



Continuous Assessment Test II – October-2024

Programme	: B.Tech. (CSE)	Semester	: Fall 2024-25
Course	: BECE204L & Microprocessors and Microcontrollers	Code	: CH2024250100392
Faculty	: Dr. Ravi Tiwari	Class Nbr	: G2 + TG2
Time	: 90 Minutes	Slot	: 50
		Max. Marks	: Fall 2024-25

Answer ALL the questions

Q.No.	Sub. Sec.	Questions	Marks	BT Level
1.		Consider an 8051 microcontroller system which takes numeric inputs between 1 and 26 from the user through the Port P2. The numeric value "1" is mapped to the character "A", "2" is mapped to "B" and likewise "26" is mapped to "Z". Process the received numeric input in such a way that you transfer the mapped character of it via serial communication with a baud rate of 9600. Assume the crystal frequency of the 8051 microcontroller is 25.8048 MHz. Write an 8051 assembly language program to implement the same. [Note: The ASCII code for A to Z starts from 41H (A) to 5AH (Z)]	15	6
2.		Write an 8051 assembly language program that calculates the Body Mass Index (BMI) based on user input and displays the BMI category on an LCD. The program should be triggered by pressing a switch connected to the INT0 pin. The height (in meters) and weight (in kilograms) should be stored in memory locations 40H and 41H, respectively. Use the formula: $BMI = \frac{Weight}{(Height)^2}$	20	6

The program should display:

- "UNDERWEIGHT" if $BMI < 18$
- "NORMAL" if $18 \leq BMI \leq 25$
- "OVERWEIGHT" if $BMI > 25$

Additionally, draw a schematic diagram with all pin connections illustrating the interface of 8051 with LCD.

3.	If SS = ABCDH, BP = 2345H, SP = 7456H, AX = 0509H and BX = BCDEH, CX = 1203H; DX = 6789H; CF = 1, CS = 6500H, DS = 9876H, SI = 1000H, IP = DEFAH, ES = 1234H.	15	4
	(a) Compute the 20-bit physical address of the stack top, code and data segments. (5 Marks) (b) If the following instructions are executed in the given sequence,		

find the output of all the registers. **(4 Marks)**

PUSH BX
PUSH AX
POP CX
ROL AX, CL

- (c) Write the contents and memory locations of SP, BP and SS after the execution of the above instructions. **(6 Marks)**

↔↔All the Best↔↔

Continuous Assessment Test (CAT) – II - OCT 2024

Programme	:	B. Tech (CSE) and its Specialization	Semester	:	Fall 24-25
Course Code & Course Title	:	BCSE308L – Computer Networks	Class Number	:	CH2024250100847 CH2024250100849 CH2024250100856 CH2024250100932 CH2024250100936 CH2024250100938 CH2024250100539 CH2024250101460 CH2024250101463 CH2024250100861
Faculty	:	Prof. NEELANARAYANAN V Prof. PUNITHA K Prof. KARMELA Prof. SHYAMALA L Prof. MENAKA PUSHPA A Prof. SWAMINATHAN Prof. SUDHA Prof. DHANALAKSHMI Prof. DEEPA NIVETHIKA Prof. KABILAN K	Slot	:	F2+TF2
Duration	:	1½ Hours	Max. Mark		50 Marks

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information.
- Only non-programmable calculator without storage is permitted

Answer all questions

Q. No	Sub Sec.	Description	Marks
1.		<p>i) In a CSMA/CD environment, consider an Ethernet network operating at a speed of 10 Mbps, with a maximum distance of 200 meters between the nodes. Calculate the minimum frame size required to ensure that a transmitting station can detect the collisions. Assume the signal propagation speed in the cable is 2×10^8 meters per second. [7 Marks]</p> <p>ii) Is CSMA/CD needed in modern full-duplex Ethernet networks? Justify your answer. [3 Marks]</p>	10
2.		<p>Consider a company offering two networks labelled as A and B, with the following IP addresses 130.158.0.0 and 195.168.125.0, respectively.</p> <p>i) Network A requires 250 hosts per subnet, find how many subnets can be created under network A. [2 Marks] → 2 → 4</p> <p>ii) Suppose, a particular subnetwork created under network A, needs 500 hosts. Is it possible to allocate? Justify your answer with complete solution. [3 Marks]</p>	10

- iii) Network B requires 120 hosts per subnet, find the First Address and Last Address about each subnetwork that can be created under network B. [5 Marks]

3.

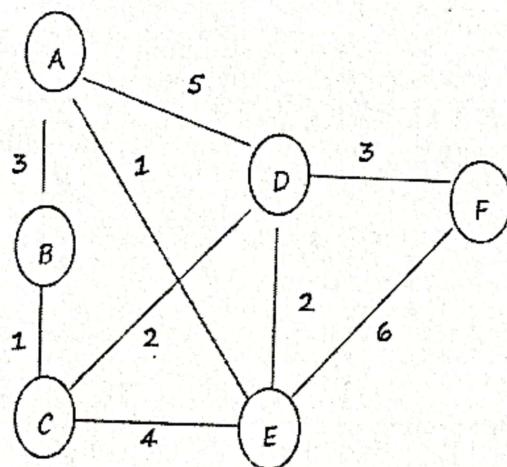
An IPv4 packet with a total size of 4280 bytes is transmitted through a network consisting of two routers: R1 and R2 with MTU as 1600 bytes, and 600 bytes, respectively.

- Illustrate how the packets are fragmented at each router. For each fragment, specify the header fields information that includes data size, total size, fragment offset, M-bit, identification, flags, and other header details. [7 Marks]
- Describe how the packets are reassembled after passing through the routers at the receiver end. [3 Marks]

10

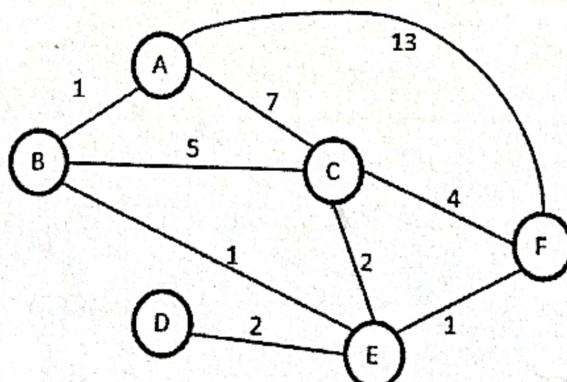
4.

Apply Distance Vector Routing protocol for the following network topology to find a final routing table for each node in the network. Show with an initial routing table and give its status or update when it is in the process of convergence as per the routing information from the neighbors.



10

Consider the given network:



10

5.

