Question 1 [16 Marks]

Carefully dry run the given program. Show complete traces of runtime stack for **both** fill and clear phases by writing the actual offset and values as provided. Write the final values of register at the end of program and also where asked in between the code in the form of comments. Suppose data segment starts at 000Dh offset. Print character commands are commented. No need to print the character just write the value stored in register before the print command, where asked.

Offset	Code
	.model small
	.data
	n db 45, 49, 52, 51, 53
	.code
0000	mov ax, @data
0001	mov ds, ax
0002	jmp start
	MySub PROC uses dx cx
0003	push bp
0004	mov bp,sp
0005	sub sp, 4
0006	mov word ptr [bp-4], 59
0007	mov word PTR [bp-2], 57
0008	
0009	mov dl, [bp-2] ;dl=
000A	;mov ah, 02
	;int 21h
000B	
000C	mov dx, [bp+4] ;dx=
000D	;mov ah, 02
	;int 21h
000E	
000F	mov bx, [bp+10] ;bx=
0010	mov dx, [bx] ;dx=
0011	;mov ah, 02
	;int 21h
0012	
0013	mov sp, bp
	pop bp
0014	ret 2
	MySub ENDP
	start:
	main proc

Stack	Fill Stack	Stack at the end
1000		
0FFE		
0FFC		
0FFA		
0FF8		
0FF6		

```
0015    mov si, offset n
0016    mov word ptr [si], 48
0017    add si, 2

0018    mov dx, [si-2]   ;dx=
0019    ;mov ah, 02
001A    ;int 21h

001B    mov dx, [si]     ;dx=
001C    ;mov ah, 02
001D    ;int 21h

001E    mov di, offset n
001F    push di
0020    mov cx, 49
0021    push cx
0022    call MySub
0023    inc cl
0024    push cx
0025    mov dx, cx       ;dx=
0026    ;mov ah, 02
0027    ;int 21h

        main endp

0028    mov ah, 4ch
0029    int 21h
0030    end
```

0FF4
0FF2
0FF0
0FEE
0FEC
0FEA
0FE8
0FE6
0FE4

Registers:

AX =	BX =	CX =	DX =

National University of Computer and Emerging Sciences

FAST School of Computing Spring-2023 Islamabad Campus

Question 2 [6+2+4 =12 Marks]

A. Consider the following array:
wordArray WORD 810Dh, 0C064h,93ABh

Note: Write the updated values of wordArray in the respective block, not the code.

a) Shift three memory words to the left by 1 bit position.

b) Logical Shift Right three memory words by 1 bit position.

B. Suppose the instruction set contained **no rotate** instructions. Show how we might use **SHR and a conditional jump** instruction to rotate the contents of the AL *register one* position to the **right.**

```
Shr al, 1
Jnc
```

C. To multiply eax*29, how many shift left operations are required. Write how the multiplier (29) is factored?

```
Shl eax, 5
Shl ebx, 1
sub eax, ebx
```