

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	20 31 34 38 35
	n db 45, 49, 52, 51, 53	DL 39 39 38 38 38
	.code	
0000	mov ax, @data	
0001	mov ds, ax	
0002	jmp start	
	MySub PROC uses dx cx	
0003	push bp	
0004	mov bp, sp FFC	
0005	sub sp, 4 FFF	
0006	mov word ptr [bp-4], 59	
0007	mov word PTR [bp-2], 57	
0008		
0009	mov dl, [bp-2] ;dl= 39	
000A	;mov ah, 02	
	;int 21h	
000B		
000C	mov dx, [bp+4] ;dx= 20	
000D	;mov ah, 02	
	;int 21h	
000E		
000F	mov bx, [bp+10] ;bx= index of array	
0010	mov dx, [bx] ;dx= value of array	
0011	;mov ah, 02	
	;int 21h	
0012		
0013	mov sp, bp FFC	
	pop bp BP= FFC	
0014	ret 2 SP= FFE	
	MySub ENDP	
	start:	
	main proc	

Stack	Fill Stack	Stack at the end
1000		
0FFE	49	
0FFC	00	
0FFA	39	
0FF8	3B	
0FF6		

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0015	mov si, offset n	0FF4		
0016	mov word ptr [si], 48			
0017	add si, 2	0FF2		
0018	mov dx, [si-2] ;dx= 30 ✓	0FF0		
0019	;mov ah, 02			
001A	;int 21h	0FEE		
001B	mov dx, [si] ;dx= 34 ✓			
001C	;mov ah, 02	0FEC		
001D	;int 21h			
001E	mov di, offset n ; offset	0FEA		
001F	push di			
0020	mov cx, 49 ; eax	0FE8		
0021	push cx			
0022	call MySub	0FE6		
0023	inc cl			
0024	push cx	0FE4		
0025	mov dx, cx ;dx= 30 ✗			
0026	;mov ah, 02			
0027	;int 21h			
	main endp			
0028	mov ah, 4ch			
0029	int 21h			
0030	end			

Registers:

AX =

BX =

CX =

DX =

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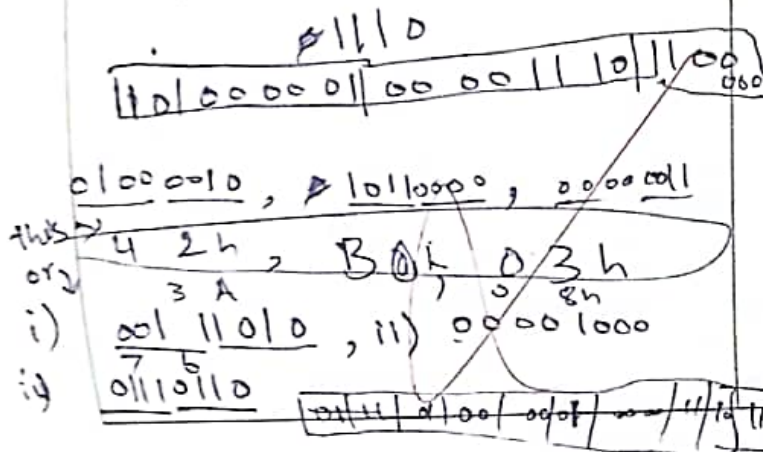
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Question 2 [6+2+4 = 12 Marks]

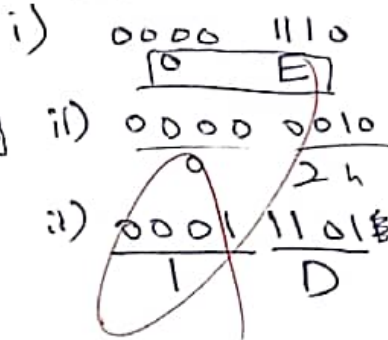
A. Consider the following array: $0000\ 0100\ 0110\ 11$
wordArray WORD 810Dh, 0C064h, 93ABh

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

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

~~eax~~
shl eax, 5 $\Rightarrow 32$
~~sub ebx, eax~~
shl ebx, 1
~~sub eax, ebx~~
add ebx, 1
sub eax, ebx