st no.
200B	96	SBB	H	Subtract higher byte of 2nd no. with borrow
200C	67	MOV	H,A	Move from acc. To H
200D	22,05,25	SHLD	2505H	Store 16-bit result at 2505 & 2506
2010	76	HLT		Terminate the program

Flowchart:

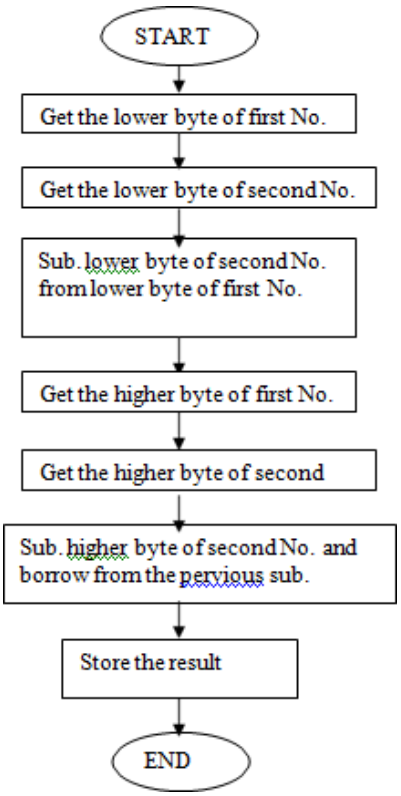

Fig 6. Flowchart for subtraction of two 16-bit numbers

Input data

2501: 30H
2502: 40H
2503: 10H
2504: 20H

Output Data

2505: 20H
2506: 20H

Precautions:-

Make sure that all the machine codes should be as per specified in the program.

EXPERIMENT NO. 4

Aim: Write a program using 8085 for multiplication of two 8-bit numbersby bit rotation method & verify.

Apparatus : 8085 microprocessor kit,5 v power supply, keyboard.

Theory(program)

Memory Address	Label	Machine Code	Mnemonics	Operands	Comments
2000		2A,01,25	LHLD	2501 H	Get Multiplicand in H-L pair.
2003		EB	XCHG		Exchange HL pair with DE pair
2004		3A,03,25	LDA	2503 H	Get 2nd no. in acc.
2007		21,00,00	LXI	H,0000	Initial product in HL=00
200A		0E,08	MVI	C,08H	Count=08 in reg .C
200C	Loop	29	DAD	H	Shift partial product left by 1 bit
200D		17	RAL		Rotate multiplication by 1 bit. Is multiplier = 1?
200E		D2,12,20	JNC	Ahead(2012)	No, go to ahead
2011		19	DAD	D	Product=Product + Multiplicand
2012	Ahead	0D	DCR	C	Decrement Count
2013		C2,0C,20	JNZ	Loop(200C)	
2016		22,04,25	SHLD	2504	Store result
2019		CF	RST 1		Terminate

