National University of Computer and Emerging Sciences, Lahore Campus

Course:	Computer Organization and Assembly Language	Course Code:	EE2003
		Semester:	Fall 2021
Program:	BS (CS, DS)	Total Marks:	30
Duration:	60 Minutes	Weightage:	15
Paper Date:	2-Dec-2021	Page(s):	8
Section(s):	All	Section:	
Exam:	Midterm II	Roll No:	

Instruction/Notes:

- Exam is Open book, Open notes.
- Properly comment your code.
- You **CANNOT** use an instruction **NOT** taught in class.
- If there is any ambiguity, make a reasonable assumption. Questions during the exam are not allowed.
- Write your answer in the space provided. You **can take extra sheets BUT they WON'T BE ATTACHED WITH THE QUESTION PAPER OR MARKED.**
- All other rules pertaining to examinations as per NUCES policy apply.

Question 1 [15 Marks]: Short Questions

i. **[2 marks]** Consider a subroutine TempSBR that uses the stack to return three output values *(each of size 1 word)* through the stack. Write a statement that will create the space for these three output variables before calling this TempSBR.

ii. **[6 marks]** Consider the following subroutine, which calculates the factorial of a number *(size = 1 word)* placed at the stack as a parameter and outputs the answer on the stack *(size = 1 word)*. However, the code has some logical errors. Correct those errors so that the required functionality can be achieved. You can ADD or MODIFY existing lines, but you cannot REMOVE any line.

```
factorial:
    push bp
    mov bp, sp
    push ax
    push bx
    push dx

    mov ax, [bp+8]; copying the input
    cmp ax, 0
    ja L1

    mov word [bp+10], 1; returning the result
    jmp L2

L1:
    sub sp, 2
    dec bp
    push bp; passing parameter for recursive subroutine
    call factorial; recursive subroutine call

returnFact:
    pop bx
    mov dx, 0
    inc ax
    mul bx

    mov [bp+10], ax; returning the result

L2:
    pop dx
    pop bx
    pop ax
    pop bp
    ret 6
```

; Rewrite your code here

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iii. [3 Marks] Consider the code given below, write out the sequence in which the instructions are executed. Each executable instruction in code is numbered so your answer should be as follows:

Sample answer:

Instructions executed in following order

I11

I6

I10

....

You also have to briefly explain the working of this program.

		Solution:
	[org 0x0100]	
I1	jmp start	
	my_rout:	
I2	mov ax, 0x8434	
I3	mov bl, 0x85	
I4	div bl	
I5	mov ax, 0xffff	
I6	mov dx, 0x0100	
I7	mov bl, 0x3	
I8	div bl	
I9	ret	
	start:	
I10	call my_rout	
I11	mov ax, 0x4c00	
I12	int 0x21	

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iv. **[4 Marks]** In the code given below, we are copying the data of video memory from one location to another using string instructions. As a result of the execution of this code, what will be the changes on the screen?

```
[org 0x0100]
        jmp start

movepixels:
        push ax
        push bx
        push cx
        push si
        push di
        push es
        push ds

        mov ax, 0xb800
        mov es, ax
        mov ds, ax
        mov si, 0
        mov di, 80
        mov bx, 0

        ; (code is continued in the second column)
```

```
loop1:
        mov cx, 80
        cld
        rep movsb
        add si, 80
        add di, 80

        add bx, 1
        cmp bx, 25
        jne loop1

        pop ds
        pop es
        pop di
        pop si
        pop cx
        pop bx
        pop ax
        ret

start:
        call movepixels

        mov ax, 0x4c00
        int 0x21
```

Solution:

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Question 2 [15 Marks]: Draw a triangle with two given points i.e. A (x1, y1) and B (x2, y2).

i. **[3 Marks]** Triangle must be isosceles (two sides equal) and right (one 90-degree angle), for that purpose check two conditions given below:
   a) y1 must be less than y2 and x1 must be less than x2.
   b) (x2-x1) must be equal to (y2-y1).

   No need to check other conditions as these two conditions are enough.

ii. **[2 Marks]** Clear screen with white background.

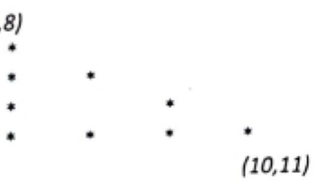
iii. **[7 Marks]** Only print the boundary of the triangle with red color and asterisk character (ASCII= 2A-Hex,42-Decimal).
   Hint: Write a generic subroutine to print an asterisk on a single point. Use loops to print borders.

iv. **[3 Marks]** Write a program with proper subroutine names and stack implementation is compulsory for parameter passing.

   Note: You can't use software interrupts. You should use hard code inputs but functions should be generic. It should run properly on any inputs.

   Example 1:
   Input: A (7, 8) and B (10, 11)

   Output :



   Example 2:
   Input: A (10, 11) and B (7, 8)
   Output: No printing on screen

   Example 3:
   Input: A (7, 8) and B (10, 10)
   Output: No printing on screen