- Derive the routing table for Router C using the protocol that utilizes Dijkstra's algorithm. [6 Marks]
- In case, the link between Router B and Router E breaks, will it affect the Router C's routing table? Discuss the reason and also provide an alternative solution to Router C. [4 Marks]

***** All the best *****



VIT

Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)
CHENNAI

Reg. Number:

23BA110 63

Continuous Assessment Test (CAT) – II October 2024

Programme	:	B.Tech.	Semester	:	FALL 2024-2025
Course Code & Course Title	:	BMAT205L, Discrete Mathematics and Graph Theory	Slot	:	D2+TD2+TDD2
Faculty	:	Dr. Kalyan Manna, Dr. Nathiya, Dr. Vidhya, Prof. Sumathi, Dr. Om Namha Shivay Dr. Pavithra, Prof. Sakthi Devi, Dr. Ashish Kumar Nandhi, Dr. Dhivya P, Dr. Berin Greeni, Dr. Radha, Dr. Sandip Saha.	Class Number	:	CH2024250102089, 2090, 2093, 2095, 2096, 2098, 2101, 2102, 2191, 2195, 2197
Duration	:	90 Minutes	Max. Marks	:	50

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information.
- Only non-programmable calculator without storage is permitted

Answer all questions
(5×10 = 50)

Q. No	Sub Sec.	Description	Marks
1	(a)	<p>A bagel shop has onion bagels, poppy seed bagels, egg bagels, salty bagels, pumpernickel bagels, sesame seed bagels, raisin bagels and plain bagels. How many ways are there to choose (i) six bagels? (ii) a dozen bagels with at least one of each kind? (iii) a dozen bagels with at least 3 egg bagels and no more than 2 salty bagels?</p> <p>(b) Let 'd' be a positive integer. Is the conclusion that "among any group of $d + 1$ (not necessarily consecutive) integers there are two with exactly the same remainder when they are divided by 'd'", correct? True. Example 1 2 3 4 6 7.</p>	(8+2) 2 region whole (2)
	(b)	<p>Construct the circuit diagram for the following Boolean function given below</p> $f(x, y, z) = (xy' + xz)' + x'$ <p>and also find its sum of product and product of sum canonical forms of the algebraic expression.</p> <p>Give the Boolean expression for the circuit diagram given below:</p> $A'B'C'$	(7+3)

<p>3.</p> <p><i>(a)</i></p> <p><i>n+1</i></p> <p><i>n+1-1</i></p> <p><i>15</i></p>	<p>A bus driver pays all tolls, using only nickels and dimes, by throwing one coin at a time into the mechanical toll collector. Find a recurrence relation for the number of different ways the bus driver can pay a toll of n cents (where the order in which the coins are used matters). Also find, in how many different ways can the driver pay a toll of 45 cents? <i>46</i></p> <p><i>Using the method of generating function, solve the recurrence relation</i></p> $a_n = a_{n-1} - a_{n-2}, \quad n \geq 2, \text{ with } a_0 = a_1 = 1.$ <p><i>$\frac{3-\sqrt{3}}{2} \left(1 + \frac{\sqrt{3}}{2} \right)^n + \frac{3+\sqrt{3}}{2} \left(1 - \frac{\sqrt{3}}{2} \right)^n$</i></p>	<p>(4+6)</p>
<p>4.</p>	<p>Consider the poset $(\{\emptyset, \{1\}, \{3\}, \{4\}, \{1, 2\}, \{2, 4\}, \{3, 4\}, \{1, 3, 4\}, \{2, 3, 4\}\}, \subseteq)$.</p> <ul style="list-style-type: none"> (i) Draw the Hasse diagram. (ii) Find the maximal and minimal elements. <i>13M 23M</i> (iii) Find greatest element, if it exists? <i>No</i> (iv) Find the least element, if it exists? <i>∅</i> (v) Find all upper and lower bounds of $\{\{1\}, \{3\}\}$, if it exists? <i>(3, 4) (1, 3, 4)</i> and <i>∅</i> (vi) Is this poset a lattice? Justify your answer. <i>No</i> 	<p><i>(3+4+3)</i></p> <p><i>7+3</i></p> <p><i>10</i></p>
<p>5.</p>	<p>Consider a communication network where five communication towers are positioned at specific locations in a 2D plane. The towers are located at the following coordinates: Tower A (2, 3), Tower B (5, 1), Tower C (7, 4), Tower D (3, 6) and Tower E (8, 8).</p>	<p>(5+2+3)</p>
<p><i>(a)</i></p>	<p>Construct a graph G where vertex corresponds to the communication tower and edge is drawn between two vertices if the signal range (distance) is greater than <i>3</i> units.</p>	<p><i>$3 < \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$</i></p>
<p><i>(b)</i></p>	<p>Check whether the constructed graph G, is a complete graph or not and provide the reason.</p>	
<p><i>(c)</i></p>	<p>Write the adjacency matrix of the constructed graph G.</p>	



Continuous Assessment Test (CAT) – II – October 2024

Programme	:	B. TECH	Semester	:	FALL 2024-25
Course Code & Course Title	:	BCSE205L & Computer Architecture and Organization	Class Number	:	CH2024250101444 CH2024250102663 CH2024250100888 CH2024250100533
Faculty	:	Dr. R. M. Bhavadharini Dr. R. Madura Meenakshi Dr. Kaja Mohideen A Dr. A.R. Revathi	Slot	:	A2+TA2
Duration	:	90 Minutes	Max. Mark	:	50

Q. No.	Sub-division	Question Text	Marks
1		<p>Consider an 8-way set associative mapped cache of size 512 KB with block size 1 KB. There are 7 bits in the tag. Find</p> <ul style="list-style-type: none"> a) Number of Bits in Block Offset, Number of Lines in Cache (2 marks) b) Number of Sets in Cache (2 marks) c) Number of Bits in Physical Address (2 marks) d) Size of main memory (2 marks) e) Tag directory size (2 marks) 	10
2		<p>a) Analyse the following time steps, Explain the meaning line-by-line and identify to which instruction it belongs. (6 marks)</p> <p>1 PCout, MARin, Read, Select4, Add, Zin 2 Zout, PCin, Yin, WMFC 3 MDRout, IRin 4 Address field of IRout, MARin 5 R1out, MDRin, Write 6 MDRoutE, WMFC, END.</p> <p>b) For the instruction identified, write down the control sequence steps for the multipath Control Unit. (4 marks)</p>	10
3		<p>A computer employs RAM chips of 1024 x 8 and ROM chips of 1024 x 8. The computer system needs 2k *8 bytes of RAM, 2k *8 bytes of ROM, and four interface units with four registers in each. A memory - mapped I/O configuration is used. The two highest-order bits of the address bus are assigned 00 for RAM, 01 for ROM, and 10 for interface registers.</p>	10

	<p>a) How many RAM and ROM chips are needed? (2 marks)</p> <p>b) Draw a memory-address map for the system. (4 marks)</p> <p>c) Give the address range in hexadecimal for RAM, ROM, and interface. (2 marks)</p> <p>d) Develop a chip layout for the above said specifications. (2 marks)</p>	
4	<p>Write a combined <u>micro routine</u> that can implement that BGT (Branch if > 0), BPL (Branch if plus), and BR (Branch Unconditionally) instructions. The branch conditions, for the BGT and BPL instructions are $Z + (N \text{ XOR } V) = 0$ and $N = 0$, respectively. What is the total number of <u>micro instructions</u> required?</p>	10
5	<p>In a real-time traffic control system, multiple events require the central processor to handle interrupts to ensure smooth <u>traffic flow</u>. The system uses a <u>vectored interrupt</u> structure with <u>prioritized events</u>: Emergency Vehicle Detection (highest priority), Pedestrian Crossing Request, and Traffic Light Timer Update (lowest priority). Each interrupt has an overhead of 5 microseconds for context switching, and handling the interrupt takes an additional 10 microseconds.</p> <p>Consider the following sequence of events:</p> <ol style="list-style-type: none"> 1. At $t = 0 \mu\text{s}$, the Traffic Light Timer Update triggers an interrupt. 2. At $t = 3 \mu\text{s}$, an Emergency Vehicle is detected, triggering an interrupt. 3. At $t = 5 \mu\text{s}$, a Pedestrian Crossing Request triggers an interrupt. 4. At $t = 10 \mu\text{s}$, another Traffic Light Timer Update triggers an interrupt. <p>a) Show how each <u>interrupt</u> is prioritized and handled by the system. (4 Marks)</p> <p>b) Discuss how the <u>vectored</u> and <u>prioritized interrupt structure</u> affects the response time of <u>lower-priority events</u>. (6 marks)</p>	10

