Lab: 1
Familiarization with data transfer instructions

(Note: Assume the value as hexadecimal if not specified.)

Data Transfer Instructions

Data transfer instructions copy data from the register (or I/O or memory) called the source to another register (or I/O or memory) called destination. Following different instructions are involved in data transfer. The data transfer instructions copy data from a source into a destination without modifying the contents of the source. Data transfer instructions do not affect flags.

a) Immediate Data Transfer

This type of instructions copy the immediate data to the destination register. The mnemonic for the immediate data transfer are `MVI` and `LXI`, which means move immediate data. They are used as follows

```
MVI R, data (8-bit)
```

e.g., `MVI A, 94` copies immediate data 94H to accumulator register

Load the following program

```
8000 MVI A, 94       3E
8001                 94
8002 RST 5           EF
```

Run the program in single step mode and examine the content of register A before and after the execution of instruction `MVI A, 94`

Output:

```
Before execution: A= . . . .
After execution:  A= . . . .
```

```
LXI Rp data (16-bit)
```

Rp denotes the register pairs BC, DE, HL or SP

e.g. `LXI B, 4534` copies immediate data 4534H to register pair BC

Load the following program

```
8000 LXI B, 2464     01
8001                 64
8002                 24
8003 RST 5           EF
```

Run the program in single step mode and examine the content of register pair BC before and after the execution of instruction `LXI B, 2464`

Output:

```
Before execution: B= -------- , C--------
After execution:  B= -------- , C--------
```

Assignment

1. Load `1A, 2B, 3C, 4D, 5E, 6F and 7A` to the accumulator, register B, C, D, E, H and L respectively. Examine the content of each register before and after the execution of each instruction. (Use `MVI` instruction)
2. Load `AABB, CCDD and EEFF` into register pair BC, DE and HL respectively. Examine the content of each register before and after the execution of each instruction. (Use `LXI` instruction)

b) Transferring data among registers/memory

This type of instructions copy the data from source register/memory to the destination register/memory. The mnemonic is `MOV`. It is used as follows

```
MOV R, R
MOV R, M
MOV M, R
```

e.g. `MOV B, D` copies content of register D to register B.

For memory related data transfer the H and L registers are used to hold the memory address.

If register pair HL has 8090H then, `MOV B, M` copies the content of memory location 8090 to register B.

Load the following program

```
8000 MVI H, 80       26 80
8002 MVI L, 90       2E 90
8004 MOV B, M        46
8005 MVI L, A0       2E A0
```

```
8007 MOV M, B        70
8008 RST 5           EF

8090 DATA            33
```

Run the program in single step mode and examine the contents of register B before and after the execution of `MOV M,B` instruction. Also examine the content at memory location 80A0 before and after execution of the program.

Output:

```
Before execution: B= -------- ,80A0=--------
After execution:  B= -------- ,80A0=--------
```

Assignment

3. Load 4455H and 6677H in register pair BC and DE respectively and exchange their contents. Examine the register contents before and after execution.
4. Write a program to copy content of memory location at 8080 to 8090.

c) Data transfer from and to memory (load/store)

These types of instructions are used to copy the data from memory to specific registers and from specific registers to memory.

`LHLD, SHLD, LDAX, STAX, LDA, STA` are the instructions for this purpose.

`LHLD 16-bit (address)` copies the contents of the memory location pointed by 16-bit address in register L and copies the content of next memory location in register H.

`SHLD 16-bit (address)` copies the contents of register pair HL to the memory location pointed by 16-bit address.

`LDAX B/D` copies the content of memory location pointed by register pair BC or DE to accumulator.

`STAX B/D` copies the content of accumulator to memory location pointed by register pair BC or DE.

`LDA 16-bit (address)` copies the contents of a memory location specified by 16-bit address to accumulator.

`STA 16-bit (address)` copies the contents of accumulator to the memory location specified by 16-bit address.

Load the following program

```
8000 LXI B, 8090     01 90 80
8003 LXI D, 80A0     11 A0 80
8006 LDAX B          0A
8007 STAX D          12
8008 RST 5           EF

8090 DATA            AA
```

Run the program in single step mode and note the contents of accumulator and registers B, C, D and E in each step. Also note the content of memory address 80A0 before and after execution of `STAX D`.

Output:

```
Before execution: 80A0=--------
After execution:  80A0=--------
```

Reg/Step	**1st**	**2nd**	**3rd**	**4th**
B				
C				
D				
E				

Load the following program

```
8000 LHLD 8100  2A 00 81
8003 SHLD 8200  22 00 82
8006 RST 5           EF

8100 DATA            AA
8101 DATA            BB
```

Run the program in single step mode and note the contents of registers H and L in each step. Also note the content of memory address 8200 and 8201 before and after execution of `SHLD 8200`.

Output:

```
Before execution: 8200=--------,8201=--------------
After execution:  8200=--------,8201=--------------
```

Reg/Step	1st	2nd
H		
L		

Load the following program

```
8000 LDA 8050  3A 50 80
8003 STA 8060  32 60 50
8006 RST 5     EF

8050 DATA      99
```

Run the program in single step mode and note the contents of accumulator in each step. Also note the content of memory address 8060 before and after execution of `STA 8060`.

Output:

```
Before execution: 8060=--------
After execution:  8060=--------
```

Reg/Step	1st	2nd
A		

Assignment

5. Load 11H, 22H, 33H, 44H and 55H into accumulator and registers B, C, D and E respectively, and store these data in memory location starting at 9000H to 9004H.
6. The data 44H and 66H are stored in memory location 9000H and 9001H respectively. Write a program to transfer these data to memory location 9050H and 9051H respectively, use LHLD and SHLD instructions.

d) Exchanging the contents of register pair DE and HL

This type of instructions is used to exchange the contents of register pair DE with the contents of register pair HL. The content of register D is exchanged with the content of register H, and the content of register E is exchanged with the content of register L. The mnemonic `XCHG` is used to exchange data between register pairs DE and HL.

Load the following program

```
8000 LXI D 2233      11 33 22
8003 LXI H 5566      21 66 55
8006 XCHG            EB
8007 RST 5           EF
```

Run the program in single step mode and examine the contents of register pairs DE and HL before and after execution of `XCHG` instruction.

Output:

```
Before execution: DE=------------      HL=---------
After execution:  DE=------------      HL=---------
```

Assignment

7. Write a program to exchange the content of register pair BC and DE with the use of `XCHG` instruction. Assume data AABBH and CCDDH are in register pair BC and DE respectively. Examine the register contents before and after execution.

e) Sending data to output port

This type of instructions used to transfer the data from accumulator to the output port.

`OUT 8-Bit port address`

e.g. `OUT 40` sends the data from accumulator to output port A.

Load the following program

```
8000 MVI A, 80       3E    80
8002 OUT 43          D3    43
8004 MVI A, 12       3E    12
8006 LXI B, 3456     01    56    34
8009 OUT 40          D3    40
800B MOV A, B        78
800C OUT 41          D3    41
800E MOV A, C        79
800F OUT 42          D3    42
8011 RST 5           EF
```

Run the program in single step mode and examine the contents of accumulator, register B and C, and output ports after execution of each instructions.

Output:

Reg/Step	**1st**	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**	**8th**	**9th**
A									
B									
C									
Port A (40)									
Port B (41)									
Port C (42)									