



University of Central Punjab

(Incorporated by Ordinance No. XXIV of 2002 promulgated by Government of the Punjab)

FACULTY OF INFORMATION TECHNOLOGY

Computer Organization and Assembly Language

Lab 03

Topic	1. Direct Addressing Mode with variations.
-------	--------------------------------------------

PART 1

Types of Registers:-

The registers are grouped into three categories:-

1. General Purpose registers

1.1. *Data registers*

- 1.1.1. **AX** is the primary accumulator.
- 1.1.2. **BX** is known as the base register.
- 1.1.3. **CX** is known as the count register.
- 1.1.4. **DX** is known as the data register.

1.2. *Pointer registers*

- 1.2.1. Instruction Pointer **IP**
- 1.2.2. Stack Pointer **SP**
- 1.2.3. Base Pointer **BP**

1.3. *Index registers*

- 1.3.1. Source Index **SI**
- 1.3.2. Destination Index **DI**

2. Control registers

- 2.1. Instruction Pointer and Flag register

3. Segment registers

- 3.1. Code Segment **CS**
- 3.2. Data Segment **DS**
- 3.3. Stack Segment **SS**
- 3.4. Extra Segment **ES**



University of Central Punjab

(Incorporated by Ordinance No. XXIV of 2002 promulgated by Government of the Punjab)

FACULTY OF INFORMATION TECHNOLOGY

Types of variables

Type	No. of bits	Example declaration:
Byte	8	Num1: db 43
Word=> 2 bytes	16	Num2: dw 0xABFF
double word=> 2 words	32	Num3: dd 0xABCDEF56

Note: size of both operands must be same for any type of instruction.

For example:

Mov ax,dh ;is wrong because destination is 2 bytes and source is 1 byte.

Viewing memory in DOSBOX

Areas highlighted in red(memory 1) “m1” and blue (memory 2) “m2” are showing the memory contents. *Note:* Two copies of the same memory is displayed in the given windows.

Area highlighted with yellow is showing the ascii values of the contents displayed in the memory m2.

```
DOSBox 0.74, Cpu speed: 3000 cycles, Frameskip 0, Program: AFD
AX 0000 SI 0000 CS 19F5 IP 0100 Stack +0 0000 Flags 7202
BX 0000 DI 0000 DS 19F5 +2 20CD
CX 0028 BP 0000 ES 19F5 HS 19F5 +4 9FFF OF DF IF SF ZF AF PF CF
DX 0000 SP FFFE SS 19F5 FS 19F5 +6 EA00 0 0 1 0 0 0 0 0

CMD >

0100 8A261D01 MOV AH,[011D]
0104 8B1E1E01 MOV BX,[011E]
0108 01D8 ADD AX,BX
010A A32001 MOV [0120],AX
010D 8B0E2201 MOV CX,[0122]
0111 A12401 MOV AX,[0124]
0114 8B1E2601 MOV BX,[0126]
0118 B8004C MOV AX,4C00

m1
1 0 1 2 3 4 5 6 7
DS:0000 CD 20 FF 9F 00 EA F0 FE
DS:0008 AD DE 1B 05 C5 06 00 00
DS:0010 18 01 10 01 18 01 92 01
DS:0018 01 01 01 00 02 FF FF FF
DS:0020 FF FF FF FF FF FF FF FF
DS:0028 FF FF FF FF EB 19 C0 11
DS:0030 A2 01 14 00 18 00 F5 19
DS:0038 FF FF FF FF 00 00 00 00
DS:0040 05 00 00 00 00 00 00 00
DS:0048 00 00 00 00 00 00 00 00

m2
2 0 1 2 3 4 5 6 7 8 9 A B C D E F
DS:0000 CD 20 FF 9F 00 EA F0 FE AD DE 1B 05 C5 06 00 00 = f.n= i | . + . .
DS:0010 18 01 10 01 18 01 92 01 01 01 01 00 02 FF FF FF .....ff. ....
DS:0020 FF FF FF FF FF FF FF FF FF FF FF FF EB 19 C0 11 .....δ. L.
DS:0030 A2 01 14 00 18 00 F5 19 FF FF FF FF 00 00 00 00 6.....J. ....
DS:0040 05 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....

1 Step 2ProcStep 3Retrieve 4Help ON 5BRK Menu 6 7 up 8 dn 9 le 10 ri
```



University of Central Punjab

(Incorporated by Ordinance No. XXIV of 2002 promulgated by Government of the Punjab)

FACULTY OF INFORMATION TECHNOLOGY

Viewing sample variable in memory.