*****All the best*****



Continuous Assessment Test-2 – March 2025

Programme	B.Tech (CSE and its Specialization)	Semester	Winter 2024-25
Course	Operating System	Code	BCSE303L
Faculty	Dr. Kumar R Dr. Manas Ranjan Prusty Dr. Manimegalai T Dr. Indra Priyadarshini S	Slot(s)	D1+TD1
		Class Nbr(s)	CH2024250502116 CH2024250502304 CH2024250502275 CH2024250502276
Time	1½ Hours	Max. Marks	50

Answer ALL Questions

1. GoTrip travel agency manages bookings for customers using three types of resources: [10]
 Booking Agents (A) - Employees who handle customer requests, Computer Systems (C) - Reservation terminals used to process bookings, Transportation Slots (T) - Limited seats on flights. The agency has multiple customers trying to book trips simultaneously and each customer requires a combination of these resources.

The goal is to allocate resources without leading to a standstill, where customers are stuck waiting for each other indefinitely. The system resources are as follows: Total Booking Agents (A): 6, Total Computer Systems (C): 4 and Total Transportation Slots (T): 7

The below table shows the maximum demand for resources and currently allocated amount of resources for four customers.

Customer	Currently Allocation (A,C,T)	Maximum Demand (A,C,T)
Customer-1	(1, 1, 2)	(3, 2, 4)
Customer-2	(2, 1, 1)	(4, 3, 3)
Customer-3	(1, 0, 1)	(2, 2, 3)
Customer-4	(0, 1, 1)	(1, 2, 2)

Determine if granting this request will keep the system in a safe state. Determine the available vector and need matrix for the above problem. Check whether the current system snapshot reaches safe state or not. [5 Marks]

The travel agency receives a new request from Customer-1 for additional resources: (1, 0, 1), can it be granted immediately? If it is safe, provide the illustration of safe sequence step-by-step. If not, explain why? [5 Marks]

2. In a busy international airport, multiple aeroplanes are waiting to take off. But the airport has a limitation; in order to maintain safety, only one aeroplane is allowed to occupy the runway. To manage this, the airport's control system needs to implement a fair and efficient method to allocate the runway to awaiting aeroplanes. Design a software solution with pseudocode where each aeroplane requests access to the runway and is granted permission based on a fair mechanism that ensures:

- 1) Only one aeroplane uses the runway at a time.
- 2) Aeroplanes are granted runway access in the order they request it, preventing any

aeroplane from being indefinitely delayed. To achieve this, consider assigning a unique identifier to each aeroplane upon its request for runway access. This identifier acts as a ticket to determine the sequence in which aeroplanes are granted permission to use the runway.

3) The system operates smoothly without any aeroplane being stuck waiting indefinitely due to resource contention.

Use comment lines to give a better understanding of the pseudocode.

3. A traffic control system manages vehicle flow at an intersection using multiple sensors and a signal controller. Sensors monitor real-time traffic conditions and transmit data to the system, which then adjusts traffic signal timings dynamically for optimal flow. [10]
- To prevent inconsistencies, synchronization is required:
- If a signal update is in progress, sensor data transmission must wait.
 - If sensors are transmitting, the signal update must be paused.

Write the pseudocode implementing two functions `TrafficSensor()` that collects and transmits real-time traffic data and `SignalController()` that updates traffic signal timings. The solution must use semaphores to ensure that multiple sensors can send data simultaneously, only one signal update occurs at a time and proper synchronization to avoid conflicts, deadlocks, or indefinite blocking. Use clear and meaningful names for variables and functions by avoiding single-letter or abbreviated nomenclature. Use comment lines to give a better understanding to each line of the code. Additionally, explain how the suggested semaphore-based synchronization solution ensures smooth traffic management. [5 Marks + 5 Marks]

4. a) At Tirupati devasthan, as the queue is large always with more devotees, the devotees are allocated waiting rooms before their darshan. Assume that the temple has different waiting rooms available with specific capacities and no group shares room with other groups. When groups of devotees arrive, they are assigned rooms based on different allocation strategies: [10]
- Assign the first room that is large enough
 - Assign the smallest suitable room to minimize unused space
 - Assign the largest available room to maximize remaining space

Available Waiting Room Capacities:

Room A: 200, Room B: 500, Room C: 300, Room D: 600, Room E: 400

Arriving Devotee Groups:

Group 1: 212 devotees, Group 2: 417 devotees, Group 3: 112 devotees Group 4: 426 devotees
With neat diagram depict the allocation of rooms and find the best allocation strategy with respect to internal and external fragmentation. [7 marks]

- b) In a paged memory system, the page size is always chosen as a power of 2 (e.g., 512, 1024, 2048 bytes). Explain why this design choice is made. [3 Marks]

5. a) Imagine a buffet where guests have two ways to fill their plates: [5 Marks] [10]
1. Fast Queue : If the required dish is available in the nearby serving counter, the guest quickly picks it up and proceeds.
 2. Slow Queue : If the dish is not found, the guest must go to the main kitchen, ask the chef and then return to pick the dish from the buffet.

If the following data applies to the buffet:

- 70% of guests find their dish in the nearby counter
- Time taken to pick a dish from the counter = 20 seconds
- Time to fetch a dish from the kitchen = 200 seconds

Calculate the effective access time for food retrieval

b) Consider a system with the following memory management setup [5 Marks]

Page size = 512 bytes

Logical address = 1200

Page no.	Frame no
0	2
1	5
2	7
3	1

1. Extract the page number and offset from the given logical address.
2. Using the page table, determine the frame number and compute the corresponding physical address for the logical address 1200.

Continuous Assessment Test(CAT) – II - APRIL 2024

82

Programme	:	B.Tech(BCE, BRS, BAI, BDS, BLC)	Semester	:	Winter 2023-2024
Course Code & Course Title	:	BCSE102L - Structured and Object-Oriented Programming	Slot	:	B2
Faculty	:	Dr.Mansoor Hussain D Dr.Amutha S Dr. Indra Priyadarshini Dr.Suguna Prof.Balaji V Prof. Rajathi C Dr.Prabha B Dr. Manas Ranjan Prusty Dr.J.Uma Maheswari	Class Number	:	CH2023240501318 CH2023240501320 CH2023240501322 CH2023240501325 CH2023240501328 CH2023240501332 CH2023240501340 CH2023240501349 CH2023240501378
Duration	:	1 Hour 30 Mins	Max. Mark	:	50

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information.
- Only non-programmable calculator without storage is permitted

