MGM'S
Jawaharlal Nehru Engineering College

Laboratory Manual

MICROPROCESSOR AND INTERFACING TECHNIQUES

For

TE (EEP)

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PREFACE

It is my great pleasure to present this laboratory manual for third year EEP students for the subject of Microprocessor and Interfacing Techniques(MIT).

Microprocessor is the brain of computer. It is a general purpose programmable logic device. A thorough understanding of 8085Microprocessor concepts, demands Assembly Language programming with in depth knowledge of instructions and clarity in analysis of the task.

Most of the students find it difficult to start with the programming assignment. Therefore, a structured approach to learn programming through steps like problem statement, analysis, logic & flowchart, actual program(Mnemonics)and comments, is illustrated with sample programs.

This lab manual introduces students to the elementary programming techniques, interfacing and designing simple applications using peripheral chips like 8255, 8279, 8253etc.

Students are advised to thoroughly go through this manual rather than only topics mentioned in the syllabus, as practical aspects are the key to understanding and conceptual visualization of theoretical aspects covered in the books.

Good Luck for your Enjoyable Laboratory Sessions.

Author

SUBJECT INDEX

DO's and DON'T's in Laboratory:

1. Do not handle any kit before reading the instructions/Instruction manuals.

2. Use correct power supply with the proper kit.

3. Do not forcefully place connectors to avoid the damage.

4. Strictly observe the instructions given by the teacher/Lab Instructor.

Instruction for Laboratory Teachers:

1. Lab work completed during prior session, should be corrected during the next lab session.

2. Students should be guided and helped whenever they face difficulties.

3. The promptness of submission should be encouraged by way of marking and evaluation patterns that will benefit the sincere students.

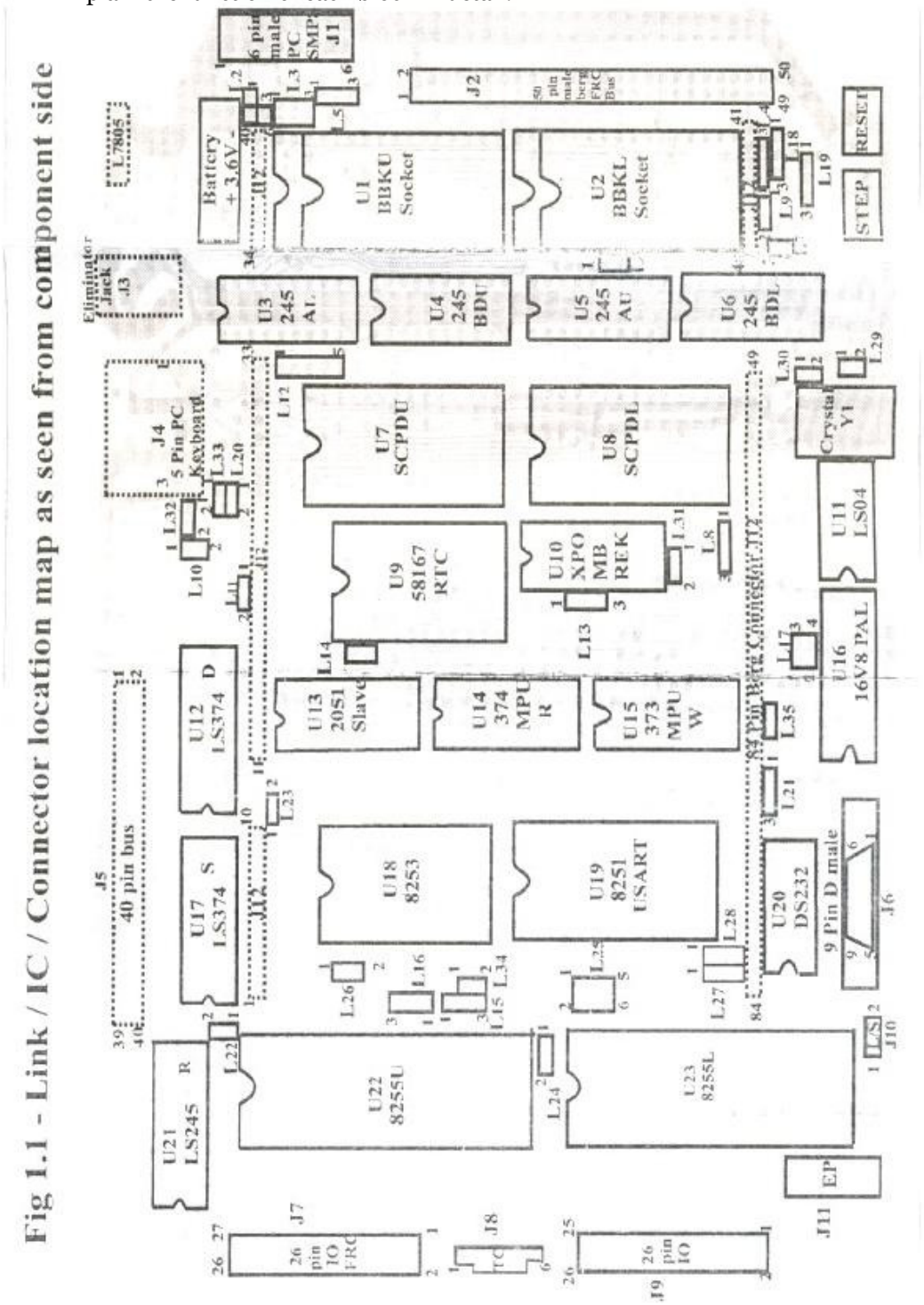
1. Lab Exercises:

[Purpose of these exercises is to introduce the students to Assembly Language Programming for 8085, types of peripheral chips, their interfacing & programming.

Introduction of 8085 kit :(Refer figure no.1.1)

THEORY:

Explain the function of each block in detail.



