Apex College

Affiliated to Pokhara University

LAB

MANUAL

ON

MICROPROCESSOR

BCIS: IV SEM

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INTRODUCTION TO MICROPROCESSOR 8085

▷ Aim

To study the microprocessor 8085

▷ Architecture of 8085 Microprocessor

a) General purpose registers

It is an 8 bit register i.e. B, C, D, E, H, and L. The combination of 8 bit register is known as register pair, which can hold 16 bit data. The HL pair is used to act as memory pointer is accessible to program.

b) Accumulator

It is an 8 bit register which hold one of the data to be processed by ALU and stored the result of the operation.

c) Program counter (PC)

It is a 16 bit pointer which maintains the address of a byte entered to line stack.

d) Stack pointer (SP)

It is a 16 bit special purpose register which is used to hold line memory address for line next instruction to be executed.

e) Arithmetic and logical unit

It carries out arithmetic and logical operation by 8 bit address it uses the accumulator content as input the ALU result is stored back into accumulator.

f) Temporary register

It is an 8 bit register associated with ALU hold data, entering an operation, used by the microprocessor and not accessible to programs.

g) Flags

Flag register is a group of fire, individual flip flops line content of line flag register will change after execution of arithmetic and logic operation. The line states flags are

i) Carry flag (C)
ii) Parity flag (P)
iii) Zero flag (Z)
iv) Auxiliary carry flag (AC)
v) Sign flag (S)

h) Timing and control unit

Synchronizes the microprocessor operation with the clock and generates control signal from it necessary to communicate between controller and peripherals.

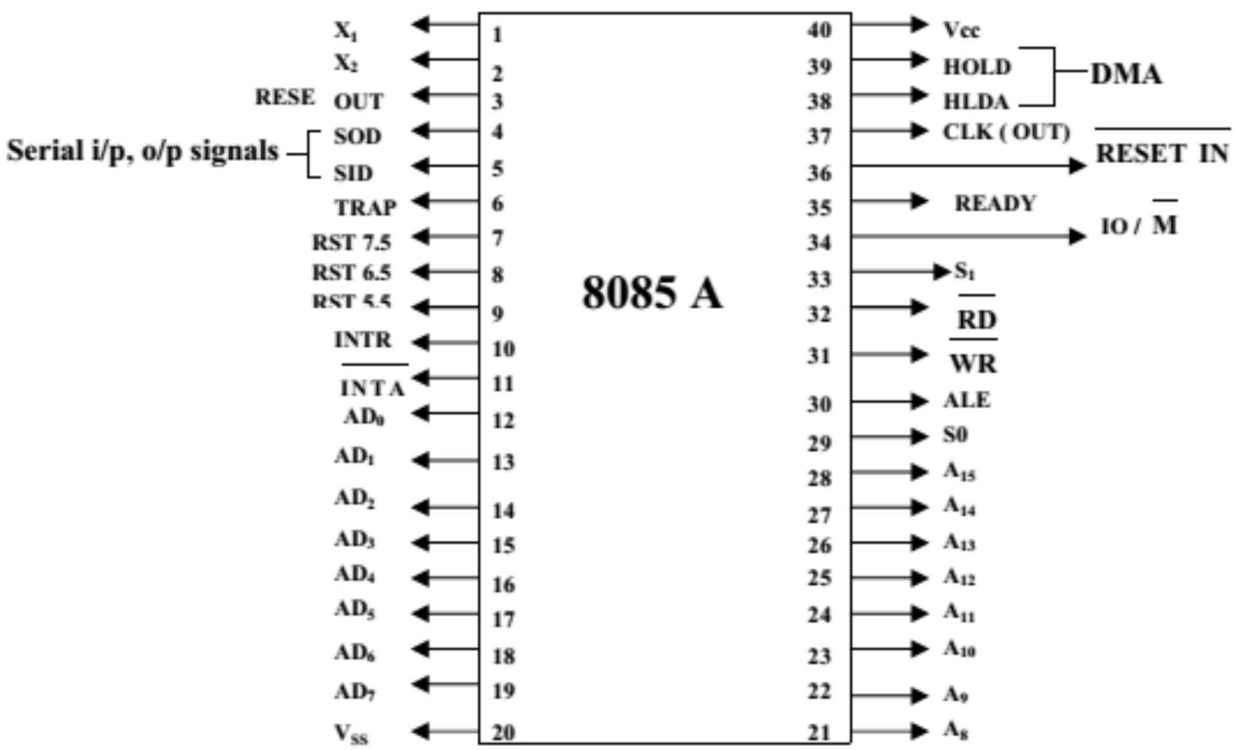
i) Instruction register and decoder

Instruction is fetched from line memory and stored in line instruction register decoder the stored information.

j) Register Array

These are used to store 8 bit data during execution of some instruction.

PIN Description



Pin Diagram of 8085

a) Address Bus

1. The pins A0 – A15 denote the address bus.
2. They are used for most significant bit.

b) Address / Data Bus

1. AD0 – AD7 constitutes the address / Data bus.
2. These pins are used for least significant bit.

c) ALE: (Address Latch Enable)

The signal goes high during the first clock cycle and enables the lower order address bits.

d) IO / M

1. This distinguishes whether the address is for memory or input. 2.
When these pins go high, the address is for an I/O device.

e) S0 – S1

S0 and S1 are status signal which provides different status and functions.

f) RD

1. This is an active low signal.
2. This signal is used to control READ operation of the microprocessor.

g) WR

1. WR is also an active low signal.
2. Controls the write operation of the microprocessor.

h) HOLD

1. This indicates if any other device is requesting the use of address and data bus.

i) HLDA

1. HLDA is the acknowledgement signal for HOLD.

j) INTR

1. INTE is an interrupt request signal.
2. IT can be enabled or disabled by using software.

k) INTA

1. Whenever the microprocessor receives interrupt signal 2.

It has to be acknowledged.

l*) RST 5.5, 6.5, 7.5*

1. These are nothing but the restart interrupts.
2. They insert an internal restart junction automatically.

m) TRAP

1. Trap is the only non-maskable interrupt.
2. It cannot be enabled (or) disabled using program.

n) RESET IN

1. This pin resets the program counter to 0 to 1 and results interrupt enable and HLDA flip flops.

o) X1, X2

These are the terminals which are connected to external oscillator to produce the necessary and suitable clock operation.

p) SID

This pin provides serial input data

q) SOD

This pin provides serial output data

r) VCC and VSS

1. VCC is +5V supply pin

2. VSS is ground pin

s) Specifications

1. Processors

Intel 8085 at E144 MHz clock **2.**

Memory

Monitor RAM: 0000 – IFFF EPROM

Expansion:2000 – 3FFF's 0000-FFFF

System RAM: 4000 – 5FFF

Monitor data area 4100 – 5FFF

RAM Expansion 6000 – BFFF

3. Input / Output

Parallel: A8 TTL input timer with 2 number of 32-55 only input timer available in

4. Serial: Only one number RS 232-C, Compatible, crucial interface using 8281A

5. Timer: 3 channels-16 bit programmable units, using 8253 channel '0' used for no band late.

6. Clock generator: Channel '1' is used for single stopping used program.

7. Display: 6 digits – 7 segments LED display with filter 4 digit for adder display and 2 digits for data display.

8. Key board: 21 keys, soft keyboard including common keys and hexadecimal keys.

RES: Reset keys allow terminating present activity and retaining to its on initialize state.

INT: Maskable interrupt connect to CPU's RST 7.5 interrupt.

DEC: Decrement the adder by 1.

EXEC: Execute line particular value after selecting address through go command.

NEXT: Increment the address by 1 and then display its content.

