

Experiment - III

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1 Aim:

Write a program using 8085 & test for typical data:

- Multiplication of two 8-bit numbers by bit rotation method

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

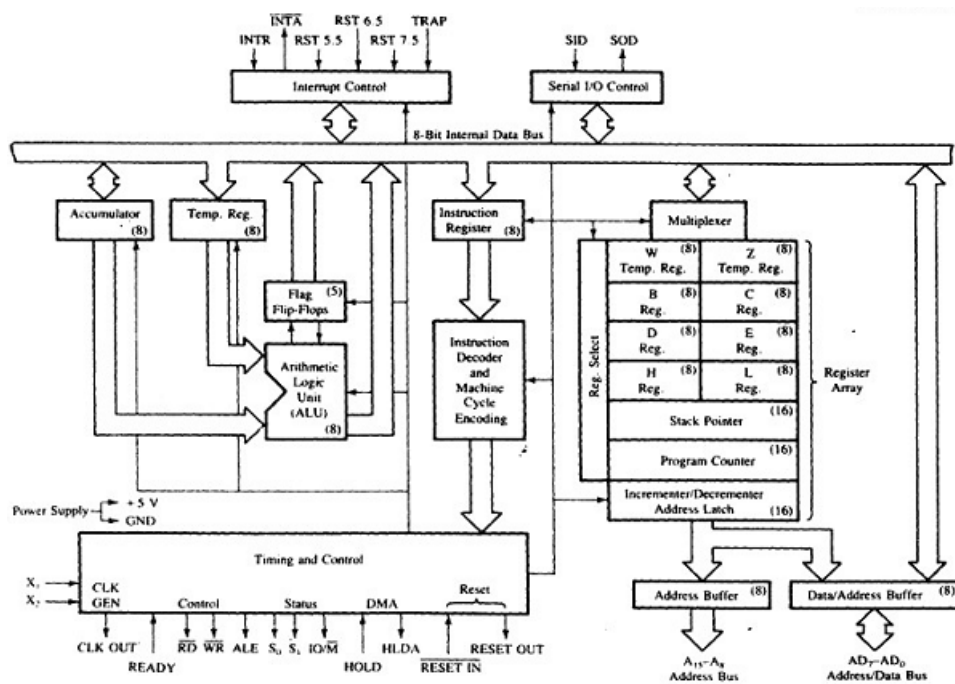


Figure 1: 8085 Architecture

2.1 Some instructions

1. **LXI H**
(Load register pair immediately) loads 16 bit data in register pair designated by operand.
2. **XCHG**
(Exchange) exchange HL with DE pair.
3. **LDA**
(Load accumulator) copies the address content to accumulator.
4. **LHLD addr.**
(Load HL pair direct) loads 16 bit data from specified address to designate in register pair.
5. **MOV A, M**
Copies the data byte into accumulator from the memory specified by the address in H-L pair.

6. MVI

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

7. DAD

Instruction adds specified register pair content to HL pair content and store results into HL pair.

8. SUB

(Subtraction) subtracts register content to accumulator and stores result into accumulator.

9. CMP

(Compare with accumulator) compares the register/memory content to accumulator

- $(A) < (\text{Reg/Mem})$; carry flag is set and zero flag is reset.
- $(A) = (\text{Reg/Mem})$; carry flag is reset and zero flag is set.
- $(A) > (\text{Reg/Mem})$; both carry flag and zero flag are reset.

10. JNC addr

Instruction jump the execution to the specified Address if carry flag is reset.

11. RAL

(Rotate accumulator left through carry)

12. DCR

instruction decrement the specified register content by 1.