Flowchart :-

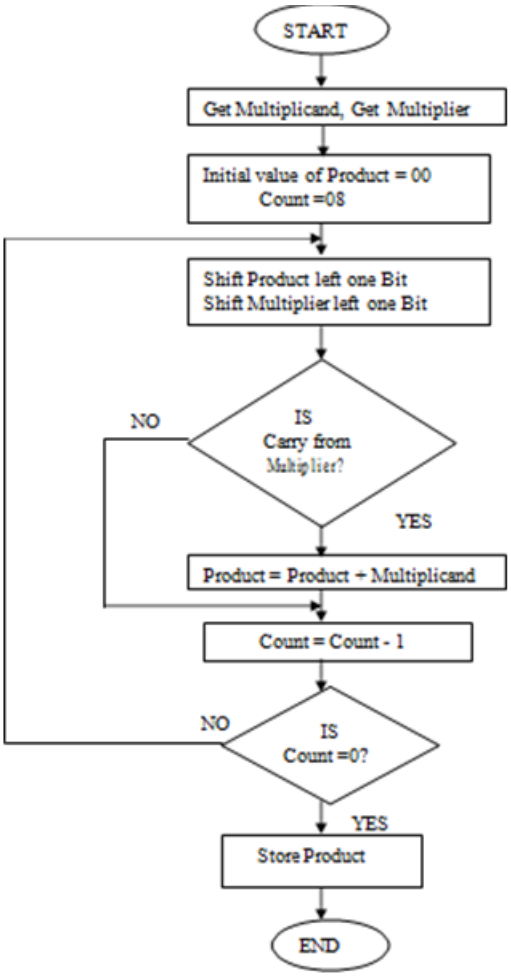

Fig 7. Flowchart for multiplication of two 8-bit numbers

Input Data

2501 : 43

2502 : 07

Output Data

2503 : 05

2504 : 01

EXPERIMENT NO. 5

Aim: Write a program using 8085 for division of two 8-bit numbers byrepeated subtraction method & test for typical data.

Apparatus : 8085 microprocessor kit, 5V power supply, Key board.

Theory (Program) :

Memory Address	Label	Machine Code	Mnemonics	Operands	Comments
2000		3A,01,25	LDA	Divisor(2501)	
2003		47	MOV B,A		Take divisor in reg,B
2004		3A,02,25	LDA	Dividend (2502)	Take dividend in reg,A
2007		0E,00	MVI	C,00	Quotient=00
2009		B8	CMP	B	
200A		DA,13,20	JC	Loop(2013)	
200D	loop1	90	SUB	B	Dividend-divisor=>A
200E		0C	INR	C	C=C+1
200F		B8	CMP	B	Is dividend < divisor
2010		D2,0D,20	JNC	Loop1(200D)	If not, go back
2013	loop	32,03,25	STA	Remainder(2503)	Store Remainder
2016		79	MOV	A,C	
2017		32,04,25	STA	Quotient(2504)	Store Quotient
201A		CF	RST 1		Terminate.

Flow Chart:

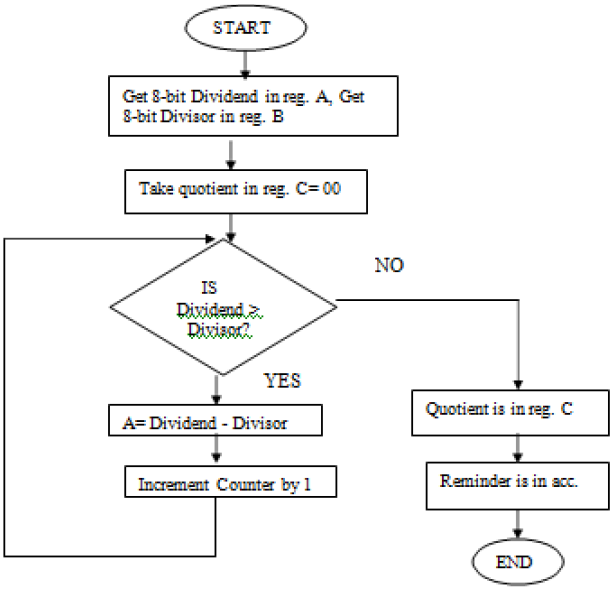

Fig 8. Flowchart for division of two 8-bit numbers

Input Data
2501- Divisor
2502- Dividend

Output Data
2503- Remainder
2504- Quotient

Precautions:
Make sure that all the machine codes should be as per specified in the program.

EXPERIMENT No.6

Aim: Write a program using 8085 for finding square-root of a number & verify.

Apparatus : 8085 microprocessor kit, 5V power supply, Keyboard.

Theory(program):

Memory Address	Label	Machine Code	Mnemonics	Operands	Comments
2000		0E,01	MVI	C,01H	Place 01 in Reg.C
2002		06,01	MVI	B,01H	Place odd number 1 in Reg.B
2004		3E,36	MVI	A,36	Load accumulator with the given number
2006	Loop	90	SUB	B	Subtract odd number from the accumulator
2007		CA,10,20	JZ	Ahead(2010)	If accumulator contents are zero, go to Ahead
200A		0C	INR	C	Increment reg. C
200B		04	INR	B	Increment odd number
200C		04	INR	B	Increment odd number
200D		C3,06,20	JMP	Loop(2006)	Repeat subtraction
2010	Ahead	79	MOV	A,C	Move the contents of C to A
2011		32,50,20	STA	2050H	Store the result in the memory location 2050H.
2014		76	HLT		Terminate the program

