

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

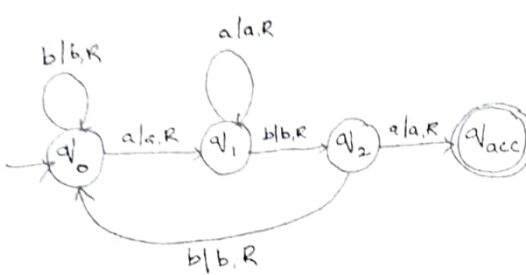
Qn.2

CO4

1.a	(5x1mark=5marks)	BTL
i)	<p>I) The transition below represents a _____ move in PDA</p> <p>A) Push B) Pop C) No change D) Erase input</p>	L1
ii)	<p>Which of the following represents a deterministic transition in a PDA?</p> <p>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) $\delta(q_1, \lambda, \lambda) = \{(q_2, c)\}$</p>	L2
iii)	<p>What transition does the following instantaneous description in a PDA represent?</p> <p>$X_1 X_2 \dots X_{i-1} q X_i X_{i+1} \dots X_n \mid \dots X_1 X_2 \dots p X_{i-1} Y X_{i+1} \dots X_n$</p> <p>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) $\delta(q, X_i) = (p, Y, L)$</p>	L2
iv)	<p>Will the language $L = \{0^n 1^n 2^n \mid n \geq 0\}$ be accepted by a PDA? Yes or No</p>	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.	L1
b.	(2 x 5 marks = 10 marks)	
i)	Convert the following PDA to CFG. Write the final CFG <pre> graph LR q1((q1)) -- "ε, ε → \$" --> q2((q2)) q2 -- "0, ε → 0" --> q2 q2 -- "1, 0 → ε" --> q3((q3)) q3 -- "1, 0 → ε" --> q3 q3 -- "ε, \$ → ε" --> q4(((q4))) </pre>	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" S → aSb bSa c	L5

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
	 <p>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 B. The set of all strings doesn't contain abba as a substring</p>	
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 II 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
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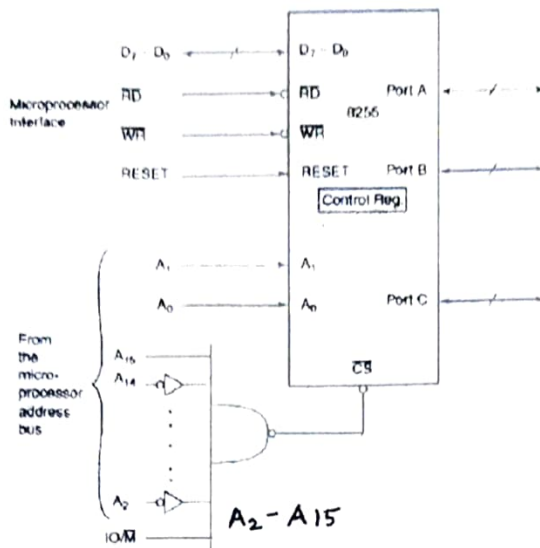
Qn.2	CO 4
------	------

1. A

- i) The transfer of data using parallel lines is
 - A) Faster and More Expensive
 - B) Faster and Less Expensive
 - C) Slower and More Expensive
 - D) Slower and Less Expensive
- ii) BSR control word of 8255A to set bit PC₇ is
 - A) 0Fh
 - B) 0Eh
 - C) 07h
 - D) 06h
- iii) In 8251A, the pin that controls the rate at which the character is to be transmitted is
 - A) TxC (Active Low)
 - B) TxC (Active High)
 - C) TxD (Active Low)
 - D) TxD (Active High)
- iv) Input port and an output port can have the same port address in I/O interfacing technique, but it is differentiated by -----.
- v) If data transmitted one way at a time, it is referred to as ----- communication.

B

- i) Contrast a memory-mapped I/O system with an isolated I/O system.
- ii) Determine the following from figure below:
 1. Addresses for Port A, B, C and Control Register.
 2. Mode 0 Control Word to configure Port A and Port C_U as output ports and Port B and Port C_L as input ports.