Answer all questions

Q. No	Sub Sec.	Description	Marks
1.		<p>Design a Super Market Billing system using Structures in C Programming. Store the details of a Bill (Bill number, Total Bill Amount, Customer Details, No of Products, Product Details) using a structure. To store the details of Customer (Customer ID, Name, Address, Phone Number) and Product (Product ID, Name, Price, Qty) use separate structures within the Bill structure.</p> <p>A customer can buy multiple products. Perform each of the following operations using a separate user-defined function. Let the required functions take the structure variable as argument.</p> <p>Use pointers to access the structure and allocate the memory dynamically. (1 mark)</p> <ol style="list-style-type: none"> 1) Read the necessary input details of the bill for customer1 and customer2 (2 marks) 2) Display the bill of customer1 with his details and all the product details including amount of each product along with bill number and total bill amount. (2 marks) 3) Display the details of the costliest and the cheapest product bought from the customer1 bill. (3 marks) 4) Sum up the total bill amount of both the customers and display their bill details along with the sum. (2 marks) 	10
2.		<p>A CD shop is selling CDs related to all genres of music. As a manager of this shop your task is to maintain the CD details such as name or title of the CD, composer name, music genre, price and stocks available (no of available CDs). Whenever the customer wants a CD, the salesperson inputs the title and composer name of that CD and the system searches the list and</p>	10

	<p>displays whether it is available or not. If it is not available, an appropriate message should be displayed. If it is there then the system should display all the details about that particular CD and request the user to enter the number of CDs required. If the requested number of CDs are available, the total cost for the requested number of CDs should be displayed otherwise display the message saying "The requested copies are not in stock".</p> <p>Write a C++ program to implement the same with suitable member functions, constructors, and destructors. You need to create '<u>n</u>' objects for the class CD. Use the default constructor to initialize the price of all CDs to 0. Use input() member function to get the CD details from the user. Create a destructor in such a way that it should depict the order of object destruction in the form of message saying "CD title(display appropriate title of CD)" is deleted. Suggest any member function of your class can be made as an inline function. Justify your answer.</p>	
3.	<p>As a volunteer with a local non-governmental organization (NGO) engaged in community initiatives, you have been entrusted with the responsibility to support the NGO's analysis of voting data obtained from Voter Verifiable Paper Audit Trail (VVPAT) system's used in a recent election. Your task involves developing a C++ program to aid the NGO in conducting this analysis. Design a <u>class called Voter</u> to represent individual voters, fulfilling the following requirements:</p> <ol style="list-style-type: none"> 1. Implement constructor overloading to initialize Voter objects with different sets of parameters (5 Marks): <ul style="list-style-type: none"> • Constructor 1: Accepts the voter's name and age as parameters • Constructor 2: Accepts the voter's name, age, and their voting status as parameters (whether they have voted or not). 2. Develop a function named <u>displayEligibleVoters()</u> outside the Voter class. Let this function be a non-member of the Voter class but has to access the class's private members. This function should (5 Marks): <ul style="list-style-type: none"> • Take multiple Voter objects as input. • Display the names of eligible voters who are above 18 years old and have not voted. 	10
4.	<p>A fitness app tracks the fitness of person by "Yoga" class with <u>yoga_duration</u> and "Exercise" class with <u>exercise_type</u> and <u>exercise_time</u>. By performing "Yoga" and "Exercise", the fitness condition is evaluated using the class "Fit" with <u>healthreport()</u> method using the following conditions:</p> <ol style="list-style-type: none"> i. If <u>exercise_time</u>>30minutes, <u>exercise_type</u>=running, and <u>yoga_duration</u>>=15minutes then fitness is good. ii. If <u>exercise_time</u><=30minutes to >10minutes, <u>exercise_type</u>=running, and <u>yoga_duration</u><15minutes to >=10minutes then fitness is average. iii. Otherwise fitness is bad. <p>"Meditation" class with property <u>Meditation_duration</u> which is inherited from "Yoga". Use member function in Meditation</p>	10

	<p>class to find the Meditation nature of a person by the following conditions:</p> <ul style="list-style-type: none"> i. If $yoga_duration \geq 15\text{minutes}$ and $Meditation_duration \geq 2\text{hours}$ to $\leq 3\text{hours}$ then the nature of meditation is good. ii. If $yoga_duration < 15\text{minutes}$ to $\geq 7\text{minutes}$ and $Meditation_duration < 2\text{hour}$ to $\geq 1\text{hours}$ then nature of meditation is average. iii. Otherwise nature of meditation is bad. <p>Develop a C++ program to implement the given scenario.</p>	
5	<p>Imagine you are designing a software system for a university that manages information about faculty, staff, and students. Each category has common attributes like name, age, and address which are declared in person class. Faculty, staff, and student classes have specific attributes unique to their roles. For example, faculty members have a department they belong to, staff members have a designation like "clerk" or "technician" and students have a field of study and a student ID.</p> <p>Use appropriate inheritance in C++ programming and design a system that represents these entities with appropriate attributes and methods. Ensure that common attributes and methods are inherited from a base class, while each specific category inherits from the base class and adds its unique attributes and methods. Additionally, provide functionality to input and display information for each entity type. Include member functions for the following operations:</p> <ul style="list-style-type: none"> i. Input information for faculty, staff, and students (2 Marks). ii. Display information for faculty, staff, and students. (2 Marks) iii. Process university details, such as calculating the average age of faculty/staff/students, listing all members of a particular department, and listing all students in a given field of study(6 Marks). 	10

***** All the best *****

Continuous Assessment Test (CAT) – II - April 2024

Programme	:	SCOPE	Semester	:	WINTER 23-24
Course Code & Course Title	:	BCSE102L Structured and Object Oriented Programming	Class Number	:	CH2023240501321 CH2023240501317 CH2023240501319 CH2023240501327 CH2023240501324 CH2023240501348 CH2023240501335 CH2023240501330 CH2023240501376 CH2023240503343
Faculty	:	Dr. Valarmathi P, Dr. Mansoor Hussain D, Dr. Amutha S, Dr. Yogesh C, Prof. Prethija G Prof. Deepika R Prof. Shree Prakash Prof. Safiya Parvin A Dr. Kavi Priya G Prof. Johnsri R	Slot	:	<u>B1</u>
Duration	:	90 Minutes	Max. Mark		50

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information.
- Only non-programmable calculator without storage is permitted

Answer all questions

Q. No	Sub Sec.	Description	Marks
1		<p>Assume that your task is to develop an application for an Event Management System to help a company to handle events efficiently. The application will manage event details such as name, type, duration, expenses, and scheduled date. Implement the following functionalities using dynamic memory allocation in C:</p> <p>Create an array of Events: Define a structure named “Event” containing members such as name(string), type(string), duration(int), expenses(float), and a nested structure for the scheduled date. Create a structure named “Date” with three members i.e., day (int), month (string), year(int). Use dynamic memory allocation to create an array of events and prompt the user to input details for each event. (6 marks)</p>	6
2		<p>Write a C++ program with a class “BankAccount” which performs constructor overloading. Data members of this class are accountholder_name, account_number and initialbalance.</p> <ul style="list-style-type: none"> • Create a default constructor, which initialize the values to the account holder name as “unknown”, account number as 	10