Flow Chart:

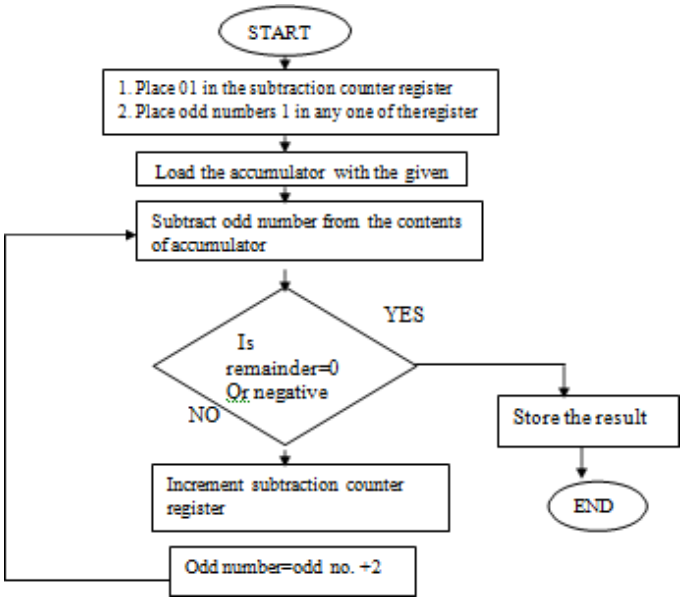

Fig 8. Flowchart for finding square-root of a number

Input Data :

2500-10H
2501- 00H

Output Data :

2550- 04H

Precautions:

Make sure that all the machine codes should be as per specified in the program.

EXPERIMENT NO. 7

Aim : Write a program using 8085 to find out largest number in an array.

Apparatus : 8085 microprocessor kit, 5V power supply, Keyboard.

Theory(program)

Memory Address	Label	Instruction	Comments
2000H		LXI H,2500H	Load starting address of list
2003H		MOV C,M	Store maximum
2004H		INX H	Store minimum
2005H		MOV A,M	Counter for 10 elements
2007H		DCR C	Retrieve list element in Accumulator
2008H	ZERO	INX H	Compare element with maximum number
2009H		MOV A,M	Jump to MIN if not maximum
200CH		DCR C	Transfer contents of A to B as A > B
200DH		INX H	Compare element with minimum number
200EH		CMP M	Jump to SKIP if not minimum
2011H		JNC CARRY	Transfer contents of A to C if A < minimum
2012H		MOV A,M	Increment memory
2013H	CARRY	DCR C	Decrement counter
2014H		JNZ ZERO	Jump to LOOP if D > 0
2017H		STA 2504	Load address to store maximum
201AH		HLT	Move maximum to 2060H

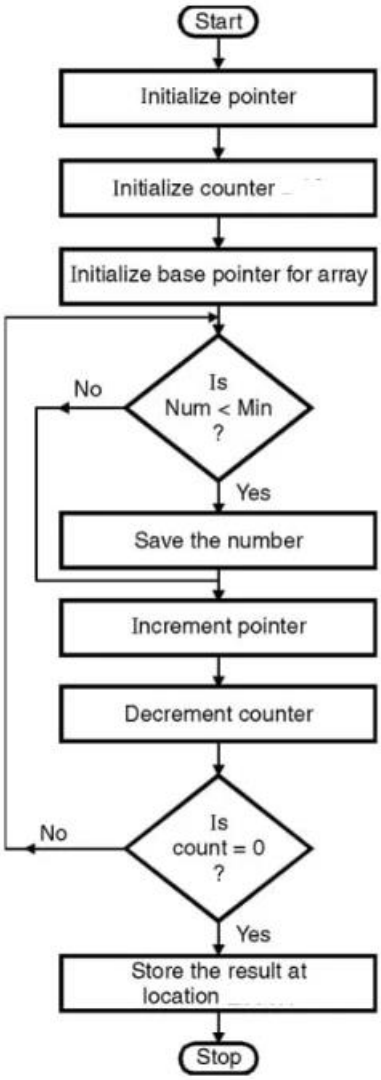

Fig 9. Flow Chart for finding largest number in an array.

