

PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004

Department of Computer Science and Engineering

BE CSE [G1 & G2] & SEM 5

CONTINUOUS ASSESSMENT TEST 2 Date: 11.9.2024

19Z501 – Theory of Computing

Time: 1 Hour 30 minutes.

Maximum Marks: 50

INSTRUCTIONS:

1. Answer ALL questions. Each Question carries 25 Marks.
2. In each question, subdivision a contains 5 questions and the weightage of each question is one mark, subdivision b(i) and b(ii) carries 5 marks each and subdivision c carries 10 marks each.
3. Subdivisions (a) and (b) will be with no choice and Subdivision (c) may be with choice but not in more than 1 question.

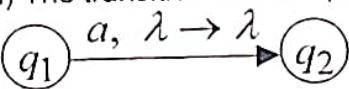
4. Course Outcome Table

Qn. I

CO3

Qn.2

CO4

1.a		(5x1mark=5marks)	BTL
i)	I) The transition below represents a _____ move in PDA 	move in PDA	L1
	A) Push B) Pop C) No change D) Erase input		
ii)	Which of the following represents a deterministic transition in a PDA? A) $\delta(q_1, a, \lambda) = \{(q_2, c)\}$ B) $\delta(q_1, a, b) = \{(q_2, c), (q_3, d)\}$ C) $\delta(q_1, \lambda, b) = \{(q_2, c)\}$ D) $\delta(q_1, \lambda, \lambda) = \{(q_2, c)\}$		L2
iii)	What transition does the following instantaneous description in a PDA represent? $x_1 x_2 \dots x_{i-1} q x_i x_{i+1} \dots x_n \dots x_1 x_2 \dots p x_i Y x_{i+1} \dots x_n$ A) $\delta(q, X_i) = (p, Y, R)$ B) $\delta(q, X_i) = (p, X_{i+1}, L)$ C) $\delta(q, X_{i-1}) = (p, Y, R)$ D) $\delta(q, X_i) = (p, Y, L)$		L2
iv)	Will the language $L = \{0^n 1^n 2^n \mid n \geq 0\}$ be accepted by a PDA? Yes or No		L1

v)	What is the language accepted by the following PDA?	
	$\delta(q_0, a, z_0) = (q_0, aaaz_0)$ $\delta(q_0, a, a) = (q_0, aaaa)$ $\delta(q_0, b, a) = (q_1, \lambda)$ $\delta(q_1, b, a) = (q_1, \lambda)$ $\delta(q_1, \epsilon, z_0) = (q_f, z_0)$, where q_f is a final state.	
b.		(2 x 5 marks = 10 marks)
i)	Convert the following PDA to CFG. Write the final CFG	L3
ii)	Design a pushdown automaton (PDA) that accepts both odd-length and even-length palindromes and explain its working process.	L5
c.	(1 x 10 marks = 10 marks)	
	Construct a Top Down and Bottom Up PDA for the following CFG. Demonstrate the sequence of moves for the automaton when processing the input string "abcab"	L5
	S--> aSb bSa c	

2.a	(5x1mark=5marks)	BTL
i)	In one move, a Turing Machine can: A) Change a state and move the tape head left or right B) Write a tape symbol in the cell scanned and change a state C) Move the tape head left or right and write a tape symbol in the cell scanned D) Change a state, write a tape symbol, and move the tape head left or right	L2
ii)	Next move function δ of a Turing Machine M is a mapping A) $\delta : Q \times \Sigma \rightarrow Q \times \Gamma$ B) $\delta : Q \times \Gamma \rightarrow Q \times \Sigma \times \{L, R\}$ C) $\delta : Q \times \Sigma \rightarrow Q \times \Gamma \times \{L, R\}$ D) $\delta : Q \times \Gamma \rightarrow Q \times \Gamma \times \{L, R\}$	L1

iii)	How would you describe the language accepted by this Turing Machine?	L2
	<pre> graph LR start(()) --> q0((q0)) q0 -- "a a,R" --> q1((q1)) q0 -- "b b,R" --> qacc(((qacc))) q1 -- "a a,R" --> q2((q2)) q2 -- "a a,R" --> qacc q2 -- "b b,R" --> q0 </pre>	
A.	The set of all strings contain ab as a substring	
B.	The set of all strings doesn't contain aba as a substring	
C.	The set of all strings contain abb as a substring	
D.	The set of all strings doesn't contain abba as a substring	
iv)	The transition function $\delta: Q \times \Gamma^k \rightarrow Q \times \Gamma^k \times \{L, R\}^k$ characterizes a Turing Machine.	L2
v)	A Turing Machine can be called a _____ because it transforms input strings into output strings through a series of state transitions and tape modifications.	L1
b.	(2 x 5 marks = 10 marks)	
i)	Illustrate the working principle of a Turing Machine with a detailed diagram.	L3
ii)	Evaluate the impact of using a Multi-Tape Turing Machine and a Multi-Head Turing Machine on the computational efficiency for solving complex problems. How does the use of multiple tapes and multiple heads affect the overall performance compared to a standard single-tape Turing Machine?	L5
c.	(1 x 10 marks = 10 marks)	
	Design a Turing Machine to recognize the Language $L = \{ a^n b^n c^n \mid n \geq 1 \}$	L5

PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004
Department of Computer Science and Engineering

BE CSE & SEMESTER V

CONTINUOUS ASSESSMENT TEST I Date: 11.09.2024
19Z502 - MICROPROCESSORS AND INTERFACING

Time: 1 Hour 30 minutes.

