Computer Organization and Assembly Language Programming
Lab Manual 1 – Setup and Running Your First Program

Activity 1: Setup

Option 1:

Follow this link to get started:

https://github.com/ASD0x41/Assembly-Programming-Package. If the above link doesn't

work for you, then follow this:

Suggested version of NASM (you will need to install this in the coming instructions)**:**
https://www.nasm.us/pub/nasm/releasebuilds/2.15.05/

Option 2:

You may follow the links given below for the **Video Tutorial on Setup**:

Tutorial part
1: https://drive.google.com/file/d/1N3lWL8hsN0ZbhF3tlNwCWWwjJ_eHQqk6/view?usp=sharing

Tutorial part
2: https://drive.google.com/file/d/10p8qyaOVOwF5lDighrMKE-uNYQX-c3bL/view?usp=sharing

AFD: https://drive.google.com/file/d/1eXnD3JEwBelFiJT6iIk7gluudV2Fu_iX/view?usp=sharing

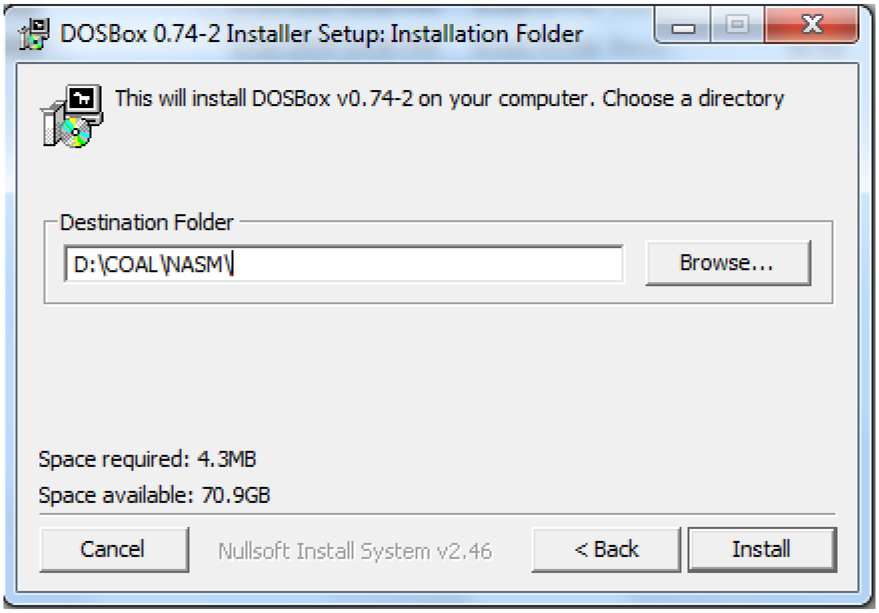
NASM: https://drive.google.com/file/d/1ZoeE2MxjNaK7DdJKCacYfAJyn006MI_F/view?usp=sharing

Dosbox: https://drive.google.com/file/d/1DnaDIk4RoGBFDP1y4Dr3q89xwM3gx1d1/view?usp=sharing

Option 3:

Create a separate folder named "COAL" and "NASM" on your machine, for example, "D:\COAL\NASM". Visit the link given below. Download and install NASM, AFD, and DOSBOX, according to the instructions, in your NASM folder.

http://wetolearn.blogspot.com/2013/09/setting-up-afd-nasm-and-dosbox-for-8086.html



DOSBox 0.74-2 Installer Setup: Installation Folder

This will install DOSBox v0.74-2 on your computer. Choose a directory

Destination Folder: D:\COAL\NASM\

Space required: 4.3MB

Space available: 70.9GB

After installation, double-click the “DOSBox 0.74-2 Options.bat” file and at the end of the file paste the following lines:

```
MOUNT C D://COAL//NASM
C:
```

(We are mounting the C drive to our folder where we have saved AFD and we will save our .asm file in this directory)

Activity 2: Running Your First Program

Follow these steps to run your first program:

