North East University Bangladesh

Department of Computer Science and Engineering
Semester Final Examination Summer 2022
Program: B.Sc. (Eng.) in CSE
Course: CSE 321(Microprocessor and Interfacing)

Total Mark: 40 Total Time: 2 Hrs

Instructions: Answer question no 1 and any four (4) from rest of the questions. Write your answers neatly with only adequate amount of explanations and diagrams where necessary. If not required avoid unnecessary explanation. Unnecessary materials will gain no marks but can lose marks if it contradicts with actual answers. In all mathematical questions you must show all the steps.
Try to answer parts of a question together.

1. a) Identify if the following statements are true or false. 2
   i. Quantization is discretization in time domain.
   ii. Baudrate and bitrate is same.
   iii. SPI can be used for multi master communication system.
   iv. Not all embedded project requires Software Architecture Design in the development phase.

   b) Answer the following questions in 1 line. 6
   i. How much EEPROM is available in ATMEGA328?
   ii. Draw the I/O pin equivalent schematic of ATMEGA328.
   iii. What is overrun error?
   iv. Write down the name of the hardware interrupts available in 8085.
   v. Write down the names of the flags available in 8085 flag registers.
   vi. Draw the pull-up configuration of a switch.

   Dr. Sheldon Cooper wants to keep track of the number of people visiting his lab and is willing to hire you to build him the Visitor Counter for his lab. His requirements are as follows.
   - Count the number of visitors coming to his lab.
   - Count the number of visitors leaving the lab.
   - Show the current occupancy of the lab.
   - Turn off the fans and lights if there is no visitor in the room.
   - All the visitor statistics should be visible in the control panel containing a LCD screen.
   - At the end of each day, the data should be uploaded to a remote web server for long term storage.
   - The device can be plugged into wall outlet but must have some sort of battery backup for power outage.

   Keeping the above requirements on your mind answer the following questions.

   c) Prepare a sample requirement form mentioning all the necessary hardware and software components. 3
   d) Draw the Hardware Architecture diagram for the system. Your Hardware Architecture diagram must include all the hardware components mentioned in the part c of your answer. 4
   e) Draw the Software Architecture diagram for the system. 3
   f) Explain the difference between requirement and specification. 2

(Total for Question 1 = 20 Marks)

2. a) A 12-bit successive approximation ADC outputs binary code 1111 1111 1111 for an analog input of 25 V. Find its Resolution and the output binary code for analog input of 5V. 2
   b) Explain with proper diagram the quantization process. 2
   c) What is quantization error? 1

(Total for Question 2 = 5 Marks)

3. DACs are used to convert digital values to analog values.
There are many different topologies in which DACs can be implemented. Two of the most common structures are Weighted resistor network DAC and R-2R ladder network DAC.
The choice of topologies dictates the performance that can be achieved through a particular DAC.
   a) Identify which of the DACs is suitable to achieve the following performance goal. 2
      i. Low cost implementation
      ii. 16-bit DAC
   b) Explain the following performance characteristics of DACs. 3
      i. Range of Operation
      ii. Resolution
      iii. Settling time

(Total for Question 3 = 5 Marks)

4. a) Explain how implied and immediate addressing mode in 8085 works. 2
   b) Explain the following instructions of 8085 (**any 2**): XCHG, INR, NOP, JNC. 2
   c) Name the hardware interrupts available in 8085. 1

(Total for Question 4 = 5 Marks)

5. a) Draw the internal block diagram of 8085 with proper labelling. 3
   b) What is the purpose of **Instruction register and decoder** block of 8085? 2

(Total for Question 5 = 5 Marks)

6. a) Design a 6-bit R-2R ladder network based DAC. 3
   b) Compute the resolution and analog output for 0011 1100 1010 of a 12-bit DAC operating with 10 V reference. 2

(Total for Question 6 = 5 Marks)

7. a) Explain with proper diagram how dual slope integrating ADC works. 3
   b) Design a 3-bit flash ADC. 2

(Total for Question 7 = 5 Marks)

8. a) Draw the internal block diagram of 8087. 3
   b) Draw a block diagram depicting coprocessor configuration of 8087 with 8086. 2

(Total for Question 8 = 5 Marks)

9. a) Explain how optical sensors and isolators work. 2
   b) Explain the difference between SPI and IIC. 2
   c) What pins are available in USB 2.0 connector? 1

(Total for Question 9 = 5 Marks)