VIT®
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

Experiment 1:

Arithmetic Operations (Addition, Subtraction, Multiplication, Division) on 8-Bit and 16-Bit Numbers

Programme	:	**BTech. CSE Core**	Semester	:	**Win 2021-22**
Course	:	**Microprocessor and Interfacing**	Code	:	**CSE2006**
Faculty	:	**Dr. Florence Gnana Poovathy J**	Slot	:	**L15+L16**
Name	:	**Hariket Sukesh Kumar Sheth**	Register No.	:	**20BCE1975**

Date: 12-01-2022 Exp. 01 Arithmetic Operations

Addition (8 bit)

Aim: To Perform Addition of 8-Bit Numbers

Algorithm:

Step 1: Mount the c drive using the command: **mount c c:\masm611\bin**

Step 2: Press **Enter,** Type **c:** to switch from z: to c: drive.

Step 3: Enter the command **edit add8.asm** for writing/editing the code.

Step 4: A pop window appears, write your code(instructions) there for Addition of 8-Bit Numbers.

i) Start.
ii) Let CS is Code and DS is Data.
iii) Code Segment starts.
iv) Move Data to AL.
v) Move Data to BL.
vi) Add Data of AL and BL.
vii) Code Segment ends.
viii) End.

Step 5: Save the Code, and exit the editor. Type the command **masm add8.asm** for running the code. The object file is created.

Step 6: Next, Type the command **link add8.obj;** to link the object file to library file present in the bin folder.

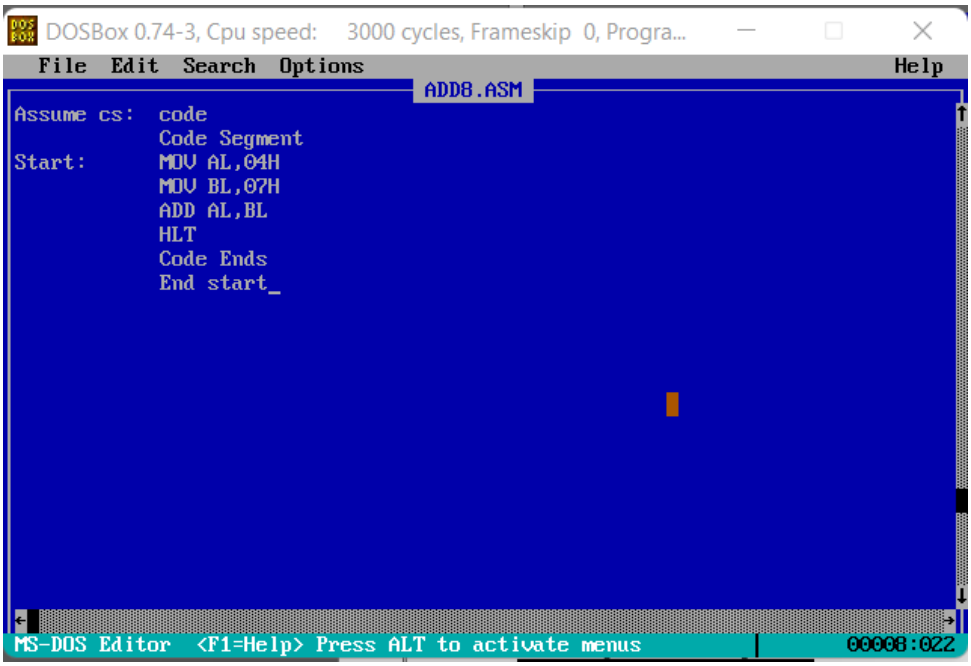
Step 7: Type **debug add8.exe** to execute the code.

-u

-g 0764:0006 to view the result in all the registers specifically at that HLT Position.
(-g <Address of HLT Command>)

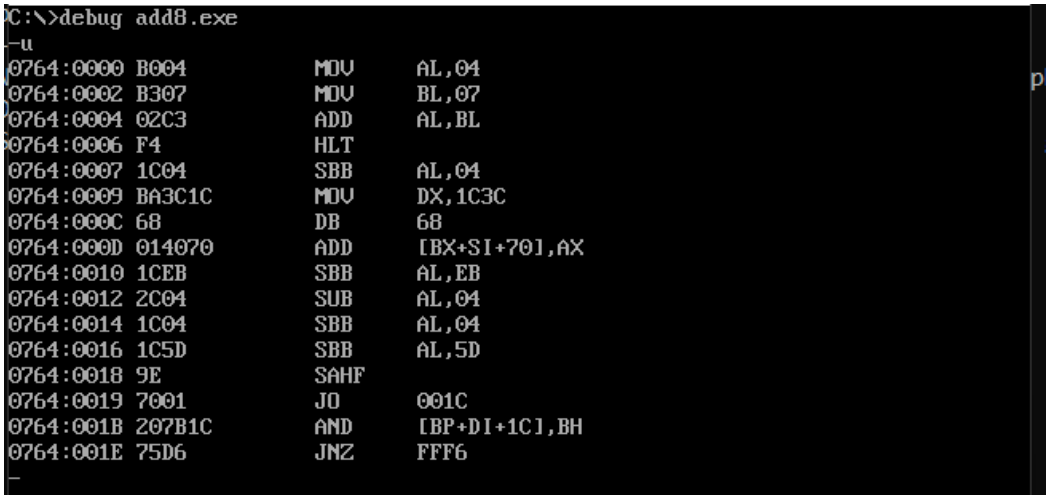
We check here the value stored in **AX register** which is the result obtained after addition of values in AL and BL registers.