Maximum Marks: 50

INSTRUCTIONS:

1. Answer **ALL** questions. Each Question carries 25 Marks.
 2. In each question, subdivision **a** carries total of 5 marks (one mark for each question), subdivisions **b(i)** and **b(ii)** carries 5 marks each and subdivision **c** carries 10 marks each.
 3. Course Outcome Table:
- | | | | |
|-------|------|-------|------|
| Qn. 1 | CO 3 | Qn. 2 | CO 4 |
|-------|------|-------|------|

1. a

(5 x 1 mark = 5 marks)

- i. Consider the following statements associated with memory mapped I/O scheme of communication with microprocessor:
 1. It reduces the memory space available.
 2. Arithmetic or logical operation can be directly performed with I/O data.
 3. The processor cannot manipulate I/O data residing in interface registers with the same instructions that are used to manipulate memory location.
 4. The processor treats an interface register as a part of the memory system.

Which of the statements given above is/are **INCORRECT**?

- A) 1 and 4 only
 - B) 3 and 4 only
 - C) 3 only
 - D) 1 and 3 only
- ii. In 8086 memory interfacing, what role does the transceiver play during a memory write cycle?
 - a) It holds the address of the memory location.
 - b) It forwards the data from the processor to the memory.
 - c) It generates the control signals for memory access.
 - d) It decodes the memory address for selecting the appropriate memory chip.
 - iii. Which pin is NOT part of 8255 Programmable Peripheral Interface
 - A) ALE B) RD C) RESET D) CS
 - iv. Write the sequence of instruction that will output the data (0x0A0BH) to an output port located at the address (0xOCODH) of the I/O address space ?
 - v. Identify the configuration of 8255 when control word value is FFH ?

MOV AX, 0x0AOB

(2 x 5 marks = 10 marks)

MOV DX, 0x0D0D

OUT DX, AX

- i. Explain the difference between Memory-Mapped I/O and Isolated I/O in microprocessor systems. How does the 8086 microprocessor differentiate between these two types of I/O addressing? Discuss with reference to the control signals used and their impact on the address space.
- ii. Describe the role of the Address Bus Latch and the Address Decoder when interfacing external memory or peripherals with the 8086 microprocessor in Maximum Mode. How do these components contribute to the system's functioning, and why are they necessary in Maximum Mode operations? Illustrate your answer with a block diagram.

V. | | | | | | |

(1 x 10 marks = 10 marks)

Port A
mode 2

- c. Identify the practical examples of I/O devices connected in Mode 0, Mode 1, Mode 2 and ~~BSR~~ mode using 8255 programmable peripheral interface. Show how interrupt logic is support Mode 1 and Mode 2 using strobe signals from Port C. Explain in detail ?
2. a. (5 x 1 mark = 5 marks)
- i. What happens when an interrupt occurs during the execution of a MOV instruction in 8086, and how does the processor handle the instruction?
- A) The processor completes the MOV instruction, then services the interrupt
B) The processor interrupts the MOV instruction and immediately jumps to the ISR
C) The instruction is partially executed, and the ISR must complete it
D) The processor flushes the pipeline, discards the instruction, and services the interrupt
- ii. Which of the following conditions will NOT generate an internal interrupt in the 8086 microprocessor?
- a) Divide by zero error
b) Execution of the INT instruction
c) Overflow condition after an arithmetic operation
d) An invalid opcode instruction is encountered
- iii. In the 8086 microprocessor, if an interrupt request (INTR) is generated by a hardware device but the Interrupt Flag (IF) is not set, what is the behavior of the processor?
- A) The processor immediately services the interrupt request regardless of the IF flag status.
B) The processor queues the interrupt request and services it as soon as the IF flag is set.
C) The processor ignores the interrupt request and does not process it until the IF flag is set.
D) The processor generates an exception and halts execution.
- iv. In 8086, which interrupt type is reserved for debugging purposes and is invoked by a breakpoint? INT 3
- v. The interrupt vector address for INT 09 is ____ (CS:IP)? (00H : 04H)
- b. (2 x 5 marks = 10 marks)
- i. Explain the role and functionality of the following interrupt instructions in the 8086 microprocessor: INT, INTO and IRET. Provide examples of situations where each of these instructions would be used.
- ii. Give a brief note of NMI and RESET interrupts ?
- c. Illustrate the events in the interrupt processing sequence of 8086:8088 with a neat flow diagram. (1 x 10 marks = 10 marks)

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B.E CSE & 5th Semester

CONTINUOUS ASSESSMENT TEST 2 Date: 12.09.2024

19Z503 - Artificial Intelligence

Time: 1 Hour 30 minutes.

