Reg. No.:

Name :

VIT

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

Continuous Assessment Test II – March 2024

Programme	:	B. Tech (CSE)	Semester	:	WS 2023-24
Course	:	Embedded Systems	Code	:	BCSE305L
			Class Nbr	:	CH2023240501899 CH2023240501891 CH2023240501842 CH2023240501890 CH2023240501893 CH2023240501902 CH2023240501894 CH2023240501909 CH2023240501907 CH2023240501892 CH2023240501888
Faculty	:	Dr. R. Dhanush Dr. Hariharan I Dr. Chanthini Baskar Dr. Sindhuja M Dr. C. Sridhar Dr. Karthikeyan P R Dr. G. Gugapriya Prof. Satheeshkumar T Dr. Balakrishnan R Dr. Bala Murugan MS Dr. Vijayakumar P	Slot	:	D2 + TD2
Time	:	90 Minutes	Max. Marks	:	50

Answer ALL the questions

Q.No.	Sub. Sec.	Questions	Marks
1.	a)	A networking company uses a compression technique to encode the message before transmitting over the network. Suppose the message contains the following characters with their frequency:	[5]

Character	Frequency
A	5
B	9
C	12
D	13
E	16
F	45

If the compression technique used is Huffman Coding, how many bits will be saved in the message? Also draw the respective Huffman coding tree. Note that each character in input message takes 1 byte.

The characters 'a' to 'h' have the set of frequencies based on the first 8 Fibonacci numbers as follows:

a : 1, b : 1, c : 2, d : 3, e : 5, f : 8, g : 13, h : 21

b) A Huffman code is used to represent the characters. What is the sequence of characters corresponding to the following code? [5]

110111100111010

2. You are tasked with designing a control system for 'n' elevators in a building with 'm' floors. The objective is to efficiently move the elevators between floors based on the following constraints and additional functionalities:

- Each elevator is equipped with 'm' buttons, one for each floor. Pressing a button illuminates it and prompts the elevator to visit the corresponding floor. The illumination is cancelled when the elevator arrives at the requested floor.
- If an elevator has no pending requests, it remains idle at its current floor with its doors closed.
- In addition to floor requests, the elevators should also respond to:
  - Emergency stop button: If pressed, the elevator immediately stops at the next available floor and opens its doors.
  - Overload detection: If the weight of passengers exceeds a predefined threshold, the elevator should prevent additional passengers from entering until the weight is reduced.
  - Maintenance mode: Elevators can be placed into maintenance mode for servicing, during which they are unavailable for regular passenger use.
  - Time-based scheduling: Elevators should prioritize floor requests based on peak hours and traffic patterns within the building.

Draw the petrinet model for the Elevator problem. [10]

3. Model an Automatic Chocolate Vending Machine (ACVM) using UML use case and sequence diagram. The functions of ACVM are given below,

- A child sends commands to the system using a GUI (Graphic User Interface).
- GUI consists of the LCD display and keypad units.
- The child inserts the coins (Rs. 1, 2 & 5) for cost of chocolate and the machine delivers the chocolate.
- If the coins are not inserted as per the cost of chocolate in reasonable times then all coins are refunded.
- If the coins are inserted of amount more than the cost of chocolate, the excess amount is refunded along with chocolate.
- The coins for the chocolates purchased collects inside the machine in a collector channel, so that owner can get the money, again through appropriate commands using the GUI.

[10]

4. Table I presents an RMS schedule for a real-time military tracking system. The system consists of 3 tasks to be scheduled, each with their corresponding computation time and period.

Table I: Task Scheduling Requirements

Task	Description	Computation Time (C)	Period (T)	Priority
UTL	Update Track Log	10	20	
UTr	Object Tracking	3	10	
GPST	GPS Triangulation	1	5	

[10]

Verify if the schedulability test for RMS was correct by calculating the response times of all three tasks in Table I. Fill the "Priority" column as necessary. State your findings and compare to the schedulability test.

5. Consider that the RMS schedule in Table I needs to be converted into an EDF schedule, with arrival times 1, 3, and 0 for tasks UTL, UTr, and GPST, respectively. Determine if this revised task set is schedulable using (1) the EDF schedulability test and (2) the timing diagram method. [10]

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