# Microprocessor Lab Report (Assignment - 1)

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Format: Question | Assembly Code (Memory Address, OpCode, Mnemonics, Comments)

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(* The programs run in simulator seamlessly, though while running into 8085 it's better to use **RST5** instead of **HLT** to return the control to monitor program, without stopping the processor by **HLT**)

**(* Simulator: GNUSim8085, ( here Only the numbers which can be stored in memory is decimal (not hex format(maybe for better/easy user's interaction))**
**So for BCD operations this online simulator has been used)**

**(Q1)** Load the contents of memory location 2200H and 2201H into Registers. Add this registers and store it into location 2202H and 2203H

```
4200 3A 00 022     LDA 2200H ; Load Content from 2200H into accumulator
4203 47      MOV B, A; Move accumulator to B register

4204 3A 01 022     LDA 2201H; Load Content from 2201H into accumulator
4207 0E 00   MVI C, 00; Reset C register for Carry

4209 80      ADD B; Addition

420A D2 0E 042     JNC NOCARRY; check is carry is generated
420D 0C      INR C; Increment C register if CY is set
420E 32 02 022     NOCARRY: STA 2202H; Store Sum into 2202H

4211 79      MOV A, C; Move carry into accumulator

4212 32 03 022     STA 2203H; Store Carry

4215 76      HLT;
```

Data Stack

Start 2200h

| Address (Hex) | Address | Dat |
|---|---|---|
| 2200 | 8704 | 4 |
| 2201 | 8705 | 30 |
| 2202 | 8706 | 34 |
| 2203 | 8707 | 0 |
| 2204 | 8708 | 0 |

Start 2200h

| Address (Hex) | Address | Data |
|---|---|---|
| 2200 | 8704 | 255 |
| 2201 | 8705 | 255 |
| 2202 | 8706 | 254 |
| 2203 | 8707 | 1 |
| 2204 | 8708 | 0 |
| 2205 | 8709 | 0 |

**(Q2)** Repeat 1 for BCD Numbers.

```
4200 2A 00 022      LHLD 2200H; Load HL pair with direct addressing from
memory

4203 0E 00    MVI C, 00H; Initiate C register with 0 for carry
4205 7D       MOV A, L; Load first byte from HL pair into Accumulator

4206 84       ADD H; Addition with Second byte.

4207 27       DAA; Decimal adjust after addition for BCD conversion

4208 D2 0C 042      JNC NOCARRY; check is carry is generated
420B 0C       INR C; Increment C register if CY is set

420C 32 02 022      NOCARRY: STA 2202H; Store Sum into 2202H
420F 79       MOV A,C;  Move carry into accumulator

4210 32 03 022      STA 2203H; Store Carry

4213 76       HLT;
```

Memory View

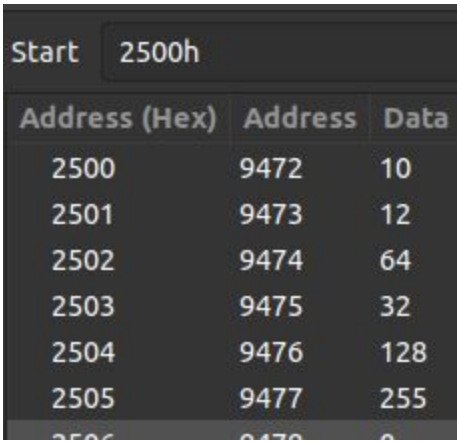
| | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| 220 | 15 | 07 | 22 | 00 | 00 | 00 |
| 221 | 00 | 00 | 00 | 00 | 00 | 00 |
| 222 | 00 | 00 | 00 | 00 | 00 | 00 |

Memory View

| | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| 220 | F2 | EF | 47 | 01 | 00 | 00 |
| 221 | 00 | 00 | 00 | 00 | 00 | 00 |
| 222 | 00 | 00 | 00 | 00 | 00 | 00 |