Program:

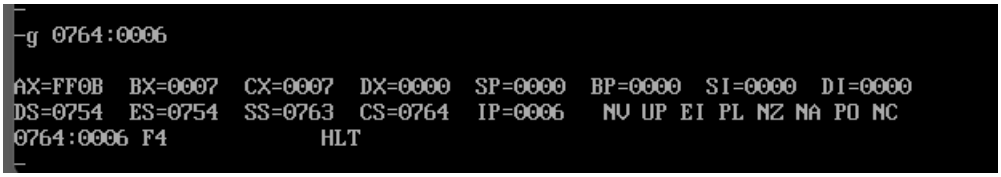


Sample Input:	**Sample Output:**
AL= 04H BL= 07H	AL=AL+BL AL=04H+07H=0BH Hence, AX=FF0B

Register / Memory Contents for I/O:



Output:



Date: 12-01-2022	Exp. 01	Arithmetic Operations	VIT Vellore Institute of Technology (Deemed to be University under section 3 of UGC Act, 1956)

Addition (16 bit)

Aim: To Perform Addition of 16-Bit Numbers

Algorithm:

Step 1: Mount the c drive using the command: **mount c c:\masm611\bin**

Step 2: Press **Enter,** Type **c:** to switch from z: to c: drive.

Step 3: Enter the command **edit add16.asm** for writing/editing the code.

Step 4: A pop window appears, write your code(instructions) there for Addition of 16-Bit Numbers.

i) Start.
ii) Let CS is Code and DS is Data.
iii) Code Segment starts.
iv) Move Data to AX.
v) Move Data to BX.
vi) Add Data of AX and BX.
vii) Code Segment ends.
viii) End.

Step 5: Save the Code, and exit the editor. Type the command **masm add16.asm** for running the code. The object file is created.

Step 6: Next, Type the command **link add16.obj;** to link the object file to library file present in the bin folder.

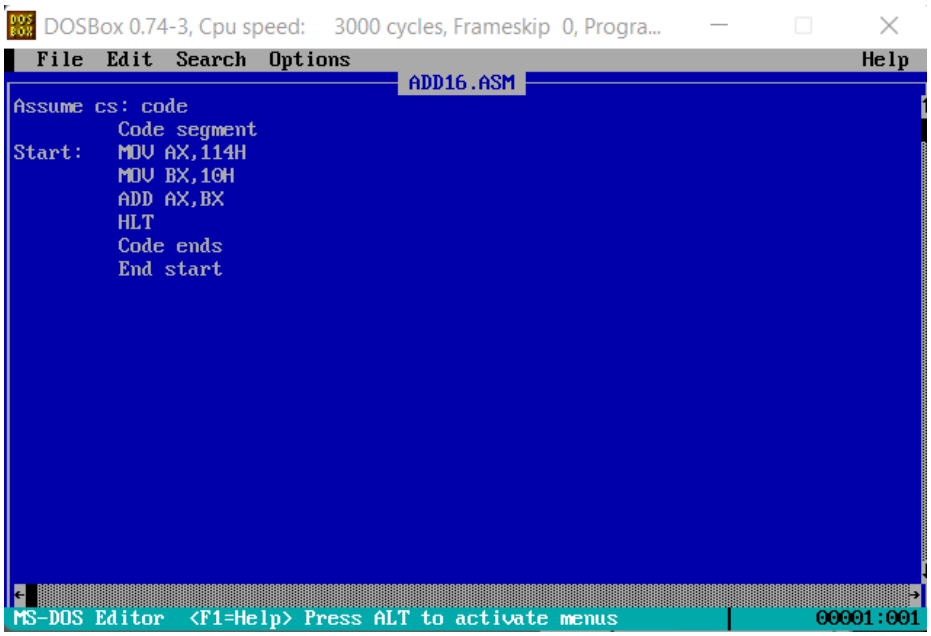
Step 7: Type **debug add16.exe** to execute the code.

-u

-g 0764:0008 to view the result in all the registers specifically at that HLT Position.
(-g <Address of HLT Command>)

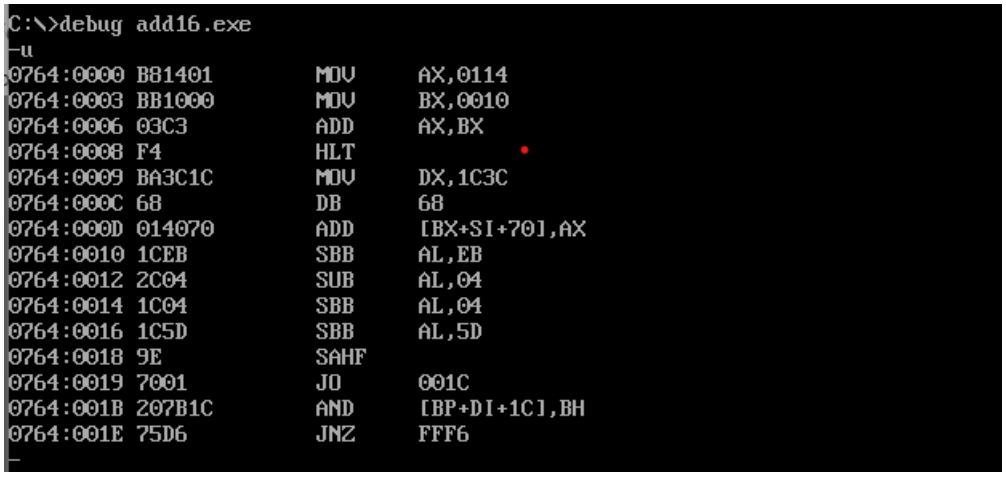
We check here the value stored in **AX register** which is the result obtained after addition of values in AX and BX registers.

