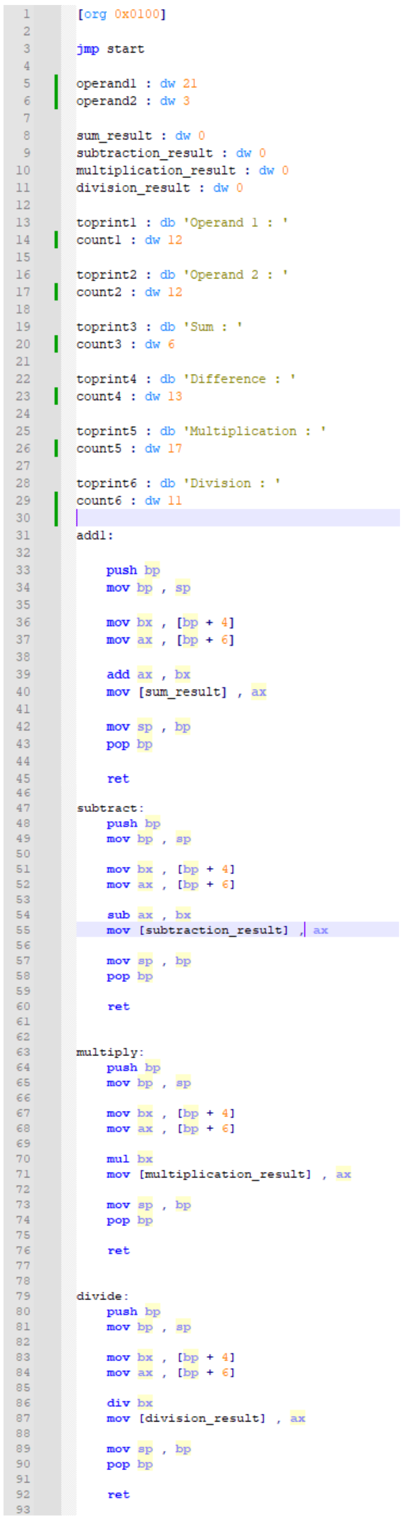
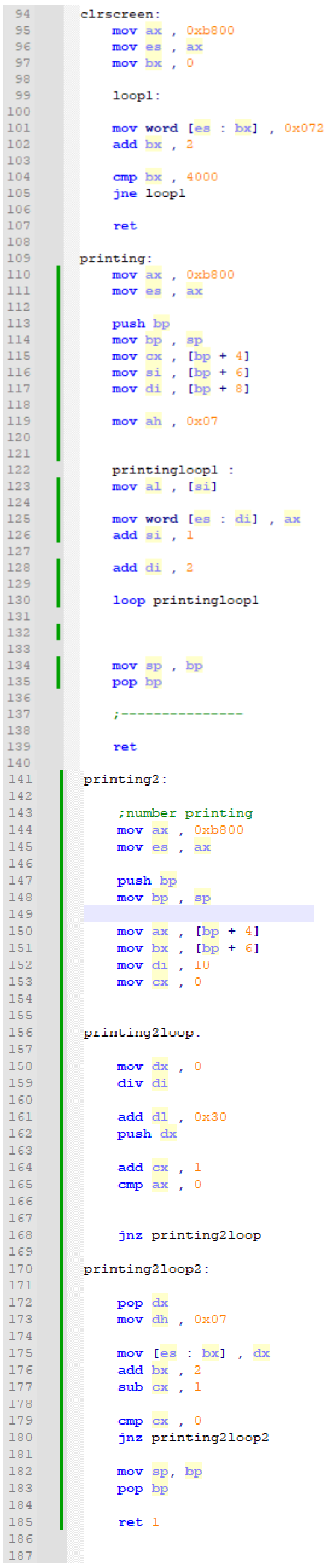
Question No. 1

