Assignment No-08

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CLASS: SE COMP A	ROLL NO.: F19111151
SEMESTER: SEM-IV	YEAR: 2020-21
DATE OF PERFORMANCE:	DATE OF SUBMISSION:
EXAMINED:	

Title:-Multiplication

Assignment Name: - Write X86/64 ALP to perform multiplication of two 8-bit hexadecimal numbers. Use successive addition and add and shift method. Accept input from the user.

Objective-

- To understand the different algorithm for multiplication.
- To understand how to write procedure.

Outcome-

- Students will be able to write code for doing multiplication.

Prerequisite -

System call of Unix for Assembly language Program.

Hardware Requirement-

Desktop PC

Software Requirement-

Ubuntu 14.04,

Assembler: NASM version 2.10.07
Linker: ld

Introduction:-

Guidelines for the algorithm:

1) Display the menu.

Enter “1” – “ADD AND SHIFT METHOD.”

Enter “2” – “SUCCESSIVE ADDITION METHOD”.

Enter “3” – EXIT

2) Take choice from user then go to the respective subroutines.

ADD AND SHIFT METHOD

1) Initialize code and bss sections.
2) Accept multiplier and multiplicand variables in data segment.
3) Initialize product variable to zero.
4) Set count as number of bits in operand, which is 8.
5) Shift product to left by 1 bit and insert zero as LSB.
6) Transfer MSB of multiplier to carry flag by rotating it to left.
7) Check if carry flag is set or not. If yes add multiplicand to product.
8) Decrement count by 1.
9) Check count=0 else repeat step 5 through step 9 till count=0.
10) Display the final product.

SUCCESSIVE ADDITION METHOD

1) Define product=0.
2) Set count=multiplicand.
3) Add product=product + multiplier.
4) Decrement count.
5) Repeat step 3 and 4 till count=0
6) Display product variable value as final product.

Conclusion: - Hence we implemented an ALP to do multiplication.

Questions:-

1) Explain successive addition algorithm with example?
2) Explain what is Interrupt?

Program:-

```
%macro dispmsg 2            ;macro for display
        mov rax,1           ;standard ouput
```

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          mov rdi,1                ;system for write
          mov rsi,%1                 ;display message address
          mov rdx,%2                  ;display message length
          syscall                ;interrupt for 64-bit
        %endmacro                     ;close macro

        %macro exitprog 0             ;macro for exit
         mov rax,60                 ;system for exit
         mov rdx,0
         syscall                 ;interrupt for 64-bit
        %endmacro                     ;close macro

        %macro gtch 1                  ;macro for accept
          mov rax,0                ;standard input
          mov rdi,0                ;system for read
          mov rsi,%1                 ;input the message
          mov rdx,1                ;message length
          syscall                ;interrupt for 64-bit
        %endmacro                     ;close macro
;-------------------------------------------------------------------------------------------------
----------------
        section .data
        nwline db 10
        m0 db 10,10,"Program to multiply two numbers using successive addition
and add-and-shift method"
        l0 equ $-m0
        m1 db 10,"1. Successive Addition method",10,"2. Add-and-Shift
method",10,"3. Exit",10,10, "Enter your choice (1/2/3 <ENTER>): "
        l1 equ $-m1
        m2 db 10,"Enter multiplicand (2 digit HEX no) : "
        l2 equ $-m2
        m3 db 10,"Enter multiplier (2 digit HEX no) : "
        l3 equ $-m3
        m4 db 10,"The Multiplication is : "
        l4 equ $-m4
;-------------------------------------------------------------------------------------------------
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        section .bss
        mcand   resq 1              ;reserve 1 quad for multiplicand
        mplier  resq 1             ;reserve 1 quad for multiplier
        input   resb 1             ;reserve 1 byte for input
        output  resb 1              ;reserve 1 byte for output
        choice  resb 1             ;reserve 1 byte for choice
;--------------------------------------------------------------------------------------------------
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        section .text
        global _start              ;starting of main program
        _start :

        dispmsg m0,l0                ;Displaying the menu

        back:
        dispmsg m1,l1                    ;Displaying the first message
        gtch input                 ;To read and discard ENTER key pressed.

        mov al, byte[input]              ;Get choice
        mov byte[choice],al

        gtch input                 ;To read and discard ENTER key pressed.