C

Illustrate how does 8251A perform serial data communication in microprocessor-based systems.

2. A

- i) Which of the following interrupt request is not independent of IF flag?
 - A) NMI
 - B) TRAP
 - C) Divide by Zero
 - D) INTR
- ii) The section of program to which control is passed is called the
 - A) Interrupt Vector
 - B) Interrupt Status Request
 - C) Interrupt Service Routine
 - D) Trap interrupt
- iii) At what address are CS_{50} and IP_{50} stored in memory?
 - A) IP_{50} is at $000C8_{16}$ and CS_{50} at $000CA_{16}$
 - B) IP_{50} is at $000CA_{16}$ and CS_{50} at $000C8_{16}$
 - C) IP_{50} is at $000C6_{16}$ and CS_{50} at $000CA_{16}$
 - D) IP_{50} is at $000CA_{16}$ and CS_{50} at $000C6_{16}$
- iv) An internal interrupt, called overflow in 8086 μ P is the ----- interrupt.
- v) An ----- instruction must be included at the end of each interrupt service routine.

B

- i) Describe the sequence of steps executed by 8086 μ P during context switching due to interrupts.
- ii) List the important instructions provided in the instruction set of 8086 μ P for interrupt processing and interpret their functions.

C

Illustrate and justify the structure of interrupt vector table in 8086 μ P and write the procedure to determine the address of each ISR.

PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004

Department of Computer Science and Engineering

CSE 5th Semester

CONTINUOUS ASSESSMENT TEST 2 Date: 12th Sept 24

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** 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.
4. Course Outcome Table : Q1: Unit3 Q2: Unit3

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. Propositional Logic

- A) Is Complete B) Has Universal quantifiers C) Has Existential quantifiers (L1)
D) All of the above

ii. In First order predicate logic 'Backward chaining' is used along with

- A) Subtraction B) Forward chaining C) Resolution Refutation D) Addition (L1)

iii. In FOL, keeping track of change in events is done through

- A) track and field B) history C) situation calculus D) change management (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. An Inference algorithm that derives only entailed sentences is _____ (L1).

v. A Horn Clause is disjunction of literals (L1)

b.

(2 x 5 marks = 10 marks)

i. For the following statements, convert to clause form

1. All Romans love Caesar
2. When a Roman loves a person they are good to them (L3)
3. Caesar was a person

ii. Compare and contrast Forward chaining and Backward chaining approaches to inference. Show Forward chaining and backward chaining on an example (L4)

C. Given below English sentences, (i) convert to Propositional statements and (ii) then to CNF. (iii) Use resolution to find what will happen a) If it is raining b) if it is sunny c) If it is sunny and warm

- (1) If it is sunny and warm day you will enjoy. *day(sunny) & day(warm) → enjoy*
- (2) If it is warm and pleasant day you will do strawberry picking (L3)
- (3) If it is raining then no strawberry picking. *day(raining) → ¬ strawberry picking*
- (4) If it is raining you will get wet. *day(raining) → wet*
- (5) It is warm day *day(warm)*
- (6) It is raining *day(raining)*
- (7) It is sunny *day(sunny)*
- (1 x 10 marks = 10 marks)

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. 'm' is a model of a sentence 'a' if 'a' is

- A) a sentence B) true in 'm' C) super set of 'm' D) false in 'm' (L1)

ii. A diagnostic rule infers

- A) Cause from effect B) Effect from cause C) All effects D) All inputs (L1)

iii. Fluent calculus introduces the attribute of

- A) Space B) Time C) Weight D) Volume (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. Common mistakes to avoid for Universal quantifiers are using _____ as main (L1)
connective while common mistakes to avoid for Existential quantifiers are using
_____ as main connective

v. The ontological commitment for Temporal logic is _____, _____, _____, and _____ (L1)

b.