Result: The result is stored at 2504 H.

EXPERIMENT NO. 8

Aim : Write a program using 8085 to find out the smallest number in an array.

Apparatus : 8085 microprocessor kit, 5V power supply, Keyboard.

Theory(program)

Memory Address	Label	Instruction	Comments
2000H		LXI H, 2500	Load starting address of list
2003H		MOV C, M	Store maximum
2004H		INX H	Store minimum
2005H		MOV A, M	Counter for 10 elements
2007H		DCR C	Retrieve list element in Accumulator
2008H	ZERO	INX H	Compare element with maximum number
2009H		CMP M	Jump to MIN if not maximum
200CH		JC CARRY	Transfer contents of A to B as A > B
200DH		MOV A, M	Compare element with minimum number
200EH	CARRY	DCR C	Jump to SKIP if not minimum
2011H		JNZ ZERO	Transfer contents of A to C if A < minimum
2012H		STA 2504	Increment memory
2013H		HLT	Decrement counter

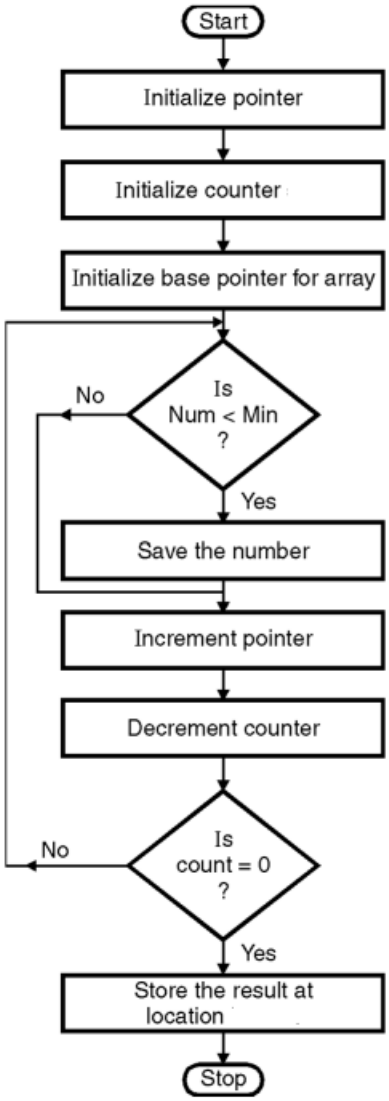

Fig 10. Flow Chart for finding smallest number in an array.

Result: The result is stored at 2504 H.

EXPERIMENT NO. 9

Aim : Write a program using 8085 to arrange the given numbers in ascending order.

Apparatus : 8085 microprocessor kit, 5V power supply, Keyboard.

Theory(program)

Address	Label	Instruction	Comment
2000		LXI H,2050H	Set pointer for array
2003		MOV C, M	Load the count value
2004		DCR C	Decrement counter
2005	REPEAT	MOV D, C	
2006		LXI H, 2051H	Set the memory pointer for data
2009	LOOP	MOV A, M	Move the number into accumulator
200A		INX H	Increment memory pointer
200B		CMP M	Compare memory and accumulator
200C		JC SKIP	jump to skip if carry generated
200F		MOV B, M	copy content of memory location to B – Register
2010		MOV M, A	copy content of Accumulator to memory location
2011		DCX H	Decrement content of HL pair of registers
2012		MOV M, B	copy content of B – Register to memory location
2013		INX H	Increment content of HL pair of registers
2014	SKIP	DCR D	Decrement content of Register – D
2015		JNZ LOOP	jump to loop if not equal to zero
2018		DCR C	decrement counter
2019		JNZ REPEAT	jump to repeat if not equal to zero
201C		HLT	Terminate the program

Flow Chart :