	<p>“00000000” and initialbalance as 0.0.</p> <ul style="list-style-type: none"> • Create two parameterised constructors: one with the account_holder_name and initial balance as parameter, one with the account_holder_name, account_number and initial balance as parameters. • Use two member functions for deposit and withdrawal of money with one argument which is the amount to be deposited or withdrawn. Before performing the withdrawal process, the balance amount should be checked. <p>Now display account_holder_name, account number and the initial balance for three accounts.</p> <p>Note: account1, account2 and account3 are the three accounts. account2 tries to withdraw more than the available balance for which “insufficient balance” alert is generated.</p>	
3	<p>Write a C++ program for a student record management system comprising two classes: Student and StudentRecords.</p> <p>The Student class represents individual student information and contains data members such as name, ID, and GPA. Utilize a parameterized constructor to instantiate three distinct objects of the Student class with the specified data members. Ensure that whenever a new student object is created, it updates the corresponding records in the StudentRecords class.</p> <p>The StudentRecords class manages the collection of student records. It contains static member variables totalStudents and totalGPA to track the total number of students and the total GPA sum. Additionally, include static member functions:</p> <ul style="list-style-type: none"> • getTotalStudents() : Retrieves the total number of students. • addStudent() : Adds a new student to the records, updating the total number of students and the total GPA sum accordingly. • calculateAverageGPA(): Calculates and returns the average GPA of all students in the records. <p>Implement a friend function checkPassFail() to determine whether a student has passed or failed based on their GPA. The condition for passing is $GPA > 2.0$; otherwise, the student fails. It should output a message indicating whether the student has passed or failed, along with their name and GPA.</p>	14
4	<p>An Inventory Management System has classes such as Product, Discountable. The Product class should encapsulate attributes like product_name, product_price, and quantity, complemented by methods such as getName(), getPrice(), and getQuantity(). Discountable class to handle items eligible for discounts, featuring a discountrate attribute and a getDiscountAmount() method to compute discounts based on product_price and discountrate.</p> <p>Finally, design a DiscountedProduct class that inherits from both Product and Discountable. This class should calculate and display the discounted price, utilizing the product_price from the Product class and the discountrate from the Discountable class. Create an object for DiscountedProduct which takes product_name, product_price, quantity and discountrate as parameters. Now display the product name,</p>	10

product_price, discounted price and quantity using the same instance created for DiscountedProduct.

An educational institute wants to assess their employees performance in three categories: Academics, Research, and collaboration with foreign universities. A class-named employee maintains an employee id and name. The academic class maintains the total years of experience. The research class has a numerical member named hindex. Collaboration class maintains the number of foreign universities the employee currently working. Gradepoint class is the derived class that calculate the total grade points(GP) for the employee from all the three classes.

The constraints to be followed:

If experience < 5 then GP1 =0

If $5 \leq \text{experience} \leq 10$ then GP1=5

If experience>10 GP1=10

5

10

If hindex>10 then GP2=50

If $5 \leq \text{hindex} \leq 10$ then GP2=25

If $1 \leq \text{hindex} \leq 5$ GP2=10

Below 1 GP2 =0

If nou >10 then GP3=25

If $5 \leq \text{nou} \leq 10$ then GP3=10

If $1 \leq \text{nou} \leq 5$ GP3=5

Below 1 GP3 =0

For the above scenario, apply the relevant object-oriented programming concept and write the code in C++.

*****All the best *****



Scanned with OKEN Scanner



VIT

Vellore Institute of Technology
(Deemed to be University under Section 3 of UGC Act, 1956)
CHENNAI

Reg. Number:

23BA11063

Continuous Assessment Test (CAT-II) – OCT 2024

Programme	B.Tech (CSE)	Semester	Fall 2024– 2025
Course Title	Data structures and Algorithms	Code	BCSE202L
Faculty	Dr. VIJAYALAKSHMI A Dr. AMRIT PAL Dr. RISHIKESHAN C A Dr. KALAIPRIYAN Dr. RAJAKUMAR Dr. VALARMATHI SUDHAKAR Dr. ABISHI CHOWDHURY Dr. SENTHIL KUMAR A M Dr. VINOETHINI A Dr. DOMINIC SAVIO M Dr. SENDHIL R Dr. ILAVENDHAN A Dr. SUDHEER KUMAR E Dr. BALASARASWATHI Dr. BALRAJ E Dr. HELEN VIJITHA P Dr. MANIKANDAN P	Slot	E2+TE2
Time	90 Minutes	Class Number	CH2024250100821 CH2024250100989 CH2024250101061 CH2024250100527 CH2024250100529 CH2024250100999 CH2024250100993 CH2024250101434 CH2024250100850 CH2024250100794 CH2024250100803 CH2024250100820 CH2024250101436 CH2024250101435 CH2024250101000 CH2024250100864 CH2024250100996
		Max. Marks	50

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information.
- If additional information is required for answering any question, assume the same and mention it in the answer.

Answer all questions

Q.No.	Sub . Sec.	Question Description	Marks
1.		A college is developing a student registration and classroom management system to manage the seating arrangements for various classes. Students register on a first-come-first-served basis. The seating queue is implemented using a circular queue where students are added to the queue as they register for a class. Initially, each class has a limited number of seats (let's say 6). However, due to high demand, to prevent registration failures, when the queue is about 80 percent full (considering the floor value), the system must create a new seating queue by doubling the previous size to accommodate more students by considering the circular nature of the current queue size. Then, it must shift the current waiting students to the new queue in the correct order for processing further.	10

Example:

- The current queue in the class has a maximum seating capacity of 6, and the current state of the registration queue is as follows:
 $\text{queue} = [\text{Aryan}, \text{Sanjana}, -, -, \text{Alex}, \text{Emily}]$ (where "-" denotes an empty seat); front = 4, rear = 1, capacity = 6.
- The incoming list of new students is John, Rhea, Bob, Seema, Krishna.

- i. Write a pseudo-code to handle the above scenario considering all possible cases and necessary operations. Note: In real time scenario, any classroom cannot accommodate unlimited capacity. So, consider the maximum capacity in a class is 75. [7 Marks]
- ii. Print the elements of the new queue from the given example and also print the front and rear index. [3 Marks] *disp lang*

2.

Consider a circular linked list 'P' consisting of n nodes. Write a pseudocode "SplitList", which will split a circular linked list 'P' of n nodes into two circular linked lists, 'P1' with the first $(n/2)$ nodes and 'P2' with last $n - (n/2)$ nodes of the list 'P'. Write a pseudocode for a function 'EvenOddList' which creates a new list 'P3' from 'P2' that prints all even positioned nodes first followed by all odd positioned nodes and also write a pseudocode for a function 'OddEvenList' which creates a new list 'P4' from P1 that prints all odd value nodes together followed by all even value nodes. Compute the time complexity of your algorithm.

Example:

P = Head->15->20->35->40->55->60->70->80->90->100->110->120->130->Head

P1 = Head->15->20->35->40->55->60->Head

P2 = Head->70->80->90->100->110->120->130->Head

P3 = Head->80->100->120->70->90->110->130->Head

P4 = Head->15->35->55->20->40->60->Head

3.