Exercise No.1: Data manipulation program:

Exercise No.1.1 : Arithmetic operation on two 8 bit numbers.

a) Addition of two 8 bit numbers.

Aim : To write assembly language program for addition of two 8 bit numbers.

Statement: Add two 8 bit numbers and store result in register A.

Algorithm: 1. Load register A with given value.
2. Load register B with given value.
3. Add contents of register B & register A.
4. Store result in Accumulator.

Sample:

Memory Address	Opcode/data/ address	label	Mnemonics	Comments
7000,01	3E,11		MVI A ,11 H	Load register A with 11
7002,03	06,12		MVI B,12 H	Load register B with 12
7005	80		ADD B	Add contents of register B to A
7006	CF		RST1	Jump to command mode saving all register.

Data: Register A=11H and register B=12H

Result: Register A=23 H

Conclusion: Thus, the program written for addition of two 8 bit numbers is successfully executed.

b) Subtraction of two 8 bit numbers.

Aim: To write assembly language program for Subtraction of two 8 bit numbers.

Statement: Subtract two 8 bit numbers & store result in register A.

Algorithm: 1. Load register A with given value .
2. Load register B with given value.
3. Subtract contents of register B from register A.
4. Store result in Accumulator.

Sample:

Memory Address	Opcode/data/addr	label	Mnemonics	Comments
7000,01	3E,05		MVI A ,05 H	Load register A with 05
7002,03	06,02		MVI B,02 H	Load register B with 02
7005	90		SUB B	Subtract contents of register B from A
7006	CF		RST1	Jump to command mode saving all register.

Data: Register A=05H and register B=02H

Result: Register A=03 H

Conclusion: Thus program written for Subtraction of two 8 bit numbers is successfully executed.

Exercise No.1.2 : Arithmetic operation on two 16 bit numbers.

a) Addition of two 16 bit numbers.

Aim: To write assembly language program for addition of two 16 bit numbers.
Statement: Write an ALP to add two 16 bit numbers where the first number is stored in memory location 2501H (LSB) and 2502H (MSB). Second number is in memory location 2503H (LSB) and 2504H (MSB) and the sum is stored in memory location 2505 (LSB) to 2507(MSB). (Consider the carry generated in the result).
Algorithm: 1. Get the first number from the memory location to HL pair.
2. Transfer it to DE pair.
3. Get the second number from the next two memory locations to HL pair.
4. Initially, set register C to 0. (Reg C is used to store the carry generated)
5. Add the two sixteen bit numbers directly.
6. If carry is generated, increment C.
7. Store result in the given memory locations.
8. Stop.

Sample:

Memory Address	Opcode/data/addr	label	Mnemonics	Comments
2000	2A,01,25		LHLD 2501	1st 16 bit number in HL pair
2003	EB		XCHG	Transfer 1st no. to DE pair
2004	2A,03,25		LHLD 2503	2nd 16 bit number in HL pair
2007	0E,00		MVI C,00	MSBs of sum in register C. initial value =00
2009	19		DAD D	1st number + 2nd number
200A	D2,0E,20		JNC AHEAD	Is carry? No, go to the label ahead
200D	0C		INR C	Yes, increment C.
200E	22,05,25	AHEAD	SHLD 2505	Store LSBs of sum in 2505 and 2506
2011	79		MOV A,C	MSBs of sum in accumulator
2012	32,07,25		STA 2507	Store MSBs of sum in 2507
2015	CF		RST1	Termination of program

Data: 2501-98H, LSB of1st number. 2502-5BH, MSB of1st number.
2503-4CH, LSB of2nd number. 2504-8EH, MSB of2nd number.
Result:2505-E4H, LSB of sum. 2506-E9H, next higher byte result 2507-00H, MSB of result.

Conclusion: Thus program written for addition of two 16 bit numbers is successfully executed.

b) Subtraction of two 16 bit numbers.

Aim: To write assembly language program for Subtraction of two 16 bit numbers

Statement: Two 16 bit numbers are stored from memory location. Subtract number stored at 2501H (LSB) & 2502H (MSB) from the 16 Bit number stored at 2503 (LSB) & 2504H (MSB).Store result at 2506H (LSB) & 2507H (MSB).

Algorithm: 1. Transfer the first number from the memory location to HL pair.
2. Transfer it to DE pair.
3. Load second 16 bit number from the next two memory locations in HL pair.
4. Subtract lower byte of 2nd number
5. Store result in L register.
6. Subtract higher byte of second number with borrow.
7. Store result in H register.
8. Stop

Sample:

Memory Address	Opcode/data/addr	label	Mnemonics	Comments
7000	2A,01,25		LHLD 2501H	Get 1st 16 bit number in HL pair
7003	EB		XCHG	Save 1st 16 bit number in DE pair
7004	2A,03,25		LHLD 2503H	Get 2nd 16 bit number in HL pair
7007	7B		MOV A,E	Get lower byte of 1st number.
7008	95		SUB L	Subtract lower byte of 2nd number
7009	6F		MOV L,A	Store the result in L register
700A	7A		MOV A,D	Get higher byte of 1st number
700B	9C		SBB H	Subtract higher byte of 2nd number with borrow
7000C	67		MOV H,A	Store result in H register
700D	22,05,25		SHLD 2505	Store result at 2505H/2506H
7010	CF		RST1	Stop

Data: 2501H = 19H
2502H = 6AH
2503H = 15H
2504H = 5CH

Result: 6A19 H-5C15 H = 0E04 H
2505H = 04H
2506H = 0EH

Conclusion: Thus program written for Subtraction of two 16 bit numbers is successfully executed.

Exercise No.1.3: Arithmetic operation on two 16 bit BCD numbers using DAA

Aim: To write assembly language program for addition of two 16 bit BCD numbers using DAA.

