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Computer Organization and Assembly Language
Assignment 03

Task 1: Assembly Language Programming

Write down the states of RAM and registers, in line by line debugging mode, in following given scenarios.

Question 1:-

```
[org 0x100]
mov ax, 3          ax = 3
add ax, 1          ax = 4
mov ax, 2          ax = 2
mov bx, 3          ax = 2 , bx = 3
sub bx, ax         bx = 1 , ax = 2
add ax, bx         ax = 3 , bx = 1
mov ax, 0x4c00     ax = 4C , bx = 1
int 0x21           ax = 0 , bx = 1
```

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Question 02:-

```
[org 0x100]

mov ax, 2
mov bx, 1
sub ax, bx
add ax, bx
add ax, bx
mov ax, 4
mov cx, 4

mov ax, 0x4c00
int 0x21
```

ax = 2

bx = 1 , ax = 2

ax = 1 , bx = 1

ax = 2 , bx = 1

ax = 3 , bx = 1

ax = 4 , bx = 1

ax = 4 , bx = 1 , cx = 4

ax = 4c , bx = 1 , cx = 4

ax = 0 , bx = 0 , cx = 0

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Question 03:-

[org 0x100]

mov ax, 2	ax = 2
mov cx, 4	ax = 2 , cx = 4
mov dx, 1	ax = 2 , cx = 4 , dx = 1
add cx, dx	ax = 2 , cx = 5 , dx = 1
add ax, dx	ax = 3 , cx = 5 , dx = 1
sub cx, dx	ax = 3 , cx = 4 , dx = 1
add dx, ax	ax = 3 , cx = 4 , dx = 4
mov bx, 8	ax = 3 , bx = 8 , cx = 4 , dx = 4
mov ax, 0x4C00	ax = 4C , bx = 8 , cx = 4 , dx = 4
int 0x21	ax = 0 , bx = 0 , cx = 0 , dx = 0

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Question 04:-

Write down state of ram and registers, in line by line debugging mode, in the following given scenario of assembly language.

i.) Fill out the values of registers in hexadecimal i.e. base - 16 after execution of each instruction. Consider values provided are in decimal i.e. base - 10.

ii.) Fill out the values of missing addresses in hexadecimal of the instructions highlighted with '?' in Sr.# 5 and 11. Consider values provided are in hexadecimal.

Sr.#	Addresses	Machine Code	Assembly Code	State of RAM/register
1			[org 0x100]	
2				
3	00000000	BB0A00	mov bx, 10	bx = A
4	00000003	B80200	mov ax, 2	ax = 2, bx = A
5	00000006	F7E3	mul bx	ax = 14, bx = A
6	00000008	B80400	mov ax, 4	ax = 4, bx = A
7	0000000B	01C3	add bx, ax	ax = 4, bx = E
8	0000000D	29C3	sub bx, ax	ax = 4, bx = A
9				
10	0000000F	B8004C	mov ax, 0x4C00	ax = 4C, bx = A
11	00000012	CD21	int 0x21	ax = 0, bx = 0

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Task 2: Instruction Groups

Question 04:-

Explain and differentiate the four instruction groups of the assembly language in which the instructions have been categorized i.e.

1. Data movement instructions
2. Arithmetic Logic Instructions
3. Program Control group instructions
4. Special group instructions

Instruction Groups of Assembly Language:-

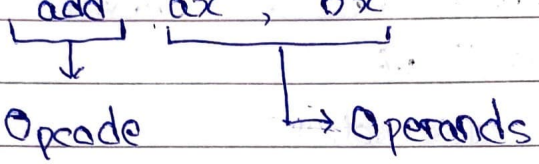
1. Data Movement Instructions:

Data movement instructions move data from one place (source) to another place (destination). For example,

```
mov   ax,   4  ⟶ source operand
      ↓
destination
operand
```

2. Arithmetic Logic Operation:

The arithmetic logic operation define the set of operations performed by the processor's Arithmetic Logic Unit. For example,



3. Program Control Group Instruction:

Program control group instructions are the machine codes that are used to command the processor to act accordingly. These instructions basically control the execution of program. For example,

```
comp ax, bx
jne 100
```

4. Special Group Instruction:

Special group instruction are instructions that change the behaviour of CPU. For example,

```
cli
```