(2 x 5 marks = 10 marks)

- i. Describe how hidden properties are found. Show an example also (L2)
- ii. Explain Situation calculus and its usage (L2)

c. The monkey-and-bananas problem is faced by a monkey in a laboratory with some (1.3) bananas hanging out of reach from the ceiling. A box is available that will enable the monkey to reach the bananas if he climbs on it. Initially, the monkey is at A, the bananas at B, and the box at C. The monkey and box have height Low, but if the monkey climbs onto the box he will have height High, the same as the bananas. The actions available to the monkey include Go from one place to another, Push an object from one place to another, ClimbUp onto or ClimbDown from an object, and Grasp or Ungrasp an object. The result of a Grasp is that the monkey holds the object if the monkey and object are in the same place at the same height.

a. Write down the initial state description.

b. Write the six action schemas.

(1 x 10 marks = 10 marks)

PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004

Department of Computer Science and Engineering

BE CSE & 5th Semester

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.
4. Course Outcome Table :

Qn. 1	CO3
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Qn.2	CO4
------	-----

i) 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) Choose the correct option

[L2]

a) Fragmentation occurs in a router when it receives a datagram that it wants to forward over a network which has (MTU < datagram)

b) The source host fragments a datagram that it wants to forward over a network which has (MTU < datagram)

A) True, True B) True, False C) False, True D) False, False

ii) The maximum number of hops to get across a certain network is never going to be more than

[L2]

A) 14 B) 32 C) 16 D) 24

iii) HLEN field in IP header refers to

[L1]

A. number of 32-bit words in header

B. number of bytes in header

C. number of bits in header

D. number of bytes in IP header and pseudoheader

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

iv) The MTU of FDDI networks is ----- bytes

[L1]

v) The number of hosts that can be connected to a class C network is -----

[L1]

b.

(2 x 5 marks = 10 marks)

- i) Consider sending a 5000 byte datagram (including IP header) sent from H1 to H9. Show the fragments produced. If the packet were originally fragmented for this MTU of 550 bytes, how many such fragmented packets would be produced? Mention the size of each fragment and the offset size.

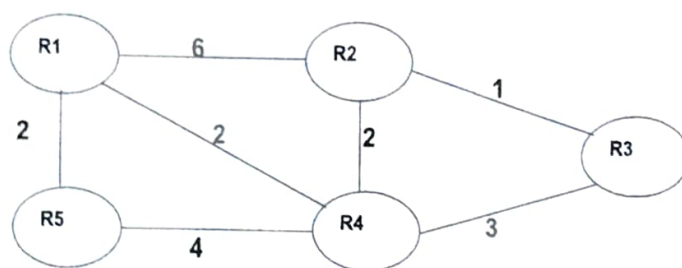
[L4]

- ii. Can an IP datagram be forwarded without any alteration in its original size all the way to the receiver? If not, show the relevant fields in the IP header that supports fragmentation. Show the other fields of the IP header also clearly.

[L5]

- C. Consider the following network, apply the link state algorithm to find shortest path for routers R3 and R1.

[L6]



(1 x 10 marks = 10 marks)

(or)

Suppose a TCP message that contains 1024 bytes of data and 20 bytes of TCP header is passed to IP for delivery across two networks of the Internet (i.e., from the source host to a router to the destination host). The first network has an MTU of 512 bytes; the second has an MTU of 250 bytes. Each network's MTU gives the size of the largest IP datagram that can be carried in a link layer frame. Show the header format, the flags and the sizes and offsets of the sequence of fragments delivered to the network layer at the destination host. Assume all IP headers are 20 bytes.

[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. Which of the following level is required for the UDP protocol to allow multiple application processes on each host to share the network?