Statement: Write program to add two 4 digit BCD numbers. Assume data already exists in BC and DE register pairs.

Algorithm: 1. Add lower registers C and E.
2. Adjust the result to BCD
3. Save LSB of register in register L
3. Add higher registers B and D.
4. Adjust the result to BCD.
5. Save MSB of register in register H.
6. Stop.

Sample:

Memory Address	Opcode/data/addr	label	Mnemonics	Comments
7000	79		MOV A,C	Move contents of register C to register A
7001	83		ADD E	Add E to accumulator.
7002	27		DAA	Adjust to BCD
7003	6F		MOV L,A	Move contents of register A to register L
7004	78		MOV A,B	Move contents of register B to register A
7005	8A		ADC D	A+CY+D->A
7006	27		DAA	Adjust to BCD
7007	67		MOV H,A	Move contents of register A to register H
7008	CF		RST1	Stop

Data: *First 16 bit BCD 1212*
Second 16 bit BCD 3939

Result: *Addition is 5151 in BCD form.*

Conclusion: Thus program written for addition of two 16 bit BCD numbers using DAA is successfully executed.

Exercise No.1.4: Data transfer programs:

Aim: To write data transfer array programs and execute.

Statement : 5 no. of bytes is stored from the memory locations 2201h. Transfer the entire block of data bytes from 2201H to 2301H onwards.

Algorithm (Logic):
1. Initialize the source memory pointer.
2. Initialize the destination memory pointer.
3. Initialize the counter with 5.
4. Move the contents of the source memory to accumulator.
5. Do whatever manipulation is specified /required.
6. Transfer the accumulator contents to destination memory location.
7. Increment source, destination memory pointer and decrement the counter.
8. If the count is not zero, jump back to step 4.
9. If the count is zero, stop.

Sample:
N=5 bytes, source location: 2201 to 2205, destination location: 2301 to 2305.
Data Transfer:

Memory Address	Opcode/data/addr	label	Mnemonics	Comments
7000,01,02	21,01,22		LXI H,2201H	Initialize HL pair with source (src) memory.
7003,04,05	01,01,23		LXI B,2301H	Initialize BC pair with destination (destn) memory.
7006,07	16,05		MVI D,05H	Initialize D with count=05
7008	7E	LOOP	MOV A,M	Transfer src data to accumulator (acc).
7009	02		STAX B	Transfer acc contents to destn.
700A	23		INX H	Increment HLpair by 1
700B	03		INX B	Increment BC pair by1
700C	15		DCRD	Decrement D by1
700D,0E,0F	C2,08,70		JNZ LOOP	Jump to loop if Zero flag is not set.
7010	CF		RST1	Stop

Data: 5 no. of bytes stored from 2201 onwards.

Result: Same 5 no. of bytes stored in 2301 onwards

Conclusion: Thus program written for data transfer is successfully executed.

Exercise No1.5: Program for finding smallest and largest element in block of data.

a. Program for finding largest number in block of data.

Aim: to write ALP for finding largest number in block of data

Statement: Count =3 is placed in memory location2500.The numbers are placed in memory locations 2501 onwards. Result is stored in memory location 2450H.

Algorithm: 1. Initialize HL pair.
2. Get count in register C.
3. Get 1st number in accumulator.
4. Is number in accumulator > next number? if no, get larger number in accumulator else decrement count.
5. When count=0, store result.
6. Stop.

Sample:

Memory Address	Opcode/data/addr	label	Mnemonics	Comments
6000	21 ,00,25		LXI H,2500H	Address for count in HL pair
6003	4E		MOV C,M	Count in register c.
6004	23		INX H	Addresses of 1st number in HL pair
6005	7E		MOV A,M	1st number in accumulator.
6006	0D		DCR C	Decrement count
6007	23	LOOP	INX H	Address of next number.
6008	BE		CMP M	Compare next number with previous maximum number. If next number>previous maximum?
6009	D2,0D,60		JNC AHEAD	No ,larger number is in accumulator go to ahead
600C	7E		MOV A,M	Yes get larger number in accumulator
600D	0D	AHEAD	DCR C	Decrement count
600E	C2,07,60		JNZ LOOP	
6011	32,50,24		STA 2450	Store result
6014	CF		RST1	Stop.

Data: 2500-03
2501-98
2502-75
2503-99

Result: 2450-99

Conclusion: thus we have studied the program for finding largest number.

b. Program for finding smallest number in block of data.

Aim: To write ALP for finding smallest number in block of data.

Statement: Count =3 is placed in memory location2500.The numbers are placed in memory locations 2501 onwards. Result is stored in memory location 2450H.Find the smallest number from the given series.

Algorithm: 1. Initialize HL pair.
2. Get count in register C.
3. Get 1st number in accumulator.
4. Is number in accumulator > next number? If no, get smaller number in accumulator else decrement count.
5. When count=0, store result.
6. Stop.

Sample:

Memory Address	Opcode/data/addr	label	Mnemonics	Comments
2000	21 ,00,25		LXI H,2500H	Address for count in HL pair
2003	4E		MOV C,M	Count in register c.
2004	23		INX H	Addresses of 1st number in HL pair
2005	7E		MOV A,M	1st number in accumulator.
2006	0D		DCR C	Decrement count
2007	23	LOOP	INX H	Address of next number .in HL pair
2008	BE		CMP M	Compare next number with previous minimum number .if next number>previous minimum?
2009	DA, OD,20		JC AHEAD	Yes ,smaller number is in accumulator go to ahead
200C	7E		MOV A,M	No . get larger number in accumulator
200D	0D	AHEAD	DCR C	Decrement count
200E	C2,07,20		JNZ LOOP	
2011	32,50,24		STA 2450	Store result
2014	CF		RST1	Stop.