Maximum Marks: 50

INSTRUCTIONS:

1. Answer **ALL** questions. Each Question carries 25 Marks.
2. In each question, subdivision a contains 5 questions and the weightage of each question is one mark, subdivision b(i) and b(ii) carries 5 marks each and subdivision c carries 10 marks each.
3. Subdivisions (a) and (b) will be with no choice and Subdivision (c) may be with choice but not in more than 1 question.
4. Course Outcome Table :

Qn. 1	CO3	Qn. 2	CO4

1. a

(5 x 1 mark = 5 marks)

Write the alphabet of your choice answer in the CA test answer book mentioning question number and subdivision number.

- i. Consider the following statements
 - i) A Compound Proposition that is always true for all possible truth values is called a tautology
 - ii) A Compound proposition that is always false is called a contradiction

Which of the following is correct?

- | | |
|---|---|
| A) Both are true | B) Both are false |
| C) (i) is true and (ii) is false | D) (ii) is true and (i) is false |

- ii. Negation of the proposition is $\neg \forall x : H(x)$

L1

- A)** $\exists x \neg H(x)$
- B)** $\forall x \neg H(x)$
- C)** $\forall x H(x)$
- D)** $\neg \exists x H(x)$

- iii. $(\neg p) \Rightarrow (\neg q)$

The above statement is logically equivalent to

L2

- A)** $p \Rightarrow q$
- B)** $\neg q \Rightarrow p$
- C)** $(\neg q) \vee p$
- D)** $(\neg p) \vee q$

Write the answer for the following Fill in the blanks questions in the CA test answer book mentioning question number and subdivision number.

iv. "some real numbers are rational" Convert the statement to first order predicate statement _____

L2

v. _____ process makes different logical expression looks identical

L1

(2 x 5 marks = 10 marks)

b.

i. Convert the following propositional statements to clausal form

$$S1: A \Leftrightarrow (B \vee E).$$

$$S2: E \Rightarrow D.$$

$$S3: C \wedge F \Rightarrow \neg B.$$

$$S4: E \Rightarrow B.$$

$$S5: B \Rightarrow F.$$

$$S6: B \Rightarrow C$$

Use resolution to prove the sentence $\neg A \wedge \neg B$ from the clauses

L3

ii. Define Skolemization. Write the steps involved. Skolemize the following statement

L3

$$(\exists X \forall Y p(X, Y)) \vee \neg \exists Y (q(Y) \rightarrow \forall Z r(Z))$$

c.

(1 x 10 marks = 10 marks)

L5

Consider the following sentences:

- Sam likes all kinds of food
 - Apples are food
 - Chicken is food
 - Anything anyone eats and isn't killed by is food
 - Bob eats peanuts and is still alive
 - Ram eats everything Bob eats
- i. Translate these sentences into FOPL
 - ii. Prove that Sam likes peanuts using backward chaining
 - iii. Convert the statements of (a) into clause form
 - iv. Prove that Bob likes peanuts using resolution
 - v. Use resolution to answer the question, "What food does Ram eat?"

2. a

(5 x 1 mark = 5 marks)

Write the alphabet of your choice answer in the CA test answer book mentioning question number and subdivision number.

- i. _____ is a language(standard) used to describe a planning problem
 - A) Planning Domain Definition language
 - B) Planning description language
 - C) FOPL
 - D) Problem solver engine
- ii. Resolution –Refutation means
 - A) proof by contradiction
 - B) proof by contraposition
 - C) proof by mathematical induction
 - D) closed chain inference
- iii. Which of the following is the correct representation of a state ?
 - i) functions are not allowed in literals
 - ii) Literals must not be ground

- B) Both are true
 C) (i) is true and (ii) is false

- B) Both are false
 D) (ii) is true and (i) is false

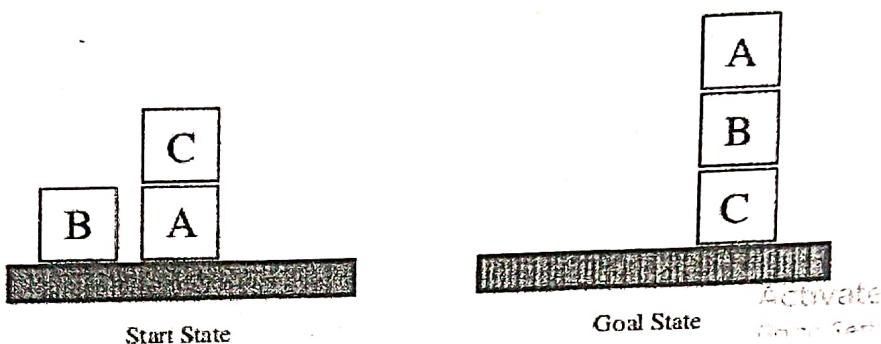
Write the answer for the following Fill in the blanks questions in the CA test answer book mentioning question number and subdivision number.