Program:

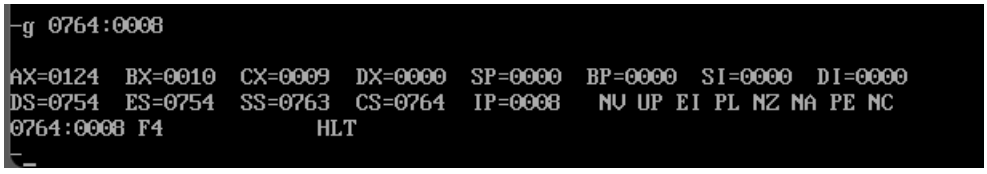


Sample Input:	**Sample Output:**
AX = 0114H BX = 0010H	AX=AX+BX AX=0114H+0010H=0124H Hence, AX=0124

Register / Memory Contents for I/O:



Output:



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Subtraction (8 bit)

Aim: To Perform Subtraction of 8-Bit Numbers

Algorithm:

Step 1: Mount the c drive using the command: **mount c c:\masm611\bin**

Step 2: Press **Enter,** Type **c:** to switch from z: to c: drive.

Step 3: Enter the command **edit sub8.asm** for writing/editing the code.

Step 4: A pop window appears, write your code(instructions) there for Subtraction of 8-Bit Numbers.

a. Start.
b. Let CS is Code and DS is Data.
c. Code Segment starts.
d. Move Data to AL.
e. Move Data to BL.
f. Subtract Data of AL and BL.
g. Code Segment ends.
h. End.

Step 5: Save the Code, and exit the editor. Type the command **masm sub8.asm** for running the code. The object file is created.

Step 6: Next, Type the command **link sub8.obj;** to link the object file to library file present in the bin folder.

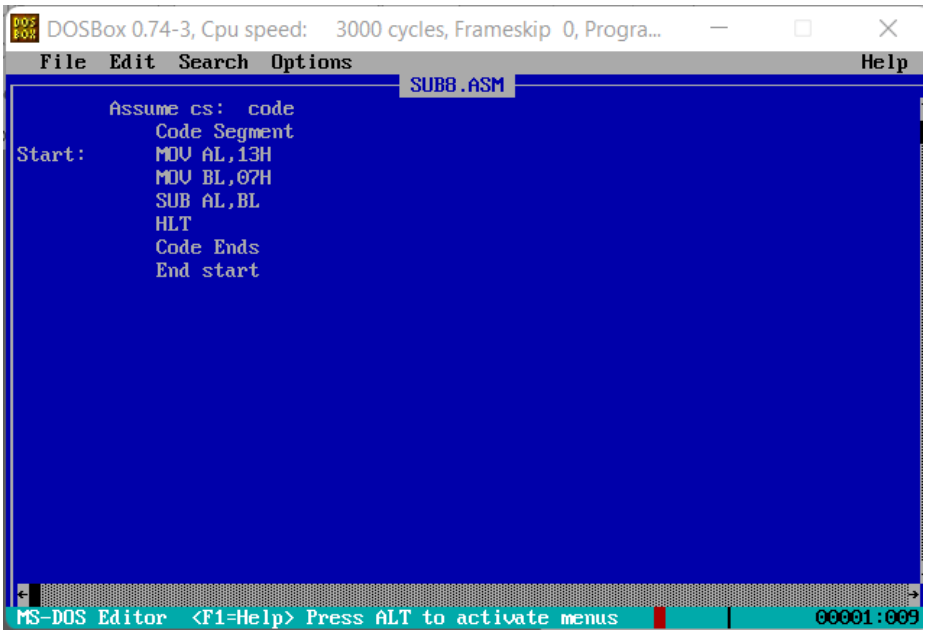
Step 7: Type **debug sub8.exe** to execute the code.

-u

-g 0764:0006 to view the result in all the registers specifically at that HLT Position.
(-g <Address of HLT Command>)

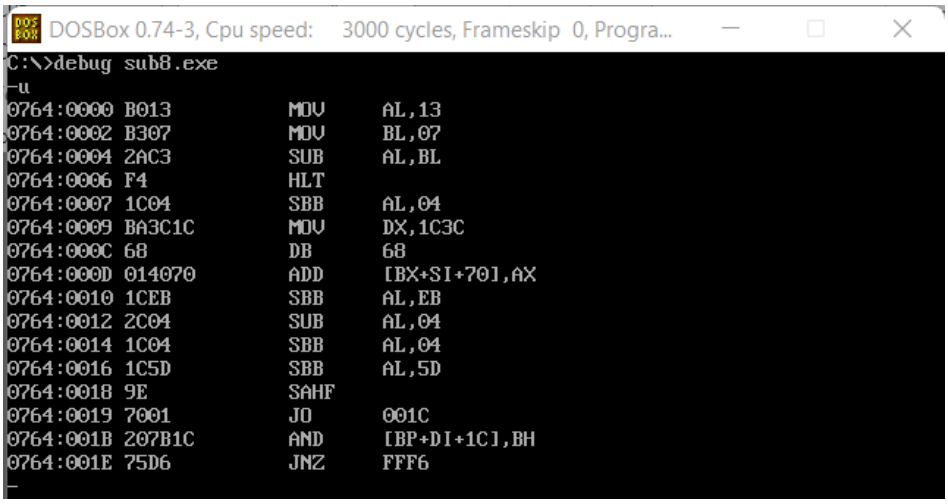
We check here the value stored in **AX register** which is the result obtained after subtraction of values in AL and BL registers.

Program:

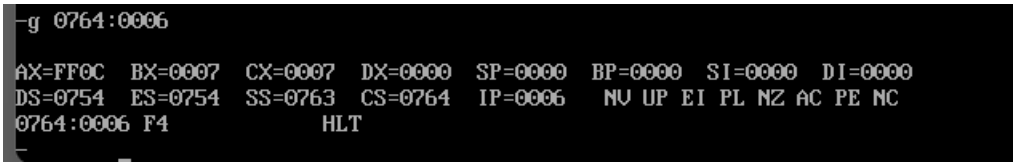


Sample Input:	**Sample Output:**
AL= 13H = 19_2 BL= 07H = 7_2	AL=AL-BL AL=13H-07H=$19_2 - 7_2 = 12_2$ = 0CH Hence, AX=FF0C

Register / Memory Contents for I/O:



Output:



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Subtraction (16 bit)

Aim: To Perform Subtraction of 16-Bit Numbers

Algorithm:

Step 1: Mount the c drive using the command: **mount c c:\masm611\bin**

Step 2: Press **Enter,** Type **c:** to switch from z: to c: drive.

Step 3: Enter the command **edit sub16.asm** for writing/editing the code.

Step 4: A pop window appears, write your code(instructions) there for Subtraction of 16-Bit Numbers.

a. Start.
b. Let CS is Code and DS is Data.
c. Code Segment starts.
d. Move Data to AX.
e. Move Data to BX.
f. Subtract Data of AX and BX.
g. Code Segment ends.
h. End.

Step 5: Save the Code, and exit the editor. Type the command **masm sub16.asm** for running the code. The object file is created.

Step 6: Next, Type the command **link sub16.obj;** to link the object file to library file present in the bin folder.

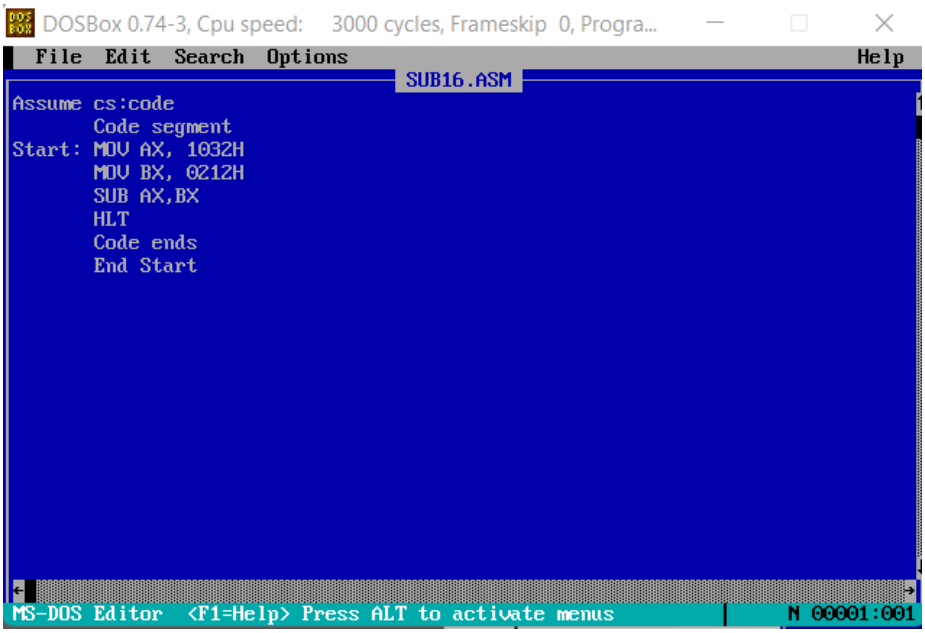
Step 7: Type **debug sub16.exe** to execute the code.

-u

-g 0764:0008 to view the result in all the registers specifically at that HLT Position.
(-g <Address of HLT Command>)

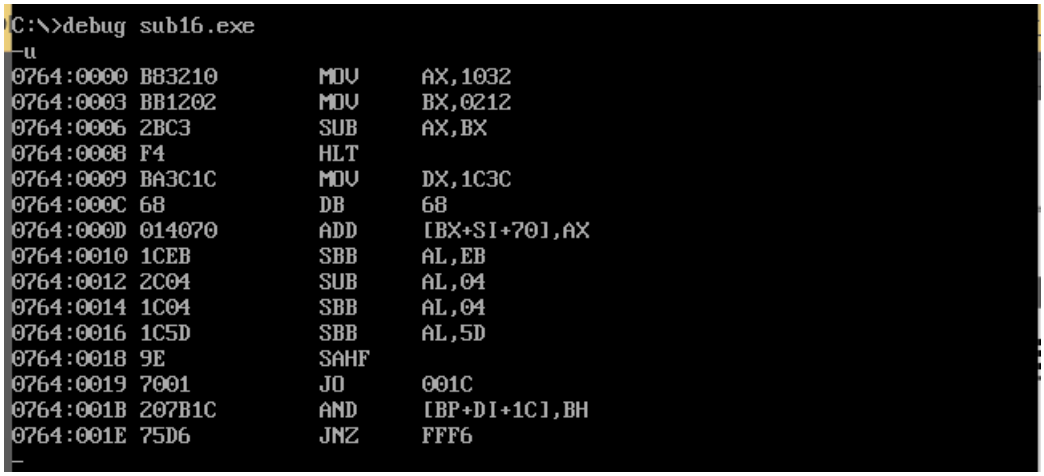
We check here the value stored in **AX register** which is the result obtained after subtraction of values in AX and BX registers.

Program:

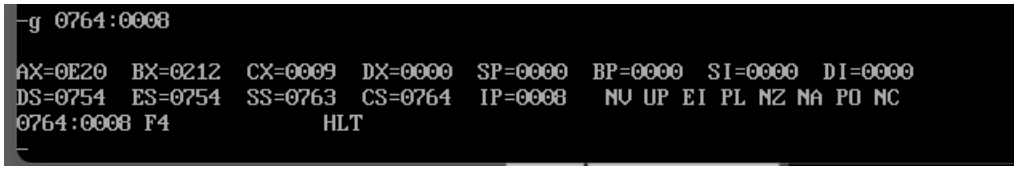


Sample Input:	**Sample Output:**
AX = 1032H = 4146_2 BX = 0212H = 530_2	AX=AX-BX AX=1032H-0212H= $4146_2 - 530_2 = 3616_2$ = 0E20H Hence, AX=0E20

Register / Memory Contents for I/O:



Output:



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Multiplication (8 bit)

Aim: To Perform Multiplication of 8-Bit Numbers

Algorithm:

Step 1: Mount the c drive using the command: **mount c c:\masm611\bin**

Step 2: Press **Enter,** Type **c:** to switch from z: to c: drive.

Step 3: Enter the command **edit mul8.asm** for writing/editing the code.

Step 4: A pop window appears, write your code(instructions) there for Multiplication of 8-Bit Numbers.

i. Start.
j. Let CS is Code and DS is Data.
k. Code Segment starts.
l. Move Data to AL.
m. Move Data to BL.
n. Multiply Data of AL and BL.
o. Code Segment ends.
p. End.

Step 5: Save the Code, and exit the editor. Type the command **masm mul8.asm** for running the code. The object file is created.

Step 6: Next, Type the command **link mul8.obj;** to link the object file to library file present in the bin folder.

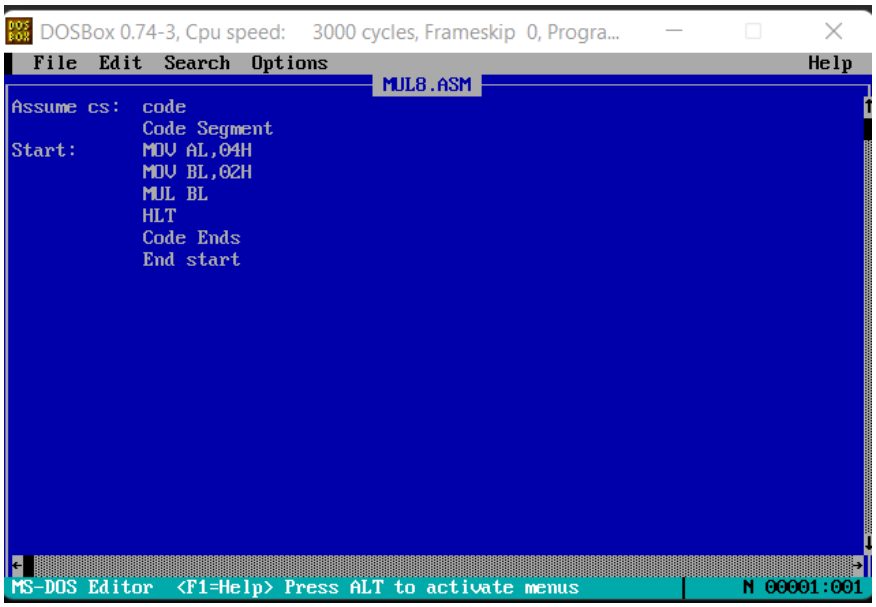
Step 7: Type **debug mul8.exe** to execute the code.

-u

-g 0764:0006 to view the result in all the registers specifically at that HLT Position.
(-g <Address of HLT Command>)

We check here the value stored in **AX register** which is the result obtained after multiplication of values in AL and BL registers.

Program:



Sample Input:	**Sample Output:**
AL= 04H BL= 02H	AL=AL*BL AL=04H * 02H = 08H Hence, AX=0008

Register / Memory Contents for I/O:

```
C:\>debug mul8.exe
-u
0764:0000 B004          MOV     AL,04
0764:0002 B302          MOV     BL,02
0764:0004 F6E3          MUL     BL
0764:0006 F4            HLT
0764:0007 1C04          SBB     AL,04
0764:0009 BA3C1C        MOV     DX,1C3C
0764:000C 68            DB      68
0764:000D 014070        ADD     [BX+SI+70],AX
0764:0010 1CEB          SBB     AL,EB
0764:0012 2C04          SUB     AL,04
0764:0014 1C04          SBB     AL,04
0764:0016 1C5D          SBB     AL,5D
0764:0018 9E            SAHF
0764:0019 7001          JO      001C
0764:001B 207B1C        AND     [BP+DI+1C],BH
0764:001E 75D6          JNZ     FFF6
-
```

Output:

```
- g 0764:0006

AX=0008  BX=0002  CX=0007  DX=0000  SP=0000  BP=0000  SI=0000  DI=0000
DS=0754  ES=0754  SS=0763  CS=0764  IP=0006   NV UP EI PL NZ NA PO NC
0764:0006 F4            HLT
-
```

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Multiplication (16 bit)

Aim: To Perform Multiplication of 16-Bit Numbers

Algorithm:

Step 1: Mount the c drive using the command: **mount c c:\masm611\bin**

Step 2: Press **Enter,** Type **c:** to switch from z: to c: drive.

Step 3: Enter the command **edit mul16.asm** for writing/editing the code.

Step 4: A pop window appears, write your code(instructions) there for Multiplication of 16-Bit Numbers.

i. Start.
j. Let CS is Code and DS is Data.
k. Code Segment starts.
l. Move Data to AX.
m. Move Data to BX.
n. Multiply Data of AX and BX.
o. Code Segment ends.
p. End.

Step 5: Save the Code, and exit the editor. Type the command **masm mul16.asm** for running the code. The object file is created.

Step 6: Next, Type the command **link mul16.obj;** to link the object file to library file present in the bin folder.

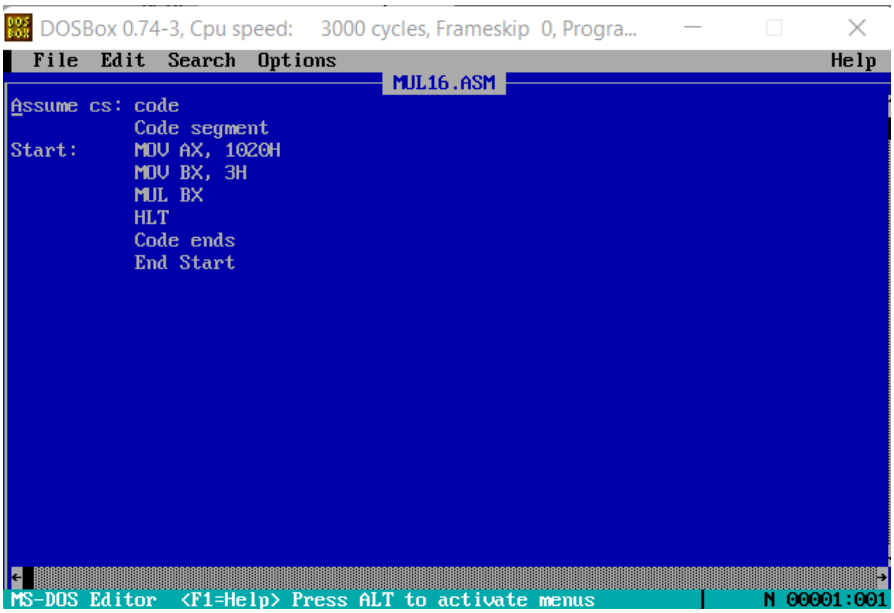
Step 7: Type **debug mul16.exe** to execute the code.

-u

-g 0764:0008 to view the result in all the registers specifically at that HLT Position.
(-g <Address of HLT Command>)

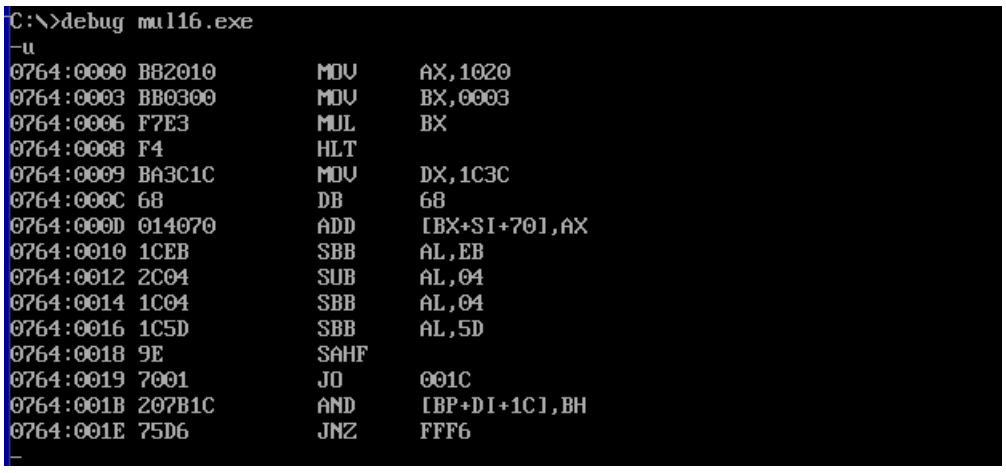
We check here the value stored in **AX register** which is the result obtained after multiplication of values in AX and BX registers.

Program:

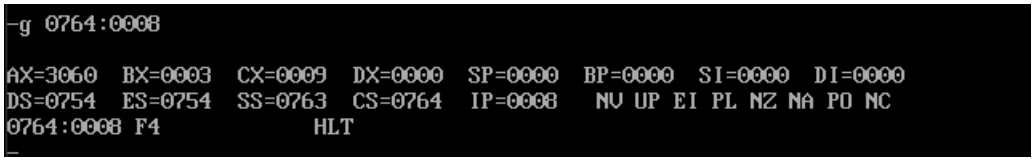


Sample Input:	**Sample Output:**
AX = 1020H BX = 0003H	AX=AX*BX AX=1020*3 = 3060H Hence, AX=3060

Register / Memory Contents for I/O:



Output:



Date: 12-01-2022	Exp. 01	Arithmetic Operations	VIT Vellore Institute of Technology (Deemed to be University under section 3 of UGC Act, 1956)

Division (8 bit)

Aim: To Perform Division of 8-Bit Numbers

Algorithm:

Step 1: Mount the c drive using the command: **mount c c:\masm611\bin**

Step 2: Press **Enter,** Type **c:** to switch from z: to c: drive.

Step 3: Enter the command **edit div8.asm** for writing/editing the code.

Step 4: A pop window appears, write your code(instructions) there for Division of 8-Bit Numbers.

q. Start.
r. Let CS is Code and DS is Data.
s. Code Segment starts.
t. Move Data to AL.(00 to AH)
u. Move Data to BL.
v. Divide Data of AX and BL.
w. Code Segment ends.
x. End.

Step 5: Save the Code, and exit the editor. Type the command **masm div8.asm** for running the code. The object file is created.

Step 6: Next, Type the command **link div8.obj;** to link the object file to library file present in the bin folder.

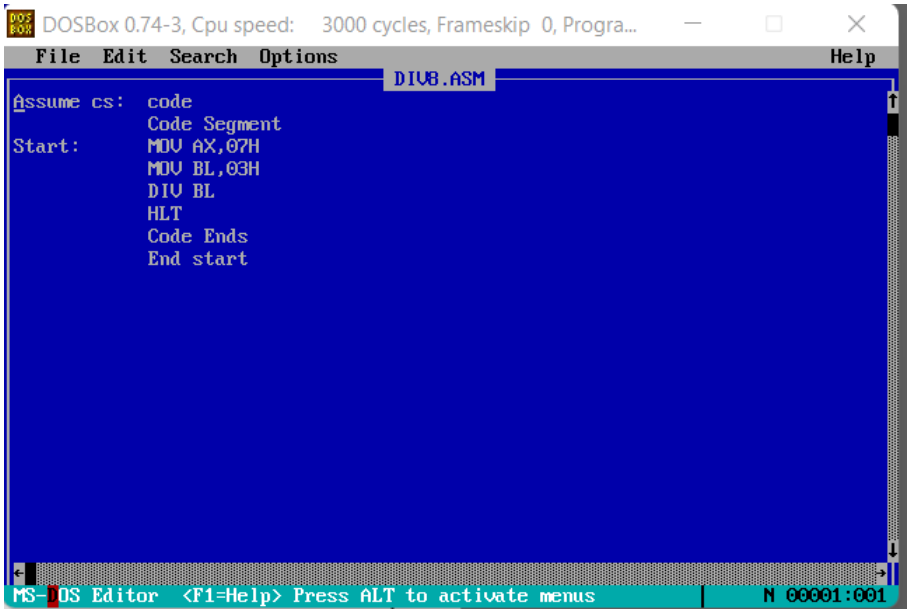
Step 7: Type **debug div8.exe** to execute the code.

-u

-g 0764:0007 to view the result in all the registers specifically at that HLT Position.
(-g <Address of HLT Command>)

We check here the value stored in **AX register** which is the result obtained after division of values in AL and BL registers.

Program:



Sample Input:	**Sample Output:**
AX= 07H BL= 03H	AX = AX/BL Remainder(AH) = 01; Quotient(AL) = 02 Hence, AX=0102

Register / Memory Contents for I/O:

```
C:\>debug div8.exe
-u
0764:0000 B80700        MOV     AX,0007
0764:0003 B303          MOV     BL,03
0764:0005 F6F3          DIV     BL
0764:0007 F4            HLT
0764:0008 04BA          ADD     AL,BA
0764:000A 3C1C          CMP     AL,1C
0764:000C 68            DB      68
0764:000D 014070        ADD     [BX+SI+70],AX
0764:0010 1CEB          SBB     AL,EB
0764:0012 2C04          SUB     AL,04
0764:0014 1C04          SBB     AL,04
0764:0016 1C5D          SBB     AL,5D
0764:0018 9E            SAHF
0764:0019 7001          JO      001C
0764:001B 207B1C        AND     [BP+DI+1C],BH
0764:001E 75D6          JNZ     FFF6
-
```

Output:

```
-g 0764:0007

AX=0102  BX=0003  CX=0008  DX=0000  SP=0000  BP=0000  SI=0000  DI=0000
DS=0754  ES=0754  SS=0763  CS=0764  IP=0007   NV UP EI PL NZ NA PO NC
0764:0007 F4            HLT
```

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Division (16 bit)

Aim: To Perform Division of 16-Bit Numbers

Algorithm:

Step 1: Mount the c drive using the command: **mount c c:\masm611\bin**

Step 2: Press **Enter,** Type **c:** to switch from z: to c: drive.

Step 3: Enter the command **edit div16.asm** for writing/editing the code.

Step 4: A pop window appears, write your code(instructions) there for Division of 16-Bit Numbers.

q. Start.
r. Let CS is Code and DS is Data.
s. Code Segment starts.
t. Move Data to AX.
u. Move Data to BX.
v. Divide Data of AX and BX.
w. Code Segment ends.
x. End.

Step 5: Save the Code, and exit the editor. Type the command **masm div16.asm** for running the code. The object file is created.

Step 6: Next, Type the command **link div16.obj;** to link the object file to library file present in the bin folder.

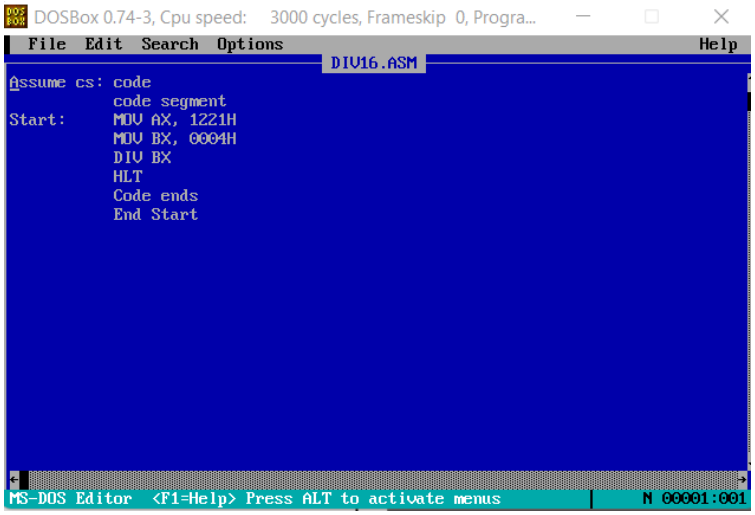
Step 7: Type **debug div16.exe** to execute the code.

-u

-g 0764:0008 to view the result in all the registers specifically at that HLT Position.
(-g <Address of HLT Command>)

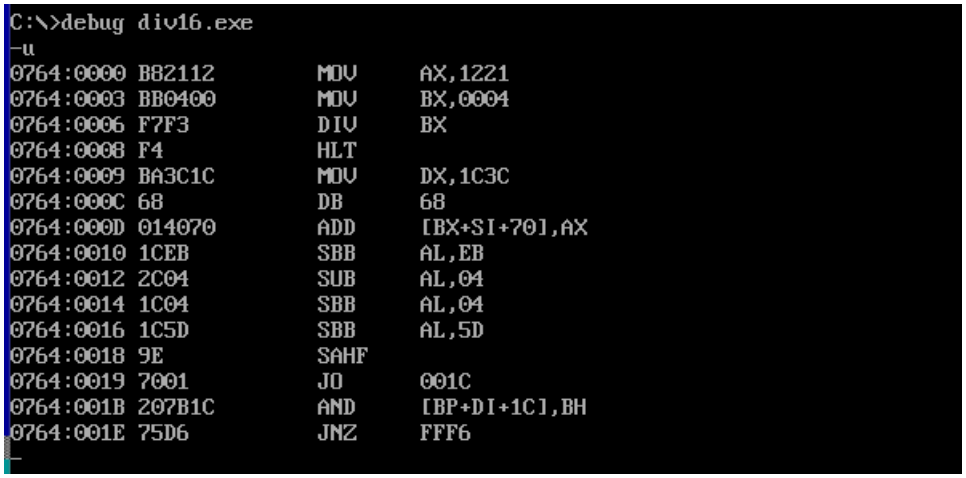
We check here the value stored in **AX register** which is the result obtained after division of values in AX and BX registers.

Program:

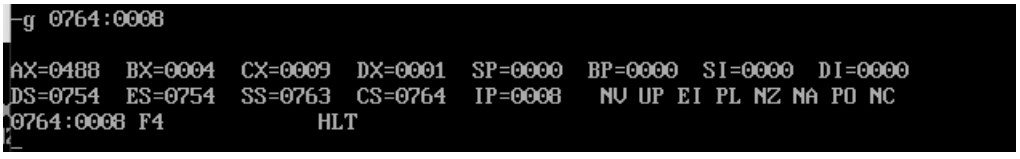


Sample Input:	**Sample Output:**
AX = 1221H = 4641_2 BX = 0004H = 4_2	AX=AX/BX AX=4641/4 = 1160_2 = 0488H Remainder: DX = 0001H Hence, AX=0488H; DX=0001H

Register / Memory Contents for I/O:



Output:



Result: The arithmetic operations are performed in accordance with the calculated values. The assembly code functions as expected