

Microprocessor Lab Report (Assignment - 2)

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

(* 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) 2 Numbers EAH and BDH are stored in 2050H and 2051H respectively, write a program to assemble them as ABH and store them in 2052H

```
2200 3A 50 20      LDA 2050H; Load Content of EA into Accumulator
2203 E6 0F      ANI 0FH; AND operation with 4 set bits LSB ( 0FH = 15(
Decimal)= 00001111(Binary)) to extract A

2205 4F          MOV C,A; Move the accumulator content to a temporary C
register.
2206 3A 51 20      LDA 2051H; Now Load the Content of BD into the
accumulator.

2209 E6 F0      ANI 0F0H; AND Immediate with Accumulator with value 4 bits
set MSB to extract B
220B 81          ADD C; Add B0H with 0AH

220C 32 52 20      STA 2052H; Store the result into 2052H
220F 76          HLT;
```

203	00	00	00	00	0					
204	00	00	00	00	0					
205	4F	C4	CF	00	0	---	--	--	--	--
206	00	00	00	00	0	204	00	00	00	00
207	00	00	00	00	0	205	A8	49	48	00
						206	00	00	00	00

(Q2) Two numbers A and B are stored in 2050H and 2051H respectively write a program to perform AxB and store the result in 2052H and 2053H

```

2200 2A 50 20      LHLD 2050H; Load HL pair with direct addressing from
memory 2050H (the 2 numbers)

2203 3E 00      MVI A, 00H; initiating accumulator with 0 to store the mul
2205 55          MOV D, L; for Subsequent adding (as No Multiplication is
supported in 8085)
2206 0E 00      MVI C,00H; Initiating the Carry count

2208 82          LOOP1: ADD D; Add D with Accumulator
2209 D2 0D 022    JNC NOCARRY; Check if carry is generated.
220C 0C          INR C; Increase Carry count
220D 25          NOCARRY: DCR H; H contains BH ( number of times) A should be
added.
220E C2 08 022    JNZ LOOP1;

2211 6F          MOV L,A; Move Accumulator to L register
2212 61          MOV H,C; Move Carry to H register

2213 22 52 20      SHLD 2052H; Store to content by HL pair pointed to 2052H
2216 76          HLT;

```

Start 2050h		
Address (Hex)	Address	Data
2050	8272	20
2051	8273	3
2052	8274	60
2053	8275	0
2054	8276	0
2055	8277	0

Start 2050h		
Address (Hex)	Address	Data
2050	8272	20
2051	8273	20
2052	8274	144
2053	8275	1
2054	8276	0
2055	8277	0

(Q3) Repeat 2 for BCD Numbers.

```

2200 2A 50 20      LHLD 2050H; Load HL pair with direct addressing from
memory 2050H (the 2 numbers)

2203 3E 00      MVI A, 00H; initiating accumulator with 0 to store the mul
2205 55          MOV D, L; for Subsequent adding (as No Multiplication is
supported in 8085)
2206 0E 00      MVI C,00; Initiating the Carry count

2208 82          LOOP1: ADD D; Add D with Accumulator
2209 27          DAA; Decimal adjust after addition for BCD conversion
220A D2 0E 022    JNC NOCARRY; Check if carry is generated.
220D 0C          INR C; Increase Carry count
220E 25          NOCARRY: DCR H; H contains BH ( number of times) A should be
added.

220F C2 08 022    JNZ LOOP1;

2212 6F          MOV L,A; Move Accumulator to L register
2213 4F          MOV A, C; Move Carry to Accumulator.

;2214 27          DAA; Perform Decimal adjust of the carry too.(for large mul)
2214 67          MOV H,A; Move Carry to H register

```

2215 22 52 20 SHLD 2052H; Store by HL pair pointed to 2052H

2218 76 HLT;

203	00	00	00	00	00	00	00
204	00	00	00	00	00	00	00
205	15	30	10	08	00	00	00
206	00	00	00	00	00	00	00
207	00	00	00	00	00	00	00