Data: 2500-03
2501-86
2502-58
2503-75

Result: 2450-58

Conclusion: Thus we have studied the program for finding smallest number.

Exercise No.1.6. Addition of Series:

a) Addition in series 8 bit result

Aim: To write Assembly Language Program (ALP) for addition of nos.in an array and execute.

Statement: N no. of bytes are stored from the memory locations 2201h. (N can be mentioned directly or given in a location(2200H) .Add the entire block of data bytes from 2201H and store the 8 bit result to 2301H .

Algorithm(Logic):

1. Initialize the source memory pointer.
2. Initialize the destination memory pointer.
3. Initialize the counter with N.
4. Move the contents of the source memory to accumulator.
5. Do whatever manipulation is specified/required. (In this program perform addition.)
6. Store the result in accumulator.
7. Increment source and decrement the counter.
8. If the count is not zero, jump back to step 4.
9. If the count is zero, Transfer the accumulator contents to destination memory location.
10. Stop.

Sample:

N is in 2200H ,source location: 2201 to 2205,destination location: 2301

Memory Address	Opcode/data/addr	label	Mnemonics	Comments
7000,01,02	21,00,22		LXI H,2200H	Initialize HL pair with count memory.
7003	4E		MOV C,M	Initialize C with count.
7004,05	3E,00		MVI A,00H	Move 00 to acc
7006	23		INX H	Increment HL pair by 1
7007	86	LOOP	ADD M	Add acc contents to src mem.
7008	23		INXH	Increment HL pair by 1
7009	0D		DCR C	Decrement C by1
700A,0B,0C	C2,07,70		JNZ LOOP	Jump to loop if Zero flag is not set.
700D,0E,0F	32,01,23		STA 2301	Store the result in 2301
7010	CF		RST1	Stop

Data: N no. of bytes stored from 2201 onwards.

Result: Addition of Same N number of bytes stored in 2301H.

Conclusion: Thus, the program written for addition has been successfully executed.

b) Addition of Series Result: 16Bits

Aim: To write Assembly Language Program (ALP) for addition of numbers in an array, assuming the result to be 16 bits and execute.

Statement: N no. of bytes are stored from the memory locations 2201H.(N can be mentioned directly or given in a location(2200H) .Add the entire block of data bytes from 2201H and store the 16 bit result to2301H(LSB) and 2302H(MSB).

Algorithm(Logic):
1. Initialize the source memory pointer.
2. Initialize the destination memory pointer.
3. Initialize the counter with N, Initialize a register to store MSB.
4. Move the contents of the source memory to accumulator.
5. Do whatever manipulation is specified/required.(In this program perform addition.)
6. Store the result in accumulator. If a carry is generated, store it in the register.
7. Increment source memory and decrement the counter.
8. If the count is not zero, jump back to step 4 .
9. If the count is zero, transfer the accumulator contents to destination memory location.
10. Transfer the register contents to acc and store it in the MSB memory.
11. Stop.

Sample:

N is in 2200h ,source location: 2201 to 2205,destination location: 2301 ,2302

Memory Address	Opcode/data/addr	label	Mnemonics	Comments
7000,01,02	21,00,22		LXI H,2200H	Initialize HL pair with count memory.
7003	4E		MOV C,M	Initialize C with count.
7004,05	3E,00		MVI A,00H	Move 00 to acc
7006,07	16,00		MVI D,00H	Initialize D to store MSB result.
7008	23		INX H	Increment HL pair by 1
7009	86	LOOP	ADD M	Add acc contents to src mem.
700A,0B, 0C	DA, 0D ,70		JNC CLEAR	Jump if no carry to clear
700D	14		INR D	Else increment D by 1
700E	23	CLEAR	INXH	Increment HL pair by 1
700F	0D		DCR C	Decrement C by1
7010,11, 12	C2,09,70		JNZ LOOP	Jump to loop if Zero flag is not set.
7013,14, 15	32,01,23		STA 2301H	Store the LSB result in 2301
7016	7A		MOV A, D	Move MSBcontents to acc
7017,18, 19	32,02,23		STA 2302H	Store MSB result
701A	CF		RST1	Stop

Data: N no. of bytes stored from 2201 onwards.

Result: Addition of Same N no. of bytes stored in 2301, 2302.

Conclusion: Thus, the program written for addition has been successfully executed.

Exercise No.1.7 SORT SERIES IN ASCENDING ORDER

Aim: To write Assembly Language Program (ALP) for sorting the series in ascending order.

Statement: N no. of bytes are stored from the memory locations 2201h.(N can be mentioned directly or given in a location (2200H). Write an ALP to sort the series in ascending order.

Algorithm(Logic): 1.Initialize the source memory pointer.

2. Initialize two counters: one to compare the data and another to repeat the process of comparison till all the nos. are over.

3. The first and the next no. are compared. Smaller of the two is retained in the first memory location. The larger of the two is moved to the next memory location.

4. Decrement the count.

5 The second memory location is compared with the third and again step 3 is repeated till the count is zero.

6. At the end, the largest number will be at the last location.

N no. of bytes stored from 2201 onwards.

Numbers stored from 2201 are arranged in ascending order.

Data:

Result: N=(2200), source location: 2201 to 2205,destination location: 2201 to 2205.