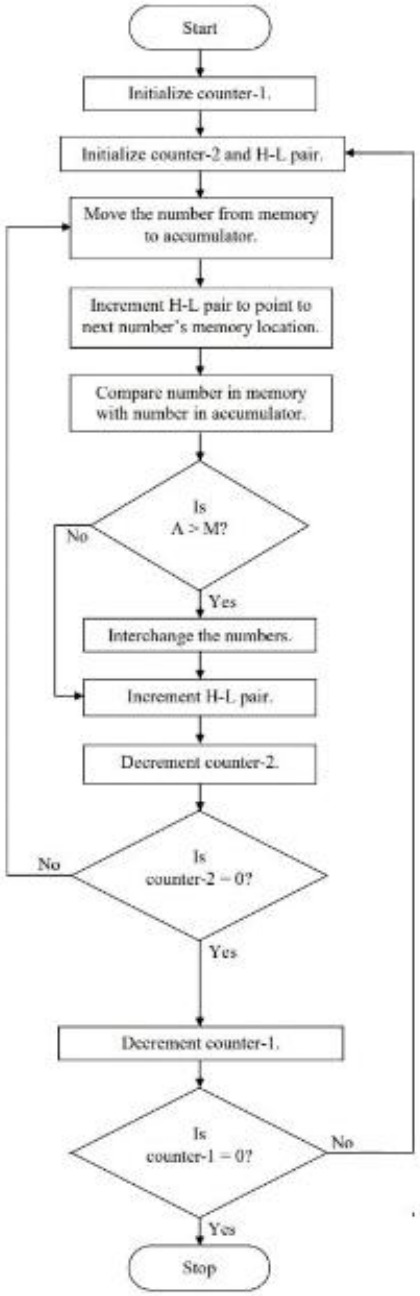

Fig 11. Flow Chart for arranging a series of numbers in ascending order.

EXPERIMENT NO. 10

Aim : Write a program using 8085 to find the sum of given 8-bit nos. in a series and display the result.

Apparatus : 8085 microprocessor kit, 5V power supply, Keyboard.

Theory(program)

Address	Label	Instruction	Comment
2000		LXI H,2500 H	Load H-L pair with address 2500H
2003		MOV C, M	Move the content of memory in register C
2004		MVI A, 00H	Initialize accumulator with value 00H
2006		MOV B, A	Move the content of accumulator in register B
2007	ZERO	INX H	Increment H-L pair
2008		ADD M	Add the content of memory with accumulator
2009		JNC CARRY	Jump if no carry is generated
200C		INR B	Increment the content of register B
200D	CARRY	DCR C	Decrement the counter
200E		JNZ ZERO	Jump if no zero is generated
2011		STA 2450H	Store the result in memory
2014		MOV A, B	Move the content of register B in accumulator
2015		STA 2451H	Store the carry in accumulator
2018		HLT	Terminate the program

Flow Chart :

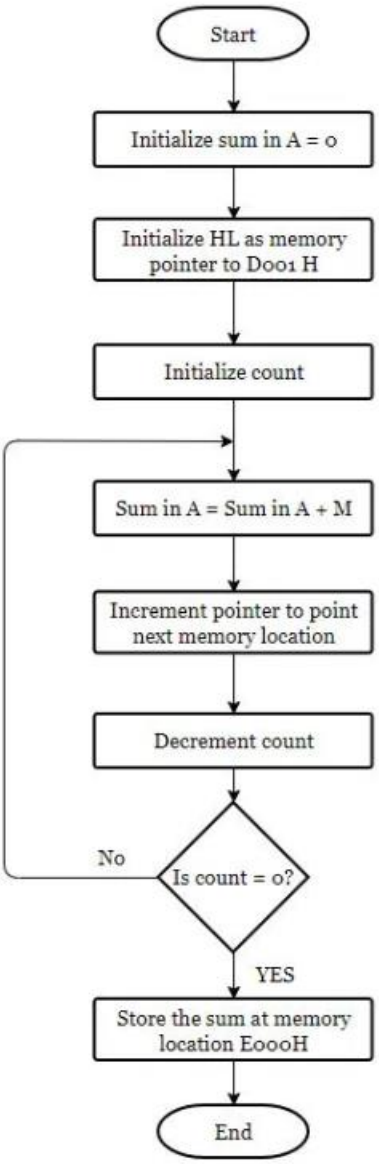

Fig 12. Flowchart to find sum of a series of numbers

EXPERIMENT NO. 11

Aim : Write a program to interface ADC & DAC with 8085 & demonstrate generation of square wave.