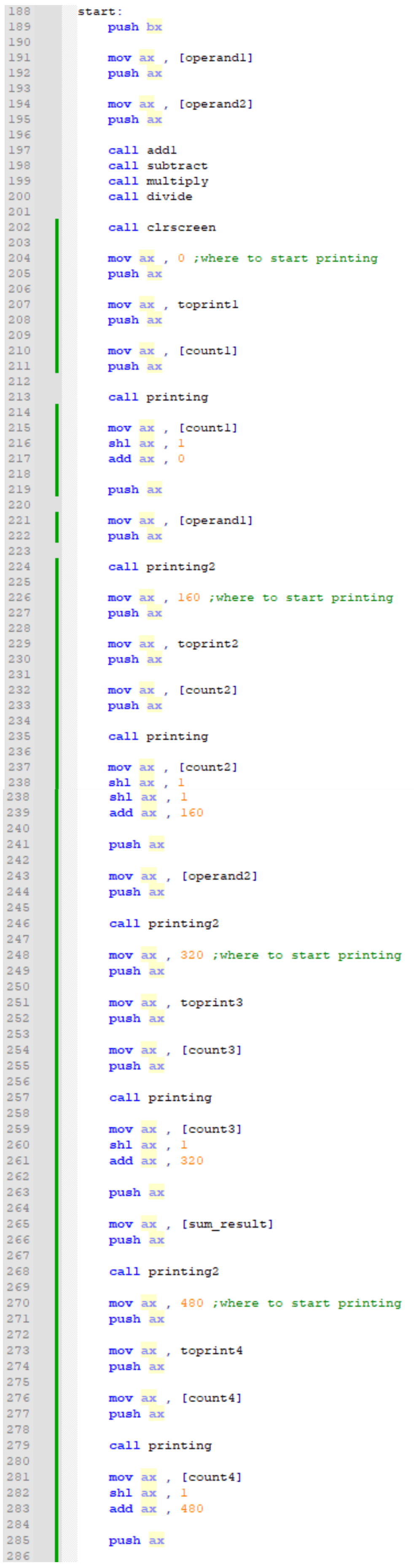
➢ Code Screen Shots



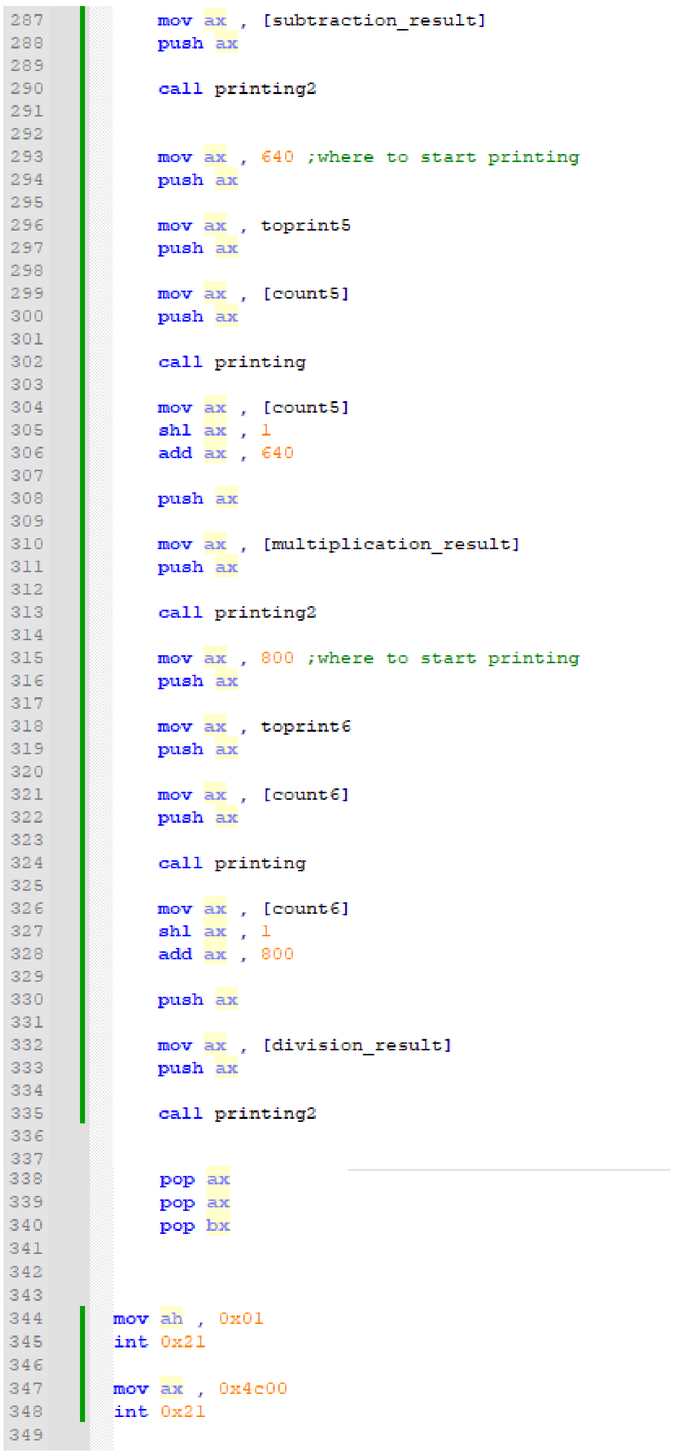
```
[org 0x0100]

jmp start

operand1 : dw 21
operand2 : dw 3

sum_result : dw 0
subtraction_result : dw 0
multiplication_result : dw 0
division_result : dw 0

toprint1 : db 'Operand 1 : '
count1 : dw 12

toprint2 : db 'Operand 2 : '
count2 : dw 12

toprint3 : db 'Sum : '
count3 : dw 6

toprint4 : db 'Difference : '
count4 : dw 13

toprint5 : db 'Multiplication : '
count5 : dw 17

toprint6 : db 'Division : '
count6 : dw 11

add1:

    push bp
    mov bp , sp

    mov bx , [bp + 4]
    mov ax , [bp + 6]

    add ax , bx
    mov [sum_result] , ax

    mov sp , bp
    pop bp

    ret

subtract:
    push bp
    mov bp , sp

    mov bx , [bp + 4]
    mov ax , [bp + 6]

    sub ax , bx
    mov [subtraction_result] , ax

    mov sp , bp
    pop bp

    ret


multiply:
    push bp
    mov bp , sp

    mov bx , [bp + 4]
    mov ax , [bp + 6]

    mul bx
    mov [multiplication_result] , ax

    mov sp , bp
    pop bp

    ret


divide:
    push bp
    mov bp , sp

    mov bx , [bp + 4]