        mov al, byte[choice]

        cmp al, '1'                ;compare contents of al with 1
        je succ_add                  ;if equal the jump to succ_add procedure

        cmp al, '2'                ;compare the contents of al with 2
        je shft_add                  ;if equal the jump to shft_add procedure

        cmp al, '3'                ;compare the contents of al with 3
        jnz back                   ;if not zero then jump to back
        exitprog                   ;exit program
;--------------------------------------------------------------------------------------------------
----------------
        ; SUCCESSIVE ADDITION
      succ_add:                    ;succ_add procedure
        dispmsg m2,l2                ;Displaying the second message
        call getnum                ;call getnum procedure
        mov [mcand],rax              ;mov contents of rax(multiplicand) into mcand
buffer
        gtch input                 ;To read and discard ENTER key pressed.

        dispmsg m3,l3                ;Displaying the third message
        call getnum                ;call getnum procedure
        mov [mplier],rax             ;mov contents of rax(multiplier) into mplier buffer
        gtch input              ;To read and discard ENTER key pressed.mov rax,0
        dispmsg m4,l4               ;Displaying the fourth message

        mov rax,0               ;clearing rax register
        cmp qword[mplier],0         ;compare contents of mplier buffer in qword with
0
        jz ll5                  ;if zero jump to loop 5
;-----------------------------------------------------------------------------------------------
----------------
        ll1:                    ;loop 1
        add rax,qword[mcand]        ;add contents of mcand buffer in qword to
contents of rax register
        dec qword[mplier]           ;decrement contents of mplier buffer
        jnz ll1                 ;if not zero jump to loop 1
;-----------------------------------------------------------------------------------------------
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        ll5:                    ;loop 5
        call disphx16           ;call disphx16 procedure to displays a 8 digit hex
number  in rax
        jmp back                ;jump to back after execution
;-----------------------------------------------------------------------------------------------
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        ; ADD & SHIFT
        shft_add:               ;shft_add procedure
        dispmsg m2,l2           ;Displaying the second message
        call getnum             ;call getnum procedure
        mov [mcand],rax                 ;mov contents of rax(multiplicand) into mcand
buffer
        gtch input              ;To read and discard ENTER key pressed.

        dispmsg m3,l3           ;Displaying the third message
        call getnum             ;call getnum procedure
        mov [mplier],rax            ;mov contents of rax(multiplier) into mplier buffer
        gtch input              ;To read and discard ENTER key pressed.

        mov rax,0               ;clearing the rax register
        dispmsg m4,l4               ;Displaying the fourth message

        mov rax,0               ;clearing the rax register
        mov rcx,8               ;taking count of 8 in rcx register
        mov rdx,qword[mplier]       ;multiplier is 8 bits so it occupies dl
        mov rbx,qword[mcand]        ;mupltiplicand is 8 bits so it occupies bl
```

```
                                ;we will put Q in higher 8 bits of ax (i.e. ah)
                                ;and multipler in lower 8 bits of ax (i.e. al)

      mov ah,0                  ;clearing ah register
        mov al,dl                 ;ah already 0 and al now contains multiplier
;-----------------------------------------------------------------------------------------
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        ll3:                    ;loop 3 (s3)
        mov dh,al                 ;mov contents of al into dh as dh is used as temporary
        and dh,1                  ;check d0 bit of multiplier
        jz ll8                  ;if d0 bit was zero, Z flag will be set (s2)(if zero jmp to
loop 8)
        add ah, bl                ;d0 bit of multiplier is set
                               ;so add multiplicand to Q(add bl into ah)
;-----------------------------------------------------------------------------------------
---------------
        ll8:                    ;loop 8 (s2)
        shr ax,1                  ;shift both Q (ah) and muplitiplier (al) right 1 bit
        dec rcx                   ;decrement contents of rcx
        jnz ll3                  ;if not zero then jump to loop 3 (s3)
        call disphx16               ;call procedure disphx16
        jmp back                  ;jump to back
;-----------------------------------------------------------------------------------------
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        getnum:                   ;Procedure to get a 2 digit hex no from user
                               ; number returned in rax
        mov cx,0204h                ;02 digits to display and 04 count to rotate
        mov rbx,0                  ;clearing rbx register
;-----------------------------------------------------------------------------------------
---------------
        ll2:                    ;loop 2
        push rcx                  ;syscall destroys rcx.Rest all regs are preserved
        gtch input                 ;To read and discard ENTER key pressed.
        pop rcx                   ;pop the contents of rcx