Sample:

Memory Address	Opcode/ data/addr	Label	Mnemonics	Comments
7000,01,02	3A,00,22		LDA 2200H	Load Acc with the count
7003	47		MOV B, A	Save count to reg B.
7004,05,06	21,01,22	LOOP2	LXI H, 2201H	Initialize HL pair with source (src) memory.
7007	48		MOV C, B	Initialize C with count
7008	7E	LOOP1	MOV A, M	Transfer src data to accumulator (acc).
7009	23		INX H	Increment HLpair by 1
700A	BE		CMP M	Compare the two nos.
700B,0C,0D	DA,13,70		JC DOWN	If no.1<no.2,go to Label DOWN
700E	56		MOV D,M	Save smaller no. in D
700F	77		MOV M,A	Larger no. in II memory location.
7010	2B		DCX H	Decrement HL
7011	72		MOVM,D	Save smaller no. in I memory location.
7012	23		INX H	Increment HL to point to next memory location.
7013	0D	DOWN	DCR C	Decrement count by 1
7014,15,16	C2,08,70		JNZ LOOP1	If not zero, jump to loop1
7017	05		DCR B	Decrement count by 1
7018,19,1A	C2,04,70		JNZ LOOP2	If not zero, jump to loop2
701B	CF		RST1	Stop

Conclusion: Thus, program written for arranging numbers in ascending order is successfully executed.

Exercise No.1.8 SORT SERIES IN DESCENDING ORDER

Aim: To write Assembly Language Program (ALP) for sorting the series in Descending order.

Statement: N no. of bytes are stored from the memory locations 2201h.(N can be mentioned directly or given in a location (2200H) .Sort the series in Descending order.

Algorithm(Logic): 1.Initialize the source memory pointer.

2.Initialize two counters: one to compare the data and another to repeat the process of comparison till all the nos. are over.

3.The first and the next no. are compared .Larger of the two is retained in the first memory location. The smaller of the two is moved to the next memory location.

4.Decrement the count.

5 The second memory location is compared with the third and again step 3 is repeated till the count is zero.

6.At the end ,the smallest no. will be at the last location. **Data**: N no. of bytes stored from 2201 onwards.

Result: Numbers stored from 2201 are arranged in descending order.

Sample:

N=(2200), source location: 2201 to 2205,destination location: 2201 to 2205.

Memory Address	Opcode/ data/addr	Label	Mnemonics	Comments
7000,01,02	3A,00,22		LDA 2200H	Load Acc with the count
7003	47		MOV B,A	Save count to reg B.
7004,05,06	21,01,22	LOOP2	LXI H,2201H	. Initialize HL pair with source(src) memory.
7007	48		MOV C,B	Initialize C with count
7008	7E	LOOP1	MOV A,M	Transfer src data to accumulator(acc).
7009	23		INX H	Increment HLpair by 1
700A	BE		CMP M	Compare the two nos.
700B,0C,0D	D2,13,70		JNC DOWN	If no.1>no.2,go to Label DOWN
700E	56		MOV D,M	Save smaller no.in D
700F	77		MOV M,A	Larger no. in II memory location.
7010	2B		DCX H	Decrement HL
7011	72		MOVM,D	Save smaller no. in I memory location.
7012	23		INX H	Increment HL to point to next memory location.
7013	0D	DOWN	DCR C	Decrement count by 1
7014,15,16	C2,08,70		JNZ LOOP1	If not zero ,jump to loop1
7017	05		DCR B	Decrement count by 1
7018,19,1A	C2,04,70		JNZ LOOP2	If not zero ,jump to loop2
701B	CF		RST1	Stop

Conclusion: Thus, program written for arranging numbers in descending order is successfully executed.

Exercise No.1.9 **:** Multiplication of two 8 bit numbers.

Aim : To write assembly language program for Multiplication of two 8 bit numbers.

Statement: Multiply two 8 bit numbers and store result at 2600h (04 and 03).

Algorithm: 1. Clear accumulator.
2. Load register B with given number.
3. Load register C with other number. Use register C as counter.
3. Add contents of register B & register A for second number of times. For that create loop using conditional jump.
4. Multiplication result will be in accumulator store it to location 2600h.

Sample:

Memory Address	Opcode/data/ address	label	Mnemonics	Comments
7000,01	3E,00		MVI A ,00 H	Load register A with 00
7002,03	06,04		MVI B,04 H	Load register B with 04
7004,05	0E,03		MVI C,03 H	Load register C with 03
7006	80	UP:	ADD B	Add contents of register B to A
7007	0D		DCR C	Decrement counter
7008, 09, 0A	C2, 06, 70		JNZ UP	Repeat addition till counter becomes 0.
700B,0C, 0D	32, 00, 26		STA 2600	Store result to memory location
700E	CF		RST1	Jump to command mode saving all register.

Data: Register B=04H and register C=03H

Result:

2600H: 0CH

Exercise No2: (2 Hours) – 1 Practical

2.1 CODE CONVERSION

Aim: To write Assembly Language Program (ALP) to convert BCD no.

Statement: A BCD number is stored at the location 2200.Convert to its equivalent binary and store the result at 2300H.

Algorithm(Logic):1.Initialize the stack pointer.

2.Initialize two memory pointers for source and destination.

3.Subroutine program is used to convert BCD to Binary.

3.1 Unpack the 8 bit packed BCD no. into two 4 bit unpacked numbers.

3.2 Convert each digit to its binary value, according to its weighted position. For e.g. a number in ten's place is multiplied by 10.

4. Add both binary numbers to obtain equivalent of BCD number.

Data: BCD no. stored in 2200 e.g. 21D.

Result: Equivalent of BCD number i.e 15H stored in 2300H.