13. STA addr

(Store accumulator direct) copies the contents of the accumulator to the memory location specified in the instruction

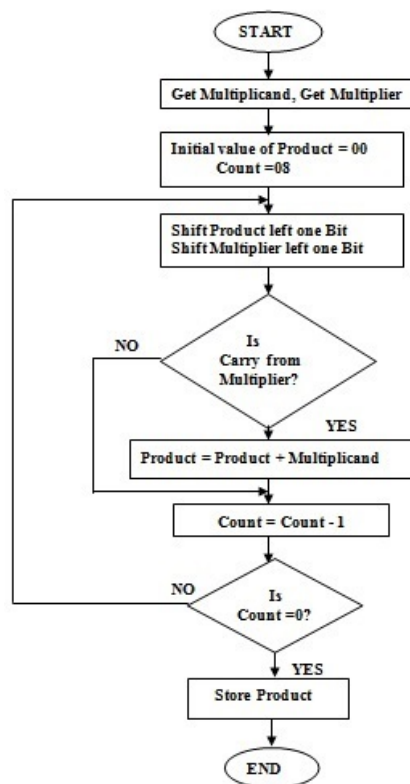
14. SHLD addr

(Store HL directly) instruction store HL pair content to specified address.

15. JNC addr

(Jump if no carry) jump to specified address if carry flag reset.

2.2 Flowchart



3 Code

3.1 Multiplication of two 8-bit numbers

```
# ORG 7000H
LHLD 7501H      // Get Multiplicand in H-L pair
XCHG           // Exchange HL pair with DE pair
LDA 7503H       // Get 2nd no in acc.
LXI H, 0000H    // Initial product in HL=00
MVI C, 08H      // Count=08 in reg C
up: DAD H       // Shift partial product left by 1 bit
RAL            // Rotate multi. by 1 bit
JNC down       // No, go to ahead
DAD D          // Product=Product + Multiplicand
down: DCR C     // Decrement Count
JNZ up         // Jump until C=0
SHLD 7504H      // Store result
RST 1          // Terminate

# ORG 7501H      // Store inputs at the address
# DB 25, 00, 05 // Get the numbers from successive locations
```

4 Observations:

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

```
# ORG 7000H
LHLD 7501H      // Get Multiplicand in H-L pair
XCHG           // Exchange HL pair with DE pair
LDA 7503H       // Get 2nd no in acc.
LXI H, 0000H    // Initial product in HL=00
MVI C, 08H      // Count=08 in reg C
up: DAD H       // Shift partial product left by 1 bit
RAL            // Rotate multi. by 1 bit
JNC down       // No, go to ahead
DAD D          // Product=Product + Multiplicand
down: DCR C     // Decrement Count
JNZ up         // Jump until C=0
SHLD 7504H      // Store result
RST 1          // Terminate

# ORG 7501H      // Store inputs at the address
# DB 25, 00, 05 // Get the numbers from successive locations
```

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

Register	Value	7	6	5	4	3	2	1	0
Accumulator	02	0	0	0	0	0	0	1	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	25	0	0	1	0	0	1	0	1
Register H	00	0	0	0	0	0	0	0	0
Register L	89	1	0	1	1	1	0	0	1
Memory(M)	00	0	0	0	0	0	0	0	0

The Flag Register window displays the following values:

Register	Value	S	Z	*	AC	*	P	*	CY
Flag Register	55	0	1	0	1	0	1	0	1

The Stack Pointer (SP) and Memory Pointer (HL) are shown as FFFE and 00B9, respectively. The Program Status Word (PSW) is 0255, the Program Counter (PC) is 0008, the Clock Cycle Counter is 393, and the Instruction Counter is 49.

The SOD, SID, INTR, TRAP, R7.5, R6.5, and R5.5 status bits are all 0. The SIM instruction status bits (SOD, SDE, *, R7.5, MSE, M..., M..., M...) are all 0. The RIM instruction status bits (SID, I7.5, I6.5, I5.5, IE, M..., M..., M...) are all 0.

The No. Converter Tool window shows the conversion of the hexadecimal value 0 to decimal 0 and binary 0.