9. System Power Consumption

Micro BSEB2 MICRO SSEB

+5V @ 1Amp +5V@ 800 mA

+12V @ 200 mA

- 12V @ 100 mA EE0310-Microprocessor & Microcontroller Lab

10. Power Supply Specification

MICRO SSEM

230V, AC @ 80 Hz

+5V @ 600 mA

▷ Enter Program into Trainer Kit

1. Press 'RESET' key
2. Sub (key processor represent address field)
3. Enter the address (16 bit) and digit in hex
4. Press 'NEXT' key
5. Enter the data
6. Again press "NEXT"

7. Again after taking the program, are use HLT instructions its Hex code
8. Press “NE

▹ How to Execute Program

1. Press “RESET”
2. Press “GO”
3. Enter the address location in which line program was executed
4. Press “Execute” key

▹ Result

Thus 8085 microprocessor was studied successfully.

8085 INSTRUCTION SET

Instructions can be categorized according to their method of addressing the hardware registers and/or memory.

▹ Implied Addressing

The addressing mode of certain instructions is implied by the instruction's function. For example, the STC (set carry flag) instruction deals only with the carry flag, the DAA (decimal adjust accumulator) instruction deals with the accumulator.

▹ Register Addressing

Quite a large set of instructions are call for register addressing. With these instructions, you must specify one of the registers A through E, H or L as well as the operation code. With these instructions, the accumulator is implied as a second operand. For example, the instruction CMP E may be interpreted as 'compare the contents of the E register with the contents of the accumulator.

▹ Immediate Addressing

Instructions that use immediate addressing have data assembled as a part of the instruction itself. For example, the instruction CPI 'C' may be interpreted as 'compare the contents of the accumulator with the letter C. When assembled, this instruction has the hexadecimal value FE43. Hexadecimal 43 is the internal representation for the letter C. When this instruction is executed, the processor fetches the first instruction byte and determines that it must fetch one more byte. The processor fetches the next byte into one of its internal registers and then performs the compare operation.

▹ Direct Addressing

Jump instructions include a 16-bit address as part of the instruction. For example, the instruction JMP 1000H causes a jump to the hexadecimal address 1000 by replacing the current contents of the program counter with the new value 1000H.Instructions that include a direct address require three bytes of storage: one for the instruction code, and two for the 16-bit address.

▹ Register Indirect Addressing

Register indirect instructions reference memory via a register pair. Thus, the instruction MOV M, C moves the contents of the C register into the memory address stored in the H and L register pair. The instruction LDAX B loads the accumulator with the byte of data specified by the address in the B and C register pair.

▹ Combined Addressing Modes

Some instructions use a combination of addressing modes. A CALL instruction, for example, combines direct addressing and registers indirect addressing. The direct address in a CALL instruction specifies the address of the desired subroutine; the register indirect address is the stack pointer. The CALL instruction pushes the current contents of the program counter into the memory location specified by the stack pointer.

▹ Timing Effects of Addressing Modes

Addressing modes affect both the amount of time required for executing an instruction and the amount of memory required for its storage. For example, instructions that use implied or register addressing, execute very quickly since they deal directly with the processor's hardware or with data already present in hardware registers. Most important, however is that the entire instruction can be fetched with a single memory access. The number of memory accesses required is the single greatest factor in determining execution timing. More memory accesses therefore require more execution time. A CALL instruction for example, requires five memory accesses: three to access the entire instruction and two more to push the contents of the program counter onto the stack.

▹ Instruction Naming Conventions

The mnemonics assigned to the instructions are designed to indicate the function of the instruction. The instructions fall into the following functional categories:

Data Transfer Group

The data transfer instructions move data between registers or between memory and registers.

MOV Move
MVI Move Immediate
LDA Load Accumulator Directly from Memory
STA Store Accumulator Directly in Memory
LHLD Load H & L Registers Directly from Memory
SHLD Store H & L Registers Directly in Memory

An 'X' in the name of a data transfer instruction implies that it deals with a register pair(16- bits).

LXI Load Register Pair with Immediate data
LDAX Load Accumulator from Address in Register Pair
STAX Store Accumulator in Address in Register Pair XCHG
Exchange H & L with D & E
XTHL Exchange Top of Stack with H & L

Arithmetic Group

The arithmetic instructions add, subtract, increment, or decrement data in registers or memory.

ADD Add to Accumulator
ADI Add Immediate Data to Accumulator
ADC Add to Accumulator Using Carry Flag
ACI Add Immediate data to Accumulator Using Carry
SUB Subtract from Accumulator
SUI Subtract Immediate Data from Accumulator
SBB Subtract from Accumulator Using Borrow (Carry) Flag
SBI Subtract Immediate from Accumulator Using Borrow (Carry) Flag
INR Increment Specified Byte by One

DCR Decrement Specified Byte by One

INX Increment Register Pair by One DCX

Decrement Register Pair by One

DAD Double Register Add; Add Content of Register Pair to H & L Register Pai

Logical Group

This group performs logical (Boolean) operations on data in registers and memory and on condition flags.

The logical AND, OR, and Exclusive OR instructions enable you to set specific bits in the accumulator ON or OFF.

ANA Logical AND with Accumulator

ANI Logical AND with Accumulator Using Immediate Data

ORA Logical OR with Accumulator

ORI Logical OR with Accumulator Using Immediate Data

XRA Exclusive Logical OR with Accumulator

XRI Exclusive OR Using Immediate Data

The Compare instructions compare the content of an 8-bit value with the contents of the accumulator.

CMP Compare

CPI Compare Using Immediate Data

The rotate instructions shift the contents of the accumulator one bit position to the left or right.

RLC Rotate Accumulator Left

RRC Rotate Accumulator Right RAL

Rotate Left Through Carry RAR Rotate

Right Through Carry

Complement and carry flag instructions:

CMA Complement Accumulator

CMC Complement Carry Flag STC

Set Carry Flag

Branch Group

The branching instructions alter normal sequential program flow, either unconditionally or conditionally. The unconditional branching instructions are as follows:

JMP Jump

CALL Call

RET Return

Conditional branching instructions examine the status of one of four condition flags to determine whether the specified branch is to be executed. The conditions that may be specified are as follows:

NZ Not Zero (Z = 0)

Z Zero (Z = 1)

NC	No Carry (C = 0)
C	Carry (C = 1)
PO	Parity Odd (P = 0)
PE	Parity Even (P = 1)
P	Plus (S = 0)
M	Minus (S = 1)

Thus, the conditional branching instructions are specified as follows:

Jumps	**Calls**	**Returns**
JC	CC	RC (Carry)
JNC	CNC	RNC (No Carry)
JZ	CZ	RZ (Zero)
JNZ	CNZ	RNZ (Not Zero)
JP	CP	RP (Plus)
JM	CM	RM (Minus)
JPE	CPE	RPE (Parity Even)
JP0	CPO	RPO (Parity Odd)

Two other instructions can affect a branch by replacing the contents or the program counter:

PCHL Move H & L to Program Counter
RST Special Restart Instruction Used with Interrupts

▹ Stack Control Instructions

The following instructions affect the Stack and/or Stack Pointer:

PUSH Push Two bytes of Data onto the
Stack POP Pop Two Bytes of Data off the
Stack XTHL Exchange Top of Stack with H &
L SPHL Move content of H & L to Stack
Pointer