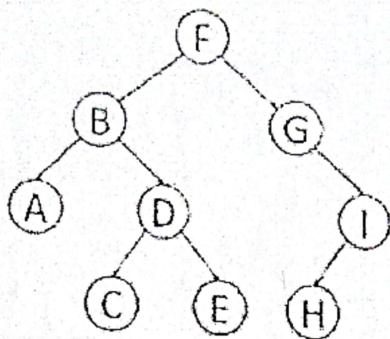
- i. Write a pseudocode to construct a binary search tree (BST) using appropriate data structure from the given array of characters that represent the preorder traversal of the BST. Discuss the time complexity of your pseudocode. Use a linked list to perform the same. Illustrate a step by step process of construction of BST. [8 Marks]
- ii. Write a pseudocode to print inorder traversal from the constructed BST. [2 Marks]

10

Example:

Input: [F, B, A, D, C, E, G, I, H]

Output:



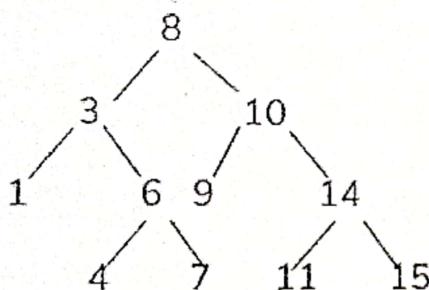
Inorder : A, B, C, D, E, F, G, H, I

4. Given a binary tree containing n nodes. Write a pseudo-code to replace each node in the binary tree with the sum of its preorder predecessor and preorder successor. Illustrate the step by step process of constructing an output tree from the given input tree. Analyze the time complexity of your pseudocode.

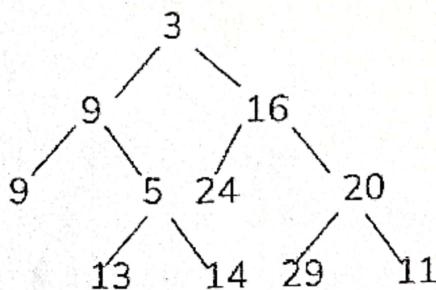
10

Example:

Input tree:



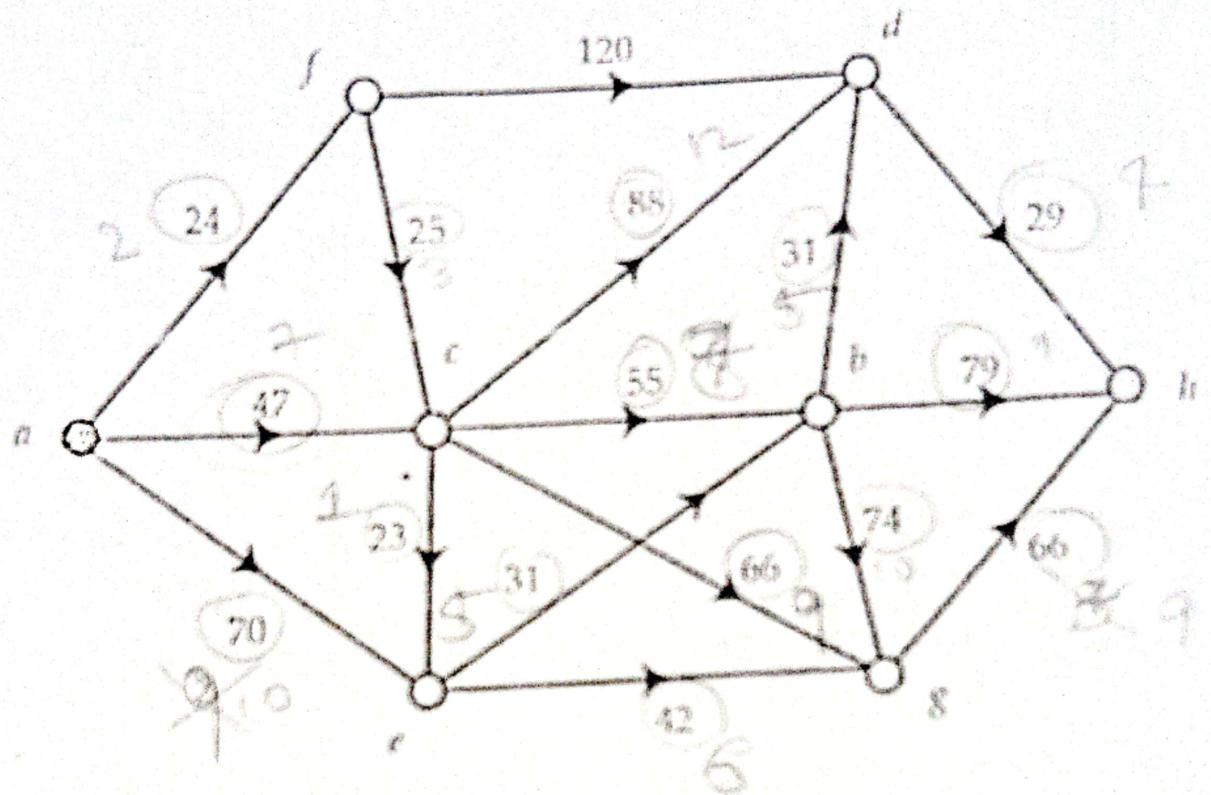
Output tree:



Kruskals
Prim's
Disjoint

5. The manager of a logistic agency needs software that automatically finds the shortest route from the given warehouse to its all delivery places. Consider a given Graph 'G', a warehouse is located at 'a' and delivery places are located at f, c, e, d, b, g, h. The time to travel from one place to another is represented as a minute (positive integer). Write a pseudo code to find the shortest distance and shortest path from the warehouse to all other places. Illustrate a step by step process of your pseudocode in the given following graph.

10



**Continuous Assessment Test (CAT) – II - March 2025**

Programme	:	B.Tech. (CSE) and its specializations	Semester	:	WINTER 2024-2025
Course Code & Course Title	:	BCSE306L Artificial Intelligence	Slot	:	F2+TF2
Faculty	:	TAMILARASI K MODIGARI NARENDRA	Class Number	:	CH2024250502324 CH2024250502335
Duration	:	1 ½ hours	Max. Mark	:	50

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write any other information.

Answer all questions

Q. No	Description	Mark
1.	<p>In a highly competitive stock trading environment, an AI-powered financial system must decide whether to <u>buy</u>, <u>sell</u>, or <u>hold</u> stocks while considering the actions of two major competitors who influence <u>market</u> trends. Since evaluating all possible future price movements is computationally expensive, the AI employs a strategic decision-making approach to efficiently <u>eliminate less promising options</u>, allowing it to focus only on the most relevant market scenarios. Given the following game tree, where the AI aims to <u>maximize profit</u> while <u>adversarial traders</u> attempt to <u>minimize its gains</u>, determine which branches can <u>be ignored</u> without affecting the final decision. How does this method improve real-time trading speed compared to evaluating all possibilities?</p> <pre> graph TD A((A)) --> B((B)) A --> C((C)) A --> D((D)) B --> E((E)) B --> F((F)) B --> G((G)) C --> H((H)) C --> I((I)) C --> J((J)) D --> K((K)) D --> L((L)) D --> M((M)) E --- v1[5] E --- v2[7] E --- v3[1] E --- v4[-2] E --- v5[B] E --- v6[-4] F --- v7[3] F --- v8[7] F --- v9[-9] F --- v10[2] F --- v11[3] G --- v12[1] G --- v13[-5] G --- v14[B] G --- v15[1] G --- v16[3] G --- v17[2] H --- v18[1] H --- v19[-5] H --- v20[8] H --- v21[1] H --- v22[3] H --- v23[2] I --- v24[1] I --- v25[-5] I --- v26[8] I --- v27[1] I --- v28[3] I --- v29[2] J --- v30[1] J --- v31[-5] J --- v32[8] J --- v33[1] J --- v34[3] J --- v35[2] K --- v36[1] K --- v37[-5] K --- v38[8] K --- v39[1] K --- v40[3] K --- v41[2] L --- v42[1] L --- v43[-5] L --- v44[8] L --- v45[1] L --- v46[3] L --- v47[2] M --- v48[1] M --- v49[-5] M --- v50[8] M --- v51[1] M --- v52[3] M --- v53[2] </pre>	10