      mov rax,0                 ;clearing the contents of rax
        mov al,byte[input]          ;Get choice
        sub rax,30h                ;subtract 30h from contents of rax
        cmp rax,09h                 ;compare the contents of rax register with 09h
        jbe skip1                 ;if equal then jump below to skip1 label
        sub rax,7                 ;subtract 7 from contents of rax register
```

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;-----------------------------------------------------------------------------------------------
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      skip1:                ;skip1 label
        shl rbx,cl              ;shift multiplicand and count to the left
        add rbx,rax               ;add contents of rax register to the contents of rbx
register
        dec ch                  ;decrement the contents of ch register
        jnz ll2                ;if not zero then jump to loop 2
        mov rax,rbx               ;mov contents of rbx register into rax register
        ret                   ;return
;-----------------------------------------------------------------------------------------------
-----------------
        disphx16:                ;Displays a 16 digit hex number passed in rax
        mov rbx,rax               ;move contents of rax register into rbx register
        mov cx,1004h                    ;16 digits to display and 04 count to rotate
;-----------------------------------------------------------------------------------------------
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        ll6:                  ;loop 6
        rol rbx,cl              ;rotate multiplicand and count to the left
        mov rdx,rbx               ;mov contents of rbx register into rdx register
        and rdx,0fh              ;anding contents of rdx register with 0fh
        add rdx,30h              ;adding contents of rdx register with 30h
        cmp rdx,039h               ;comparing the contents of rdx register with 39h
        jbe skip4               ;if equal then jump below to skip4 label
        add rdx,7               ;add 7 to the contents of rdx register
;-----------------------------------------------------------------------------------------------
-----------------
        skip4:                 ;skip4 label
        mov byte[output],dl        ;mov contents of dl register into output buffer in
bytes
        push rcx                ;push the contents of rcx register
        dispmsg output,1           ;Displaying the output
        pop rcx                ;pop the contents of rcx
        dec ch                 ;decrement the count(contents of ch)
        jnz ll6                ;if not zero the jump to loop 6
        ret                   ;return
```
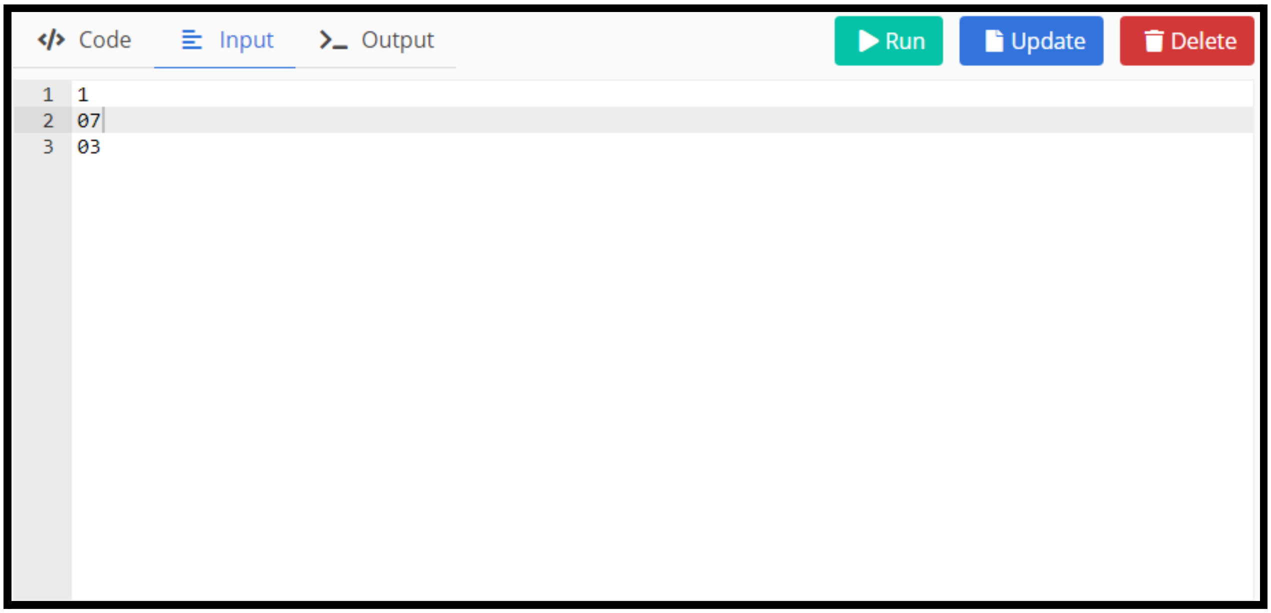
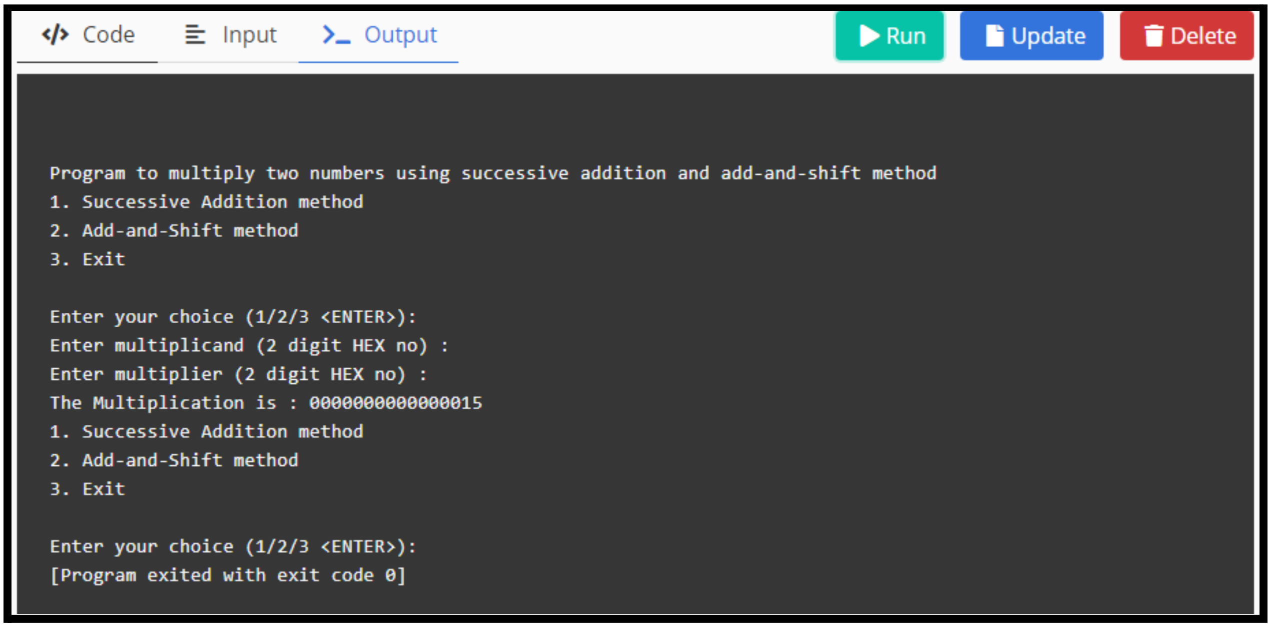