▹ The I/O instructions

IN Initiate Input
Operation OUT Initiate Output
Operation

▹ Machine Control

instruction

EI Enable Interrupt System
DI Disable Interrupt System
HLT Halt
NOP No Operation

LIST OF INSTRUCTIONS (WITH OPCODE AND DESCRIPTION) OF 8085 MICROPROCESSOR

Sr. No.	Mnemonics, Operand	Opcode	Bytes
1.	ACI Data	CE	2
2.	ADC A	8F	1
3.	ADC B	88	1
4.	ADC C	89	1
5.	ADC D	8A	1
6.	ADC E	8B	1
7.	ADC H	8C	1
8.	ADC L	8D	1
9.	ADC M	8E	1
10.	ADD A	87	1
11.	ADD B	80	1
12.	ADD C	81	1
13.	ADD D	82	1
14.	ADD E	83	1
15.	ADD H	84	1
16.	ADD L	85	1
17.	ADD M	86	1
18.	ADI Data	C6	2
19.	ANA A	A7	1
20.	ANA B	A0	1
21.	ANA C	A1	1
22.	ANA D	A2	1
23.	ANA E	A3	1
24.	ANA H	A4	1
25.	ANA L	A5	1
26.	ANA M	A6	1
27.	ANI Data	E6	2
28.	CALL Label	CD	3
29.	CC Label	DC	3
30.	CM Label	FC	3
31.	CMA	2F	1
32.	CMC	3F	1
33.	CMP A	BF	1
34.	CMP B	B8	1
35.	CMP C	B9	1
36.	CMP D	BA	1
37.	CMP E	BB	1
38.	CMP H	BC	1
39.	CMP L	BD	1
40.	CMP M	BD	1
41.	CNC Label	D4	3
42.	CNZ Label	C4	3

Sr. No.	Mnemonics, Operand	Opcode	Bytes
43.	CP Label	F4	3
44.	CPE Label	EC	3
45.	CPI Data	FE	2
46.	CPO Label	E4	3
47.	CZ Label	CC	3
48.	DAA	27	1
49.	DAD B	09	1
50.	DAD D	19	1
51.	DAD H	29	1
52.	DAD SP	39	1
53.	DCR A	3D	1
54.	DCR B	05	1
55.	DCR C	0D	1
56.	DCR D	15	1
57.	DCR E	1D	1
58.	DCR H	25	1
59.	DCR L	2D	1
60.	DCR M	35	1
61.	DCX B	0B	1
62.	DCX D	1B	1
63.	DCX H	2B	1
64.	DCX SP	3B	1
65.	DI	F3	1
66.	EI	FB	1
67.	HLT	76	1
68.	IN Port-address	DB	2
69.	INR A	3C	1
70.	INR B	04	1
71.	INR C	0C	1
72.	INR D	14	1
73.	INR E	1C	1
74.	INR H	24	1
75.	INR L	2C	1
76.	INR M	34	1
77.	INX B	03	1
78.	INX D	13	1
79.	INX H	23	1
80.	INX SP	33	1
81.	JC Label	DA	3
82.	JM Label	FA	3
83.	JMP Label	C3	3
84.	JNC Label	D2	3
85.	JNZ Label	C2	3
86.	JP Label	F2	3
87.	JPE Label	EA	3
88.	JPO Label	E2	3
89.	JZ Label	CA	3

Sr. No.	Mnemonics, Operand	Opcode	Bytes
90.	LDA Address	3A	3
91.	LDAX B	0A	1
92.	LDAX D	1A	1
93.	LHLD Address	2A	3
94.	LXI B	01	3
95.	LXI D	11	3
96.	LXI H	21	3
97.	LXI SP	31	3
98.	MOV A, A	7F	1
99.	MOV A, B	78	1
100.	MOV A, C	79	1
101.	MOV A, D	7A	1
102.	MOV A, E	7B	1
103.	MOV A, H	7C	1
104.	MOV A, L	7D	1
105.	MOV A, M	7E	1
106.	MOV B, A	47	1
107.	MOV B, B	40	1
108.	MOV B, C	41	1
109.	MOV B, D	42	1
110.	MOV B, E	43	1
111.	MOV B, H	44	1
112.	MOV B, L	45	1
113.	MOV B, M	46	1
114.	MOV C, A	4F	1
115.	MOV C, B	48	1
116.	MOV C, C	49	1
117.	MOV C, D	4A	1
118.	MOV C, E	4B	1
119.	MOV C, H	4C	1
120.	MOV C, L	4D	1
121.	MOV C, M	4E	1
122.	MOV D, A	57	1
123.	MOV D, B	50	1
124.	MOV D, C	51	1
125.	MOV D, D	52	1
126.	MOV D, E	53	1
127.	MOV D, H	54	1
128.	MOV D, L	55	1
129.	MOV D, M	56	1
130.	MOV E, A	5F	1
131.	MOV E, B	58	1
132.	MOV E, C	59	1
133.	MOV E, D	5A	1
134.	MOV E, E	5B	1
135.	MOV E, H	5C	1
136.	MOV E, L	5D	1

Sr. No.	Mnemonics, Operand	Opcode	Bytes
137.	MOV E, M	5E	1
138.	MOV H, A	67	1
139.	MOV H, B	60	1
140.	MOV H, C	61	1
141.	MOV H, D	62	1
142.	MOV H, E	63	1
143.	MOV H, H	64	1
144.	MOV H, L	65	1
145.	MOV H, M	66	1
146.	MOV L, A	6F	1
147.	MOV L, B	68	1
148.	MOV L, C	69	1
149.	MOV L, D	6A	1
150.	MOV L, E	6B	1
151.	MOV L, H	6C	1
152.	MOV L, L	6D	1
153.	MOV L, M	6E	1
154.	MOV M, A	77	1
155.	MOV M, B	70	1
156.	MOV M, C	71	1
157.	MOV M, D	72	1
158.	MOV M, E	73	1
159.	MOV M, H	74	1
160.	MOV M, L	75	1
161.	MVI A, Data	3E	2
162.	MVI B, Data	06	2
163.	MVI C, Data	0E	2
164.	MVI D, Data	16	2
165.	MVI E, Data	1E	2
166.	MVI H, Data	26	2
167.	MVI L, Data	2E	2
168.	MVI M, Data	36	2
169.	NOP	00	1
170.	ORA A	B7	1
171.	ORA B	B0	1
172.	ORA C	B1	1
173.	ORA D	B2	1
174.	ORA E	B3	1
175.	ORA H	B4	1
176.	ORA L	B5	1
177.	ORA M	B6	1
178.	ORI Data	F6	2
179.	OUT Port-Address	D3	2
180.	PCHL	E9	1
181.	POP B	C1	1
182.	POP D	D1	1
183.	POP H	E1	1

Sr. No.	Mnemonics, Operand	Opcode	Bytes
184.	POP PSW	F1	1
185.	PUSH B	C5	1
186.	PUSH D	D5	1
187.	PUSH H	E5	1
188.	PUSH PSW	F5	1
189.	RAL	17	1
190.	RAR	1F	1
191.	RC	D8	1
192.	RET	C9	1
193.	RIM	20	1
194.	RLC	07	1
195.	RM	F8	1
196.	RNC	D0	1
197.	RNZ	C0	1
198.	RP	F0	1
199.	RPE	E8	1
200.	RPO	E0	1
201.	RRC	0F	1
202.	RST 0	C7	1
203.	RST 1	CF	1
204.	RST 2	D7	1
205.	RST 3	DF	1
206.	RST 4	E7	1
207.	RST 5	EF	1
208.	RST 6	F7	1
209.	RST 7	FF	1
210.	RZ	C8	1
211.	SBB A	9F	1
212.	SBB B	98	1
213.	SBB C	99	1
214.	SBB D	9A	1
215.	SBB E	9B	1
216.	SBB H	9C	1
217.	SBB L	9D	1
218.	SBB M	9E	1
219.	SBI Data	DE	2
220.	SHLD Address	22	3
221.	SIM	30	1
222.	SPHL	F9	1
223.	STA Address	32	3
224.	STAX B	02	1
225.	STAX D	12	1
226.	STC	37	1
227.	SUB A	97	1
228.	SUB B	90	1

Sr. No.	Mnemonics, Operand	Opcode	Bytes
229.	SUB C	91	1
230.	SUB D	92	1

Sr. No.	Mnemonics, Operand	Opcode	Bytes
231.	SUB E	93	1
232.	SUB H	94	1
233.	SUB L	95	1
234.	SUB M	96	1
235.	SUI Data	D6	2
236.	XCHG	EB	1
237.	XRA A	AF	1
238.	XRA B	A8	1
239.	XRA C	A9	1
240.	XRA D	AA	1
241.	XRA E	AB	1
242.	XRA H	AC	1
243.	XRA L	AD	1
244.	XRA M	AE	1
245.	XRI Data	EE	2
246.	XTHL	E3	1

LIST OF EXEPRIMENTS

ADDITION OF TWO 8-BIT NUMBERS

Aim: Write 8085 assembly language program for addition of two 8-bit numbers.