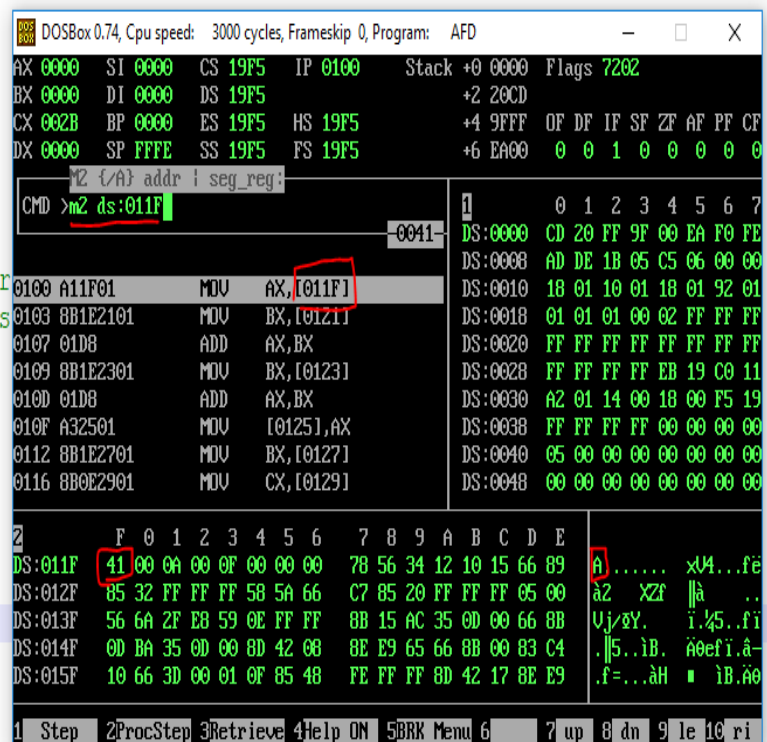
- To view memory from window m2 run the command “m2 ds:Addressofvariable”
example: m2 ds:011F
- A variable with name “num1” is initialized at memory location 11F with value 65 decimal.
41 hex = 65 decimal is the ascii of “A”.

```
[org 0x0100]
```

```
mov ax, [num1] ; load first number in ax
mov bx, [num2] ; load second number in bx
add ax, bx ; accumulate sum in ax
mov bx, [num3] ; load third number in bx
add ax, bx ; accumulate sum in ax
mov [num4], ax ; store sum in num4
mov bx, [num5]; load lower 2 bytes of num5 in bx register
mov cx, [num5+2]; load higher 2 bytes of num5 in cx register

mov ax, 0x4c00 ; terminate program
int 0x21
```

```
num1: dw 65
num2: dw 10
num3: dw 15
num4: dw 0
num5: dd 0x12345678
```





University of Central Punjab

(Incorporated by Ordinance No. XXIV of 2002 promulgated by Government of the Punjab)

FACULTY OF INFORMATION TECHNOLOGY

Direct Addressing Mode

Direct

A fixed offset is given in brackets and the memory at that offset is accessed. For example “mov [1234], ax” stores the contents of the AX registers in two bytes starting at address 1234 in the current data segment. The instruction “mov [1234], al” stores the contents of the AL register in the byte at offset 1234.

- Mov ax,[num1]
;reading
- Mov [num2],ax ;writing

Execute every part of Question 1 in *Nasm with Dosbox* and observe the memory variables and register values.

Example 1.

```
1 ; a program to add three numbers using memory variables by direct mode.
2 [org 0x0100]
3 mov ax, [num1] ; load first number in ax
4 mov bx, [num2] ; load second number in bx
5 add ax, bx ; accumulate sum in ax
6 mov bx, [num3] ; load third number in bx
7 add ax, bx ; accumulate sum in ax
8 mov [num4], ax ; store sum in num4
9
10 mov ax, 0x4c00 ; terminate program
11 int 0x21
12
13 num1:dw 5
14 num2:dw 10
15 num3:dw 15
16 num4:dw 0
```



University of Central Punjab

(Incorporated by Ordinance No. XXIV of 2002 promulgated by Government of the Punjab)

FACULTY OF INFORMATION TECHNOLOGY

Example 2

```
1 ; a program to add three numbers accessed using a single label
2 [org 0x0100]
3 mov ax, [num1] ; load first number in ax
4 mov bx, [num1+2] ; load second number in bx
5 add ax, bx ; accumulate sum in ax
6 mov bx, [num1+4] ; load third number in bx
7 add ax, bx ; accumulate sum in ax
8 mov [num1+6], ax ; store sum at num1+6
9 mov ax, 0x4c00 ; terminate program
10 int 0x21
11
12 num1: dw 5
13 dw 10
14 dw 15
15 dw 0
```

Example 3

```
1
2 ; a program to add three numbers using byte variables
3 [org 0x0100]
4 mov al, [num1] ; load first number in al
5 mov bl, [num1+1] ; load second number in bl
6 add al, bl ; accumulate sum in al
7 mov bl, [num1+2] ; load third number in bl
8 add al, bl ; accumulate sum in al
9 mov [num1+3], al ; store sum at num1+3
10
11 mov ax, 0x4c00 ; terminate program
12 int 0x21
13
14 num1: db 5, 10, 15, 0
```



University of Central Punjab

(Incorporated by Ordinance No. XXIV of 2002 promulgated by Government of the Punjab)

FACULTY OF INFORMATION TECHNOLOGY

Practice Tasks

Write a program to solve the following:

Use **Direct addressing mode** to access memory variables:

Let

Var1=10

Var2=20

Var3=2

Var4=50

Var5=90

Save the sum of these (using **Direct addressing mode**) Five variables (Var1+ Var2+ Var3+ Var4+Var5) in ax.

NOTE: *Execute the code in sequence.*