Figure 2: (a) 8-bit multiplication

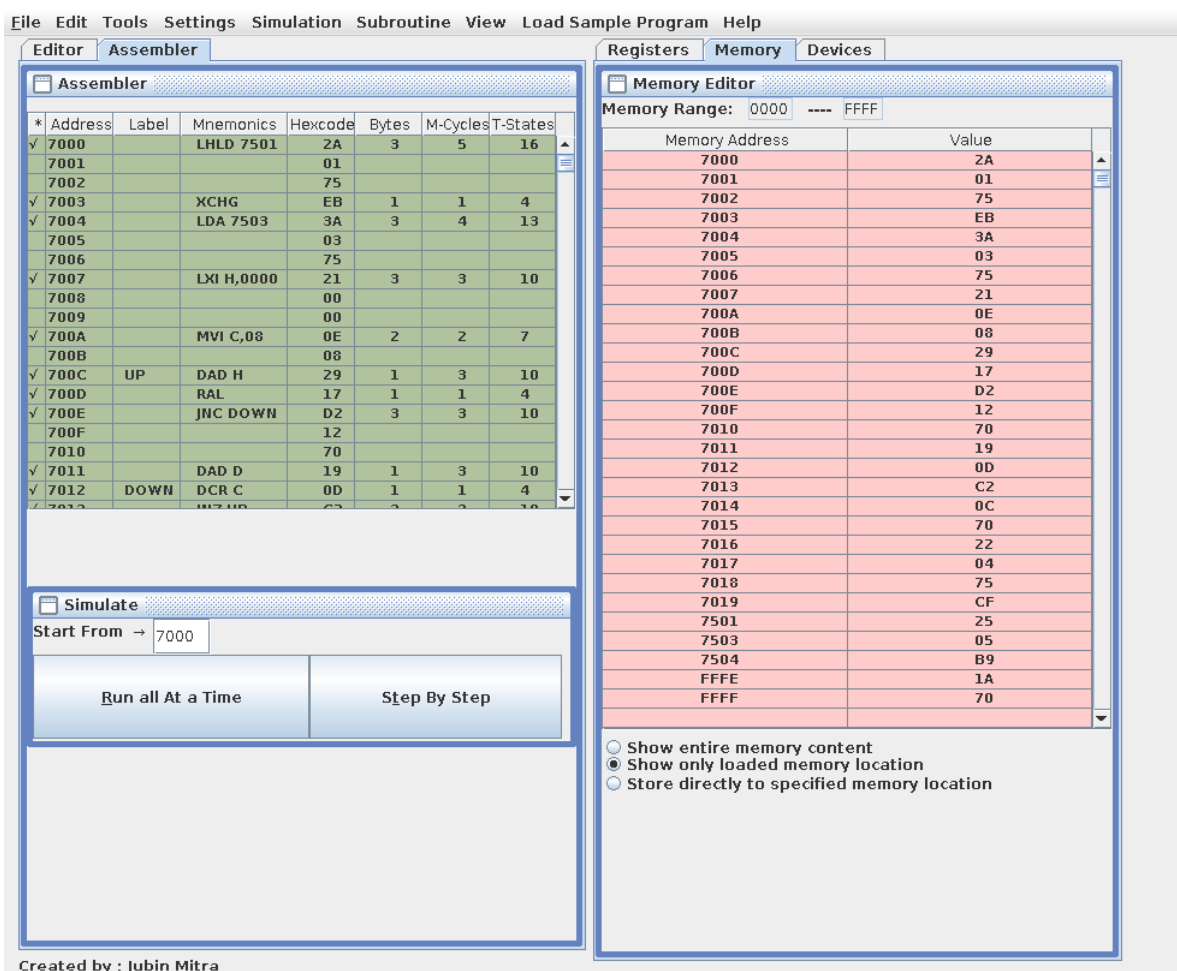


Figure 3: (b) 8-bit multiplication

5 Conclusion:

Input: 7501 – 25H, 7502 – 00H, 7503 – 05H
Output: 7504 – B9H, 7505 – 00H

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