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Question Paper Code : 19043

B.E. / B.TECH. DEGREE EXAMINATION, NOVEMBER / DECEMBER 2022

Seventh Semester

B.Tech. – Information Technology

19IT701 – EMBEDDED SYSTEMS PROGRAMMING

(Regulations: Mepco – R2019)

Duration: 3 Hours Max. : 100 Marks

Answer ALL Questions

BTL, CO

PART A – (10 × 2 = 20 Marks)

U, CO1 1. Which of the following bits is used to make timer 0 to work in 8 bit mode? Justify your answer.

A) TMR0ON B) T08bit C) T016bit D) T0SE

A, CO1 2. Write the code snippet to continuously output the following pattern on port 4.

00000001
00000010
00000100
00001000
00010000
00100000
01000000
10000000
00000001 etc.

U, CO2 3. E pin requires the _____ pulse to latch in the information at the data pins of the LCD. Justify your answer.

A) H to L B) H to H C) L to H D) L to L

U, CO2 4. What is the use of GO/DONE bit in ADCON register?

U, CO3 5. Choose the correct statement which best describes the RTOS design. Justify your answer.

A) Maximize the throughput of the system
B) Maximize the processor utilization
C) Minimize the response time
D) Assign equal priority to all tasks

U, CO3 6. Differentiate Host and Target machines.

U, CO4 7. Write the advantages of using Instruction Set Simulator.

U, CO4 8. Writing data to flash memory can be done one byte at a time. Say True or False. Justify your answer.

U, CO5 9. Which of the following statement(s) is / are true for light-dependent resistor? Justify your answer.

A) The resistance value decreases when light falls on it

B) The variation of resistance with illumination is non-linear

C) The resistance value increases when light falls on it

D) The variation of resistance with illumination is linear

A, CO5 10. What should be the logic level of Resister Select (RS) pin of LCD module in order to access command register and what should be the logic level of RD / WR' pin of LCD, if we wish to write data word in data register of LCD module?

PART B – (5 × 16 = 80 Marks)

A, CO1 11. a) i. A simple sequencer such as a washing machine program.

Configure ports :

Port 4 = Inputs : bit 0 = power switch, bit 1 = water level switch,

bit 2 = thermostat

Port 6 = Outputs : bit 0 = valve to allow cold water in

bit 1 = heater to heat up water

bit 2 = motor for agitating washing

bit 3 = pump to empty water

Write a program that repeatedly performs the following sequence:

- wait for power switch to become logic 1
- open valve i.e. set to logic 1
- wait for level switch to become 1
- close valve i.e set to logic 0
- turn on heater i.e set to logic 1
- wait for thermostat to become 1
- turn off heater
- turn on motor i.e set to logic 1
- delay for about 6 seconds
- turn motor off i.e. set to logic 0
- turn on pump
- wait for level switch to become 0
- turn off pump
- wait for power switch to become 0 (10 Marks)

U, CO1 11. a) ii. Write down the various possibilities involved in program ROM allocation. (6 Marks)

OR

A, CO1 11. b) i. Write a program that uses repetitive periodic interrupts from a hardware timer T0 to output the message "Tick" to the serial port every second. Implement by using the following two methods:

A) Set a timer to produce the interrupt exactly every second

B) Use a smaller time of, say, 5 ms and count the number of interrupts in the interrupt service routine. When the count reaches 200, one second of time will have elapsed (200 x 5 mS = 1 second). (10 Marks)

U, CO1 11. b) ii. What is meant by PORT B change interrupt? With a suitable diagram, explain the registers and its working principle. (6 Marks)

A, CO2 12. a) i. Using the keypad routines and the keys of the keypad to control the sampling of the ADC. The sampling should initially be disabled. Pressing the '1' key should start sampling and the '2' key should stop sampling. Write a suitable C18 program to perform this functionality. (8 Marks)

A, CO2 12. a) ii. Write a C18 program that repeatedly inputs a value from ADC channel 0 and outputs the value to the Serial Port. Modify the program to output the value in degrees centigrade by applying a scaling factor. Assume that the input to the ADC is from a temperature sensor which generates 0 to 5 volts for temperatures from 0 degrees to 100 degrees centigrade. (8 Marks)

OR

A, CO2 12. b) i. Using the LCD routines, write a program that continuously reads from the ADC at regular intervals of 0.25 seconds and displays the digital value on the LCD. (8 Marks)

A, CO2 12. b) ii. Write a C18 program to rotate stepper motor by monitoring the status of a switch (S). If S = 0, motor rotates clockwise else counter clockwise. (8 Marks)

A, CO3 13. a) i. Write a RTOS program that makes two different tasks to communicate each other using mailbox and queues. Give comments on both mechanisms. (8 Marks)

U, CO3 13. a) ii. What is the meaning of shared data problem? How that problem is solved by semaphore? Explain semaphore encapsulation. (8 Marks)

OR

A, CO3 13. b) i. Write an RTOS program for controlling the Washing Machine. (8 Marks)

U, CO3 13. b) ii. Discuss how RTOS handles the shared data problem by semaphore. (8 Marks)

U, CO4 14. a) i. Elaborate the significances of logic analyzer and In-circuit Emulators in testing. (8 Marks)

U, CO4 14. a) ii. Write in detail the various debugging techniques of embedded software. (8 Marks)

OR

U, CO4 14. b) i. Write in detail the various techniques involved in testing a host machine. (8 Marks)

U, CO4 14. b) ii. What is the use of assert macro? Write a simple program to illustrate the use of assert macro. (8 Marks)

A, CO5 15. a) i. Write a suitable program for Arduino to create a festive lights display with 8 light bulbs (B7-B0). When activated (A0 = 1), the appearance is of two balls bouncing off each other, as follows: 10000001, 01000010, 00100100, 00011000, 00100100, 01000010, 10000001, repeat. Each output configuration lasts for one second. Use bit-manipulation methods (and, or, complement) rather than numeric values. When deactivated, the display turns off all bulbs within 3 seconds. (8 Marks)

A, CO5 15. a) ii. Interface a humidity and room temperature sensor DHT11 and LED with Arduino and draw the circuit diagram and write a program to turn on the LED and display ambient humidity and temperature value on the serial monitor, if the humidity and temperature are greater than 90 % and 25°C, respectively. (8 Marks)

OR

A, CO5 15. b) i. Write the Arduino code for the following specification:

A) To turn on and off each of these LEDs

B) Write the suitable program that cycles through the pattern R, RG, G, GB, B, RB, ALL_OFF3 whenever a button is pressed. (8 Marks)

A, CO5 15. b) ii. Interface LM35 temperature sensor with Arduino UNO board and write a program to turn on the LED, if the room temperature is greater than or equal to 30 °C and turn off the LED, if the room temperature is less than 30 °C. Display the room temperature and the status of LED on the serial monitor. (8 Marks)