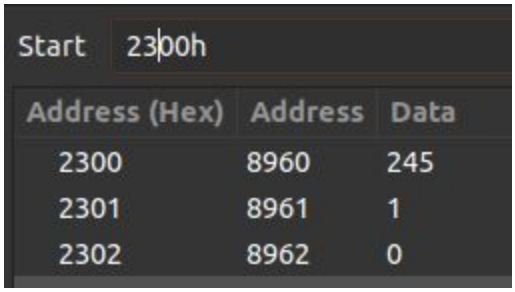
**(Q3)** Find Sum of N numbers stored in consecutive location starting from 2500H, the value of N is stored into 2200H, Store the result into 2300H and 2301H

```
4200 21 00 025     LXI H,2500H; Store 2500H in HL register Pair, pointing N
numbers
4203 0E 00   MVI C, 00H; Initiate Carry count

4205 3A 00 022     LDA 2200H; loading N into Accumulator

4208 47      MOV B, A; Move N to B register

4209 AF      XRA A; Exclusive OR Accumulator with itself to clear it's
value

420A 86      LOOP1: ADD M; Add Content of Memory location pointed by HL
pair

420B D2 0F 042     JNC NOCARRY; Check if carry generated
420E 0C      INR C; Increment C register if CY is set

420F 23      NOCARRY: INX H; Increment the HL pair( Extended register
pair).

4210 05      DCR B; Decrement the N by 1
4211 C2 0A 042     JNZ LOOP1; If Zero flag is set, i.e. N is zero, we are
done adding.

4214 32 00 023     STA 2300H; Store Sum into 2300H

4217 79      MOV A,C;
4218 32 01 023     STA 2301H; Store Carry into 2301H

421B 76      HLT;
```



Start 2500h

| Address (Hex) | Address | Data |
|---|---|---|
| 2500 | 9472 | 10 |
| 2501 | 9473 | 12 |
| 2502 | 9474 | 64 |
| 2503 | 9475 | 32 |
| 2504 | 9476 | 128 |
| 2505 | 9477 | 255 |



Start 2300h

| Address (Hex) | Address | Data |
|---|---|---|
| 2300 | 8960 | 245 |
| 2301 | 8961 | 1 |
| 2302 | 8962 | 0 |

**(Q4)** Repeat 3 For BCD NUMBERS.

```
4200 21 00 025      LXI H,2500H; Store 2500H in HL register Pair, pointing N
numbers

4203 0E 00    MVI C, 00H;  Initiate Carry count
4205 3A 00 022      LDA 2200H; loading N into Accumulator

4208 47       MOV B, A; Move N to B register

4209 AF       XRA A; Exclusive OR Accumulator with itself to clear it's
value

420A 86       LOOP1: ADD M; Add Content of Memory location pointed by HL
pair

420B 27       DAA;  Decimal adjust after addition for BCD conversion

420C D2 10 42       JNC NOCARRY; Check if carry generated
420F 0C       INR C;
4210 23       NOCARRY: INX H; Increment the HL pair( Extended register
pair).
4211 05       DCR B; Decrement the N by 1
4212 C2 0A 042      JNZ LOOP1; If Zero flag is set, i.e. N is zero, we are
done adding.

4215 32 00 023      STA 2300H; Store Sum into 2300H
4218 79       MOV A,C;

4219 32 01 023      STA 2301H; Store Carry into 2301H
421C 76       HLT;
```

Memor

| | 0 | 1 |
|---|---|---|
| 220 | 05 | 0 |
| 221 | 00 | 0 |

Memory View

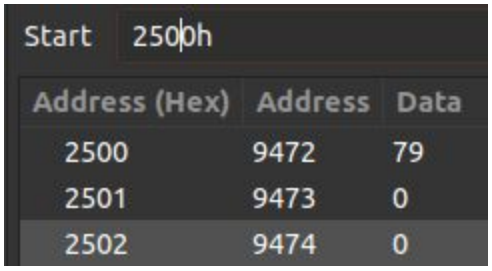
| | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| 250 | 12 | 22 | 38 | EF | FF | 00 |
| 251 | 00 | 00 | 00 | 00 | 00 | 00 |

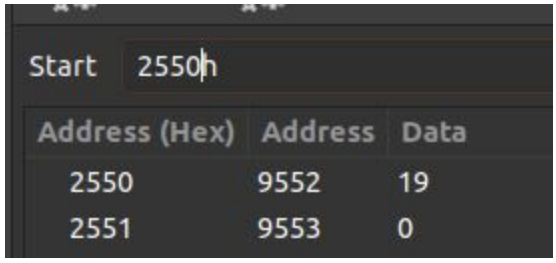
Memory View

| | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| 230 | 32 | 01 | 00 | 00 | 00 | 00 |
| 231 | 00 | 00 | 00 | 00 | 00 | 00 |

**(Q5)** Find the sum of least significant 4 bits and Most Significant 4 bits of a byte stored in 2500H and store the result into 2550H

```
2200 3A 00 025      LDA 2500H; Load Content from 2500H into accumulator
2203 57       MOV D, A; keeping backup due to multiple AND operation

2204 E6 0F    ANI 00FH; AND operation with least 4 set bits( 0FH = 15(
Decimal)= 00001111(Binary))

2206 47       MOV B,A; Cache least 4 bits into B register

2207 7A       MOV A,D; Since content changed, load Accumulator freshly from
backup

       ; 4 times ROTATE LEFT ACCUMULATOR to take 4 MSB into LSB
2208 07       RLC;
2209 07       RLC;
220A 07       RLC;
220B 07       RLC;

220C E6 0F    ANI 00FH; AND Immediate with 15 in decimal to get 4 most
Significant bits

220E 80       ADD B; Add 4bit MSB to 4 bit LSB
220F 32 50 25       STA 2550H; Store the result in 2550H
2212 76       HLT;
```