1.Copy/paste the following code in Notepad

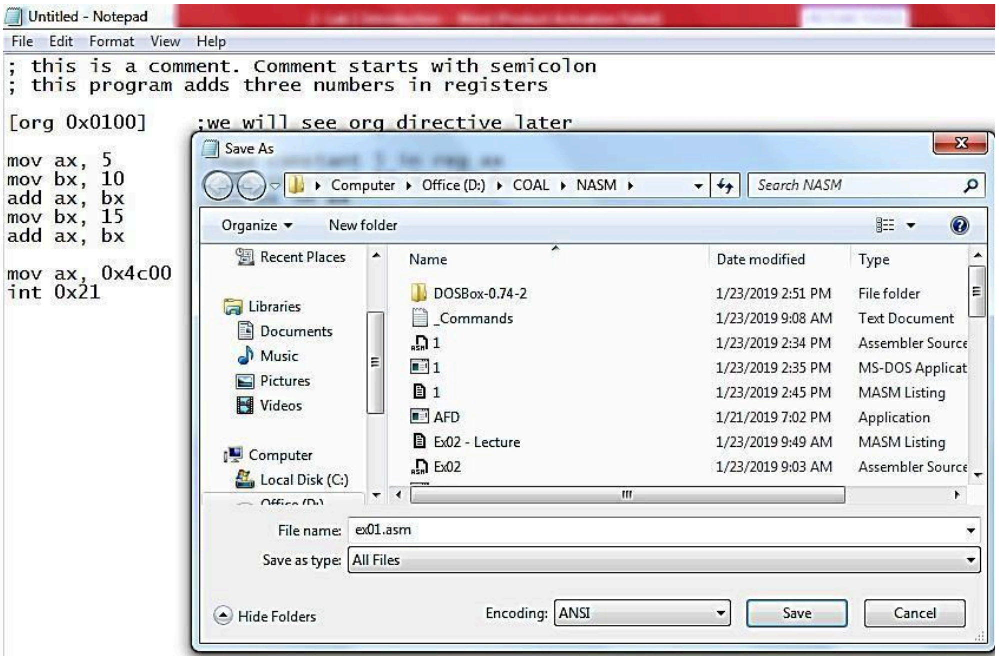
```
; this is a comment. Comment starts with semicolon
; this program adds three numbers in registers

[org 0x0100]    ;we will see org directive later

mov ax, 5       ; AX = 5
mov bx, 10      ; BX = 10
add ax, bx      ; AX = AX + BX
mov bx, 15      ; BX = 15
add ax, bx      ; AX = AX + BX

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

2.Save this file as “ex01.asm” in your NASM folder e.g., “D:\COAL\NASM”:



```
; this is a comment. Comment starts with semicolon
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[org 0x0100]    ;we will see org directive later