203	00	00	00	00	00	00	00
204	00	00	00	00	00	00	00
205	2F	40	20	15	00	00	00
206	00	00	00	00	00	00	00
207	00	00	00	00	00	00	00

(Q4) N numbers are stored in consecutive m/m location starting from 2050H the value of N is stored in 204FH

Start	204eh	
Address (Hex)	Address	Data
204E	8270	0
204F	8271	7
2050	8272	3
2051	8273	9
2052	8274	12
2053	8275	25
2054	8276	5
2055	8277	64
2056	8278	18
2057	8279	0

(i) Find Max of N numbers.

2200 21 50 20 LXI H, 2050H; Store 2050H in HL register pair, the m/m location where consecutive numbers are stored.

2203 3A 4F 20 LDA 204FH; Load content of 204FH (Number of elements N) in accumulator

```

2206 47      MOV B, A; Move N into B register
2207 AF      XRA A; Exclusive or A with A to clear the content of
Accumulator.

2208 BE      LOOP: CMP M; Compare Accumulator with the content pointer by
HL register pair.
2209 D2 0D 022 JNC CARRYRESET; If carry is generated or CY is set then
(M> A)
220C 7E      MOV A,M; Replace Accumulator with current Max
220D 23      CARRYRESET: INX H; Increment the HL pair( Extended register
pair)
220E 05      DCR B; Decrement the counter( the N)
220F C2 08 022 JNZ LOOP; if Zero flag is set N =0 exit loop

2212 32 4E 20 STA 204EH; Store Accumulator( The Max) into 204EH
2215 76      HLT

```

Start	204eh	
Address (Hex)	Address	Data
204E	8270	64
204F	8271	7
2050	8272	3
2051	8273	9
2052	8274	12
2053	8275	25
2054	8276	5
2055	8277	64
2056	8278	18
2057	8279	0

(ii) Find Min of N Numbers

```

2200 21 50 20 LXI H, 2050H; Store 2050H in HL register pair, the m/m
location where consecutive numbers are stored.
2203 3A 4F 20 LDA 204FH; Load content of 204FH (Number of elements N)
in accumulator

```

```

2206 47      MOV B, A; Move N into B register
2207 7E      MOV A,M; Move First element (with the content pointer by HL
register pair.) to Accumulator for start comparing.

2208 BE      LOOP: CMP M; Compare Accumulator with the content pointer by
HL register pair.

2209 DA 0D 022 JC CARRYSET; If no carry is generated or CY is not set
then (M< A)
220C 7E      MOV A,M; Replace Accumulator with current Min
220D 23      CARRYSET: INX H; Increment the HL pair( Extended register
pair)

220E 05      DCR B; Decrement the counter( the N)
220F C2 08 022 JNZ LOOP; if Zero flag is set ie. N =0 exit loop

2212 32 4E 20 STA 204EH; Store Accumulator( The Min) into 204EH
2215 76      HLT

```

Start 204eh		
Address (Hex)	Address	Data
204E	8270	3
204F	8271	7
2050	8272	3
2051	8273	9
2052	8274	12
2053	8275	25
2054	8276	5
2055	8277	64
2056	8278	18
2057	8279	0

(iii) Sort Numbers in Ascending Order.

```

2200 06 01    MVI B, 01H;
2202 21 4F 20  LOOP: LXI H, 204FH; Store 204FH in HL register pair, the
m/m location where consecutive numbers are stored along with N.
2205 4E      MOV C,M; Move the number of elements(N) to C register.
2206 23      INX H; Increment the HL pair( Extended register pair)