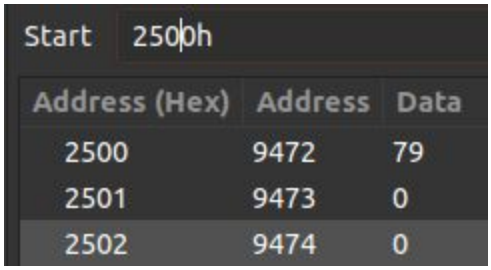

**79 = 0100 1111 (4 + 15)**

**(Q6)** Repeat 5 for BCD

```
3200 3A 00 025      LDA 2500H; Load Content from 2500H into accumulator

       ; fist have to achieve the binary representation of the BCD

3203 16 00    MVI D, 00H; Most sig bit of The BCD
3205 4F       MOV C, A; Move hex to C reg

3206 AF       XRA A; Clear Accumulator

3207 C6 01    LOOP: ADI 01; ADD immediate 01 with the Accumulator for the
value Stored in C

3209 27       DAA; Subsequently it will convert into BCD
320A D2 0E 032      JNC NOCARRY;
320D 14       INR D;
320E 0D       NOCARRY: DCR C;
320F C2 07 032      JNZ LOOP;
3212 82       ADD D; As a contains any overflowing bits;

       ;A now contains the BCD
3213 57       MOV D,A; keeping backup due to multiple AND operation

3214 E6 0F    ANI 00FH; AND operation with least 4 set bits( 0FH = 15(
Decimal)= 00001111(Binary))
3216 4F       MOV C,A; Cache least 4 bits into C register

3217 7A       MOV A,D; Since content changed, load Accumulator freshly from
backup

3218 E6 F0    ANI 0F0H; AND immediate with F0H ie (11110000) to extract the
most sig 4 bits
```

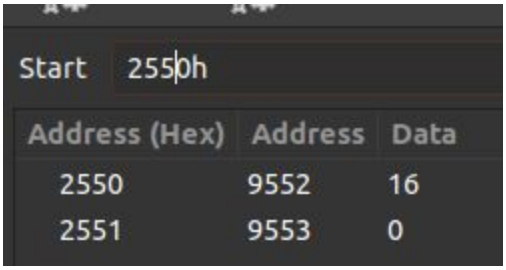
```
321A CA 21 32      JZ SKIP; if zero flag is set i.e. the number is less
than 32 no need to rotate the content just to get 0

321D 07      RLC;
321E 07      RLC;
321F 07      RLC;
3220 07      RLC;

3221 81      SKIP: ADD C; Add 4bit MSB to 4 bit LSB

3222 32 50 25      STA 2550H; Store the result in 2550H
3225 76      HLT;
```

**79 in BCD 0111 1001 (7+9) = 16**



Start 2500h

| Address (Hex) | Address | Data |
|---|---|---|
| 2500 | 9472 | 79 |
| 2501 | 9473 | 0 |
| 2502 | 9474 | 0 |



Start 2550h

| Address (Hex) | Address | Data |
|---|---|---|
| 2550 | 9552 | 16 |
| 2551 | 9553 | 0 |

**(Q7)** Write a Program to count number of 0's and 1's of a byte stored in 2500H, Store the result into 2510H and 2511H
LDA 2500H; Load accumulator with the Number.

```
4200 3A 00 025      LDA 2500H; Load accumulator with the Number.

4203 47      MOV B, A; Keeping a backup in B register
4204 0E 08   MVI C, 008H; Move Immediate 08 ( the number of bits) to C

4206 16 00   MVI D,00H; Initiating with 0 to count set bits

4208 E6 01   LOOP: ANI 001H; And operation with 01 to check the LSB is it
set or not?
420A CA 0E 042      JZ NOSETBIT; is Zero flag is set, The the bit was not
set
420D 14      INR D; Increase set bit count
```

```
420E 78      NOSETBIT: MOV A,B; Reloading the number to Accumulator

420F 07      RLC; Rotate left accumulator by 1 bit.
4210 47      MOV B,A; Store the new number to B for next use.
4211 0D      DCR C; Decrease counter.
4212 C2 08 042     JNZ LOOP;

4215 3E 08   MVI A, 008H; For number of unset bits.
4217 92      SUB D; Substract the number of set bits from a byte(8 bit)
4218 32 10 25      STA 2510H; Store the unset bits count in 2610H
421B 7A      MOV A, D; Mov D accumulator content to Accumulator.
421C 32 11 25      STA 2511H; Store set bits into 2511H

421F 76      HLT;
```