    mov ax , [bp + 6]

    div bx
    mov [division_result] , ax

    mov sp , bp
    pop bp

    ret

```



```
clrscreen:
    mov ax , 0xb800
    mov es , ax
    mov bx , 0

    loop1:

    mov word [es : bx] , 0x072
    add bx , 2

    cmp bx , 4000
    jne loop1

    ret

printing:
    mov ax , 0xb800
    mov es , ax

    push bp
    mov bp , sp
    mov cx , [bp + 4]
    mov si , [bp + 6]
    mov di , [bp + 8]

    mov ah , 0x07


    printingloop1 :
    mov al , [si]

    mov word [es : di] , ax
    add si , 1

    add di , 2

    loop printingloop1



    mov sp , bp
    pop bp

    ;---------------

    ret
printing2:

    ;number printing
    mov ax , 0xb800
    mov es , ax

    push bp
    mov bp , sp

    mov ax , [bp + 4]
    mov bx , [bp + 6]
    mov di , 10
    mov cx , 0


printing2loop:

    mov dx , 0
    div di

    add dl , 0x30
    push dx

    add cx , 1
    cmp ax , 0


    jnz printing2loop

printing2loop2:

    pop dx
    mov dh , 0x07

    mov [es : bx] , dx
    add bx , 2
    sub cx , 1

    cmp cx , 0
    jnz printing2loop2

    mov sp, bp
    pop bp

    ret 1
```

