

Experiment - II

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1 Aim:

Write a program using 8085 & verify for:

- Subtraction of two 8-bit numbers (with borrow)
- Subtraction of two 16-bit numbers (with borrow)

2 Theory:

The 8085 is an 8-bit microprocessor produced by Intel. It has the following configuration –

- 8-bit data bus
- 16-bit address bus, which can address upto 64KB
- A 16-bit program counter
- A 16-bit stack pointer
- Six 8-bit registers arranged in pairs: BC, DE, HL
- Requires +5V supply to operate at 3.2 MHz single phase clock

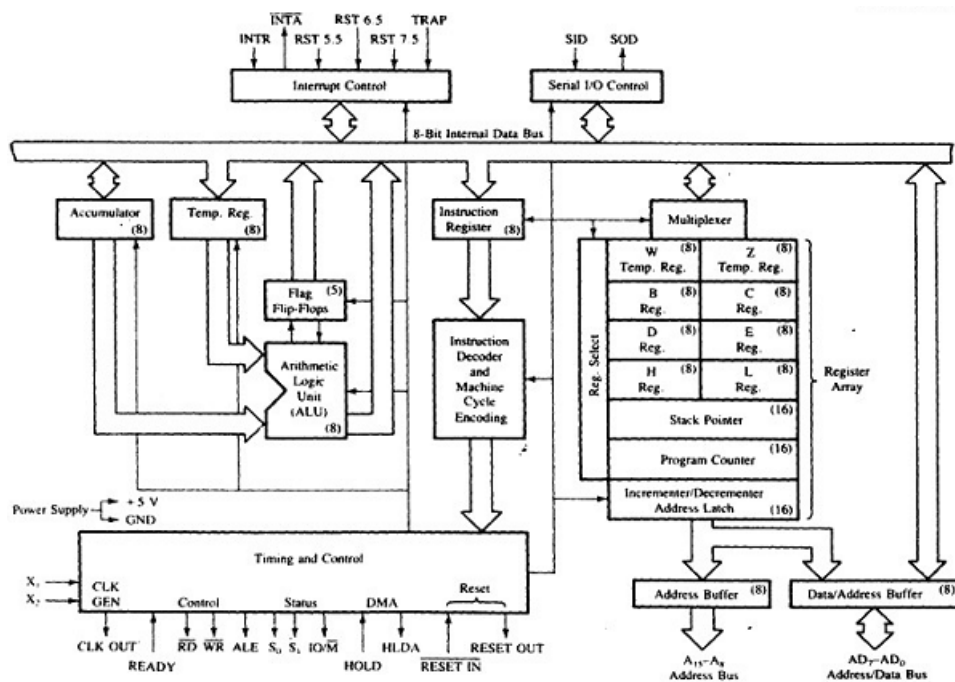


Figure 1: 8085 Architecture

2.1 Some instructions

1. ORG addr

Directive reserves the starting address for program code or data in specified memory array,

2. LXI H

(Load register pair immediately) loads 16 bit data in register pair designated by operand.

3. LHLD addr

(Load HL pair direct) loads 16 bit data from specified address to designate in register pair.

4. MOV A

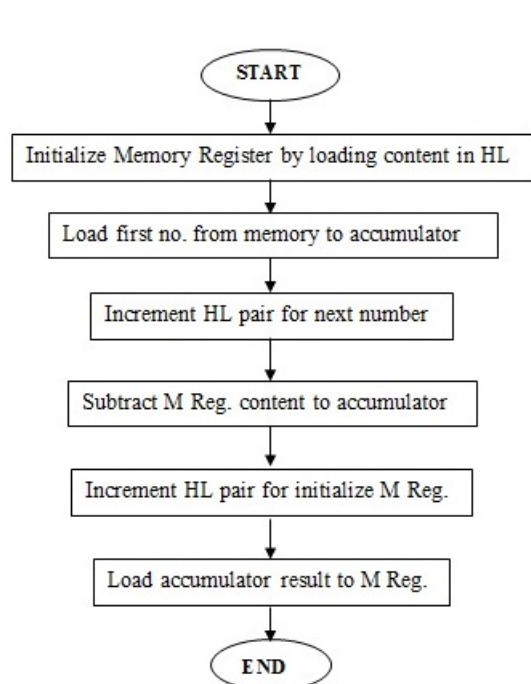
M copies the data byte into accumulator from the memory specified by the address in H-L pair.