- iv. Backward reasoning uses _____ search strategy L2
 v. Standard planning algorithms assume the environment to be _____ L2

b. (2 x 5 marks = 10 marks)

i. How are states represented in classical planning approach? What is the role of closed world assumption? Give an example. L4

ii. Given a simple blocks world problem where you need to stack three blocks A, B, and C such that A is on B, and B is on C L4



Use the following schema and devise a plan to reach the goal state. Explain the steps involved.

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Init(On(A, Table) ∧ On(B, Table) ∧ On(C, A)
     ∧ Block(A) ∧ Block(B) ∧ Block(C) ∧ Clear(B) ∧ Clear(C))
Goal(On(A, B) ∧ On(B, C))
Action(Move(b, x, y),
      PRECOND: On(b, x) ∧ Clear(b) ∧ Clear(y) ∧ Block(b) ∧ Block(y) ∧
                (b ≠ x) ∧ (b ≠ y) ∧ (x ≠ y),
      EFFECT: On(b, y) ∧ Clear(x) ∧ ¬On(b, x) ∧ ¬Clear(y))
Action(MoveToTable(b, x),
      PRECOND: On(b, x) ∧ Clear(b) ∧ Block(b) ∧ (b ≠ x),
      EFFECT: On(b, Table) ∧ Clear(x) ∧ ¬On(b, x))
  
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c. (1 x 10 marks = 10 marks)

Define the following concepts in the context of classical planning:

L5

1. State Space
2. Initial State
3. Goal State
4. Actions/Operators
5. Plan

How do these concepts interact to solve a planning problem? Write the action schema (Load, Unload, Fly etc) of the air cargo transportation planning problem in PDDL and formulate a plan to Load Cargo1 from place A and unload in Place b

PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004
Department of CSE
BE CSE&SEM 5
CONTINUOUS ASSESSMENT TEST 2 Date: 12.09.2024

19Z504 -COMPUTER NETWORKS

Time: 1 Hour 30 minutes.

Maximum Marks: 50

INSTRUCTIONS:

1. Answer **ALL** questions. Each Question carries 25 Marks.
2. In each question, subdivision a carries total of 5 marks (one mark for each question), subdivisions b(i) and b(ii) carries 5 marks each and subdivision c carries 10 marks each.
3. Course Outcome Table :

Qn. 1	CO3	Qn. 2	CO4
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1.a	(5 x 1 mark = 5 marks)	BTL
i)	Which of the following routing algorithm used by OSPF routing protocol. A) Distance Vector B) Flooding C) Path vector D) Link state	L1
ii)	In which of the following, a network administrator borrows bits from the original host portion and designates them as the subnet field? A) Circuit switching B) Classless Addressing C) Subnetting D) Supernetting	L2
2iii)	Which one of the values not presents in the VC table? A) VCI B) VC C) incoming interface D) outgoing interface	L2
iv)	C Class of IP address provides a maximum of only 254 host addresses per network ID?	L2
v)	In manually technique a host may set up and delete such a VC dynamically without the involvement of a network administrator.	L3
1. b	(2 x 5 marks = 10 marks)	
i)	Consider a message from TCP layer contains 1044 bytes of data including the header. It is passed to network layer's IP protocol for delivery across 3 networks with MTUs 1024 and 500 and 200. Show the values of all the Flag bits and offset field of IP header and the size of each data packet when it passes through each network and reach the destination host. (Assume all IP and TCP headers are 20 bytes).	L5
ii)	How by means of signaling, a VC is dynamically set up for a functional network. Show the corresponding VC table entries with an example.	L3
1.c	(1 x 10 marks = 10 marks)	
i)	a. For the network given in the Figure 1, give the datagram forwarding table (both initial and final) for each node. The links are labeled with relative costs; your table should forward each packet via the lowest-cost path to its destination using distance vector routing.	L5

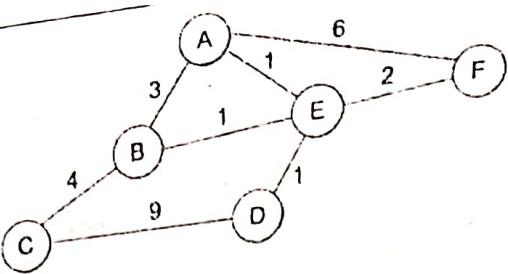


Figure 1

b. Consider the figure 2. Initially both the node A and B know how to reach node C. But suddenly the link B to C goes down. What will happen in distance routing and also discuss how to overcome that problem?

