National University of Computer & Emerging Sciences, Karachi.
FAST School of Computing,
Mid Term I, Fall 2021.
October 13, 2021, 9:00 am – 10:00 am.

Course Code: EE 2003	**Course Name:** Computer Organization and Assembly Language
Instructors: Dr. Nouman M Durrani, Shoaib Rauf, Aashir Mahboob, Aamir Ali, and Qurat ul Ain	
Student's Roll No:	**Section:**

Instructions:

- Except for your Roll No and Section, DO NOT SOLVE anything on this paper.
- Return the question paper.
- Read each question completely before answering it. There are **3 questions on 2 pages (1 Sheet).**
- In case of any ambiguity, you may make an assumption. But your assumption should not contradict any statement in the question paper.
- All the answers must be solved according to the SEQUENCE given in the question paper, otherwise, points will be deducted.
- This paper is subjective.
- Where asked for values, only provide the **hex-decimal** values.
- Problems needing iterations should be coded using iterative instructions. No points will be awarded otherwise.

Time Allowed: 60 minutes. **Maximum Points**: 32 points

==========

Q. No. 1 Briefly answer each of the following: [8 x 2 = 16 points]

(i) Explain the difference between the direct-offset and indexed operands with examples.

(ii) In which case, we use MOVSX instruction? Explain one example of MOVSX in which a smaller value is moved into a larger destination.

(iii) Discuss the Signed and Unsigned integers with reference to the hardware viewpoint.

(iv) Discuss the term label as an identifier and directive with examples.

(v) The LOOP instruction creates a counting loop. What happens when a loop instruction is encountered?

(vi) Why the concept of virtual machines is important in computer organization? At which level does assembly language appear at the virtual machine level? Consider L1 as the lowest level.

(vii) How do we load and store the status flag bits? Give example instructions.

(viii) Compare the following x86 processors' mode of operations:

(a) Real address mode

(b) Protected address mode

Q. No. 2 Consider the following initialization: [3 + 3 + 2 = 8 points]

```
X1   WORD  0E342H, 4 DUP(0Eh)
```

(i) Assign proper physical addresses (using a real address mode) to each byte stored in the data segment, and draw a memory map. (Assume DS= 2FF0h, and the starting offset is 2304h).

(ii) For the above data definition directives, give the content of the destination register after execution of each of the following instructions:

```
MOV  EAX, DWORD PTR X1          ;(a) EAX =

MOV  BL, SIZEOF X1              ;(b) BL =

MOV ESI, 4

MOV   BX, [X1+ESI]              ;(c) BX =
```

(iii) Where indicated, write down the values of the Carry, Sign, Zero, and Overflow flags after the execution of each instruction below:

```
MOV AX,7FF0H
ADD AL,10H          ; (a) CF =    SF =       ZF =       OF =
ADD AH,1            ; (b) CF =    SF =       ZF =       OF =
```

Q. No. 3 Write assembly language programs for the following problems: [4 + 4 = 8 points]

(i) Declare two variables “val1” of type BYTE and “val2” of type WORD, initialized with hexadecimal values 79h and 100h respectively. Find the multiplication of these variables using a loop instruction and store the result into a third variable “val3” of type DWORD.

(ii) The Lucas sequence has the same recursive relationship as the Fibonacci sequence, where each term is the sum of the previous two terms, but with different starting values. If the starting values are 2 and 1, write an assembly language program that finds and stores the missing elements in the following series into a WORD type variable X1:
2, 1, 3, 4, 7,__, __, __, __, __ .

Hint: X1 word 2, 1, 3, 4, 7, 5 DUP(?)

Best of LUCK