5. MVI

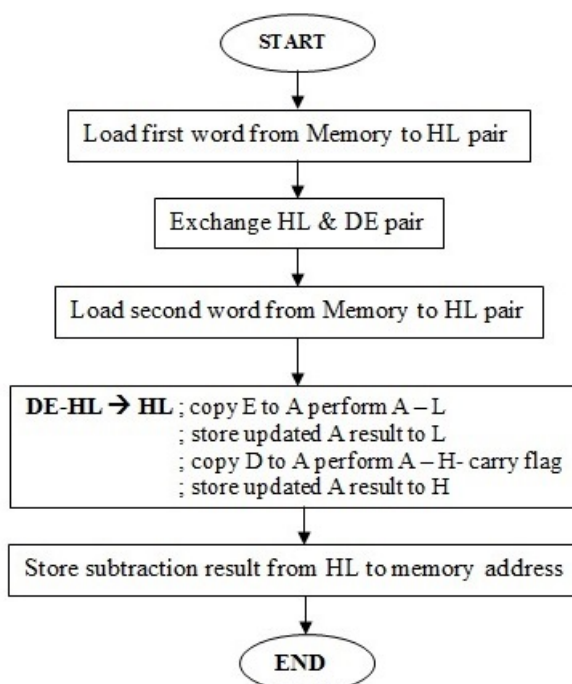
(Move immediate data) moves immediate value to specified register.

6. **SBB** instruction
subtracts specified register content and carry flag to accumulator and store results into accumulator.
7. **JNC** addr
Instruction jump the execution to the specified address if carry flag is reset.
8. **INR** instruction
increment the specified register content by 1.
9. **INX** H
(Increment register pair) increments the contents of the register pair by one.
10. **SUB** M
(Subtraction) subtracts the contents of register to accumulator.
11. **STA** addr
(Store accumulator direct) copies the contents of the accumulator to the memory location specified in the instruction
12. **SHLD** addr
(Store HL direct) instruction store HL pair content to specified address.
13. **RST** 1
(Restart) finishes the execution of the current instruction and stops any further execution.

2.2 Flowchart



(a) 8-bit subtraction



(b) 16-bit subtraction

3 Code

3.1 A) Subtraction of two 8-bit numbers

```

# ORG 7000H
LXI H, 7501H      // Get address of 1st no. in HL pair
MOV A, M          // Move no. into accumulator
INX H             // HL points 7502 H.
SBB M             // Subtract 2nd no. from 1st no.
INX H             // HL points 7503 H.
MOV M, A          // Move contents of acc. to memory
RST 1             // Terminate

# ORG 7501H      // Store no. at address
# DB 20, 10      // Get the two 8 bit no. at successive location
  
```

3.2 B) Subtraction of two 16-bit numbers

```
# ORG 7000H

LHLD 7501H          // Get 1st 16 bit no. in HL pair
XCHG                // Exchange HL pair with DE.
LHLD 7503H          // Get 2nd 16 bit no. in HL pair
MOV A, E            // Get lower byte of 1st no.
SUB L               // Subtract lower byte of 2nd no.
MOV L, A            // Store the result in reg. L
MOV A, D            // Get higher byte of 1st no.
SBB H               // Subtract higher byte of 2nd no. with borrow
MOV H, A            // Move from acc. To H
SHLD 7505H          // Store 16 bit result at 7505 H & 7506 H
RST 1               // Terminate

# ORG 7501H          // Store inputs at the address
# DB 30, 40, 10, 20 // Get two 16 bit no. from successive locations
```