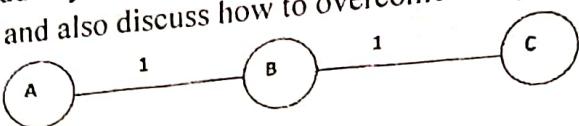


Figure 2

OR

- ii) Given IP Address 200.1.2.0. To design six subnets. Find the number of hosts per subnet, first address, last address and broadcast address of each subnet.

2.a (5 x 1 mark = 5 marks)

L6

- i) What is a basic task of the transport layer?
 A) provides reliable data transfer B) encodes and decodes a message
 C) delivers a packet to the next hop D) delivers a packet to the destination

L1

- ii) Which of the following is not reliability mechanisms used by TCP?
A) Sequence number B) Acknowledgements ~~C) Source and Destination port~~ D) Sliding window protocol for flow control

L1

- iii) Which of the following is not a valid port number in TCP/IP?
A) 21 B) 80 C) 443 ~~D) 80800~~

L1

- iv) Size of the UDP Header is 8 byte.

L3

- v) UDP protocol extends the host-to host delivery service of the underlying network into a process-to-process communication service.

L1

2. b (2 x 5 marks = 10 marks)

- i) Illustrate the working of TCP sliding window algorithm to ensure reliable end to end segment delivery.

L2

- ii) Consider the 3-way handshake mechanism followed during TCP connection establishment between hosts A (IP address: 192.10.12.5, port no = 6054) and B (IP address: 12.10.1.115, port no = 5058). Let x and y be two random sequence numbers chosen by A and B respectively.

L5

- a. Suppose A sends a TCP connection request message to B. What are the values for src port, rev port ,SYN bit, Seqnum ACK bit , ACK num and FIN bit in TCP segment?
- b. B accept the above request and sends a TCP response message to A. What are the values for src port, rev port ,SYN bit, Seqnum ACK bit , ACK num and FIN bit in TCP segment?

2.c

(1 x 10 marks = 10 marks)

- i) a. The sequence number field in the TCP header is 32 bits long, which is big enough to cover over 4 billion bytes of data. Even if this many bytes were never transferred over a single connection, why might the sequence number still wrap around from $2^{32}-1$ to 0?
- b. You are hired to design a reliable byte-stream protocol that uses a sliding window (likeTCP). This protocol will run over a 100-Mbps network. The RTT of the network is 100ms
- What is Bandwidth Delay Product BDP?
 - Significance of the BDP in this scenario
 - How many bits required to represent the Advertised Window, port address and acknowledgment fields of TCP header?

L6

PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004

Department of CSE

BE CSE & SEMESTER 5

CONTINUOUS ASSESSMENT TEST 2 Date: 13/09/2024

19Z505 – Object-oriented Analysis and Design

Maximum Marks: 50

Time: 1 Hour 30 minutes.

INSTRUCTIONS:

1. Answer **ALL** questions. Each Question carries 25 Marks.
2. In each question, subdivision **a** contains 5 questions and the weightage of each question is one mark, subdivision **b(i)** and **b(ii)** carries 5 marks each and subdivision **c** carries 10 marks each.
3. Subdivisions (a) and (b) will be with no choice and Subdivision (c) may be with choice but not in more than 1 question.
4. Course Outcome Table :

Qn. 1	CO3	Qn. 2	CO4
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(5 x 1 mark = 5 marks)

1. a

Write the alphabet of your choice answer in the CA test answer book mentioning question number and subdivision number.

- i. In a sequence diagram which of the following represents the time during which an object is performing an operation? L1
- A) Activation B) Lifeline C) Message D) Role

- ii. Which of the following element allows the activity diagram creators or collaborators to communicate additional messages that don't fit within the diagram itself? L1
- A) Note B) Activity C) Action D) Swimlane

- iii. In a Timing Diagram, what aspect of the system is represented? L1
- A) The structure of system components B) The flow of data
C) Changes in state or condition over time D) Communication between objects

Write the answer for the following Fill in the blanks questions in the CA test answer book mentioning question number and subdivision number.

- iv. Suppliers objects receive the message in collaboration diagram. L1

- v. Effect is an action which will be invoked directly on the object that owns the state machine as a result of the transition. L1

(2 x 5 marks = 10 marks)

b.

- i. In a University system, the Student Class has a number of states as described below. Draw a State machine diagram for the object of this class.
When a person submits an application, the state is applied. The application is then evaluated and a decision is made to either offer the person a place on a course by sending out an offer letter or to reject them. the student state is changed to offered once the applicant is offered a place on the course. Rejected applicants are not offered a place and a rejection letter is sent out (student state becomes rejected). The student state changes to confirmed when the applicant accepts the place on the course otherwise it is set to declined. After the student has confirmed, a student number is generated one month before the student starts and the state is changed to matriculated, there are then 2 possibilities:

- if the student has passed all the required assessments the state is set to graduated
- if the student withdraws the state becomes withdrawn

L3

ii. Draw a timing diagram for the case study given below.
A student enters the hall, and occupies his allotted seat. He listens to the announcement from the Chief Superintendent. He receives the question paper from the Hall invigilator, starts writing the answers. At the end of the exam, he hands over the answer sheet to the Invigilator and leaves the hall. Draw a timing diagram showing the Student object and the Invigilator object and their states. Include appropriate durations, give proper names to different states.

