Indian Institute of Engineering Science and Technology, Shibpur

B. Tech. (CST) 5^{th} Semester End-Term Examination, November, 2022

Microprocessor Based Systems (CS 3101)

Full Marks: 50 Time: 3 Hours

- Attempt any five (5) questions.
- Answers should be precise, to the point, and in your own words as far as practicable.
- If not explicitly mentioned, assume Intel 8085A as the base microprocessor.
- Make your own assumptions, if necessary, and state them at proper places.

1. (a) What are the addressing modes supported by Intel 8086 microprocessor?
   (b) Describe the advantages of the additional addressing modes that Intel 8086 microprocessor has over Intel 8085 microprocessor. [4+6]

2. In the context of Intel 8086 microprocessor based IBM PC running Microsoft DOS operating system, explain with suitable examples the interrelationship among hardware (CPU, Main Memory, IO Devices), BIOS (firmware), Operating System, and user programs. [10]

3. Say, in a hypothetical Intel 8085 based system 2 user programs need to be executed parallelly. That is, at a time 2 user programs, P_1 and P_2 say, would reside in the main memory and after execution of one instruction from P_1, the 8085 microprocessor would execute one instruction from P_2, after which the next instruction of P_1 would be executed and so on. Propose a suitable scheme to achieve this. Please note that your scheme should ensure that the result of such execution of 2 programs would be consistent in the sense that the result would be "same" as their normal independent executions. Make your own assumptions, if necessary. [10]

4. (a) Justify how a particular memory location (having a unique physical address) in an 8086 based system may be referred by multiple logical addresses (Segment Address:Offset). How many such logical addresses are possible for a memory location?
   (b) Write an Intel 8086 assembly language progam to find the largest element of an array of n integers (16bit). [3+7]

5. (a) Can a Memory device be interfaced in the IO space of a microprocessor? If yes, what will be the limitation(s) of such memory?
   (b) Write an interrupt service routine for a software interrupt instruction of Intel 8085 microprocessor (RST 5, say), that saves the contents held by all the registers (before the execution of the instruction starts) at stack. [4+6]

6. (a) Write an 8085 **Assembly Language Function** "*unsigned int mult(unsigned int m, unsigned int n)*" that takes two 8-bit numbers m and n as parameters and returns their product $m \times n$.

   (b) Write an 8085 **Assembly Language Program** that reads a 2-bit number from the Port A of an 8255 PPI chip (from its PA_0 and PA_1 pins) and computes its factorial. You may use the *mult*() function of the previous part in your program. [4+6]

7. Write short notes on the following.

   (a) NodeMcu

   (b) Intel 8051 Microcontroller [5+5]