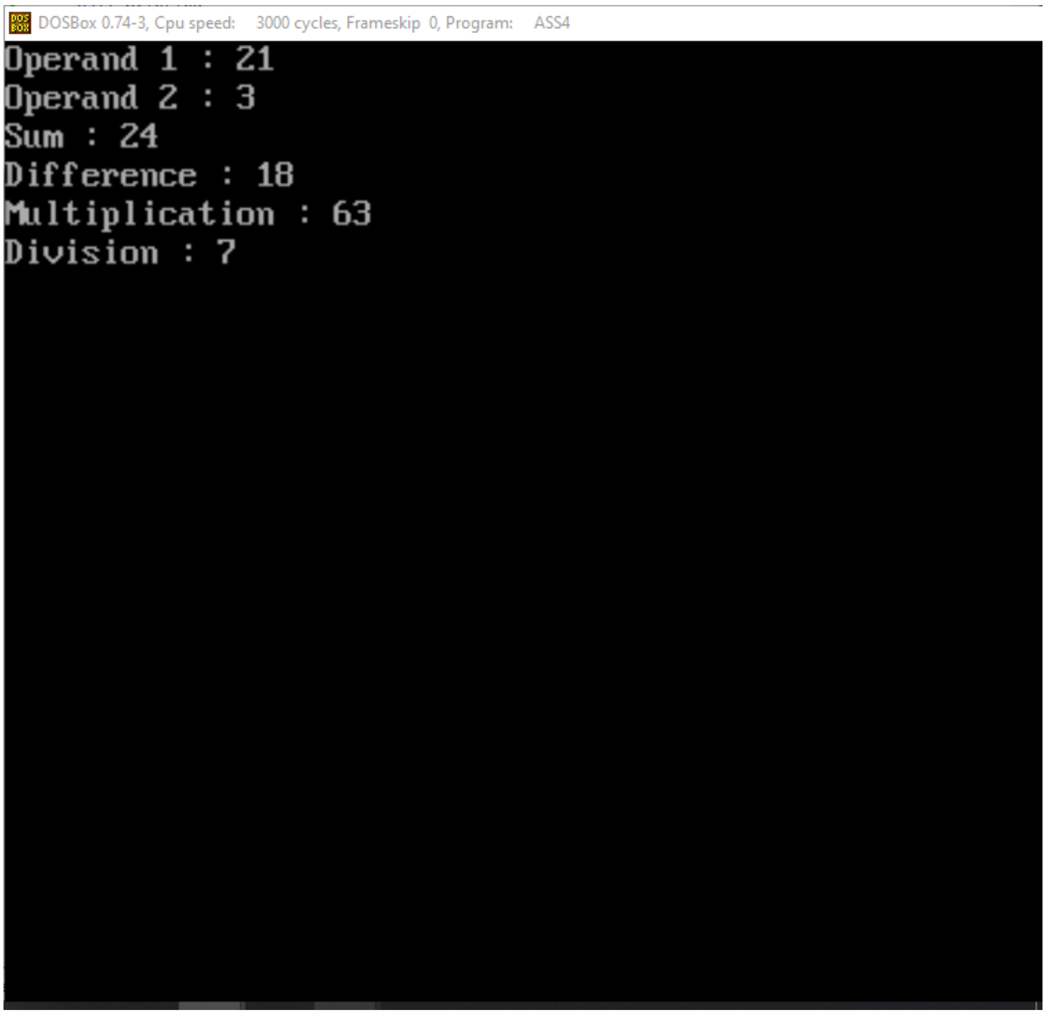


```
start:
    push bx

    mov ax , [operand1]
    push ax

    mov ax , [operand2]
    push ax

    call add1
    call subtract
    call multiply
    call divide

    call clrscreen

    mov ax , 0 ;where to start printing
    push ax

    mov ax , toprint1
    push ax

    mov ax , [count1]
    push ax

    call printing

    mov ax , [count1]
    shl ax , 1
    add ax , 0

    push ax

    mov ax , [operand1]
    push ax

    call printing2

    mov ax , 160 ;where to start printing
    push ax

    mov ax , toprint2
    push ax

    mov ax , [count2]
    push ax

    call printing

    mov ax , [count2]
    shl ax , 1
    shl ax , 1
    add ax , 160

    push ax

    mov ax , [operand2]
    push ax

    call printing2

    mov ax , 320 ;where to start printing
    push ax

    mov ax , toprint3
    push ax

    mov ax , [count3]
    push ax

    call printing

    mov ax , [count3]
    shl ax , 1
    add ax , 320

    push ax

    mov ax , [sum_result]
    push ax

    call printing2

    mov ax , 480 ;where to start printing
    push ax

    mov ax , toprint4
    push ax

    mov ax , [count4]
    push ax

    call printing

    mov ax , [count4]
    shl ax , 1
    add ax , 480

    push ax