[L2]

A. Multiplexer

B. Demultiplexer

C. Decoder

D. Process creation

- ii. In TCP, the processes identify each other using an abstract locator called [L2]
 A. Process Id B. Host Id
 C. Port number D. Port mapper
- iii. Which of the following fields in TCP header carry information about the flow of data going from receiver and sender? [L2]
 A. Sequence number and checksum
 B. Sequence number and Advertised Window
 C. Acknowledgment and Advertised Window
 D. Acknowledgement and checksum

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

- iv. The default time a TCP segment is allowed to survive in the Internet is 60 [L2]
 v. FIN flag in TCP header indicates that the connection is being aborted. [L2]

b.

(2 x 5 marks = 10 marks)

- ii. a. Illustrate how TCP manages a byte stream with a suitable diagram. (2) [L2]
 b. Can a TCP connection be established in one single request. If not, argue how it is established. (3) [L4]
- iii. Imagine that you are hired to design a reliable byte stream protocol. The protocol will run over a 2 Gbps advanced network. The RTT of the network is 60 msec, and the max segment lifetime is 60 seconds. How many bits would you include in the Advertised window and Sequence Number fields of your protocol header. Show the steps clearly. [L6]

c.

Demonstrate with suitable examples, how TCP uses sliding window to achieve flow control in which the receiver window controls the size of the sender window? [L4]

(1 x 10 marks = 10 marks)

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

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. 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. _____ objects receive the message in collaboration diagram. L1

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

b.

(2 x 5 marks = 10 marks)

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

c.

(1 x 10 marks = 10 marks)

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

L1

A) Atomic B) Derived C) Public D) Protected

ii. A Student object using a Mobile object to call is represented by _____ relationship

L2

A) Association B) Dependency C) Realization D) Composition

iii. An adjective in a use case specification can be used to identify the _____ of a class

L1

A) Name B) Attribute C) Operation D) No. of instances

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 _____

L2

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

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

(1 x 10 marks = 10 marks)

c.

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.

L6

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

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. _____ Data book / _____ table(s) may be permitted

5. 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. 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]

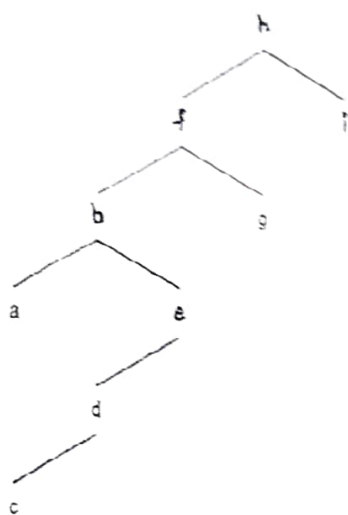


v. _____ operation fixes the double horizontal link problem in AA tree [L1]

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]



- 1) If root is already a leaf, then make it a leaf node.
- 2) If root is not a leaf, then find the leaf node which is the left child of the root.
- 3) If the leaf node is the left child of the root, then make it the root.
- 4) If the leaf node is the right child of the root, then make it the root.
- 5) If the leaf node is the left child of the root, then make it the root.
- 6) If the leaf node is the right child of the root, then make it the root.
- 7) If the leaf node is the left child of the root, then make it the root.
- 8) If the leaf node is the right child of the root, then make it the root.

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? [L2]

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.

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]

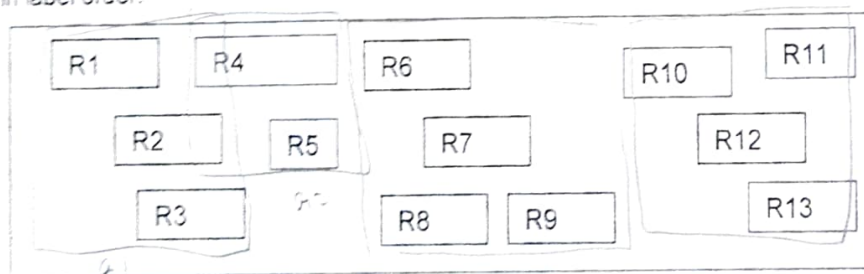
b.

(2 x 5 marks = 10 marks)

- 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]



c.

(1 x 10 marks = 10 marks)

- 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]