L3

(1 x 10 marks = 10 marks)

c.

i) Consider an e-commerce platform that handles customer returns and refunds through a multi-step workflow. A customer initiates a return request for a product, and the platform validates the request based on return policies, such as product condition and return window. Once validated, the request is sent to the warehouse for inspection. Upon receiving and inspecting the item, the warehouse confirms the condition, allowing the platform to notify the payment gateway to process the refund. The payment gateway then handles the refund and confirms the completion of the transaction to both the customer and the platform. Develop a Sequence Diagram that illustrate the interactions between the objects involved in this process. Ensure your diagram captures the sequence of events. Use combined fragments if necessary. How do exceptions, such as an invalid return request or product damage, affect the workflow?

L6

OR

II) Create an activity diagram for the above case study.

L6

2. a

(5 x 1 mark = 5 marks)

Write the alphabet of your choice answer in the CA test answer book mentioning question number and subdivision number.

i. In the UML, a hash symbol (#) is used for specifying a/an _____ attribute
A) Atomic B) Derived C) Public D) Protected

L1

ii. A Student object using a Mobile object to call is represented by _____ relationship
A) Association B) Dependency C) Realization D) Composition

L2

iii. An adjective in a use case specification can be used to identify the _____ of a class
A) Name B) Attribute C) Operation D) No. of instances

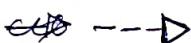
L1

Write the answer for the following Fill in the blanks questions in the CA test answer book mentioning question number and subdivision number.

iv. The relationship between a Library and the books it contains can be represented by the multiplicity 1 1..*

v. _____ symbol is used to represent the relationship between an interface and a class

L2



L1

b.

(2 x 5 marks = 10 marks)

i. Discover at least five different objects which students are using to write the exam. Find their attributes and behaviours. Draw an object diagram representing a particular moment and also the class diagram.

L4

ii. Discuss generalization, weak aggregation and composition with appropriate examples from real world. Draw the corresponding class diagrams with appropriate multiplicities and necessary attributes for each class.

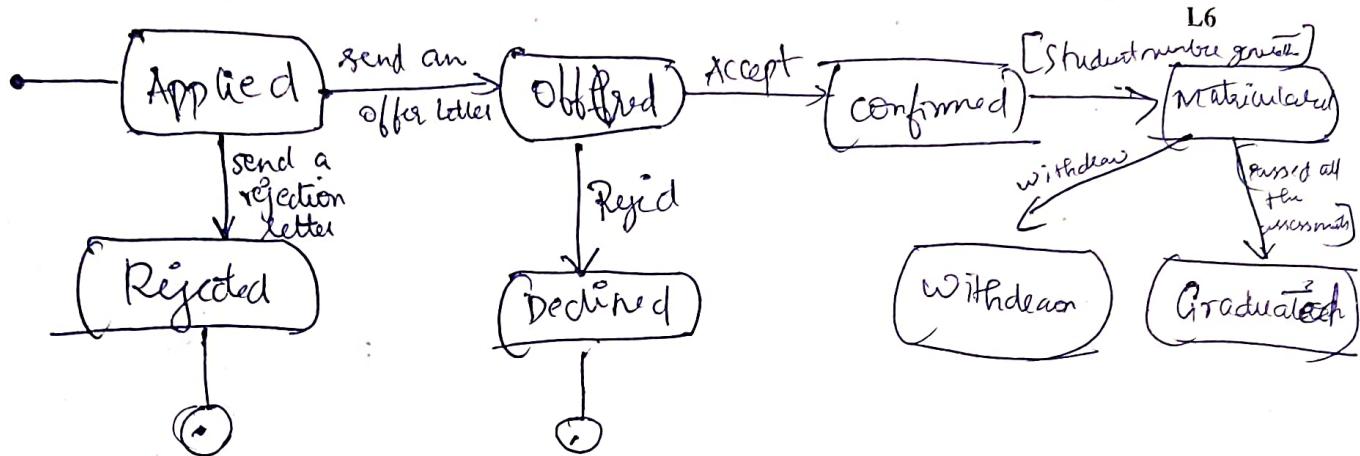
L3

c.