Sample:

Source location (BCD No):2200, Destination location(Binary no.): 2300H

Memory Address	Opcode/data/addr	Label	Mnemonics	Comments
7000,01,02	31,FF,23		LXI SP,23FF	Initialize stack pointer
7003,04,05	21,00,22		LXI H ,2200H	Initialize source memory pointer
7006,07,08	01,00,23	LOOP2	LXI B ,2300H	Initialize destination mem pointer
7009	7E		MOV A,M	Move bcd no. to acc
700A,0B,0C	CD,00,71	LOOP1	CALL 7100H	Call the subroutine
700D	02		STAX B	Load destination location with the result
700E	CF		RST1	Stop
SUBROUTINE:				
7100	C5		PUSH B	Save BC contents to stack
7101	D5		PUSH D	Save DE contents to stack
7102	57		MOV D,A	Save bcd no. to D
7103,04	E6,0F		ANI 0F H	Mask the upper nibble
7105	4F	DOWN	MOV C,A	Save the unpacked lower nibble to C.
7106	78		MOV A,D	Load original no.
7107,08	E6,F0		ANI F0 H	Mask lower nibble
7109	0F		RRC	Shift the upper nibble right by 1
710A	0F		RRC	Repeat
710B	0F		RRC	Repeat
710C	0F		RRC	Repeat, so that no. is now an unpacked BCD NO.
710D	57		MOV D,A	Save this no. in register B
710E	AF		XRA A	Clear Acc.
710F,10	1E,0A		MVI E,0A H	Set E as multiplier
7111	83	SUM	ADD E	Add E until D=0

7112				
7113,14,15	C2,11,71		JNZ SUM	Jump if not Zero.
7116	81		ADD C	Add first no.
7117	D1		POP D	Retrieve previous contents of DE
7118	C1		POP B	Retrieve previous contents of BC
7119	C9		RET	Return to the main program

Conclusion: Thus program written for code conversion is successfully executed

Exercise No3: (2 Hours) – 1 Practical

ADC INTERFACING WITH 8255

Aim: To write a program to interface the ADC with 8255.

Statement: Interface the ADC to 8255.Take analog data from the first channel, convert it in the digital form .Use port A of 8255 and display the digital data .

Circuit Diagram:

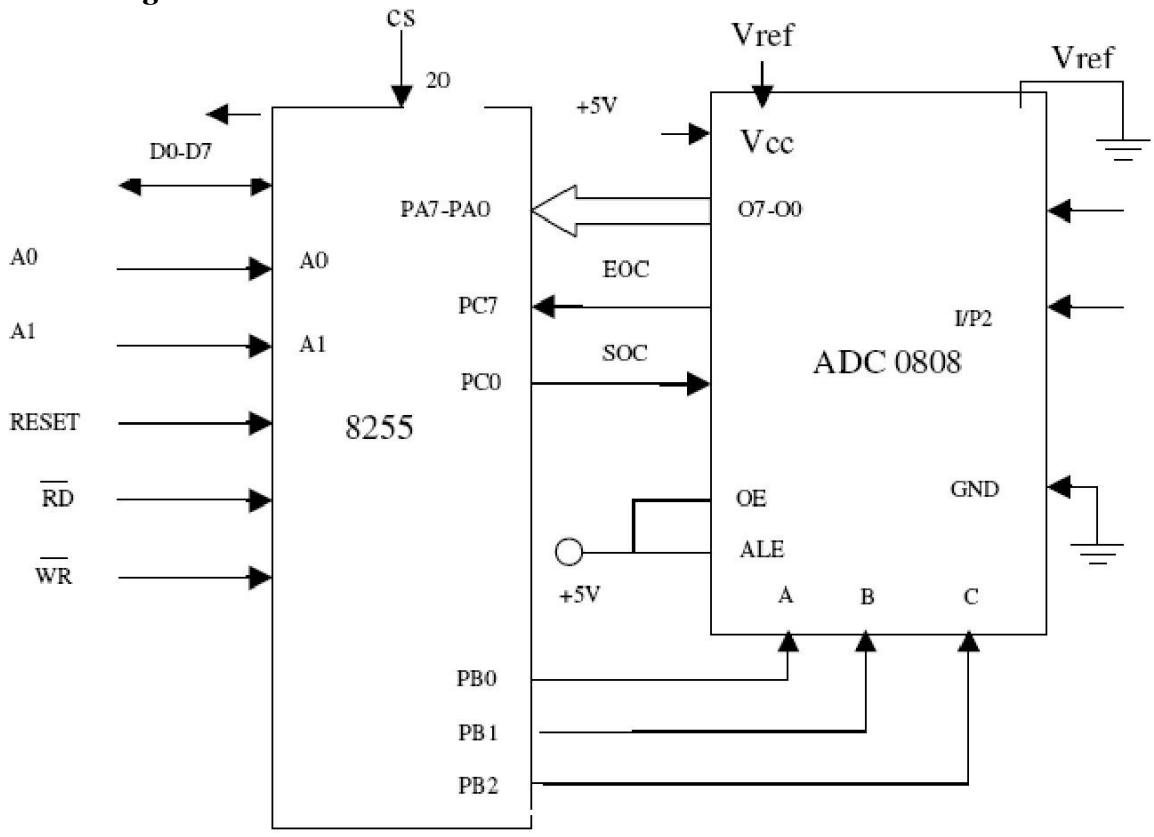


Fig. Interfacing ADC 0808 with 8085

Logic: Initialize 8255 with port A as i/p port, port B as output port and port C_{lower} as input port.

Out this control word to control word register.
Select the channel for taking analog data.
Make the SOC(Start of conversion) and ALE (Address Latch Enable) High. Make SOC low.
CHECK: Check EOC connected to port C of 8255 for high. If no, Jump to CHECK.
If yes, clear the contents of accumulator.
Read the digital data available on Port A from the ADC. Display it in the data field.

Theory: Explain ADC0808 pin diagram, block diagram and operation.
Explain interfacing of ADC with 8085 with neat diagram.

ALP: Initialization and program for 8255

Conclusion: The program written for ADC I/F is verified and proved correct.

Exercise No4: (2 Hours) – 1 Practical

DAC I/F WITH 8255

Aim: To write a program to interface the DAC with 8255.

Statement: Interface the DAC to 8255.Generate Square Wave.