```



```
    mov ax , [subtraction_result]
    push ax

    call printing2


    mov ax , 640 ;where to start printing
    push ax

    mov ax , toprint5
    push ax

    mov ax , [count5]
    push ax

    call printing

    mov ax , [count5]
    shl ax , 1
    add ax , 640

    push ax

    mov ax , [multiplication_result]
    push ax

    call printing2

    mov ax , 800 ;where to start printing
    push ax

    mov ax , toprint6
    push ax

    mov ax , [count6]
    push ax

    call printing

    mov ax , [count6]
    shl ax , 1
    add ax , 800

    push ax

    mov ax , [division_result]
    push ax

    call printing2


    pop ax
    pop ax
    pop bx



mov ah , 0x01
int 0x21

mov ax , 0x4c00
int 0x21
```

Dos Box Screen Shot



DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Program: ASS4

```
Operand 1 : 21
Operand 2 : 3
Sum : 24
Difference : 18
Multiplication : 63
Division : 7
```

Explanation

The logic here is pretty simple but calling it again and again is a bit complicated so what ive done is copy the code from the assignment 3 question 1 that is calculating the sum subtraction multiplication and division of a given 2 operands , and storing that result in desired data labels. Additional here we need the character count of each string that we are printing so ive stored that in the data labels of each string named as count1 , count2 and so on that I'm printing. After which I've created two subroutines named printing and printing2 , printing is printing the string and printing 2 is printing the result . But first of all im calling the clrscreen subroutine what it does is clear all the screen of the dos box and it actually not clearing it it is printing spaces on the whole dos box concept of physical address accessing of the video base we start from the first cell to the last cell and keep on printing spaces which actually clears the dos box .

Before calling the printing subroutine I'm passing ax that decides from where to start printing , add of the first string character and count of the string. The Count of the string act as a counter where to stop printing the characters one by one. After that string is printed it returns back and after which i again set the parameters for the second subroutine which is printing2 what it does it prints the number or you can call the result of sum , subtract and so on but before calling it I set the parameters that is from where to start , this was one of the main problems faced as it was overwriting the string printed . So what I did was i didn’t change the value of bx which was used in the printing subroutine for accessing the cells and like this the number is printed just in front of the string . The printing2 subroutine logic is different from the printing subroutine as it is printing the number. And we cant print the number directly we have to break it and push it into stack and then pop and print it. So we have to divide it by 10 . So what is happening is that take a number like 23 , 23 will be divided by 10 the remainder will be stored in dx which is 3 after which we will add 0x30 with dl which will convert it into ascii and push this value into the stack (as the number is broken down oppositely but we have to print it as 2 , 3 so stack is helpful to invert this and do our work). We will continue this process until the number has become 0 . After which we will start popping dx and printing the values this resembles printing the string somehow. But keep in mind after popping everytime we will move 0x07 into dh for the characteristics of the value to be printed.

Like this we have printed the first line now to print the second and other lines similarly we add 160 with previous line first cell in ax that we pass as parameters so that the second string and value is printed on the second line and similarly the address of the first string character and the count of the characters in the string will be sent as parameters rest the logic will remain the same.

In the same way printing on the next line we will add 160 with the previous line which is 160 and then push it to start printing from that specific location.