Start 2510h

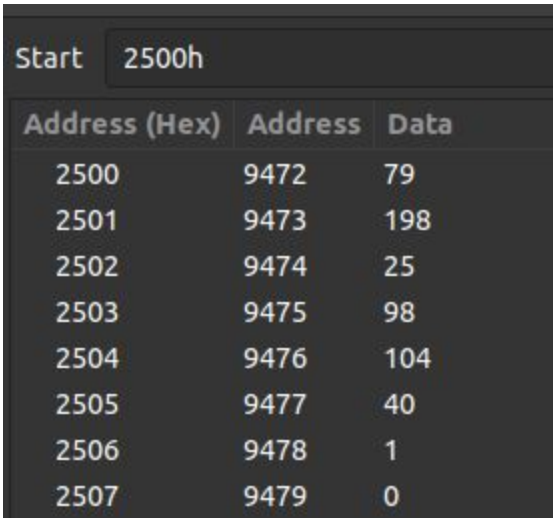
| Address (Hex) | Address | Data |
|---|---|---|
| 2500 | 9472 | 63 |
| 2501 | 9473 | 0 |

| | | |
|---|---|---|
| 250F | 9487 | 0 |
| 2510 | 9488 | 2 |
| 2511 | 9489 | 6 |
| 2512 | 9490 | 0 |
| 2513 | 9491 | 0 |

(**Q8**) Write a program to add two 16 bit binary numbers.

```
2200 21 00 025     LXI H, 2500H; Store 2500H in HL register pair, the first
16 bit number.
2203 16 00   MVI D,00; Initiating Carry Count
2205 01 02 025     LXI B, 2502H; Store 2502H in BC register pair, the
second 26 bit number.

2208 0A      LDAX B; Load accumulator with content pointed by BC register
pair.
2209 86      ADD M; Add with Content pointed by HL pair
220A 32 04 025     STA 2504H; Store the sum of the first 8 bit to 2504H.

       ; Increment the HL and BC pair( Extended register pair).
220D 23      INX H;
220E 03      INX B;
```

```
220F 0A      LDAX B; Again Load accumulator with content pointed by BC
register pair.
2210 8E      ADC M; Add with Content pointed by HL pair and the carry(if
generated) by previous addition.

2211 D2 15 22      JNC NOCARRY; Check if any carry generated
2214 14      INR D; Increase the carry count
2215 32 05 025     NOCARRY: STA 2505H; Store the next 8 bit sum to 2505H

2218 7A      MOV A,D; Move D(carry) to accumulator
2219 32 06 025     STA 2506H; Store the result in 2500H

221C 76      HLT;
```



Start 2500h

| Address (Hex) | Address | Data |
|---|---|---|
| 2500 | 9472 | 79 |
| 2501 | 9473 | 198 |
| 2502 | 9474 | 25 |
| 2503 | 9475 | 98 |
| 2504 | 9476 | 104 |
| 2505 | 9477 | 40 |
| 2506 | 9478 | 1 |
| 2507 | 9479 | 0 |

(**Q9**) Repeat 8 for BCD Numbers.

```
2200 21 00 025     LXI H, 2500H;  Store 2500H in HL register pair, the
first 16 bit number.
2203 01 02 025     LXI B, 2502H;   Store 2502H in BC register pair, the
second 26 bit number.

2206 16 00   MVI D, 00H; Initiate Carry Count.
```

```
2208 0A      LDAX B;  Load accumulator with content pointed by BC register
pair.
2209 86      ADD M; Add with Content pointed by HL pair
220A 27      DAA; Decimal adjust after addition for BCD conversion

220B 32 04 025     STA 2504H; Store the sum of the first 8 bit to 2504H.

       ; Increment the HL and BC pair( Extended register pair).
220E 23      INX H;
220F 03      INX B;

2210 0A      LDAX B; Again Load accumulator with content pointed by BC
register pair.
2211 8E      ADC M; Add with Content pointed by HL pair and the carry(if
generated) by previous addition.
2212 27      DAA; Decimal adjust after addition for BCD conversion
2213 D2 17 22      JNC NOCARRY; Check if any carry generated

2216 14      INR D; Increase the carry count
2217 32 05 025     NOCARRY: STA 2505H; Store the next 8 bit sum to 2505H
221A 7A      MOV A,D;  Move D(carry) to accumulator

221B 32 06 025     STA 2506H; Store the result in 2500H
221E 76      HLT;
```

Memory View

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| 250 | 12 | 22 | 38 | EF | 50 | 77 | 00 |
| 251 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |