16 BIT ARITHMETIC OPERATIONS

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AIM:

To write assembly language programs to perform 16-bit arithmetic operations and execute them.

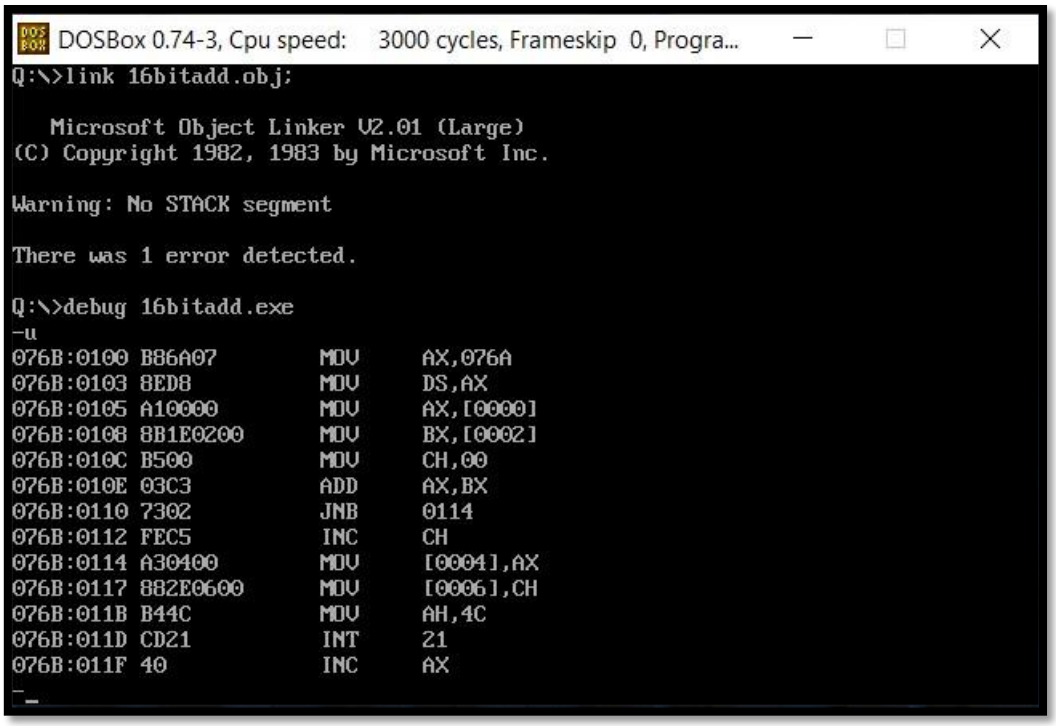
ALGORITHM:

- Begin.
- Open data segment.
- Initialize data segment with required operands, data types and values.
- Close the data segment.
- Open code segment.
- Set a preferred offset (preferably 100)
- Load the data segment content into AX register.
- Transfer the contents of AX register to DS register.
- Do the required operation (ADD, SUB, MUL, DIV) on the registers.
  - Jump (whenever ever carry/ overflow is a possibility) o Increment carry(add) or negate the value. (2's complement) • Introduce an interrupt for safe exit. (INT 21h)
- Close the code segment.
- End.

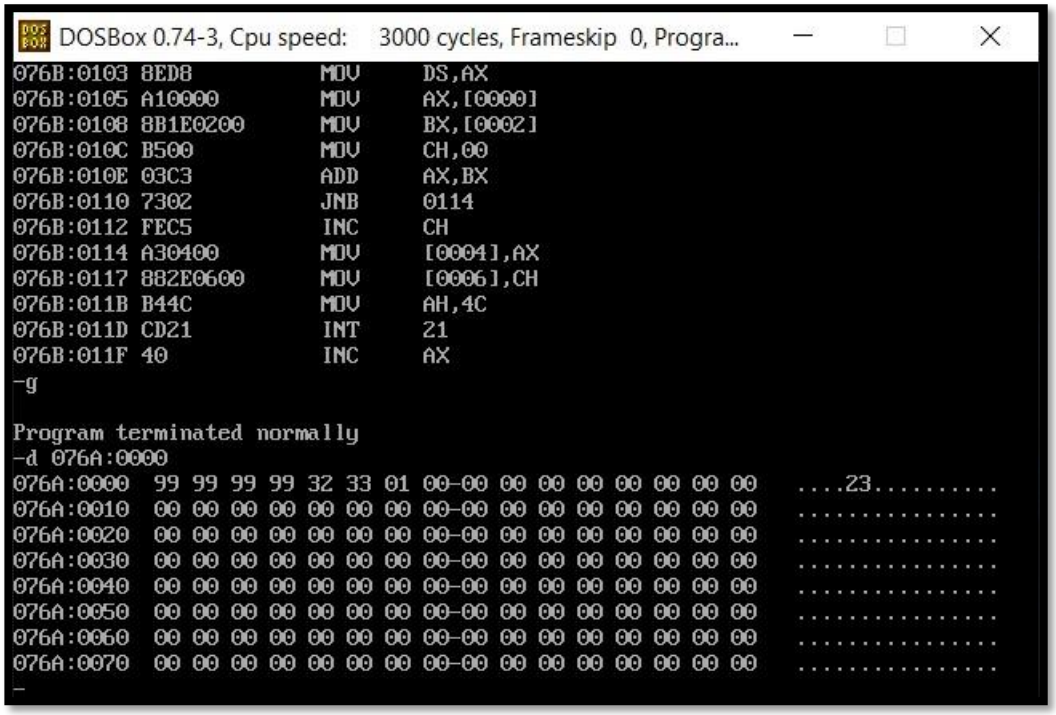
PROGRAM 1: 16 BIT ADDITION

PROGRAM	COMMENTS
assume cs:code, ds:data	Declare code and data segment.
data segment	Initialize data segment with values.
opr1 dw 9999h	Stores operand 1.
opr2 dw 9999h	Stores operand 2.
result dw 0000h	Stores the result of the operation.
carry db 00h	Stores the carry, if any.
data ends	
code segment	Start the code segment.
org 0100h	Initialize an offset address.
start: mov ax, data	Transfer data from memory location [0000] and [0001] to AL AND AH respectively.
mov ds, ax	Transfer data from memory location AX to DS.
mov ax, opr1	Transfer value of opr1 to AX.
mov bx, opr2	Transfer value of opr2 to BX.
mov ch, 00h	CH = 0.
add ax, bx	AX = AX + BX.
jnc here	Jump if no carry to “here”. Else, continue.
inc ch	CH = CH + 1
here: mov result, ax	Transfer value of AX to result.
mov carry, ch	Transfer value of CH to carry.
mov ah, 4ch	
int 21h	Interrupt the process with return code and exit.
code ends	
end start	

UNASSEMBLED CODE:



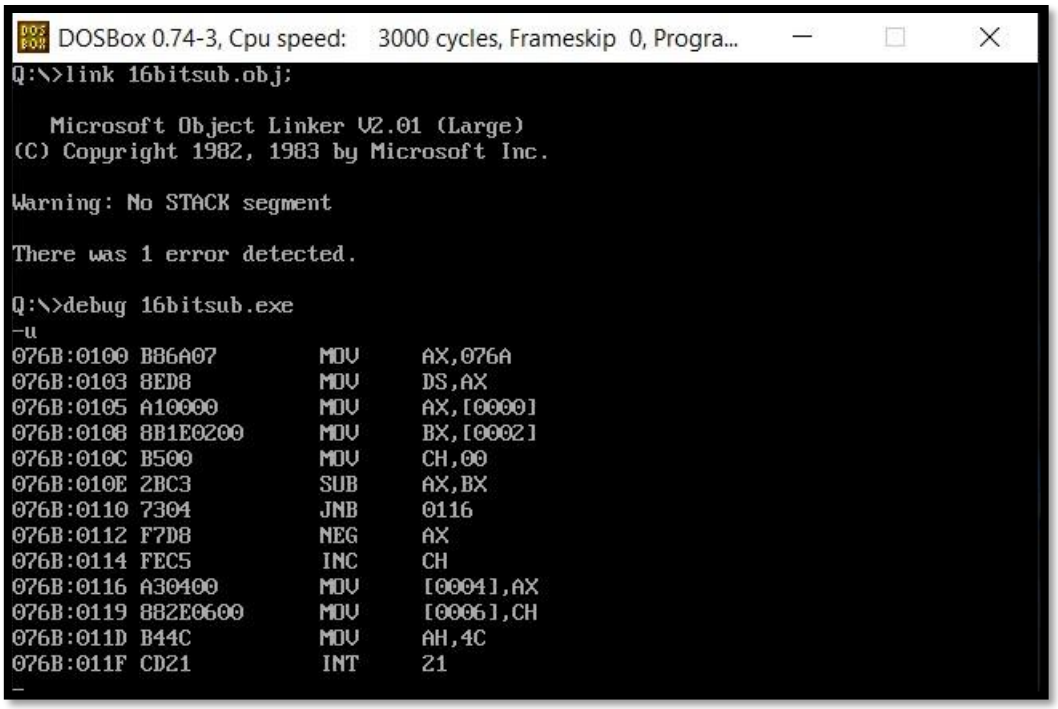
SAMPLE I/O :



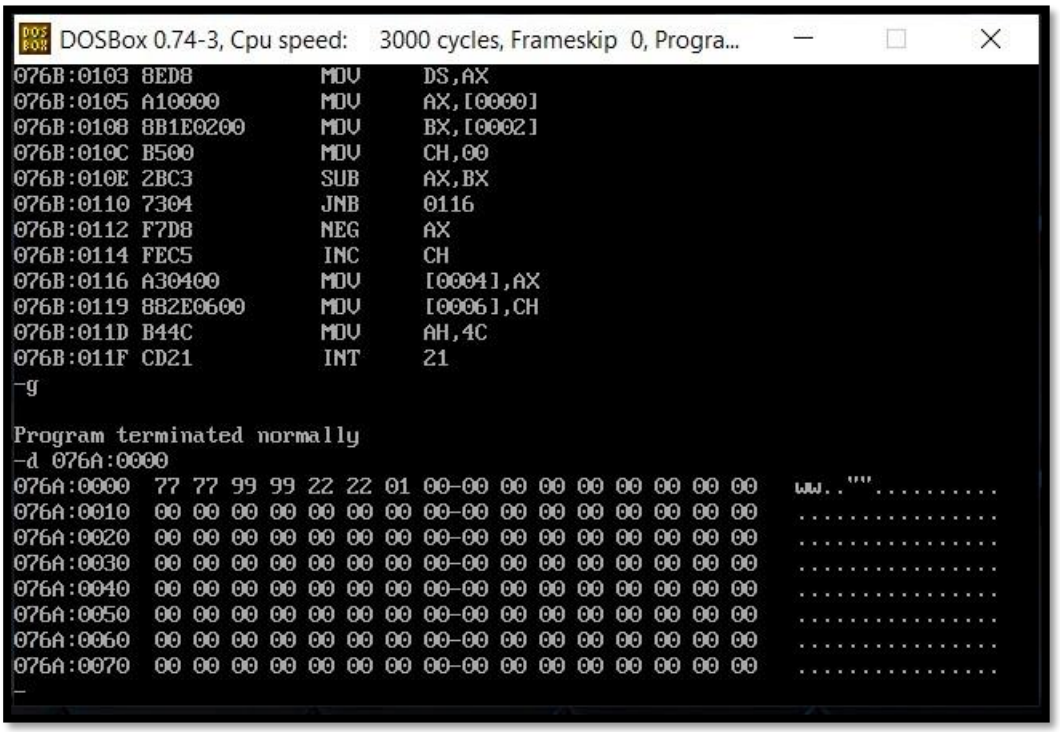
PROGRAM – 2: 16 – BIT SUBTRACTION:

PROGRAM	COMMENTS
assume cs:code, ds:data	Declare code and data segment.
data segment	Initialize data segment with values.
opr1 dw 7777h	Stores operand 1.
opr2 dw 9999h	Stores operand 2.
diff dw 0000h	Stores the result of the operation.
sign db 00h	Stores the sign bit.
data ends	
code segment	Start the code segment.
org 0100h	Initialize an offset address.
start: mov ax, data	Transfer data from memory location [0000] and [0001] to AL AND AH respectively.
mov ds, ax	Transfer data from memory location AX to DS.
mov ax, opr1	Transfer value of opr1 to AX.
mov bx, opr2	Transfer value of opr2 to BX.
mov ch, 00h	CH = 0.
sub ax, bx	AX = AX – BX.
jnc here	Jump if no sign change to “here”. Else, continue.
neg ax	Take 2’s Complement if negative value.
inc ch	CH = CH + 1
here: mov diff, ax	Transfer value of AX to diff.
mov sign, ch	Transfer value of CH to sign.
mov ah, 4ch	
int 21h	Interrupt the process with return code and exit.
code ends	
end start	

UNASSEMBLED CODE



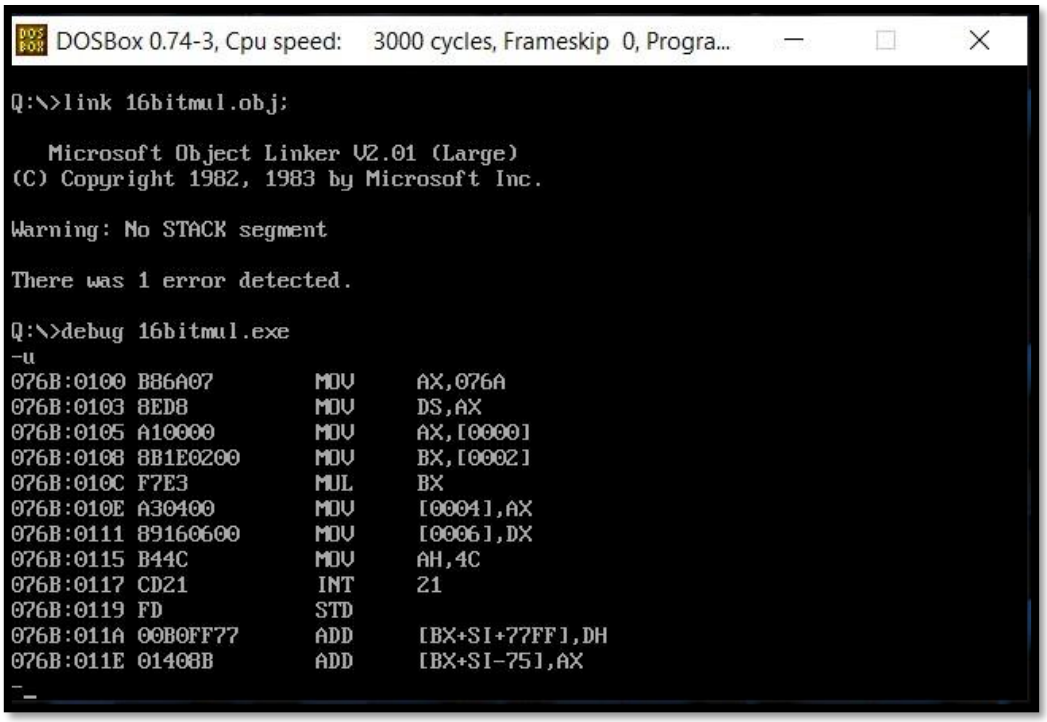
SAMPLE I/O :