Instruments Required: 1. 8085 Microprocessor Kit
2. +5V Power supply

Theory : Consider the first number 42H is stored in memory location 8000H and the second number 35H is stored in memory location 8001H. The result after addition of two numbers is to be stored in the memory location 8002 H. Assume program starts from memory location 8500H.

Algorithm

1. Initialize the memory location of first number in HL register pair
2. Move first number/data into accumulator
3. Increment the content of HL register pair to initialize the memory location of second data
4. Add the second data with accumulator
5. Store the result in memory location 8003H

Program

Memory address	*Machine Codes*	*Mnemonics*	*Comments*
8500	21	LXI H, 8000 H	Address of first number in H-L register pair.
8501	00		
8502	80		
8503	7E	MOV A,M	Transfer first number in accumulator.
8504	23	INX H	Increment content of H-L register pair
8505	66	ADD M	Add first number and second number
8506	32	STA 8003H	Store sum in 8003 H
8507	03		
8508	80		
8509	76	HLT	Halt

Experimental Results

Input Data		*Result*	
Memory location	*Data*	*Memory location*	*Data*
8000	42H	8003	77H
8001	35H		

Calculation

Data 1: 42 - 0100 0010

Data 2: 35 - 0011 0101

Sum: 77 – 01110111

Carry: 00

Conclusion

The addition of two 8-bit numbers is performed using 8085 microprocessor where sum is 8-bit.

Precautions

1. Properly connect the 8085 microprocessor kit with power supply terminals.
2. Switch on the power supply after checking connections.
3. Handle the Trainer kit carefully.

Viva-Voice Questions

1. What is the function of LXI H, 8000 H instruction?
2. How you can store a data in a memory location?
3. How you can read a data from a memory location?
4. What are flags available in 8085?
5. What is the function of RESET key of an 8085 microprocessor kit?

SUBTRACTION OF TWO 8 BIT NUMBERS

Aim: Write 8085 assembly language program for subtraction of two 8-bit numbers.

Instruments Required: 1. 8085 Microprocessor Kit
2. +5V Power supply

Theory : Consider the first number 55H is stored in memory location 8000H and the second number 32H is stored in memory location 8001H. The result after subtraction of two numbers is to be stored in the memory location 8002H. Assume program starts from memory location 8500H.

Algorithm

1. Initialize the memory location of first number in HL register pair
2. Move first number/data into accumulator
3. Increment the content of HL register pair to initialize the memory location of second data
4. Subtract the second data with accumulator
5. Store the result in memory location 8003H

Program

Memory address	*Machine Codes*	*Mnemonics*	*Comments*
8500	21	LXI H, 8000 H	Address of first number in H-L register pair.
8501	00		
8502	80		
8503	7E	MOV A,M	Transfer first number in accumulator.
8504	23	INX H	Increment content of H-L register pair
8505	66	SUB M	Subtract first number and second number
Memory address	*Machine Codes*	*Mnemonics*	*Comments*
8506	32	STA 8003H	Store sum in 8003 H
8507	03		
8508	80		
8509	76	HLT	Halt

Experimental Results

Input Data		*Result*	
Memory location	*Data*	*Memory location*	*Data*
8000	55H	8003	23H
8001	32H		

Calculation

Data 1: 55 -0101 0101

Data 2: 32 -0011 0010

Difference: 23 -0010 0011

Borrow: 00

Conclusion

Subtraction of two 8-bit numbers is performed using 8085 microprocessor where sum is 8-bit.

Precautions

1. Properly connect the 8085 microprocessor kit with power supply terminals.
2. Switch on the power supply after checking connections.
3. Handle the Trainer kit carefully.

Viva-Voice Questions

1. What is the function of LXI H, 8000 H instruction?
2. How you can store a data in a memory location?
3. How you can read a data from a memory location?
4. What are flags available in 8085?
5. What is the function of RESET key of an 8085 microprocessor kit?

ADDITION OF TWO 16 BIT NUMBERS

Aim: To write an assembly language program for adding two 16 bit numbers using 8085 micro processor kit.

Instruments required: 1. 8085 Microprocessor Kit
2. +5V Power supply

Theory: Consider the first number 4283H is stored in memory location 8000H and 8001H; the second number 2931H is stored in memory location 8002H and 8003H. The result after addition of two numbers is to be stored in the memory location 8004H and 8005H. Assume program starts from memory location 8500H.

Algorithm

1. Start the microprocessor
2. Get the 1st 8 bit in 'C' register (LSB) and 2nd 8 bit in 'H' register (MSB) of 16 bit number.
3. Save the 1st 16 bit in 'DE' register pair
4. Similarly get the 2nd 16 bit number and store it in 'HL' register pair.
5. Get the lower byte of 1st number into 'L' register
6. Add it with lower byte of 2nd number
7. Store the result in 'L' register
8. Get the higher byte of 1st number into accumulator
9. Add it with higher byte of 2nd number and carry of the lower bit addition.
10. Store the result in 'H' register
11. Store 16 bit addition value in 'HL' register pair
12. Stop program execution

Program

Memory address	*Label*	*Mnemonics*		*Hex Code*	*Comments*
8500		MVI	C,00	0E	C = 00H
8501				00	
8502		LHLD	8000	2A	HL – 1st No.
8503				00	
8504				80	
8505		XCHG		EB	HL – DE
8506		LHLD	8002	2A	HL – 2nd No.
8507				02	
8508				80	
8509		DAD	D	19	Double addition DE + HL
850A		JNC	Ahead	D2	If Cy = 0, G0 to 850E
850B				0E	

Memory address	***Label***	***Mnemonics***		***Hex Code***	***Comments***
850C				85	
850D		INR	C	0C	C = C + 01
850E	AHEAD	SHLD	8004	22	HL –8004 (sum)
850F				04	
8510				80	
8511		MOV	C,A	79	Cy – A
8512		STA	8006	32	Cy – 8006
8513				06	
8514				80	
8515		HLT		76	Stop execution

Experimental Results

Input Data		***Result***	
Memory location	***Value***	***Memory location***	***Value***
8000	83 (addend)	8004	B4 (sum)
8001	42 (addend)	8005	6B (sum)
8002	31 (augend)	8006	00 (carry)
8003	29 (augend)		

Calculation

Lower Byte of Data1: $(83)_{16}$ 1000 0011 Higher Byte of Data1: $(42)_{16}$ 0100 0010

Lower Byte of Data2: $(31)_{16}$ 0011 0001 Higher Byte of Data2: $(29)_{16}$ 0010 1001

Lower Byte of Sum: $(B4)_{16}$ 1011 0100 Higher Byte of Sum: $(6B)_{16}$ 0110 1011

Carry: 00

Conclusion

Addition of two 16-bit numbers is performed using 8085 microprocessor where sum is 16-bit.

Precautions

1. Properly connect the 8085 microprocessor kit with power supply terminals.
2. Switch on the power supply after checking connections.
3. Handle the Trainer kit carefully.

Viva-Voice Questions

1. What is the function of XCHG instruction?
2. How you can store a data in a memory location?
3. How you can read a data from a memory location?
4. What are flags available in 8085?
5. What is the function of DAD, LHLD and SHLD instructions of 8085 microprocessor?

SUBTRACTION OF TWO 16 BIT NUMBERS

Aim: To write an assembly language program for subtracting two 16 bit numbers using 8085 microprocessor kit.