	<p>2.</p> <p>a. A doctor is scheduled to visit a patient, and based on past experience, the probabilities that he will use a train, bus, scooter, or other means of transport are respectively $2/10$, $1/5$, $1/10$ and $2/5$. The probabilities of him being late if he travels by train, bus, or scooter are also $1/4$, $1/3$ and $1/12$. However, if he uses other means of transport, he will not be late. Given that he is late upon arrival, what is the probability that he travelled by train? (5 Marks)</p> <p>b. A manufacturing company sources electronic components from four suppliers—X, Y, Z, and W—each providing batches with a mix of functional, defective, and untested components. Supplier X's batch contains 1 functional, 6 defective, and 3 untested components; Supplier Y's batch has 6 functional, 2 defective, and 2 untested components; Supplier Z's batch includes 8 functional, 1 defective, and 1 untested component; and Supplier W's batch consists of 6 defective and 4 untested components. A batch is randomly selected, and a single component is tested. Given that the tested component is functional, what is the probability that it was sourced from Supplier X? (5 Marks)</p>	10
3	<p>In the ever-evolving landscape of cybersecurity, organizations must rely on logical reasoning and inference mechanisms to detect and mitigate potential cyberattacks. Consider a network that exhibits the following observed facts:</p> <ul style="list-style-type: none"> • The network experiences a high number of failed login attempts. • The network has unusual outbound traffic. • The network shows signs of data exfiltration. • The network logs indicate the presence of anomalous admin access. • Security monitoring tools detect communication with a known malicious IP address. <p>Based on extensive cybersecurity threat intelligence, the following rules are established:</p> <ul style="list-style-type: none"> • If a network experiences a high number of failed login attempts and unusual outbound traffic, then it may be experiencing a brute force attack. • If a network is experiencing a brute force attack and shows signs of data exfiltration, then it may be compromised. • If a network is compromised and anomalous admin access is detected, then privilege escalation may have occurred. • If privilege escalation is detected and the network is communicating with a known malicious IP, then an advanced persistent threat (APT) attack is likely underway. • If an APT attack is in progress, then an immediate incident response must be initiated to prevent further damage. <p>a. Apply the Forward Chaining algorithm to analyze the logical sequence of inferences and determine whether the network is under an advanced cyberattack requiring immediate incident response. (5 Marks)</p> <p>b. Apply the Backward Chaining algorithm to verify whether the network is under an advanced cyberattack requiring immediate incident response. (5 Marks)</p>	10
4	<p>Consider the following axioms:</p> <ul style="list-style-type: none"> • Every musician loves music. 	10

- Anyone who loves music appreciates any composer.
- Beethoven is a composer, and Beethoven was deaf.
- Anyone who is deaf is either resilient or requires assistance.
- No composer requires assistance.
- Jack does not appreciate anything that is resilient.

Represent the facts in

- Predicate logic. (3 Marks)
- Convert to CNF form. (3 Marks)
- Prove by resolution: "Jack is not a musician" (4 Marks)

5

In a logistics and delivery optimization scenario, a company needs to find the most efficient route for a delivery truck to visit five cities (A, B, C, D, and E) and return to its starting point while minimizing travel distance. Since traditional brute-force methods become impractical, the company uses a Genetic Algorithm with fixed parameters: Rank based Selection to choose parents, Single point cross over to generate new routes, Swap Mutation (probability = 0.2) to introduce diversity, and Total Distance Calculation for fitness evaluation. The initial population of six routes is predefined. Perform two complete iterations of the algorithm by selecting parents, applying crossover and mutation, computing fitness values, and determining the best routes to move forward. The following table represents distances (in km) between five cities (A, B, C, D, and E):

10

	A	B	C	D	E
A	0	10	15	20	25
B	10	0	35	25	30
C	15	35	0	30	20
D	20	25	30	0	15
E	25	30	20	15	0

The initial population: A → B → C → D → E → A, A → C → B → E → D → A, A → D → E → B → C → A, A → E → D → C → B → A, A → B → E → C → D → A, A → C → D → B → E → A

***** All the Best *****

Continuous Assessment Test (CAT) – II OCTOBER 2024

Programme	:	B. Tech Computer Science and Engineering	Semester	:	FALL 24-25
Course Code & Course Title	:	BCSE304L THEORY OF COMPUTATION	Class Number	:	CH2024250100534, CH2024250100912, CH2024250101447
Faculty	:	Dr. S. KIRUTHIKA, Dr. NATHEZHATHA T, Dr. ANAND M	Slot	:	A2+TA2
Duration	:	90 MINUTES	Max. Mark	:	50

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information.
- Use statistical tables supplied from the exam cell as necessary
- Use graph sheets supplied from the exam cell as necessary
- Only non-programmable calculator without storage is permitted

Answer all questions

Q. No	Sub Sec.	Description	Marks
1.		$L = \{(ab)^{n+m} b^n a^m \mid n, m \geq 1\}$ (a) You are tasked with creating a Context-Free Grammar (CFG) for the language L. [8 Marks] (b) validate the sample string abababbaaa using Left Most Derivation (LMD) [2 Marks]	10
2.		Consider the following context free grammar $X \rightarrow AY \mid YX \mid b, Y \rightarrow XY \mid YX \mid a$ For the strings bab and bbb, construct the CYK parsing table. Are these strings in L(G)?	10
3.		Imagine you are developing a syntax checker for a simplified programming language that only supports variable assignment and arithmetic operations. The language includes: <ul style="list-style-type: none"> • Variables (x, y, z) • Assignment (=) • Operators (+, -) The given grammar is: <ol style="list-style-type: none"> 1. $S \rightarrow V=E$ 2. $E \rightarrow E+E \mid E-E \mid V$ 	10

3. $V \rightarrow x / y / z$

Task:

- a). Convert the above grammar into CNF. (5 marks)
- b). Validate if the statement $x = y + z - x$ can be generated using the CNF grammar by drawing a parse tree. (5 marks)

a) In a school excursion to marina beach the kids are asked to collect three colours of shells white, pale yellow and blue and collection should be arranged in the following order white followed by pale yellow and blue

the count of pale-yellow shells should be greater than white shells and count of blue should be greater than pale yellow.

10

Prove whether the above scenario is a context free language or not (5 Marks)

b) Show that $L = \{ a^n b a^m b a^{n+m} \mid n, m > 1 \}$ is not regular.(5 Marks)

5.

$L = \{ W X^R X W^R \}, W \in \Sigma(a,b)^*$ and $X \in \Sigma(c,d)^+$, construct push down automata to validate the language L.

10

NOTE: W, and X are words, W^R , X^R are reverses of the words.