```

```

2207 0D      DCR C; Decrease N by 1 to make it ready for counting.
2208 1E 00    MVI E, 00H; Register E is working somewhat like flag to check
if the list got sorted or not

220A 7E      LOOP2: MOV A, M; Move Content pointed to HL m/m location to
accumulator.
220B 23      INX H; increment H
220C BE      CMP M; Compare with next number ( consecutive 2 nums)

220D DA 17 22 JC AISNOTGREATER; if carry is generated A<M

        ;else swapping the 2 consecutives.
2210 56      MOV D, M;
2211 77      MOV M,A;
2212 2B      DCX H;
2213 72      MOV M,D;
2214 23      INX H; swapping Done.
2215 1E 01    MVI E, 01H; Set E flag that swapping occured.

2217 0D      AISNOTGREATER: DCR C; Decrease loop count.
2218 C2 0A 022 JNZ LOOP2; if zero flag is not set continue looping.

221B 7B      MOV A, E;
221C 0F      RRC; Right rotate accumulator;
221D DA 02 022 JC LOOP; if E has 01H, RRC sets the CY flag, i.e need to
traverse the list again.
2220 76      HLT;

```

Start 204eh		
Address (Hex)	Address	Data
204E	8270	3
204F	8271	7
2050	8272	3
2051	8273	5
2052	8274	9
2053	8275	12
2054	8276	18
2055	8277	25
2056	8278	64
2057	8279	0

(iv) Sort Numbers in descending Order.

```
2200 21 4F 20      LOOP: LXI H, 204FH; Store 204FH in HL register pair, the
m/m location where consecutive numbers are stored along with N.
2203 4E          MOV C,M; Move the number of elements(N) to C register.
2204 23          INX H; Increment the HL pair( Extended register pair)
2205 0D          DCR C; Decrease N by 1 to make it ready for counting.
2206 1E 00      MVI E, 00H; Register E is working somewhat like flag to check
if the list got sorted or not

2208 7E          LOOP2: MOV A, M; Move Content pointed to HL m/m location to
accumulator.
2209 23          INX H; increment H
220A BE          CMP M; Compare with next number ( consecutive 2 nums)

220B D2 15 22      JNC AISGREATER; if carry is generated A>M

                ;else swapping the 2 consecutives.
220E 56          MOV D, M;
220F 77          MOV M,A;
2210 2B          DCX H;
2211 72          MOV M,D;
2212 23          INX H;

2213 1E 01      MVI E, 01H; Set E flag that swapping occurred.
2215 0D          AISGREATER: DCR C; Decrease loop count.
2216 C2 08 022    JNZ LOOP2; if zero flag is not set continue looping.

2219 7B          MOV A, E;
221A 0F          RRC; Right rotate accumulator;
221B DA 00 022    JC LOOP; if E has 01H, RRC sets the CY flag, i.e need to
traverse the list again.
221E 76          HLT;
```


Start 204eh		
Address (Hex)	Address	Data
204E	8270	3
204F	8271	7
2050	8272	64
2051	8273	25
2052	8274	18
2053	8275	12
2054	8276	9
2055	8277	5
2056	8278	3
2057	8279	0

(Q5) N numbers are stored in consecutive m/m location starting from 2050H the value of N is Stored in 204FH write a program to copy the even odd numbers starting from 2100H and 2200H Store the total number of ODD and EVEN in 2301H and 2300H.

```

2200 31 00 045    LXI SP, 4500H; Store Stack Pointer with 4500H

2203 21 50 20     LXI H, 2050H; Store 2500H in HL pair the m/m where
numbers are stored.
2206 01 00 021     LXI B, 2100H; For even numbers storing purpose
2209 11 00 022     LXI D, 2200H; For odd numbers storing purpose

220C 3A 4F 20     LDA 204FH; Load Accumulator with N(number of element)
220F F5          PUSH PSW; Push Acc and Flags to SP, since I already exhausted
all registers.