Instruments required: 1.8085 Microprocessor Kit
2. +5V Power supply

Theory: Consider the first number 4398H is stored in memory location 8000H and 8001H; the second number 4621H is stored in memory location 8002H and 8003H. The result after subtraction of two numbers is to be stored in the memory location 8004H and 8005H. Assume program starts from memory location 8500H.

Algorithm

1. Start the microprocessor
2. Get the 1st 16 bit in ‘HL’ register pair
3. Save the 1st 16 bit in DE register pair
4. Get the 2nd 16 bit number in HL register pair
5. Get the lower byte of 1st number
6. Get the subtracted value of 2nd number of lower byte by subtracting it with lower byte of 1st number
7. Store the result in ‘L’ register
8. Get the higher byte of 2nd number
9. Subtract the higher byte of 1st number from 2nd numbr with borrow
10. Store the result in ‘HL’ register
11. Stop the program execution

Program

Memory address	***Label***	***Mnemonics***		***Hex Code***	***Comments***
8500		MVI	C,00	0E	C = 00H
8501				00	
8502		LHLD	8000	2A	L – 1st No.
8503				00	
8504				80	
8505		XLHG		EB	HL – DE
8506		LHLD	8002	2A	HL – 2nd No.
8507				02	
8508				80	
8509		MOV	A,E	7B	LSB of ‘1’ to ‘A’
850A		SUB	L	95	A – A – L
850B		STA	8004	32	A – memory
850C				04	
850D				80	
850E		MOV	A,D	7A	MSB of 1 to A
850F		SBB	H	9C	A- A – H

Memory address	***Label***	***Mnemonics***	***Hex Code***	***Comments***

8510		STA	8005	32	A – memory
8511				05	
8512				80	
8513		HLT		76	Stop execution

Experimental Results

Input Data		***Result***	
Memory location	***Value***	***Memory location***	***Value***
8000	98	8004	22
8001	43	8005	55
8002	21	8006	00 (Borrow)
8003	46		

Calculation

Lower Byte of Data 1: 43 0100 0011

Lower Byte of Data 2: 21 0010 0001

Lower Byte of Difference: 22 00100010

Higher Byte of Data1: 98 1001 1000

Higher Byte of Data 2: 46 0100 0110

Higher Byte of Difference: 55

01010101 Borrow: 00

Conclusion

The subtraction of two 16-bit numbers is performed using 8085 microprocessor where result is 16-bit.

Precautions

1. Properly connect the 8085 microprocessor kit with power supply terminals.
2. Switch on the power supply after checking connections.
3. Handle the Trainer kit carefully.

Viva-Voice Questions

1. What is the function of XLHG instruction?
2. How you can store a data in a memory location?
3. How you can read a data from a memory location?
4. What are flags available in 8085?
5. What is the function of SBB, LHLD instructions of 8085 microprocessor?

MULTIPLICATION OF TWO 8 BIT NUMBERS

Aim: To write an assembly language for multiplying two 8 bit numbers by using 8085 micro processor kit.

Instruments required: 1.8085 Microprocessor Kit
2. +5V Power supply

Theory: Consider the first number 03H is stored in accumulator directly; the second number 05H is stored in memory location 8001H. The result after multiplication of two numbers is to be stored in the memory location 8001H and 8002H. Assume program starts from memory location 8500H.

Algorithm

1. Start the microprocessor
2. Get the 1st 8 bit No.
3. Move the 1st 8it No. to a register
4. Get the 2nd 8 bit number
5. Move the 2nd 8 bit No. to another register
6. Initialize the accumulator as zero
7. Initialize the carry as zero
8. Add both register value accumulator
9. Jump on if no carry
10. Increment carries by 1 if there is
11. Decrement the 2nd value and repeat from step 8, till the 2nd value becomes zero.
12. Store the multiplied value in accumulator
13. Move the carry value to
accumulator 14. Store the carry value in
accumulator

Program

Memory address	*Label*	*Mnemonics*		*Hex Code*	*Comments*
8500		MVI	A, 03	3E	A = 00H
8501				03	
8502		MOV	E,A	5F	E = A.
8503		MVI	D, 00	16	Get the first number in DE register pair
8504				00	
8505		LDA	8000	3A	Store the content of memory location into A
8506				00	
8507				80	
8508		MOV	C,A	4F	Initialize counter
8509		LXI	H, 0000	21	Result = 0
850A				00	
850B				00	
850C	BACK	DAD	D	19	Result = Result + first number

Memory address	*Label*	*Mnemonics*		*Hex Code*	*Comments*
850D		DCR	C	0D	Decrement counter
850E		JNZ	BACK	C2	If count 0 repeat
850F				0C	
8510				85	
8511		SHLD	8001	22	Store result
8512				01	
8513				80	
8514		HLT		76	Stop execution

Experimental Results

Input Data		*Result*	
Memory location	*Value*	*Memory location*	*Value*
8000	05	8001	0F
Accumulator	03	8002	00

Calculation

05 - 0000 0101

+ 05 -0000

0101

----- 0A - 0000

1010 + 05 -0000

0101

= 0F - 0000 1111

Conclusion

The multiplication of two 8-bit numbers is performed using 8085 microprocessor where result is 16-bit.

Precautions

1. Properly connect the 8085 microprocessor kit with power supply terminals.
2. Switch on the power supply after checking connections.
3. Handle the Trainer kit carefully.

Viva-Voice Questions

1. What is the function of DAD instruction?

2. How you can store a data in a memory location?
3. How you can read a data from a memory location?
4. What are flags available in 8085?
5. What is the function of SHLD instruction of 8085 microprocessor?

DIVISION OF TWO 8 BIT NUMBERS

Aim: To write an assembly language program for dividing two 8 bit numbers using microprocessor kit.

Instruments required: 1.8085 Microprocessor Kit
2. +5V Power supply

Theory: Consider the first number 09H is stored in memory location 8000H AND the second number 02H is stored in memory location 8001H. The result after division of two numbers is to be stored in the memory location 8002H (quotient) and 8003H (remainder). Assume program starts from memory location 8500H.

Algorithm

1. Start the microprocessor
2. Initialize the Quotient as 0
3. Load the 1st 8 bit data
4. Copy the contents of accumulator to register 'B'
5. Load the 2nd 8 bit data
6. Compare both the values
7. Jump if divisor is greater than dividend
8. Subtract the dividend value by divisor
9. Increment Quotient
10. Jump to step 7, till the dividend becomes zero
11. Store the result(Quotient) value in accumulator
12. Move the remainder value to accumulator
13. Store result in accumulator
14. Stop the program execution

Program

Memory address	*Label*	*Mnemonics*		*Hex Code*	*Comments*
8500		MVI	C, 00	0E	Initialize Quotient as zero
8501				00	
8502		LDA	8000	3A	Get the first number in Accumulator
8503				00	
8504				80	
8505		MOV	B,A	47	Copy the 1st data into register B

Memory address	*Label*	*Mnemonics*		*Hex Code*	*Comments*
8506		LDA	8001	3A	Get the second number in Accumulator
8507				01	
8508				80	
8509		CMP	B	B8	Compare the 2 values
850A		JC	LOOP1	DA	Jump if dividend lesser than divisor
850B				12	
850C				85	
850D	LOOP2	SUB	B	90	Subtract the 1st value by 2nd value
850E		INR	C	0C	Increment Quotient
850F		JMP		C3	Jump to Loop 1 till the value of dividend becomes zero
8510				0D	
8511				85	
8512	LOOP1	STA	8002	32	Store result
8513				02	
8514				80	
8515		MOV	A,C	79	Move the value of remainder to accumulator
8516		STA	8003	32	Store the remainder value in accumulator
8517				03	
8518				80	
8519		HLT			Stop execution

Experimental Results

Input Data		*Result*	
Memory location	*Value*	*Memory location*	*Value*
8000	09	8002	04 (quotient)
8001	02	8003	01 (reminder)

Calculation

1001
0010 – I

0111
0010 –
II ------
0101
0010 – III

-
001
1
0010 –
IV ------
0001 – carry

Quotient -

04 Carry -

01

Conclusion

The division of two 8-bit numbers is performed using 8085 microprocessor where result is 8 bit number quotient and 8 bit number remainder.

Precautions

1. Properly connect the 8085 microprocessor kit with power supply terminals.
2. Switch on the power supply after checking connections.
3. Handle the Trainer kit carefully.

Viva-Voice Questions

1. What is the function of CMP instruction?
2. How you can store a data in a memory location?
3. How you can read a data from a memory location?
4. What are flags available in 8085?
5. What is the function of JMP and JC instructions of 8085 microprocessor?

ASCENDING ORDER

Aim: To write a program to sort given 'n' numbers in ascending order

Instruments required: 1.8085 Microprocessor Kit
2. +5V Power supply

Theory: A series of five words 04, AB, BC, 01,0A in memory locations from 8000 to 8004 and number of words is stored in memory location 17B3:0300. Arrange the above words in Descending Order.

Algorithm

1. Start the microprocessor
2. Accumulator is loaded with number of values to sorted and is saved
3. Decrement 8 register (N-1) Repetitions)
4. Set 'HL' register pair as data array
5. Set C register as counter for (N-1) repetitions
6. Load a data of the array in accumulator
7. Compare the data pointed in 'HL' pair
8. If the value of accumulator is smaller than memory, then jump to step 10.
9. Otherwise exchange the contents of 'HL' pair and accumulator
10. Decrement 'C' register, if the of 'C' is not zero go to step 6
11. Decrement 'B' register, if value of B is not zero, go step 3
12. Stop the program execution

Program

Memory address	*Label*	*Mnemonics*	*Hex Code*	*Comments*
8500		LDA 8000	3A	Load the number of values
8501			00	
8502			80	
8503		MOV B,A	47	Move it 'B' register
8504		DCR B	05	For (N-1) comparisons
8505	Loop 3	LXI H, 8000	21	Set the pointer for array
8506			00	
8507			80	
8508		MOV C,M	4E	Count for (N-1) comparisons
8509		DCR C	0D	For (N-1) comparisons
850A		INX H	23	Increment pointer
850B	Loop 2	MOV A,M	7E	Get one data in array 'A'
850C		INX H	23	Increment pointer
850D		CMP M	BE	Compare next with accumulator

Memory address	*Label*	*Mnemonics*	*Hex Code*	*Comments*
850E		JC Loop1	DA	If content less memory go ahead
850F			16	
8510			85	
8511		MOV D,M	56	If it is greater than interchange it
8512		MOV M,A	77	Memory content
8513		DCX H	2B	Exchange the content of memory pointed by 'HL' by previous location
8514		MOV M,D	72	One in by 'HL' and previous location
8515		INX H	23	Increment pointer
8516	Loop 1	DCR C	0D	Decrement 'C' register
8517		JNZ Loop 1	C2	Repeat until 'C' is zero
8518			0B	
8519			85	
851A		DCR B	05	Decrement in 'B' values
851B		JNZ Loop 2	C2	Repeat till 'B' is zero
851C			05	
851D			80	
851E		HLT	76	Stop the program execution

Experimental Results

Input Data		*Result*	
Input Address	*Value*	*Output Address*	*Value*
8000	04	8000	04
8001	AB	8001	01
8002	BC	8002	0A
8003	01	8003	AB
8004	0A	8004	BC

Conclusion

The above assembly language program for sorting numbers in ascending order was executed by microprocessor kit and this program is stored into memory 8500 to 851E.

Precautions

1. Properly connect the 8085 microprocessor kit with power supply terminals.
2. Switch on the power supply after checking connections.
3. Handle the Trainer kit carefully.

Viva-Voice Questions

1. What do you mean by ascending order?
2. What is the function of CMP, LXI instructions?
3. How you can store the smallest number in memory?

LARGEST IN ARRAY

Aim: To find the largest element in an array of size ‘n’ using 8085 Microprocessor.

Instruments required: 1.8085 Microprocessor Kit
2. +5V Power supply

Theory: Find the largest number in a block of data. The length of the block is in memory location 8000H and the block itself starts from memory location 8001H. Store the maximum number in memory location 8050H. Assume that the numbers in the block are all 8 bit unsigned binary numbers.

Algorithm

1. Initialize counter
2. Maximum = Minimum possible value =0
3. Initialize pointer
4. Is number> maximum
5. Yes replace maximum
6. Decrement counter by one
7. Go to step 4 until counter= 0
8. Store maximum number
9. Terminate program execution

Program

Memory address	*Label*	*Mnemonics*	*Hex Code*	*Comments*
8500		LDA 8000	3A	Load the number of values
8501			00	
8502			80	
8503		MOV C,A	79	Initialize counter
8504		XRA A	AF	Clear Accumulator
8505		LXI H, 8001	21	Set the pointer for array
8506			01	
8507			80	
8508	BACK	CMP M	BD	Is number> maximum
8509		JNC SKIP	D2	No, jump to SKIP
850A			0D	
850B			85	
850C		MOV A,M	7E	replace maximum
850D	SKIP	INX H	23	Increment pointer
850E		DCR C	0D	Decrement counter by one
850F		JNZ BACK	C2	Go to next iteration
8510			08	
8511			85	

Memory address	*Label*	*Mnemonics*	*Hex Code*	*Comments*
8512		STA 8050	32	Store maximum number
8513			50	
8514			80	
8515		HLT	76	Terminate program execution

Experimental Results

Input Data		*Result*	
Input Address	*Value*	*Output Address*	*Value*
8000	04	8050	A9
8001	34		
8002	A9		
8003	78		
8004	56		

Conclusion

Program to find the smallest element in an array of size ‘n’ using 8085 Microprocessor has been executed.

Precautions

1. Properly connect the 8085 microprocessor kit with power supply terminals.
2. Switch on the power supply after checking connections.
3. Handle the Trainer kit carefully.

Viva-Voice Questions

1. What do you mean by XRA A?
2. What is the function of CMP, LXI, JNC, JNZ instructions?
3. How you can store the largest number in memory?

FIBONACCI SERIES

Aim: To write an assembly language program to display 'n' elements of the Fibonacci series using 8085 Microprocessor.

Instruments required: 1.8085 Microprocessor Kit
2. +5V Power supply

Theory: Find the Fibonacci series, where the length of the series is in memory location 8000H and the series itself starts from memory location 8001H.

Algorithm

1. Start the microprocessor
2. Load the length of series in the accumulator and decrement by 2
3. Move the value to register 'D'
4. Load the starting value of data address
5. Initialize the 1st number as 00
6. Move the pointer to 2nd data and initialize as '01'
7. Move the pointer to next position for next data
8. Initialize B as 00 and C as '01' for calculations
9. Copy the contents of 'B' to accumulator
10. Add the content of C register to accumulator
11. Move the content 'C' to 'B' and 'A' to C
12. Now store the result to memory pointed by HL pair
13. Move the pointer to next pointer
14. Decrement 0 by 1 for counter
15. If 'D' is not zero, go to step 9
16. If D is zero, end the program

Program

Memory address	*Label*	*Mnemonics*	*Hex Code*	*Comments*
8500		LDA 8000	3A	Store the length of series in 'A'
8501			00	
8502			80	
8503		SUI 02	D6	Decrement 'A' by 02
8504			02	
8505		MOV D,A	57	Move 'A' to 'D' (counter)
8506		LXI H, 8001	21	Load the starting address of array
8507			01	
8508			80	
8509		MVI M,00	36	Initialize 8001 as '00'
850A			00	

Memory address	*Label*	*Mnemonics*	*Hex Code*	*Comments*
850B		INX H	23	Increment pointer
850C		MVI M, 01	36	Initialize 2nd as '01'
850D			01	
850E		INX H	23	Increment pointer
850F		MVI B,00	06	Initialize 'B' as '00'
8510			00	
8511		MVI, C, 01	0E	Initialize 'C' as '01'
8512			01	
8513	Loop	MOV A,B	78	Move B to A
8514		ADD C	81	Add 'A' and 'C'
8515		MOV B,C	41	Move C to B
8516		MOV C,A	4F	Move A to C
8517		MOV M,A	77	Move the result to memory
8518		INX H	23	Increment pointer
8519		DCR D	15	Decrement counter
851A		JNZ Loop	C2	If D = 0, jump to loop
851B			13	
851C			80	
851D		HLT	76	Stop the program

Experimental Results

Input Data		*Result*	
Input Address	***Value***	***Output Address***	***Value***
8000	05	8001	00
		8002	01
		8003	01
		8004	02
		8005	03

Conclusion

The assembly language for Fibonacci series was executed successfully using 8085 microprocessor kit.

Precautions

1. Properly connect the 8085 microprocessor kit with power supply terminals.
2. Switch on the power supply after checking connections.
3. Handle the Trainer kit carefully.

Viva-Voice Questions

1. What do you mean by SUI?
2. What is the function of LXI, JNC, JNZ instructions?
3. How you can store the series in memory?

SUM OF SERIES OF DATA

Aim: To write an assembly language program to calculate the sum of data using 8085 microprocessor kit.

Instruments required: 1.8085 Microprocessor Kit
2. +5V Power supply

Theory: This program finds the sum of series of data stored from 8001H on wards, where length of series is stored in memory location 8000H. The sum is stored in memory location 8050H and carry is stored in 8051H memory location.

Algorithm

1. Start the microprocessor
2. Load the number of values in series in accumulator and move it to register C and load the starting address of array
3. Initialize the value of A as ‘00’
4. Move the value of ‘A’ to ‘B’ register
5. Add the content of accumulator with the data pointed by HL pair
6. If there exists a carry, increment ‘B’ by 1, if not continue
7. Increment the pointer to next data
8. Decrement the value of C by 1, which is used as counter
9. If ‘C’ is equal to zero, go to step 10 if not go to step 5.
10. Store the value of ‘A’ to memory, it shows the result
11. Move the content of B to A
12. Store the value of A tomemory
13. Stop the program

Program

Memory address	*Label*	*Mnemonics*	*Hex Code*	*Comments*
8500		LDA 8000	3A	Load accumulator with number of values
8501			00	
8502			80	
8503		MOV B,A	4F	Move it from A to C
8504		LXI H, 8001	21	Load the starting address of data array
8505			01	
8506			80	
8507		SUB A	97	Initialize 'A' as 00
8508		MOV B,A	47	Initialize 'B' as 00
8509	Loop	ADD M	86	Add the previous sum with next data

Memory address	*Label*	*Mnemonics*	*Hex Code*	*Comments*
850A		JNC Skip	D2	Jump on if no carry
850B			0E	
850C			85	
850D		INR B	04	Increment carry by one
850E	Skip	INX H	23	Increment pointer for next data
850F		DCR C	0D	Decrement 'C' by one
8510		JNZ Loop	C2	Jump if not zero
8511			09	
8512			85	
8513		STA 8050	32	Store the sum in accumulator
8514			50	
8515			80	
8516		MOV A,B	78	Move the value of carry to A from B
8517		STA 8051	32	Store the carry in memory
8518			51	
8519			80	
851A		HLT	76	End of program

Experimental Results

Input Data		*Result*	
Input Address	*Value*	*Output Address*	*Value*
8000	04	8050	17
8001	07	8051	00
8002	09		
8003	03		
8004	04		

Calculation

07 + 09 + 03 + 04 =
23 = 17(in Hexa
decimal) (0F + 8 =233)
0F = 0000
1111 08 =
0000 1000 -----
----------0001
0111

Conclusion

The assembly language program for sum of data was executed successfully using 8085 microprocessor kit.

Precautions

1. Properly connect the 8085 microprocessor kit with power supply terminals.
2. Switch on the power supply after checking connections.
3. Handle the Trainer kit carefully.

Viva-Voice Questions

1. What do you mean by carry?
2. What is the function of LXI, JNC, JNZ instructions?
3. How you can store the series in memory?

FACTORIAL OF 8 BIT NUMBER USING SUBROUTINE

Aim: To write a program to calculate the factorial of a number (between 0 to 8)

Instruments required: 1.8085 Microprocessor
Kit 2. +5V Power supply

Theory: This program finds the factorial of a number stored in 8000H memory location. The result is stored in memory location 8050H.

Algorithm:

1. Initialize the stack pointer
2. Get the number in accumulator
3. Check for if the number is greater than 1. If no store the result otherwise go to next step.
4. Load the counter and initialize result
5. Now factorial program in sub-routine is called.
6. In factorial,initialize HL RP with0. Move the count value to B
7. Add HL content with Rp.
8. Decrement count (for multiplication)
9. Exchange content of Rp(DE) with HL.
10. Decrement counter (for factorial)till zero flag is set.
11. Store the result
12. Halt

Program

Memory Address	***Label***	***Hex Code***	***Mnemonics***	***Comments***
8500 8501 8502		3A 00 80	LDA 8000	Get the number in accumulator
8503 8504		FE 02	CPI 02H	Compare data with 2 and check it is greater than 1
8505 8506 8507		DA 17 85	JC Loop 1	If cy =1 jump to loop 1 If cy = 0 proceed
8508		5F	MOV E,A	Move content of A to E
8509 850A		16 00	MVI D,00	Load this term as a result
850B		3D	DCR A	Decrement accumulator by 1
850C		4F	MOV C,A	Move ‘A’ content to ‘C’ (counter 1 less than A)

Memory Address	Label	Hex Code	Mnemonics	Comments
850D 850E 850F		CD 00 86	CALL Facto	Call sub routine program Facto
8510		EB	XCHG	Exchange (DE) – (HL)
8511 8512 8513		22 50 80	SHLD 8050	Store content of HL in specified memory location
8514 8515 8516		C3 1D 85	JMP Loop 3	Jump to Loop 3
8517 8518 8519	Loop1	21 00 01	LXI H,0001H	HL is loaded with data 01
851A 851B 851C		22 50 80	SHLD 8050	Store the result in memory
851D	Loop3	76	HLT	Terminate the program

Sub Routine

Memory Address	Label	Hex Code	Mnemonics	Comments
8600 8601 8602	Facto	21 00 00	LXI H,0000	Initialize HL pair
8603		41	MOV B,C	Content of 'C' is moved to B
8604	Loop2	19	DAD D	Content of DE is added with HL
8605		05	DCR B	'B' is decremented
8606 8607 8608		C2 04 86	JNZ Loop 2	Multiply by successive addition till zero flag is set
		EB	XCHG	[DE] – [HL]
		0D	DCR C	Decrement counter value
		C4 00 46	CNZ Facto	Call on no zero to facto (i.e repeat process till zero flag for c = 1)
		C9	RET	Return to main program

Experimental Results

Input Data		Result	
Input Address	**Value**	**Output Address**	**Value**
8000	04	8050	18

Conclusion

The assembly language program for factorial of 8 bit number was executed successfully using 8085 microprocessor kit.

Precautions

1. Properly connect the 8085 microprocessor kit with power supply terminals.
2. Switch on the power supply after checking connections.
3. Handle the Trainer kit carefully.

Viva-Voice Questions

1. What do you mean by CALL?
2. What is the function of SHLD, CNZ instructions?
3. How subroutine is executed?

1's COMPLEMENT OF AN 8 BIT NUMBER

Aim: Write 8085 assembly language program for one's complement of an 8-bit numbers **Instruments Required**: 1.8085 Microprocessor Kit

2. +5V Power supply

Theory: The number is stored in memory location 8050H and one's complement of number will be stored in location 8051H. Assume the program memory starts from 8000H.

Algorithm

1. Load memory location of data 8000H in H-L registers pair.
2. Move data into accumulator
3. Complement accumulator
4. Store the result in memory location

8050H **Program**

Memory Address	*Hex Code*	*Mnemonics*	*Comments*
8500	21	LXI H,8000H	Load address of number in H-L register pair
8501	00		
8502	80		
8503	7E	MOV A,M	Move number into accumulator
8504	3F	CMA	Complement accumulator
8505	32	STA 8050H	Store the result in 8050H
8506	50		
8507	80		
8508	76	HLT	Stop Execution

Experimental Results

Input Data		*Result*	
Input Address	*Value*	*Output Address*	*Value*
8000	F0H	8050	0FH

Conclusion

The one's complement of an 8-bit numbers is performed using 8085 microprocessor**.**

Precautions

1. Properly connect the 8085 microprocessor kit with power supply terminals.
2. Switch on the power supply after checking connections.
3. Handle the Trainer kit carefully.

Viva-Voice Questions:

1. Define one's complement of an 8-bit numbers.
2. What is the function of CMA instruction?

2's COMPLEMENT OF AN 8 BIT NUMBER

Aim: Write 8085 assembly language program for two's complement of an 8-bit numbers

Instruments Required: 1.8085 Microprocessor Kit
2. +5V Power supply

Theory: The number is stored in memory location 8000H. The two's complement will be stored in 8050H. The program is written from memory location 8500H.

Algorithm

1. Transfer the content of memory location 8500H to accumulator.
2. Complement the content of accumulator
3. Add 01H with accumulator to get two's complement of number
4. Store the result in memory location 8501H

Program

Memory Address	*Hex Code*	*Mnemonics*	*Comments*
8500	21	LXI H,8000H	Load address of number in H-L register pair
8501	00		
8502	80		
8503	7E	MOV A,M	Move number into accumulator
8504	3F	CMA	Complement accumulator
8505	C6	ADI 01	Add 01H with accumulator to find two's complement of number
8506	01	01	
8507	32	STA 8050H	Store the result in 8050H
8508	50		
8509	80		
850A	76	HLT	Stop Execution

Experimental Results

Input Data		*Result*	
Input Address	*Value*	*Output Address*	*Value*
8000	F0H	8050	10H

Conclusion:

The two's complement of an 8-bit numbers is performed using 8085 microprocessor.

Precautions

1. Properly connect the 8085 microprocessor kit with power supply terminals.
2. Switch on the power supply after checking connections.
3. Handle the Trainer kit carefully.

Viva-Voice Questions:

1. Define two's complement of an 8-bit numbers.
2. What is the function of CMA instruction?
3. Why ADI 01H is used in two's complement of an 8-bit number.

BLOCK TRANSFER PROGRAM

Aim: Write 8085 assembly language program to transfer block of 16 bytes data from source to destination.

Instruments Required: 1.8085 Microprocessor Kit
2. +5V Power supply

Theory: The block of 16 byte data stored in memory locations 8000H onwards and transfers this data to another memory locations and store from 8050 onwards.

Algorithm

1. Initialize counter
2. Initialize source memory pointer
3. Initialize destinationMemory pointer
4. Get byte from source memory block
5. Store byte in the destinationMemory block
6. Decrement source memory pointer
7. Decrement destinationMemory pointer
8. Decrement counter
9. If counter0 repeat
10. Stop execution

Program

Memory Address	***Hex Code***	***Label***	***Mnemonics***	***Comments***
8500	21		LXI H,8000H	Load address of number in H-L register pair
8501	00			
8502	80			
8503	11		LXI D,8050H	Load address of number in D-E register pair
8504	50			
8505	80			
8506	0E		MVI C, 0F	Initialize the counter C
8507	0F			
8508	7E	Loop	MOV A,M	Move number into accumulator
8509	12		STAX D	Data transfer from source to destination
850A	C6		INX H	Increment source pointer
850B	01		INX D	Increment destination pointer
850C	0D		DCR C	Decrement counter
850D	C2		JNZ Loop	Go to the loop staring location if z= 0
850E	08			
850F	85			
8510	76		HLT	Stop Execution

Experimental Results

Input Data		*Result*	
Input Address	***Value***	***Output Address***	***Value***
8000	00	8050	00
8001	01	8051	01
8002	02	8052	02
8003	03	8053	03
8004	04	8054	04
8005	05	8055	05
8006	06	8056	06
8007	07	8057	07
8008	08	8058	08
8009	09	8059	09
800A	0A	805A	0A
800B	0B	805B	0B
800C	0C	805C	0C
800D	0D	805D	0D
800E	0E	805E	0E
800F	0F	805F	0F

Conclusion:

The block transfer is performed using 8085 microprocessor.

Precautions

1. Properly connect the 8085 microprocessor kit with power supply terminals.
2. Switch on the power supply after checking connections.
3. Handle the Trainer kit carefully.

Viva-Voice Questions:

1. Define block transfer.
2. What is the function of STAX instruction?
3. Why INX H and INX D is used?

SUM OF TWO BCD NUMBERS

Aim: To perform addition of two 8-bit BCD numbers using 8085 microprocessor.

Instruments Required: 1. 8085 Microprocessor Kit
2. +5V Power supply

Theory: The two numbers in BCD are stored in memory locations 8000H and 8001H respectively. This program adds these two BCD numbers and stores the results in memory locations 8003H and 8004H.

Algorithm

1. Load Data 1 into Accumulator
2. Move Accumulator contents to B
3. Load Data 2 into accumulator
4. Add Data1 and Data2 and store into Accumulator
5. Convert the accumulator value to BCD value
6. Store Accumulator content (Result) to memory

Program

Memory Address	*Hex Code*	*Label*	*Mnemonics*	*Comments*
8500	3A		LDA 8000	Load Data 1 into Accumulator
8501	00			
8502	80			
8503	47		MOV B,A	Move Accumulator contents to B
8504	3A		LDA 8001	Load Data 2 into accumulator
8505	01			
8506	80			
8507	0E		MVI C, 00	Clear C to account for Carry
8508	00			
8509	86		ADD B	Add Data 2 to Data 1 and store in Accumulator
850A	27		DAA	Convert the accumulator value to BCD value
850B	D2		JNC Next	If carry==0 , go to Next
850C	0F			
850D	85			
850E	0C		INR C	If carry==1, Increment C by 1
850F	32	Next	STA 8003	Store Accumulator content (Result) to memory
8510	03			
8511	80			

Memory Address	*Hex Code*	*Label*	*Mnemonics*	*Comments*
8512	79		MOV A,C	Move contents of C to Accumulator
8513	32		STA 8004	Store Register C (Carry) content to memory
8514	04			
8515	80			
8516	76		HLT	End of program

Experimental Results

Input Data		*Result*	
Input Address	*Value*	*Output Address*	*Value*
8000	13 (Input1)	8003	63
8001	4A (Input2)	8004	0

Calculation

Input 1: 13 0001 0011

Input22: 4A 0100 1010

Gives 0101 1101

After adding 06 0000 0110

Result: 63 0110 0011 Carry: 00

Note: If hexadecimal number is in units place 06 is added, if hexadecimal is in tens place 60 is added to sum by the DAA command.

Conclusion:

The BCD addition is performed using 8085 microprocessor successfully.

Precautions

1. Properly connect the 8085 microprocessor kit with power supply terminals.
2. Switch on the power supply after checking connections.
3. Handle the Trainer kit carefully.

Viva-Voice Questions:

1. How BCD number store in memory?
2. What is the function of DAA instruction?
3. How you can store the results in memory?