Output:-

1)

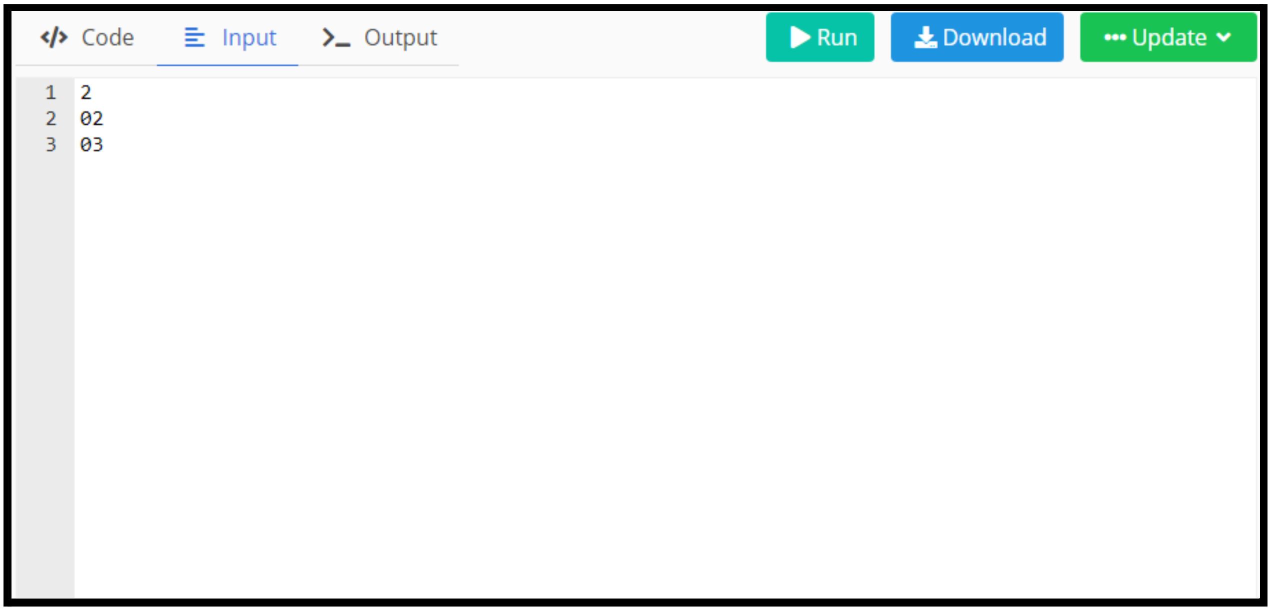


```
1
07
03
```

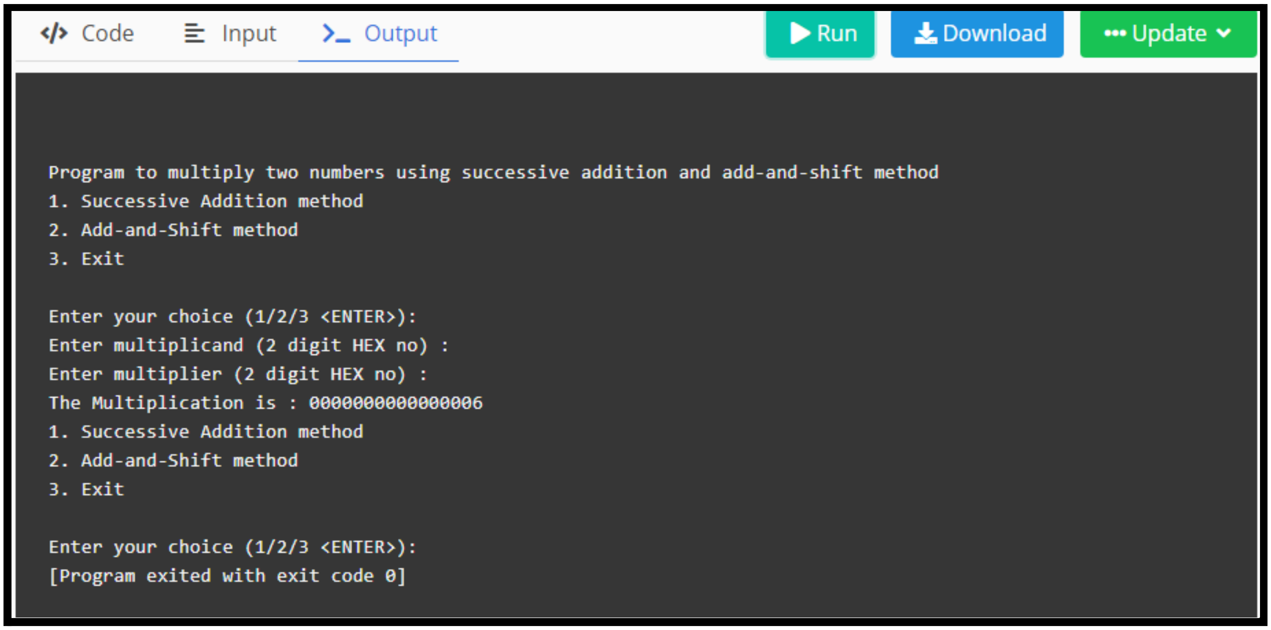


```
Program to multiply two numbers using successive addition and add-and-shift method
1. Successive Addition method
2. Add-and-Shift method
3. Exit

Enter your choice (1/2/3 <ENTER>):
Enter multiplicand (2 digit HEX no) :
Enter multiplier (2 digit HEX no) :
The Multiplication is : 0000000000000015
1. Successive Addition method
2. Add-and-Shift method
3. Exit

Enter your choice (1/2/3 <ENTER>):
[Program exited with exit code 0]
```

2)



```
2
02
03
```



```
Program to multiply two numbers using successive addition and add-and-shift method
1. Successive Addition method
2. Add-and-Shift method
3. Exit

Enter your choice (1/2/3 <ENTER>):
Enter multiplicand (2 digit HEX no) :
Enter multiplier (2 digit HEX no) :
The Multiplication is : 0000000000000006
1. Successive Addition method
2. Add-and-Shift method
3. Exit

Enter your choice (1/2/3 <ENTER>):
[Program exited with exit code 0]
```

2)