```

```

2210 7E      LOOP: MOV A, M; Move content of HL Pair to Accumulator.

2211 E6 01   ANI 001H; To check the LSB if zero flag is set it's even else
odd.
2213 7E      MOV A,M; Move original content to Acc

2214 C2 1C 22      JNZ NOTEVEN;

        ; If even store it into location pointed by BC pair
2217 02      STAX B;
2218 03      INX B; Increment BC pair
2219 C3 1E 22      JMP REGULAR; No need to execute the odd part, jump
regular execution

        ; If odd store it into location pointed by DE pair
221C 12      NOTEVEN: STAX D;
221D 13      INX D;

        ;pop Process status word or Accumulator + Flags into the same
221E F1      REGULAR: POP PSW;
221F 23      INX H; Increment HL pair
2220 3D      DCR A; Decrease Accumulator

2221 F5      PUSH PSW; Repush with updates
2222 C2 10 22      JNZ LOOP; If N is not 0 keep looping.

2225 79      MOV A,C;
2226 32 00 023    STA 2300H; Store C, which denotes the number of Even
writes.

2229 7B      MOV A, E;
222A 32 01 023    STA 2301H; Store E, which denotes the number of Even
writes.
222D 76      HLT;

```

Start 204fh		
Address (Hex)	Address	Data
204F	8271	6
2050	8272	3
2051	8273	6
2052	8274	1
2053	8275	10
2054	8276	12
2055	8277	14
2056	8278	0
2057	8279	0

Start 2100h		
Address (Hex)	Address	Data
2100	8448	6
2101	8449	10
2102	8450	12
2103	8451	14
2104	8452	0

Start 2200h		
Address (Hex)	Address	Data
2200	8704	3
2201	8705	1
2202	8706	0
2203	8707	0

Start 2300h		
Address (Hex)	Address	Data
2300	8960	4
2301	8961	2
2302	8962	0
2303	8963	0
2304	8964	0

(Q6) N numbers are stored in consecutive m/m locations starting from 2050H. The value of N is stored in 204FH. Write a Program to test whether a number stored in 204EH is present in the list, if Present Store its position in the list in 204DH; otherwise store FFH.

```

2200 21 50 20      LXI H, 2050H; Store 2050H in HL Register pair
2203 3A 4F 20      LDA 204FH; Load content of 204FH (Number of elements N)
                   in accumulator
2206 47           MOV B, A; Move N into B register

2207 3A 4E 20      LDA 204EH; Load the Element that needs to be checked(if
                   it is present in the list or not) into the accumulator.

```

```

220A BE      LOOP: CMP M; Compare the content pointed by Hl pair with
accumulator.

220B CA 19 22    JZ MATCHED; If zero flag is set it's a Match.
220E 23      INX H; increment H
220F 05      DCR B; Decreasing N ( the number of Element)
2210 C2 0A 022  JNZ LOOP; if Zero flag is set close loop

2213 3E FF    MVI A, 0FFH; Loop ended No match, Load FF into Accumulator.
2215 32 4D 20  STA 204DH; Store it into 204DH
2218 76      HLT

2219 22 4D 20    MATCHED: SHLD 204DH; If match Found, Store HL Pair into
204DH and 204EH.
221C 76      HLT

```

Start 204Dh		
Address (Hex)	Address	Data
204D	8269	255
204E	8270	4
204F	8271	7
2050	8272	64
2051	8273	25
2052	8274	18
2053	8275	12
2054	8276	9
2055	8277	5
2056	8278	3
2057	8279	0

Start 204Dh		
Address (Hex)	Address	Data
204D	8269	81
204E	8270	32
204F	8271	7
2050	8272	64
2051	8273	25
2052	8274	18
2053	8275	12
2054	8276	9
2055	8277	5
2056	8278	3
2057	8279	0

art 204Dh		
Address (Hex)	Address	Data
204D	8269	0
204E	8270	25
204F	8271	7
2050	8272	64
2051	8273	25
2052	8274	18
2053	8275	12
2054	8276	9
2055	8277	5
2056	8278	3

81 in HEX = 51

32 in Hex = 20 i.e (2051H = address of 25 in the consecutive 204DH & 204EH)