Apparatus : 8085 microprocessor kit, 5V power supply, Keyboard.

Description: A D/A converter chip DAC 0800 has been provided on the board of M85-07 to enable the user to have analog output. This can be used for generating various waveforms or for any closed loop applications. The chip has been used in I/O mapped mode and has an address of (A0-A7), i.e. any of A0 to A7 can be used as an address. This chip has been designed to give an output of 0 to 8 Volts. The output of DAC 0800 is coming at Pin No.13 of connector CN11.

Theory(Program)

Memory Address	Label	Machine Code	Mnemonics	Operands	Comments
2000		CD 4D OF	CALL	LECHO	CLEAR LCD DISPLAY
2003		06 0E	MVI	B,0EH	
2005		21 1F 20	LXI	H,WAVE	
2008		CD 47 17	CALL	PRINTF	DISPLAY MESGAE
200B	DAC	3E 00	MVI	A,00H	
200D		D3 38	OUT	38H	
200F		CD 31 0F	CALL	DELAY1	
2012		06 14	MVI	B,14H	
2014		CD 47 17	CALL	PRINTF	DISPLAY MESSAGE
2017		3E FF	MVI	A,FFH	
2019		D3 A0	OUT	0A0H	
201B		CD 31 0F	CALL	DELAY1	
201E		C3 0B 20	JMP	DAC	LOOP
2021		52 41 4D 50 20			WAVE OUTPUT AT
2026		50 49 4E 20 4E			PIN NO. 2 CONN. C9

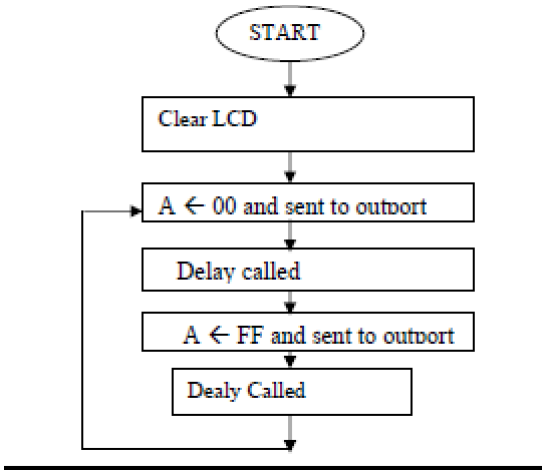

Fig 13. Flowchart for interfacing ADC & DAC with 8085

RESULT: Waveform observed on the CRO from Pin No. 2 of connector 9.

PRECAUTIONS:-

Make sure that all the machine codes should be as per specified in the program.

EXPERIMENT NO.12

Aim : Write a program using 8086 for arranging an array of numbers indescending order & verify.

Apparatus : 8086 microprocessor kit, 5V power supply, Keyboard.

Theory(Program)

Memory Address	Label	Machine Code	Mnemonics	Operands	Comments
0200		BE,00,03	MOV	SI,0300	Initialize SI Reg. with Memory Location. 0300.
0203		8B,1C	MOV	BX,[SI]	BX has no. of bytes
0205		4B	DEC	BX	Decrement the no. of bytes by one
0206	(3)	8B 0C	MOV	CX ,[SI]	Move no. of bytes in CX
0208		49	DEC	CX	Decrement the no. of bytes by one
0209		BE,02,03	MOV	SI,0303	Initialize SI reg. with the starting address of string
020C	(2)	8A,04	MOV	AL,[SI]	Move first data byte of string into AL
020E		46	INC	SI	Point at the next bytes of the string
020F		3A,04	CMP	AL,[SI]	Com. the two bytes of string.
0211		73,06	JAE	(1)	If two bytes are equal or 1stbyte is above that the second byte branch to (1)
0213		86,04	XCHG	AL,[SI]	Else
0215		4E	DEC	SI	Second byte is less than first byte and swap the two bytes.
0216		88,04	MOV	[SI],AL	
0218		46	INC	SI	Point at next location of string
0219	(1)	E2,F1	LOOP	(2)	Loop if CX is not zero
021B		4B	DEC	BX	
021C		BE,00,03	MOV	SI,0300	
021F		75,E5	JNZ	(3)	
0221		F4	HLT		Halt.

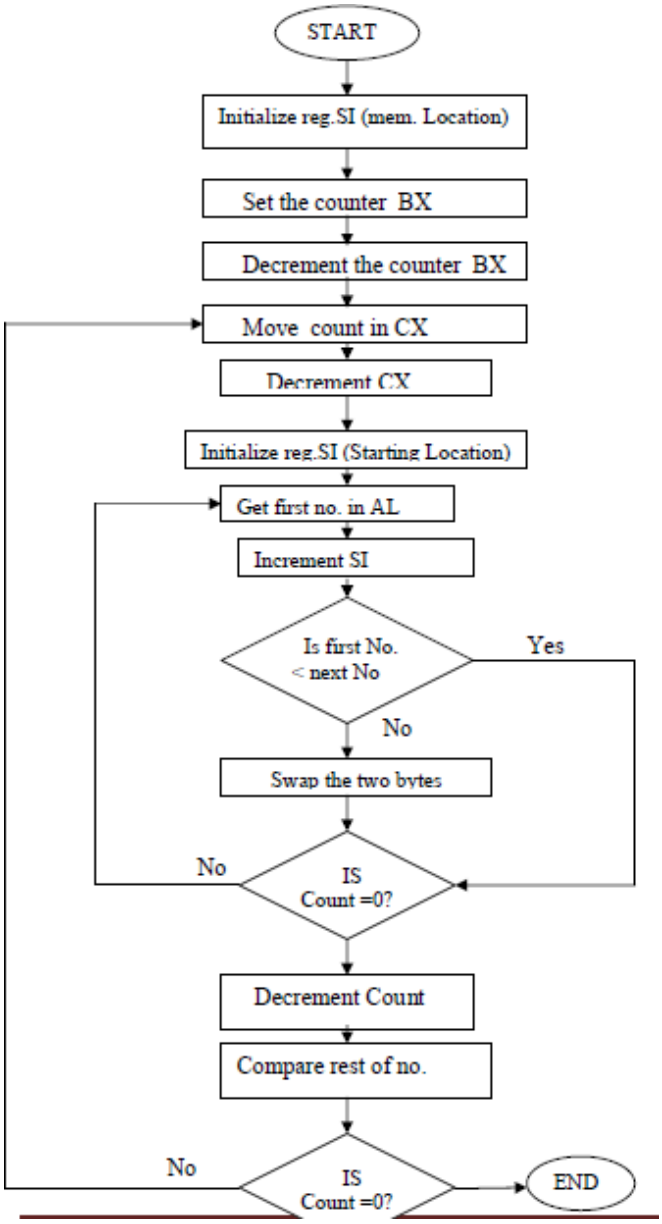

Fig 14. Flow chart for arranging an array of numbers in descending order

INPUT DATA

0300	: 05
0301	: 00
0302	: 20
0303	: 25
0304	: 28
0305	: 15
0306	: 07

OUTPUT DATA

0302	: 28
0303	: 25
0304	: 20
0305	: 15
0306	: 07

PRECAUTIONS:-

Make sure that all the machine codes should be as per specified in the program.

EXPERIMENT NO. 13

Aim : Write a program using 8086 for copying 12 bytes of data from source to destination & verify.

Apparatus : 8086 microprocessor kit, 5V power supply, Keyboard.

Theory(Program)

Memory Address	Label	Machine Code	Mnemonics	Operands	Comments
0101		FC	CLD		Clear direction flag DF
0102		BE,00,03	MOV	SI,0300	Source address in SI
0105		BF,02,02	MOV	DI,0202	Destination address in DI
0108		8B,0C	MOV	CX,[SI]	Count in CX
010A		46	INC	SI	Increment SI
010B		46	INC	SI	Increment SI
010C	BACK	A4	MOV	SB	Move byte
010D		E2,FD	LOOP	BACK	Jump to BACK until CX becomes zero
010F		CC	INT		Interrupt program

Flow Chart:-

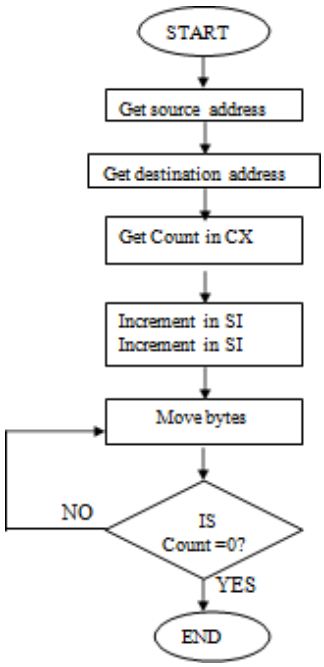

Fig 15. Flow Chart for copying data bytes from source to destination.

INPUT DATA

0300	: 0B
0301	: 00
0302	: 03
0303	: 04
0304	: 05
0305	: 06
0306	: 15
0307	: 07
0308	: 12
0309	: 08
030A	: 09
030B	: 0A
030C	: 0B
030D	: 0E

OUTPUT DATA

0202	: 03
0203	: 04
0204	: 05
0205	: 06
0206	: 15
0207	: 07
0208	: 12
0209	: 08
020A	:09
020B	: 0A
020C	: 0B
020D	: 0E

Precautions:-

Make sure that all the machine codes should be as per specified in the program.

EXPERIMENT NO.14

Aim : Write a program using 8086 for division of a defined double wordby another word & verify.

Apparatus : 8086 microprocessor kit, 5V power supply, Keyboard.

Theory(Program)

Memory Address	Machine Code	Mnemonics	Operands	Comments
100	B8,78,56	MOV	AX,5678H	Move 5678 to AX
103	BA,34,12	MOV	DX,1234H	Move 1234 to DX
106	B9,25,25	MOV	CX,2525	Move 2525 to CX
109	F7,F1	DIV	CX	Divide AX&DX by CX
10b	CD,A5	INT	A5	

Flowchart:-

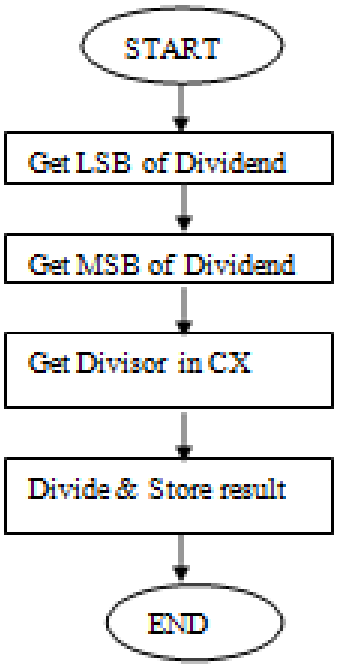

Fig 16. Flowchart for division of a defined double wordby another word

Input data

AX : 5678H
DX : 1234H
CX : 2525H

Output data

AX : 7D77(Quotient)
DX : 0145(Remainder)

Precautions:-

Make sure that all the machine codes should be as per specified in the program.

EXPERIMENT NO. 15

Aim: Write a program to generate a square wave of 1KHz frequency on OUT 1 pin of 8253/54. Assume CLK1frequency is 1MHz and address for control register =0BH, counter 1 = 09H and counter 2 = 0AH.

Control Word:

D7	D6	D5	D4	D3	D2	D1	D0
SC1	SC2	RW1	RW0	M2	M1	M0	BCD
0	1	1	1	0	1	1	1

Instructions	**Comment**
MOV AL,77H	Comment
OUT 0BH,AL	Loads control word (77H) in; the control register.
MOV AL,00H	; loads lower byte (00) of the count
OUT 09H,AL	
MOV AL,10	; Loads higher byte (10) of the count
OUT 09H,AL	
HLT	

Result: The result is checked at pin 1.

Precautions:-

Make sure that all the machine codes should be as per specified in the program.