4 Observations:

4.1 A) Subtraction of two 8-bit numbers

The screenshot displays the 8085 Assembly Language Editor interface. The main window shows the assembly code for 8-bit subtraction. The code is as follows:

```
# ORG 7000H
LXI H, 7501H // Get address of 1st no. in HL pair
MOV A, M     // Move no. into accumulator
INX H       // HL points 7502 H.
SBB M       // Subtract 2nd no. from 1st no.
INX H       // HL points 7503 H.
MOV M, A     // Move contents of acc. to memory
RST 1       // Terminate

#ORG 7501H   // Store no. at address
#DB 20, 10   // Get the two 8 bit no. at successive location
```

The right-hand panel shows the state of the 8085 registers and flags. The Register window displays the following values:

Register	Value	7	6	5	4	3	2	1	0
Accumulator	10	0	0	0	1	0	0	0	0
Register B	00	0	0	0	0	0	0	0	0
Register C	00	0	0	0	0	0	0	0	0
Register D	00	0	0	0	0	0	0	0	0
Register E	00	0	0	0	0	0	0	0	0
Register H	75	0	1	1	1	0	1	0	1
Register L	03	0	0	0	0	0	0	1	1
Memory(M)	10	0	0	0	1	0	0	0	0

The Flag Register window displays the following values:

Register	Value	S	Z	*	AC	*	P	*	CY
Flag Register	00	0	0	0	0	0	0	0	0

The Type window displays the following values:

Type	Value
Stack Pointer(SP)	FFFE
Memory Pointer (HL)	7503
Program Status Word(PSW)	1000
Program Counter(PC)	0008
Clock Cycle Counter	55
Instruction Counter	7

The SOD, SID, INTR, TRAP, R7.5, R6.5, R5.5 windows display the following values:

SOD	SID	INTR	TRAP	R7.5	R6.5	R5.5
0	0	0	0	0	0	0

The For SIM instruction window displays the following values:

SOD	SDE	*	R7.5	MSE	M...	M...	M...
0	0	0	0	0	0	0	0

The For RIM instruction window displays the following values:

SID	17.5	16.5	15.5	IE	M...	M...	M...
0	0	0	0	0	0	0	0

The No. Converter Tool window displays the following values:

Hexadecimal	Decimal	Binary
0		0

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Figure 2: (a) 8-bit subtraction