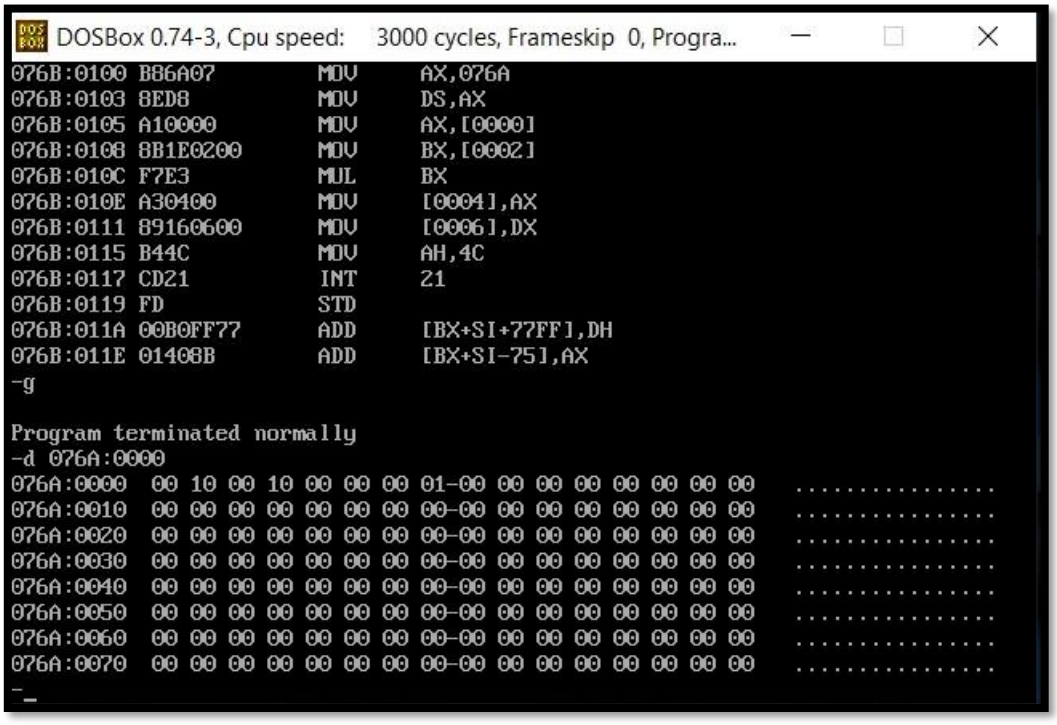
PROGRAM 3: 16 BIT MULTIPLICATION

PROGRAM	COMMENTS
assume cs:code, ds:data	Declare code and data segment.
data segment	Initialize data segment with values.
opr1 dw 1000h	Stores operand 1.
opr2 dw 1000h	Stores operand 2.
product1 dw 0000h	Stores the lower 16 bits of the operation.
product2 dw 0000h	Stores the higher 16 bits of the operation.
data ends	
code segment	Start the code segment.
org 0100h	Initialize an offset address.
start: mov ax, data	Transfer data from memory location [0000] and [0001] to AL AND AH respectively.
mov ds, ax	Transfer data from memory location AX to DS.
mov ax, opr1	Transfer value of opr1 to AX.
mov bx, opr2	Transfer value of opr2 to BX.
mul bx	DXAX = AX * BX.
mov product1, ax	Transfer value of AX to product1.
mov product2, dx	Transfer value of DX to product2.
mov ah, 4ch	
int 21h	Interrupt the process with return code and exit.
code ends	
end start	

UNASSEMBLED CODE



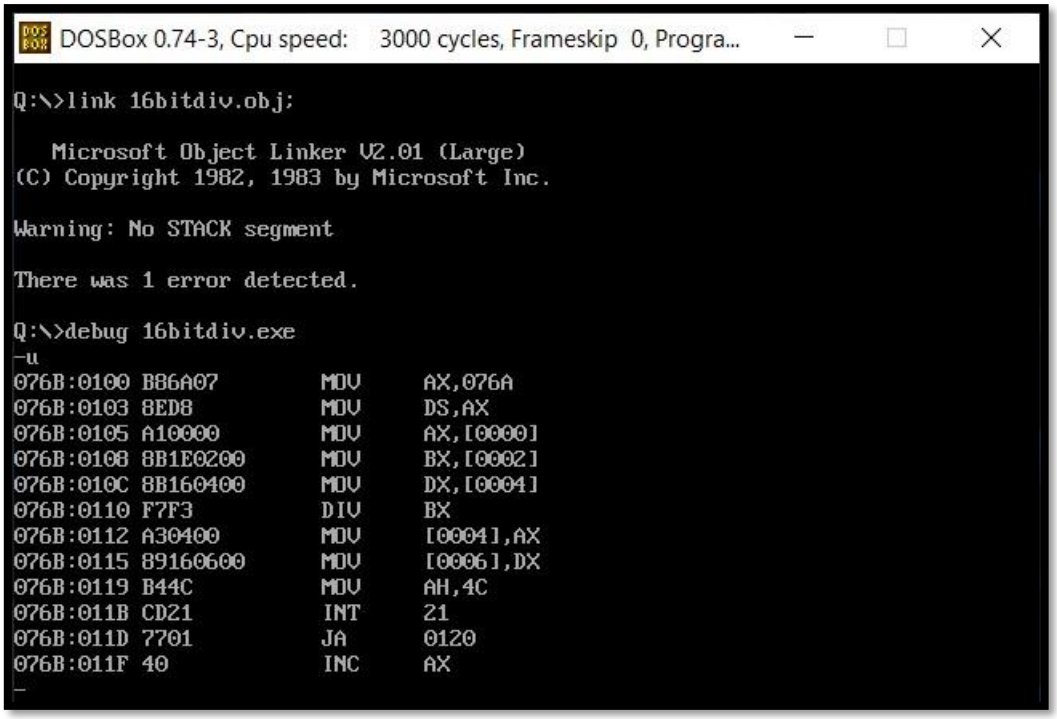
SAMPLE I/O :