***** All the best *****

Continuous Assessment Test (CAT) – II - March 2025

Programme :	B.Tech	Semester :	Win-24-25
Course Code & Course Title :	BMAT201L & Complex Variables and Linear Algebra	Slot :	A2+TA2+TA2
Faculty :	Dr. R. Jayagopal, Dr. S. Balaji, Dr. A. Manivannan, Dr. Amit Kumar Rahul, Dr. P. Vijay Kumar, Dr. P. Durgaprasad, Dr. R. Pavithra, Dr. C. Rajivganthi, Dr. Prosenjit Paul	Class Numbers :	CH20242505009 934, 936, 937, 938, 939, 940, 941, 942
Duration :	1 hour 30 mins	Max. Marks :	50

General Instructions:

1. Write only your registration number on the question paper in the box provided and do not write other information.
2. Only non-programmable calculator without storage is permitted.

Course Outcomes (CO):

2. Find the image of straight lines by elementary transformations and to express analytic functions in power series.
3. Evaluate real integrals using techniques of contour integration.
5. Use matrices and transformations for solving engineering problems.

Bloom's Taxonomy (BT): K1-Remembering, K2-Understanding, K3-Applying, K4-Analysing, K5-Evaluating

Answer all questions (5*10=50 marks)

Q. No	Sub Sec.	Questions	Mark
1	✓	Expand $f(z) = \frac{1}{(z+1)(z+3)}$ as a Laurent's series if $1 < z < 3$.	10
1	③	Identify the singularities of the function $f(z) = \frac{\cosh(\operatorname{cosec} z)}{z^2}$ and classify their nature.	5
2		Evaluate $\int_0^{2\pi} \frac{e^{\sin \theta + i \cos \theta}}{5+4 \cos \theta} d\theta$ using contour integration.	10
3	a	Determine whether or not the W is a subspace of V , where $W = \{f: f(7) = 2 + f(1)\}$.	5
3	b	Let V be the vector space of polynomials of degree 3 (or less) over \mathbb{R} . Determine whether $y = t^3 - 3t^2 + 5t + 1$, $v = t^3 - t^2 + 8t + 2$, $w = 2t^3 + 4t^2 + 9t + 5$ are linearly independent or not?	10
4	c	Find the basis and dimension of solution space $W = \{(x, y, z, r, s) \in \mathbb{R}^5 \mid x + 2y - 4z + 3r - s = 0, x + 2y - 2z + 2r + s = 0, 2x + 4y - 2z + 3r + 4s = 0\}$.	10
4	d	Determine the linear transform $T: \mathbb{R}^4 \rightarrow \mathbb{R}^4$ which maps the basis vectors $(1, 0, 0, 0), (0, 1, 0, 0), (0, 0, 1, 0), (0, 0, 0, 1)$ to $(0, 0, 1, 0), (0, 1, 0, 0), (1, 0, 0, 0)$ and $(0, 0, 0, 1)$ respectively. Also, find $T(1, 2, 3, 4)$.	10
5		Find a basis for row space, column space, and null space of the matrix given below: $A = \begin{bmatrix} 3 & 4 & 0 & 7 \\ 1 & -5 & 2 & -2 \\ -1 & 4 & 0 & 3 \\ 1 & -1 & 2 & 2 \end{bmatrix}$	10

Ref No 950 885 1.4-3

Programme	:	B.Tech.(CSE Specialization in BAI, BDS, BRS and BPS)	Semester	:	Winter 24-25
Course Code & Course Title	:	BCSE304L THEORY OF COMPUTATION	Class Number	:	CH2024250503121 CH2024250502105 CH2024250501768 CH2024250502298
Faculty	:	Dr. P.Saravanan Dr. Renuka Devi R Dr. Natarajan B Dr. S K. Karthika	Slot	:	E2+TE2
Duration	:	90 MINUTES	Max. Mark	:	50

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information.

Answer all questions

Q. No	Sub Sec.	Description	Marks
1.		<p>A company developing IoT devices is working on a network protocol parser. The parser relies on a context-free grammar to validate incoming messages. However, some grammar rules cause inefficiencies and redundancy in message processing. The original Context Free Grammar (CFG) is as follows: $S \rightarrow AX B$, $A \rightarrow a c$, $B \rightarrow A b$, $X \rightarrow Y$, $Y \rightarrow Z$, $Z \rightarrow c$</p> <p>As a software engineer responsible for protocol optimization, your task is to refine the grammar for better parsing performance. Follow these steps:</p> <p>(a) Identify and remove any useless productions that do not contribute to generating valid messages. (2 Marks)</p> <p>(b) Eliminate unit productions to simplify the parsing process. (2 Marks)</p> <p>(c) Remove ϵ-productions while ensuring message validity is preserved. (2 Marks)</p> <p>(d) Simplify the CFG into Greibach Normal Form (GNF). (4 Marks)</p>	10
2.		<p>A speech recognition company is developing a pattern matching algorithm for a voice assistant. The assistant must recognize specific word patterns in user commands. The current system uses a Finite Automaton (FA) to model the recognition process. Still, it needs to be converted into a Regular Expression (RE) for integration into a search-based approach.</p> <p>FA Description:</p> <ul style="list-style-type: none"> • States: $\{q_0, q_1, q_2, q_3\}$ • Alphabet: $\{y, e, s, a, h, p\}$ • Transitions: <ul style="list-style-type: none"> ◦ $q_0 \rightarrow q_1$ on y ◦ $q_1 \rightarrow q_2$ on e 	10

- $q_2 \rightarrow q_3$ on s
- $q_2 \rightarrow q_3$ on a
- $q_3 \rightarrow q_3$ on h
- $q_2 \rightarrow q_3$ on p
- Start state: q_0
- Final state: q_3

(a) Convert the given FA into an equivalent regular expression using Arden's theorem. (7 Marks)

(b) Check whether the given grammar is ambiguous or not for the string "abbbb" (3 Marks)

$$\begin{aligned} S &\rightarrow aAB \\ A &\rightarrow bBb \\ B &\rightarrow A|\epsilon \end{aligned}$$

A compiler development team is working on improving the efficiency of a query processor for a database system. The processor uses a Context-Free Grammar (CFG) to parse SQL-like queries. However, the current grammar is not in Chomsky Normal Form (CNF), making parsing inefficient and increasing processing time. To optimize the query processing engine,
Convert the given CFG to CNF by the necessary steps.

3.

$$\begin{aligned} G = \{ S \rightarrow ASA \mid aB, \\ A \rightarrow B|S, \\ B \rightarrow b|\epsilon \} \end{aligned}$$

10

(a) Convert the resulting grammar into Chomsky Normal Form (CNF). (8 Marks)

(b) Can every context-free grammar be efficiently converted to CNF without increasing complexity? Justify your answer. (2 Marks)

4.

The language consists of input symbols a, b, and c, where the language is defined as m occurrences of a, followed by n occurrences of b, and then k occurrences of c, such that $m < n < k$ for all positive integers m, n, and k.

10

(a) Construct the context-free grammar for the language. (5 Marks)

(b) Check whether the given language is regular or not. (5 Marks)

5.

Detecting errors in a Binary Transmission System-You are designing a system to verify whether a transmitted binary sequence (consisting of only 0s and 1s) is not a palindrome, as palindromic patterns could indicate interference-related errors. To achieve this, construct a Pushdown Automaton that accepts all binary strings that are not palindromes. Explain how your PDA processes input and guarantees that only non-palindromic sequences are accepted.

10

***** All the best *****



Scanned with OKEN Scanner