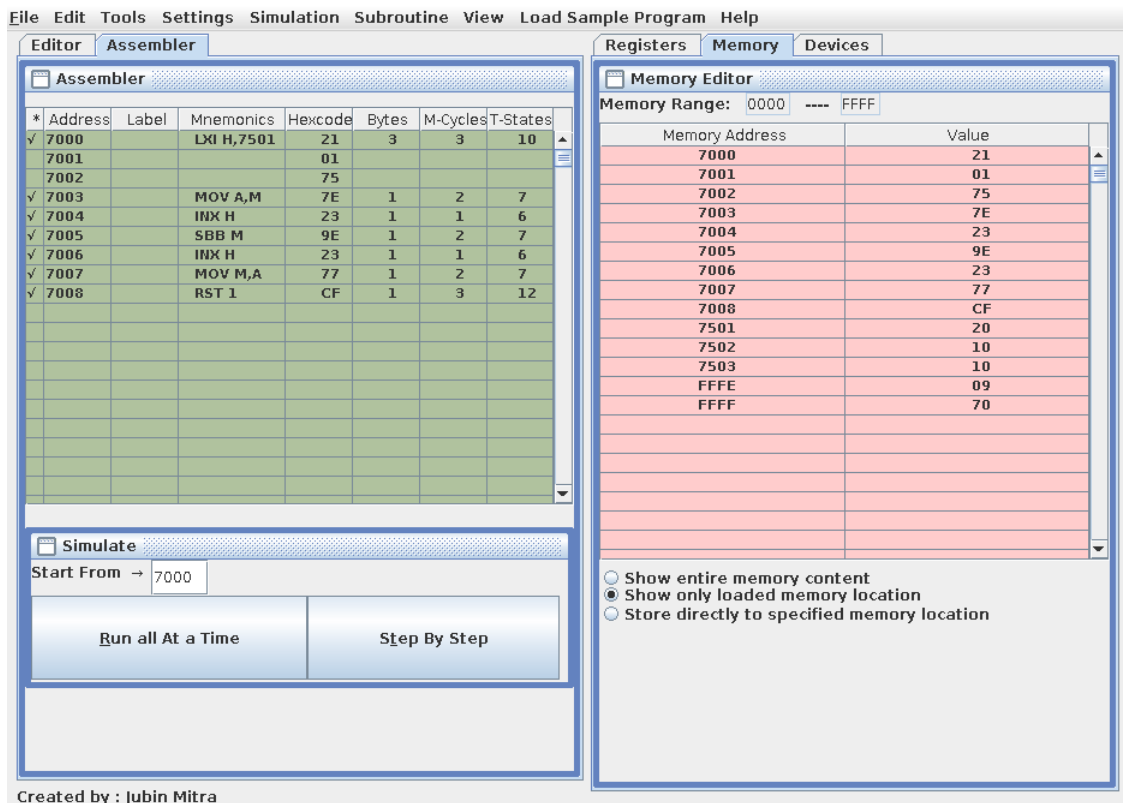


Figure 3: (b) 8-bit subtraction

4.2 B) Subtraction of two 16-bit numbers

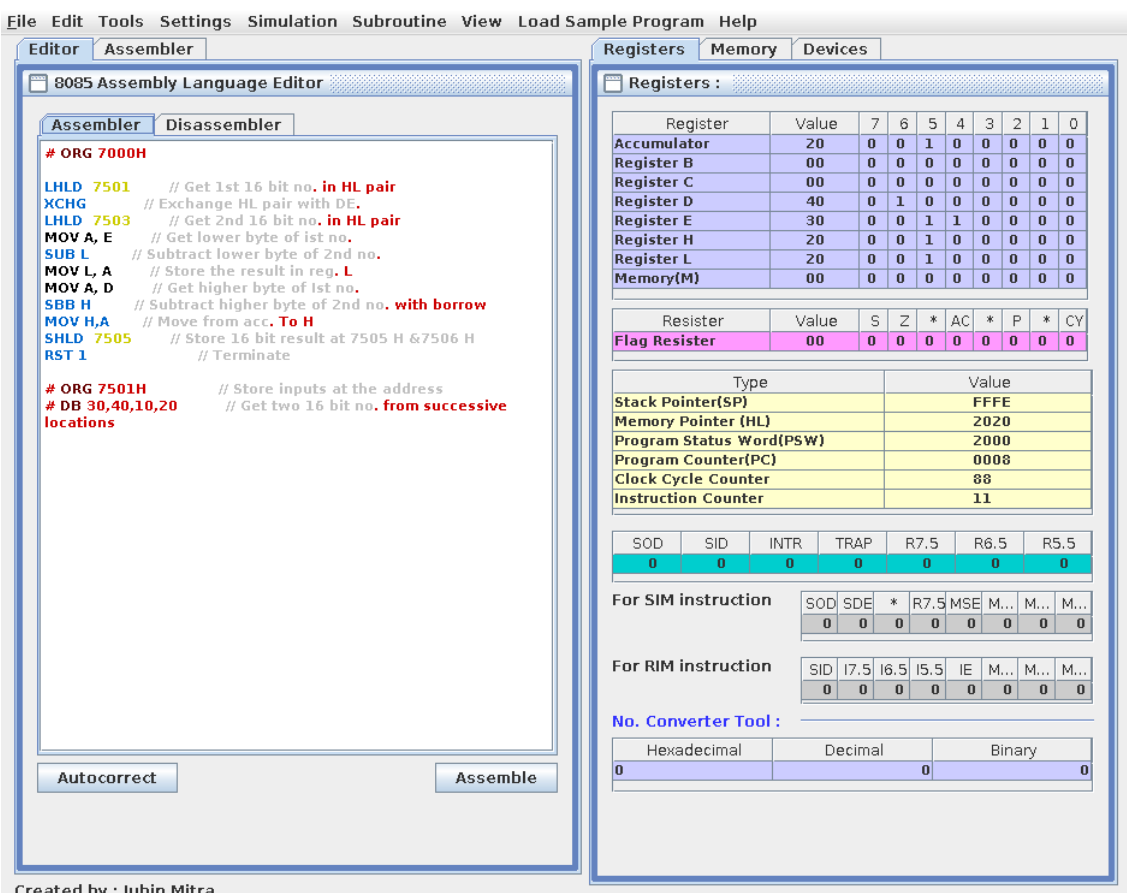


Figure 4: (a) 16-bit subtraction

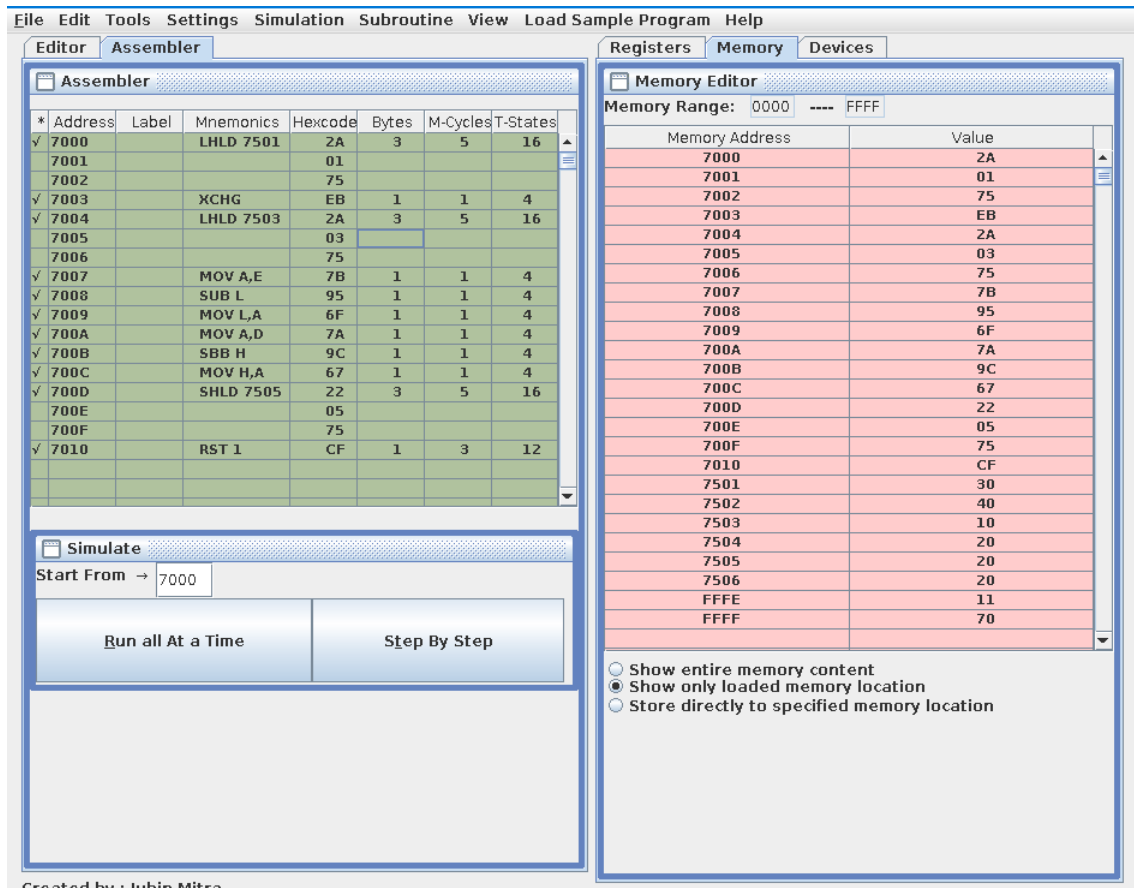


Figure 5: (b) 16-bit subtraction

5 Conclusion:

(A)
Input: 7501 – 20H, 7502 – 10H
Output: 7503 – 10H
(B)
Input: 7501 – 30H, 7502 – 40H, 7503 – 10H, 7504 – 20H
Output: 7505 – 20H, 7506 – 20H

Hence the programs for subtraction of two 8-bit and two 16-bit numbers given in [section 3](#) works as expected for 8085 microprocessor.