mov ax, 5
mov bx, 10
add ax, bx
mov bx, 15
add ax, bx

mov ax, 0x4c00
int 0x21
```

Name	Date modified	Type
DOSBox-0.74-2	1/23/2019 2:51 PM	File folder
_Commands	1/23/2019 9:08 AM	Text Document
1	1/23/2019 2:34 PM	Assembler Source
1	1/23/2019 2:35 PM	MS-DOS Applicat
1	1/23/2019 2:45 PM	MASM Listing
AFD	1/21/2019 7:02 PM	Application
Ex02 - Lecture	1/23/2019 9:49 AM	MASM Listing
Ex02	1/23/2019 9:03 AM	Assembler Source

File name: ex01.asm

Save as type: All Files

Encoding: ANSI

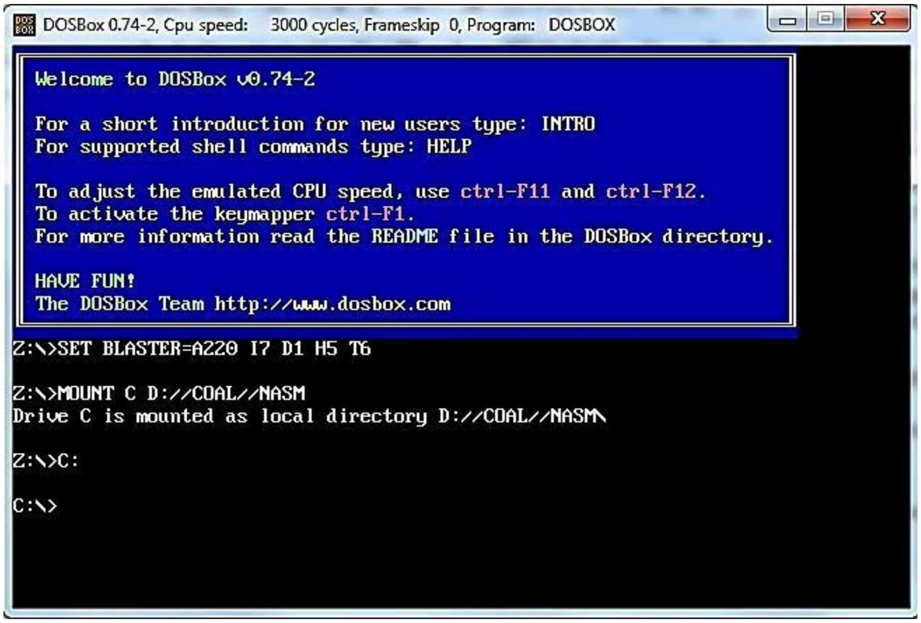
3. Write the following command in the DOSBox: (Your .asm file and nasm should be in one folder)

nasm ex01.asm -o ex01.com -l ex01.lst

4. The above command will assemble your code and create ex01.com and ex01.lst files. Open ex01.lst file in Notepad.

a. What is the opcode of the instruction “mov ax, someConstant”
b. Verify the above opcode in all instances where the instruction has been used.
c. What does “B80500” mean?
d. Verify the opcode of the instruction “mov bx, someConstant” throughout the machine code.
e. What is the offset of first instruction?
f. Why are offsets of second and third instructions 3 and 6?
g. What should be the size of ex01.com file?
h. Right click ex01.com and verify its size.

5. Open DOSBox (by double clicking dosbox.exe), following window will appear:

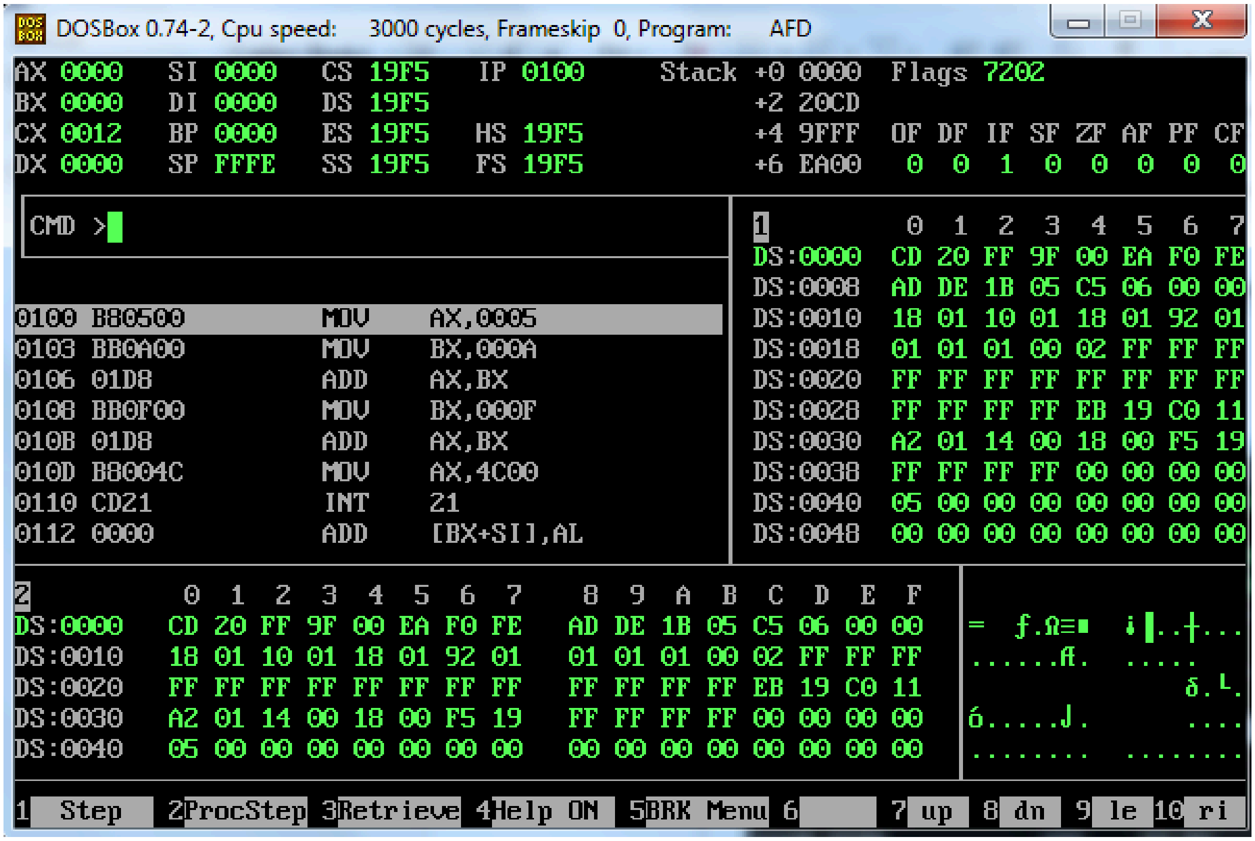

DOSBox 0.74-2, Cpu speed: 3000 cycles, Frameskip 0, Program: DOSBOX