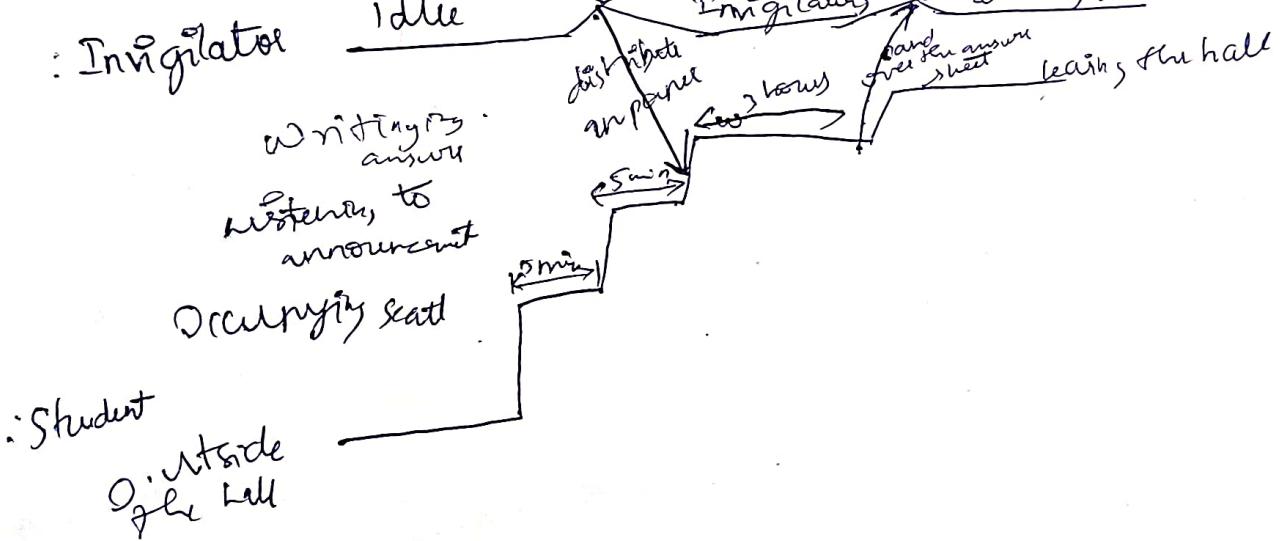
(1 x 10 marks = 10 marks)

A Professor has a name, address, phone number, email address, and salary. A student has also a name, etc., but no salary. A student, however, has an average mark (of the final marks of his or her seminars). A seminar has a name and a number. When a student is enrolled in a seminar, the marks for this enrollment are recorded and the current average as well as the final mark (if there is one) can be obtained from the enrollment. From a student one can obtain a list of seminars he or she is enrolled in. Professors teach seminars. Each seminar has at least one and at most three teachers. There are two types of seminars: bachelor and master. From a bachelor seminar students can not withdraw. From a master seminar they can. Construct a class diagram for this information following the nine steps performed in constructing a class diagram, and be sure to label all types of associations with appropriate multiplicities.

1.b.i.



1.b.ii.



PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004

Department of Computer Science and Engineering

BE-CSE V SEM

CONTINUOUS ASSESSMENT TEST 2 Date: 13.09.2024

19Z002 - Advanced Data Structures

Maximum Marks: 50

Time: 1 Hour 30 minutes.

INSTRUCTIONS:

1. Answer ALL questions. Each Question carries 25 Marks.
2. In each question, subdivision a contains 5 questions and the weightage of each question is one mark, subdivision b(i) and b(ii) carries 5 marks each and subdivision c carries 10 marks each.
3. Subdivisions (a) and (b) will be with no choice and Subdivision (c) may be with choice but not in more than 1 question.
4. _____ Data book / _____ table(s) may be permitted.

5. Course Outcome Table :	<table border="1"><tr><td>Qn. 1</td><td>CO3</td><td>Qn.2</td><td>CO4</td></tr></table>	Qn. 1	CO3	Qn.2	CO4
Qn. 1	CO3	Qn.2	CO4		

(5 x 1 mark = 5 marks)

1. a

Write the alphabet of your choice answer in the CA test answer book mentioning question number and subdivision number.

i. What output does the below pseudo code produces?

Tree_node function(Tree_node x)

{

```
    Tree_node y = x.left;
    x.left = y.right;
    y.right = x;
    return y;
```

}

~~A~~ right rotation of subtree

B) left rotation of subtree

C) zig-zag operation

D) zig-zig operation

[L2]

ii. Which of the following is NOT correct when inserting a new node into a red-black tree?

A) If the new node's parent is black then insertion is done

~~B~~) If the new node is the root then it starts as red

C) If the new node is not the root then it starts as red

D) If the new node's parent is red and uncle is black then rotation will be done before recoloring

[L1]

iii. What is the prime condition of AA-tree which makes it simpler than a red-black tree?