But keep in mind while printing the value what we do is to access that specific location we add the count of the character in the string multiply by 2 (which im doing by shifting left) and the line number for example (mov ax , [count2]

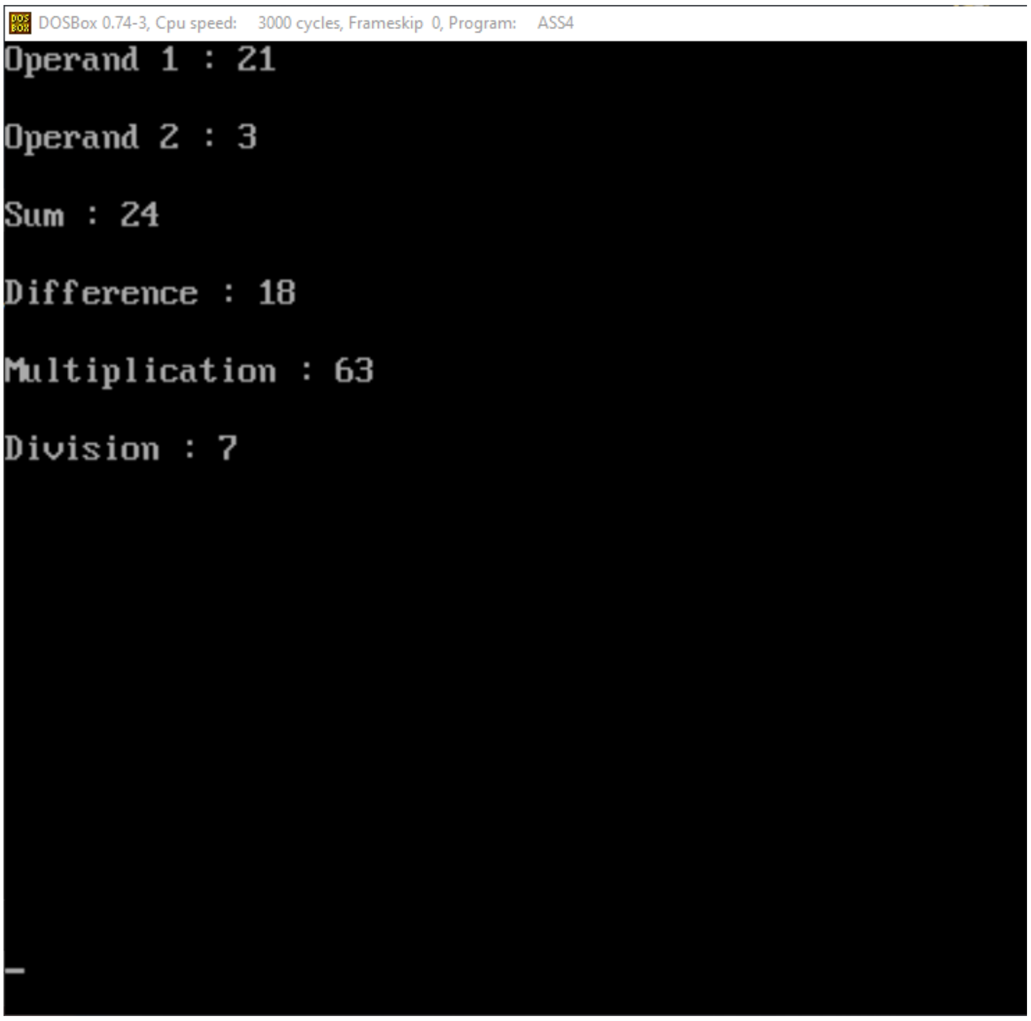
```
                                        shl ax , 1
                                        add ax , 160    )
```

what is happening here is that we are finding the place where to start printing the number this is written for printing the value on the second line infront of the string. And similarly we will add 160 with the previous line to switch to the next line (explained above) and multiply 2 with the count of characters in the string to skip that much so it doesn’t overwrite that string printing before.

Continue this process and eventually we will achieve the printing as given.

Skipping A Line And Printing

We Can also achieve this by skipping a line which is by 320 where we are adding 160 what it will do is it will skip a line.



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