```
Welcome to DOSBox v0.74-2

For a short introduction for new users type: INTRO
For supported shell commands type: HELP

To adjust the emulated CPU speed, use ctrl-F11 and ctrl-F12.
To activate the keymapper ctrl-F1.
For more information read the README file in the DOSBox directory.

HAVE FUN!
The DOSBox Team http://www.dosbox.com

Z:\>SET BLASTER=A220 I7 D1 H5 T6

Z:\>MOUNT C D://COAL//NASM
Drive C is mounted as local directory D://COAL//NASM\

Z:\>C:

C:\>
```

6. Write following command and press enter.

Afd ex01.com

(Your AFD.exe should be in same directory where we have installed everything)


DOSBox 0.74-2, 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 0012   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 >                                          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
0100 B80500          MOV     AX,0005            DS:0010  18 01 10 01 18 01 92 01
0103 BB0A00          MOV     BX,000A            DS:0018  01 01 01 00 02 FF FF FF
0106 01D8            ADD     AX,BX              DS:0020  FF FF FF FF FF FF FF FF
0108 BB0F00          MOV     BX,000F            DS:0028  FF FF FF FF EB 19 C0 11
010B 01D8            ADD     AX,BX              DS:0030  A2 01 14 00 18 00 F5 19
010D B8004C          MOV     AX,4C00            DS:0038  FF FF FF FF 00 00 00 00
0110 CD21            INT     21                 DS:0040  05 00 00 00 00 00 00 00
0112 0000            ADD     [BX+SI],AL         DS:0048  00 00 00 00 00 00 00 00

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   =  ƒ.Ω≡■  ¡▌..┼...
DS:0010   18 01 10 01 18 01 92 01  01 01 01 00 02 FF FF FF   ......Æ.  .....
DS:0020   FF FF FF FF FF FF FF FF  FF FF FF FF EB 19 C0 11                δ.└.
DS:0030   A2 01 14 00 18 00 F5 19  FF FF FF FF 00 00 00 00   ó.....⌡.      ....
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
```

7. Above command will open the debugger and load your ex01.com file in it.
   a. What is the value of IP register? And what will be its effect?

b. Note the initial values of the data registers
c. Press F1 and watch the values of the data registers

Activity 3: Explore different functions available in the debugger (after completing activity 4).

Activity 4: Make a program to generate the sum of three numbers, and watch its execution in the debugger.

Activity 5: Write a program in assembly language that calculates the square of five by adding five to the AX register 5 times. Watch the execution of your code in the debugger to ensure that the result is correct or not.

Activity 6: Write a program in assembly language that adds the contents of the registers ax and bx, subtracts the contents of the cx register from it, and stores the final result in the dx register. Given initial value of ax=0x1234, bx = 0x3456, and cx = 0x1132. Watch the execution of your code in the debugger to ensure that the result is correct or not.