A) Right children should strictly be black

~~B~~) Only left children can be red

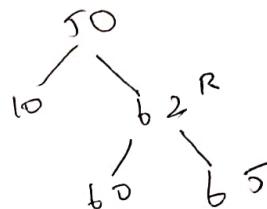
~~C~~) Only right children can be red

D) Left child is at the same level as parent

[L1]

Write the answer for the following Fill in the blanks questions in the CA test answer book mentioning question number and subdivision number.

iv. The resultant tree after deletion node 70 in the following red black tree is _____ [L3]

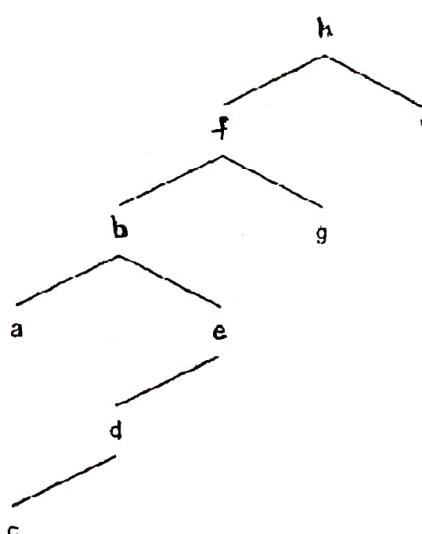


v. _____ operation fixes the double horizontal link problem in AA tree [L1]

b. (2 x 5 marks = 10 marks)

i. Outline an algorithm for inserting an element into a splay tree. With clear steps show how the element c can be accessed from the following splay tree.

[L4]



ii. In an initially empty AA tree insert M, A, C, H, I, N, E, P, O, D in the given order and delete A from the resultant structure. Show all steps involved. [L5]

(1 x 10 marks = 10 marks)

c. In an initially empty Red-Black tree insert the following keys in the given order: 13, 16, 7, 9, 10, 22, 11, 33, 12 and 3. Then delete 11, 22, 3 and 10 from the constructed Red black tree, one after other in sequence. Show all steps clearly [L5]

2. a (5 x 1 mark = 5 marks)

Write the alphabet of your choice answer in the CA test answer book mentioning question number and subdivision number.

i. In a k-d tree, k originally meant?

- A) Height of node B) Height of a tree C) Degree of a node D) Number of dimensions

[L1]

- ii. In _____ tree a node N splits a region by drawing a horizontal and a vertical line through the point (N.xval, N.yval).

A) KD Tree B) Point Quad Tree C) R – Tree D) B – Tree

[L1]

- iii. Which of the following is not true about MX quad tree?

A) All points are represented at leaf level
 B) Each node N represents a region and splits the region into two sub regions
 C) Shape of the tree is independent of number of nodes.
 D) MX-quadtree aimed at providing efficient deletion and search algorithms.

[L2]

- Write the answer for the following Fill in the blanks questions in the CA test answer book mentioning question number and subdivision number.

iv. In an $2^k \times 2^k$ MX Quad tree, the height of the tree is always equal to _____ [L1]

v. Each node except root node in R tree of order K may contain at least _____ rectangles. [L1]

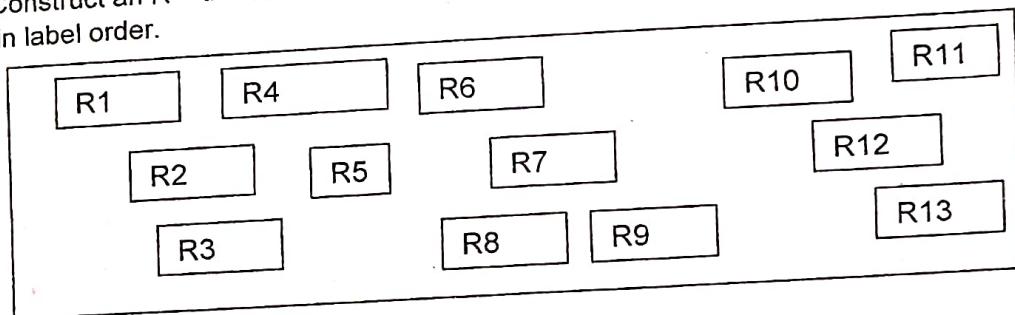
(2 x 5 marks = 10 marks)

b.

- i. Consider a map with left bottom coordinate as (0,0). Construct MX Quad tree by inserting the points given in the following table and show corresponding regions. Perform search for Coimbatore in the tree you have constructed. Clearly show all steps involved in construction and search operation of the tree. [L5]

City name	Point (XVAL, YVAL)
Chennai	2, 4
Bangalore	2, 3
Nagpur	1, 4
Pune	2, 6
Delhi	3, 4
Bombay	3, 5
Coimbatore	0, 2

- ii. Construct an R – tree of order 5 by inserting the rectangles shown in the following figure in label order. [L5]



(1 x 10 marks = 10 marks)

- c. Insert the following points in a 2-d tree: (7, 9), (2, 3), (10, 2), (3, 14), (15, 1), (3, 2), (4, 14) and (6, 3). Show the tree after inserting each point and also the regions marked by the points in a 20 x 20 grid. Illustrate the resultant tree after deletion of the node (2,3). [L5]