Circuit Diagram:

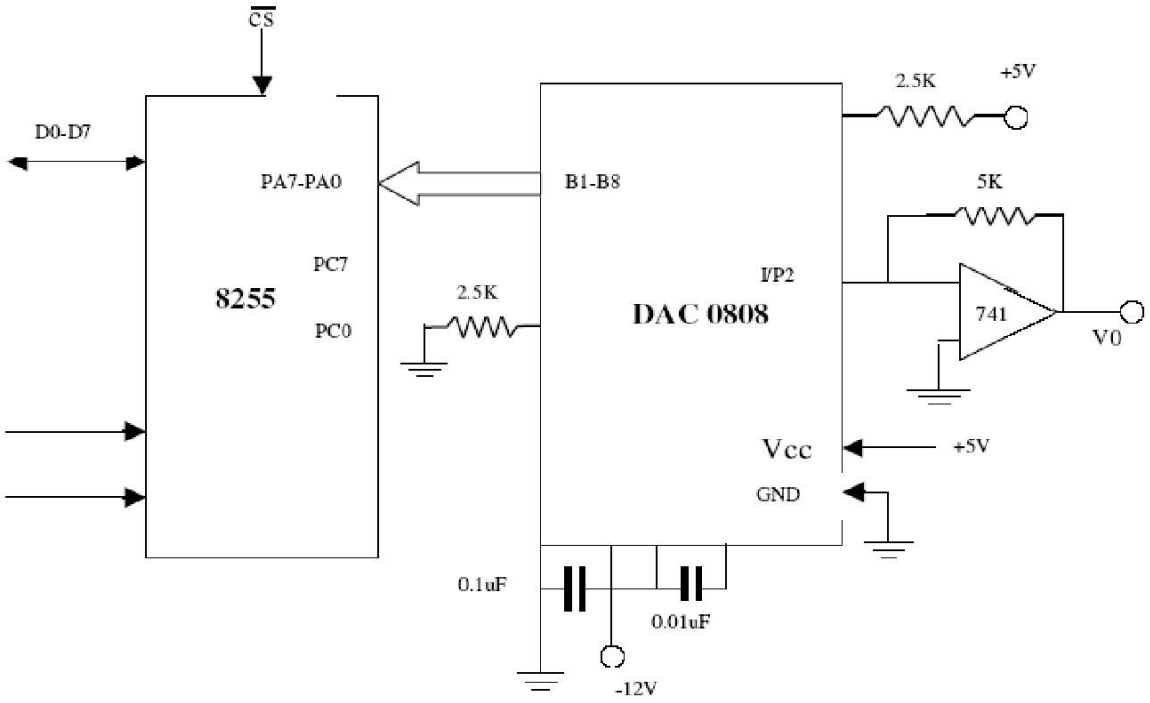


Fig. Interfacing DAC0808 with 8085

Logic: Initialise Stack pointer and 8255 port A as output port.
Out this control word to control word register.
START: Take the data 00Hin the Accumulator.
Out it to PortA.
Call delay subroutine.
Take the data FFH in the Accumulator.
Out it to port A.
Call the delay Subroutine.
Jump to START.
DELAY: Load one register with count.
Decrement the register.
Check for Zero.
If no, Jump to step 2of the delay.
If yes, Return to the main program.

Theory: Explain DAC0808/09 pin diagram, block diagram and operation.
Explain interfacing of ADC with 8085 with neat diagram
Write and verify programs for Triangular, Square, Positive going Ramp waveform generation.

Conclusion: Square wave generated, observed on CRO, proves the program for DAC I/F is correct.

Exercise No5: (2 Hours) – 1 Practical

RELAY INTERFACING USING 8255

Aim: Write an ALP to interface a relay with 8085 using 8255.
Statement : Control the ON-OFF action of relay using any one port of 8255.Provide appropriate delay routine.
Logic: 1.Initialise stack pointer.
2 Control Word is given to control register to set ports in different modes. Port A of 8255 is used in output mode
3 To make relay on data FF should be outputted on Port A.
4 Delay is provided.
5 To Off the relay 00 should be outputted.
6 Delay is provided.
7 Repeat steps 3 to 6 for continuous operation.
Subroutine:
1S.Initialise one register pair with count(Max=FFFF H). 2S.Decrement the register pair.
3S.Check if the count has become zero. 4S.If no, jump to step 2S.
5S.Otherwise return to main program.

Port addresses	Port A	Port B	Port C	Control Register
8255 Upper 00H	01H	02H	03H	
8255 Lower 08H	09H	0AH	0BH	

Control Word:

BSR/IO	modeA	PA	PCu	ModeB	PB	PCl	
1	0 0	0	* *		* *		=80H

Write a program according to the logic of the program.
Theory: Explain working of a relay and the interfacing circuit**.**
Explain in detail the interfacing of relay with 8085
Result: Relay turns ON-OFF.

Exercise No6: (2 Hours) – 1 Practical

LED INTERFACING USING 8255

Aim: Write an ALP to interface a LEDs with 8085 using 8255.,to turn the LEDS on and off. **Logic**: 1 Connect Leds to Port A of 8255 ,according to the circuit diagram shown.
Port A is used in output mode .Mode0.
2 Control Word is given to control register to set ports in different modes.
3 To make LEDS on,data FF should be outputed on Port A.
4 Delay is provided.
5 To Off the LEDs, 00 should be outputed.
6 Delay is provided.
7 Repeat steps 3 to 6 for continuous operation.

Subroutine:
1S.Initialise one register pair with count(Max=FFFF H). 2S.Decrement the reg pair.
3S.Check if the count has become zero. 4S.If no,jump to step 2S.
5S. Otherwise return to main program.

Port addresses	Port A	Port B	Port C	Control Register
8255 Upper 00H	01H	02H	03H	
8255 Lower 08H	09H	0AH	0BH	

Control Word:

BSR/IO	modeA	PA	PCu	ModeB	PB	PCl	
1	0 0	0	* *		* *		=80H

Write a program according to the logic of the program.