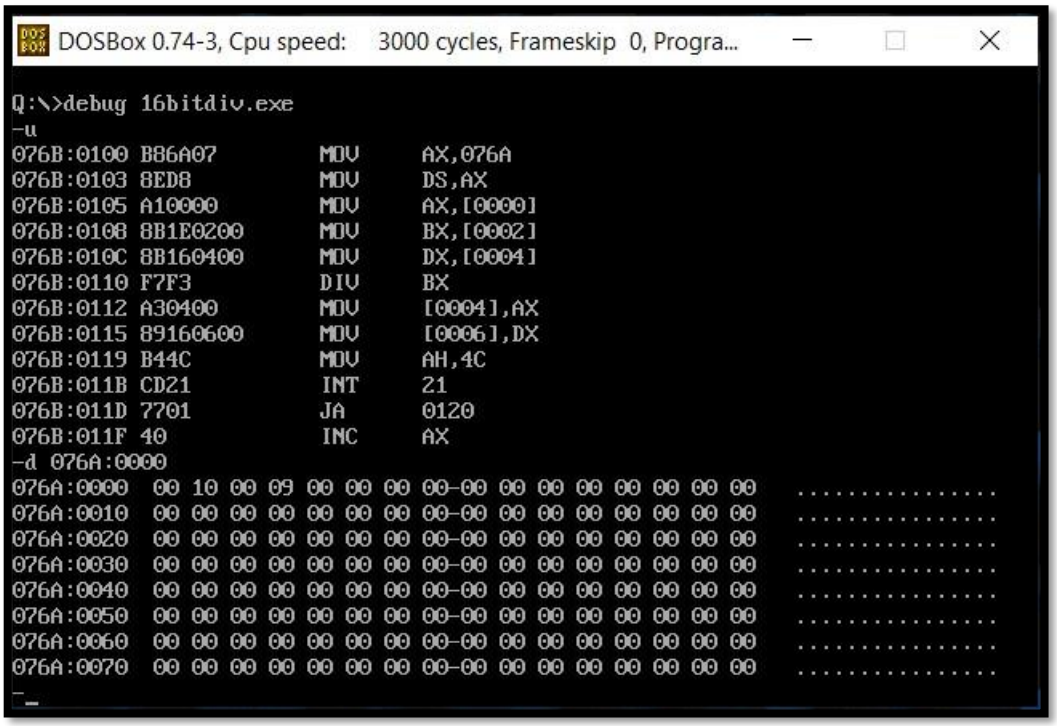
PROGRAM 4: 16 BIT DIVISION

PROGRAM	COMMENTS
assume cs:code, ds:data	Declare code and data segment.
data segment	Initialize data segment with values.
opr1 dw 1000h	Stores the dividend.
opr2 dw 0900h	Stores the divisor.
quot dw 0000h	Stores the quotient of the division.
rem dw 0000h	Stores the remainder of the division.
data ends	
code segment	Start the code segment.
org 0100h	Initialize an offset address.
start: mov ax, data	Transfer data from memory location [0000] and [0001] to AL AND AH respectively.
mov ds, ax	Transfer data from memory location AX to DS.
mov ax, opr1	Transfer value of dividend to AX.
mov bx, opr2	Transfer value of divisor to BX.
mov dx, quot	Transfer value of quotient (0000h) to DX.
div bx	AX = DXAX / BL. (AX has quotient, DX has remainder)
mov quot, ax	Transfer value of AX to quot.
mov rem, dx	Transfer value of DX to rem.
mov ah, 4ch	
int 21h	Interrupt the process with return code and exit.
code ends	
end start	

UNASSEMBLED CODE



SAMPLE I/O :



RESULT:

The assembly level programs were written to perform the 16 bit arithmetic operations and compiled. The results were observed and noted down.