Theory: Explain working of LED interfacing circuit**.**
Explain in detail the interfacing of LED with 8085

Result: Calculate the Delay .Generate a delay of 0.5 sec.

Exercise No7: (2 Hours) – 1 Practical

STEPPER MOTOR INTERFACING WITH 8255

Aim: To write a program to rotate the stepper motor clockwise/anticlockwise through definite number of steps.

Statement: Interface the stepper motor to 8255. Rotate the stepper motor clockwise/anticlockwise direction.

Logic: Initialize Stack pointer and 8255 port A as output port.
Out this control word to control word register.
Give data CC H to accumulator to activate the stepper motor.
Load the count in one of the register to determine number of steps.

LOOP1: Use RLC instruction in order to rotate clockwise.
Out it to PortA where we have connected stepper motor.
Call delay subroutine.
Decrement the count.
Check the count for Zero. If no, Jump to LOOP1.Otherwise,
Give data CC H to accumulator to activate the stepper motor.
Load the count in one of the register to determine number of steps

LOOP2: Use RRC instruction in order to rotate anticlockwise.
Out it to PortA where we have connected stepper motor.
Call delay subroutine.
Decrement the count.
Check the count for Zero. If no, Jump to LOOP2
Stop.

DELAY: Load one register with count.
Decrement the register.
Check for Zero.
If no, Jump to step 2of the delay.
If yes, Return to the main program.

Theory: Write a program according to the logic .
Write the control word for 8255 interfacing for stepper motor explaining in details ,the design steps.
Explain working of a stepper motor and the interfacing circuit with neat diagram.
Explain in detail the interfacing of stepper motor with 8085.

Conclusion: Stepper motor rotating clockwise and anticlockwise proves the program for I/F is correct.

Exercise No8: (2 Hours) – 1 Practical

STUDY OF 8253

Aim: Study 8253, "The programmable interval timer"
Description: Explain:

1. Features of 8253.
2. Pin diagram ,Block diagram and functional description of 8253.
3. Modes of 8253(e.g 8253 is a Programmable interval timer IC working in 6 different modes-Modes0 to5.
   Mode 0 is Interrupt on terminal count mode.
   Mode 1 is Programmable one shot mode.
   Mode 2 is Rate/Pulse generator mode. Mode 3 is square wave generator mode. Mode 4 is software triggered strobe.
   Mode 5 is Hardware triggered strobe.
   Explain each mode in detail considering different cases with neat diagrams
4. Write the control word for 8253.
5. 8253 interfacing with 8085.

Exercise No 9: (2 Hours) – 1 Practical

11 STUDY OF 8259

Aim: Study of the priority interrupt controller 8259
Description: Explain

1. Features of 8259.
2. Pin diagram, Block diagram and functional description of 8259.
3. Priority modes of 8259.
4. 8259 interfacing
5. Cascading of 8259

3. Quiz on the subject:

Quiz should be conducted on tips in the laboratory, recent trends and subject knowledge of the subject. The quiz questions should be formulated such that questions are normally are from the scope outside of the books. However twisted questions and self formulated questions by the faculty can be asked but correctness of it is necessarily to be thoroughly checked before the conduction of the quiz.

Sample Questions:

1. Define Microprocessor.
2. Define stack, stack pointer.
3. Define Memory.
4. What is RAM? Is RAM a volatile memory?
5. What is ROM? Is ROM used to store the binary codes for the instructions or lookup table?Why?
6. What is the function of 'Timing and control unit' in microprocessor?
7. Which are the different types of buses used in microprocessor?
8. Explain fetching, decoding and execution operations of microprocessor.
9. Explain the difference between PROM,EPROM AND EEPROM.
10. Explain Different Blocks Of Microprocessor.
11. How many data lines, address lines are present in 8085.
12. How many address lines are required to access 2MB of memory.
13. List the internal registers in 8085.Describe the primary function of each register.
14. Give the clock frequency of 8085 operating with each of following frequency crystals:6.25MHZ,6.144MHz,5MHz,4MHz
15. Give the format of Flag Register in 8085.Explain each flag.
16. Why AD0-AD7 lines are multiplexed?
17. What is the use of ALE signal?
18. What is the use of 'clock out' and 'reset out' signals of 8085?
19. Describe function of following pins in 8085:
    (1) READY (2) ALE (3) IO/M' (4) HOLD (5) RESET
20. List the instructions related to DMA operation in 8085.
21. Stress out the necessity of having two status lines S1 and S0 in 8085.
22. List out different control signals used by 8085.
23. On power on reset, what is the content of PC ?
24. List the instructions related to serial operation in 8085.
25. List the different addressing modes of 8085.
26. Explain following instructions:
    1) PUSH 2)POP 3)CALL 4)RET
27. Explain 8255.
28 Explain 8253.
29. Explain 8257.
30. Explain 8279.
31. Explain 8259.

4. Conduction of Viva-Voce Examinations:

Teacher should conduct oral exams of the students with full preparation. Normally, the objective questions with guess should be avoided. To make it meaningful, the questions should be such that depth of the students in the subject is tested. Oral examinations are to be conducted in cordial environment amongst the teachers taking the examination. Teachers taking such examinations should not have ill thoughts about each other and courtesies should be offered to each other. Difference of opinion, if any, should be critically suppressed in front of the students.

5. Evaluation and marking system:

Basic honesty in the evaluation and marking system is absolutely essential and in the process impartial nature of the evaluator is required in the examination. It is a wrong approach to award the students by way of easy marking to get cheap popularity among the students, which they do not deserve. It is a primary responsibility of the teacher to see that right students who are really putting up lot of hard work with right kind of intelligence are correctly awarded.

The marking patterns should be justifiable to the students without any ambiguity and teacher should see that students are faced with just circumstances.