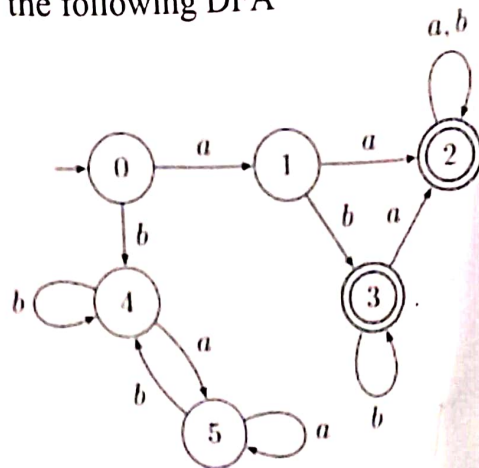


b) Minimize the following DFA



(6+6)

10.	<p>Give context-free grammars generating the following languages.</p> <ol style="list-style-type: none"> $\{w \mid w \text{ contains at least three 1s over } \Sigma \{0,1\}\}$ $\{w \mid \text{the length of } w \text{ is odd and its middle symbol is a 0 over } \Sigma \{0,1\}\}$ The set of strings over the alphabet $\{a, b\}$ with more a's than b's A language of properly nested strings of parentheses, square brackets $([,])$ and braces $\{, \}$. 	K3	CO2	1.1.1 1.4.1 2.1.3 13.1.1
(Or)				
11.	<p>Consider the following grammar, with the terminals true, false, &&, and :</p> $T \rightarrow \text{true} \mid \text{false} \mid T \ \&\& \ T \mid T \ \ T$ <p>(a) Demonstrate that the grammar is ambiguous by showing at least two parse trees for the string true && false true.</p> <p>(b) Reconstruct the grammar so that it is unambiguous, the && operator is right-associative, the operator is left-associative, and && has higher precedence than .</p> <p>(c) Draw the parse tree for true && false true in your refactored grammar.</p>	K3	CO2	1.1.1 1.4.1 2.1.3 13.1.1

(4+4+4)



Sri Sivasubramaniya Nadar College of Engineering, Kalavakkam – 603 110
(An Autonomous Institution, Affiliated to Anna University, Chennai)

Information Technology
Continuous Assessment Test – I

Regulations – R2021

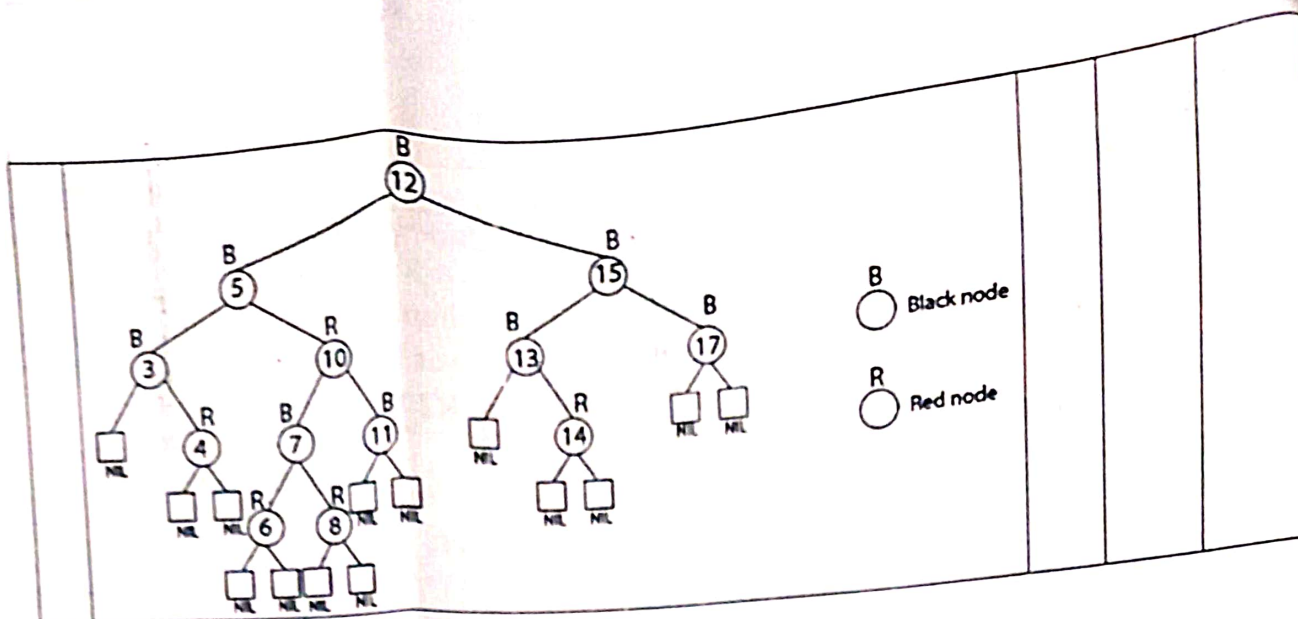
Degree B.E. / B. Tech.	B.Tech	Branch	Information Technology
Semester	IV	Date of CAT	21.4.23
Subject Code & Name	UIT2402 – Advanced Data Structures and Algorithm Analysis		
Time: 90 Minutes	Answer All Questions	Maximum: 50 Marks	

(K1: Remembering, K2: Understanding, K3: Applying, K4: Analyzing, K5: Evaluating)

CO1:	Design and implement algorithms using hierarchical data structures
CO2:	Judiciously select and apply algorithm design techniques for efficiently solving problems
CO3:	Analyze the time and space complexity of algorithms and their implementations
CO4:	Explain intractability and characterization of NP problems
CO5:	Apply best practices for IT project management for design and development of software intensive systems
CO6:	Communicate efficiently in team meetings & presentations and prepare documents in the context of software development projects

Part – A ($4 \times 2 = 8$ Marks)

		KL	CO	PI
1.	Compare the amortized running time of Fibonacci heap and binomial heap.	K2	CO3	2.2.3
2.	<p>Compute the time complexity of the following algorithm.</p> <pre> Algorithm Secret($A[0..n-1]$) //Input: An array $A[0..n-1]$ of n real numbers minval $\leftarrow A[0]$; maxval $\leftarrow A[0]$ for $i \leftarrow 1$ to $n-1$ do if $A[i] < \text{minval}$ minval $\leftarrow A[i]$ if $A[i] > \text{maxval}$ maxval $\leftarrow A[i]$ return maxval - minval </pre>	K2	CO3	1.1.2 2.1.3
3.	Imagine a robot on a 2D plane that tries to navigate from point A to point B on 2D space. Assume that the planned path has many obstacles on its way. The obstacles can be sampled as points in 2D space. State an algorithm that would be able to derive a collision free path.	K3	CO2	2.1.3 2.2.3
4.	State the properties of Red-Black Trees and check whether the tree given below is a Red-Black tree?	K3	CO1	1.4.1

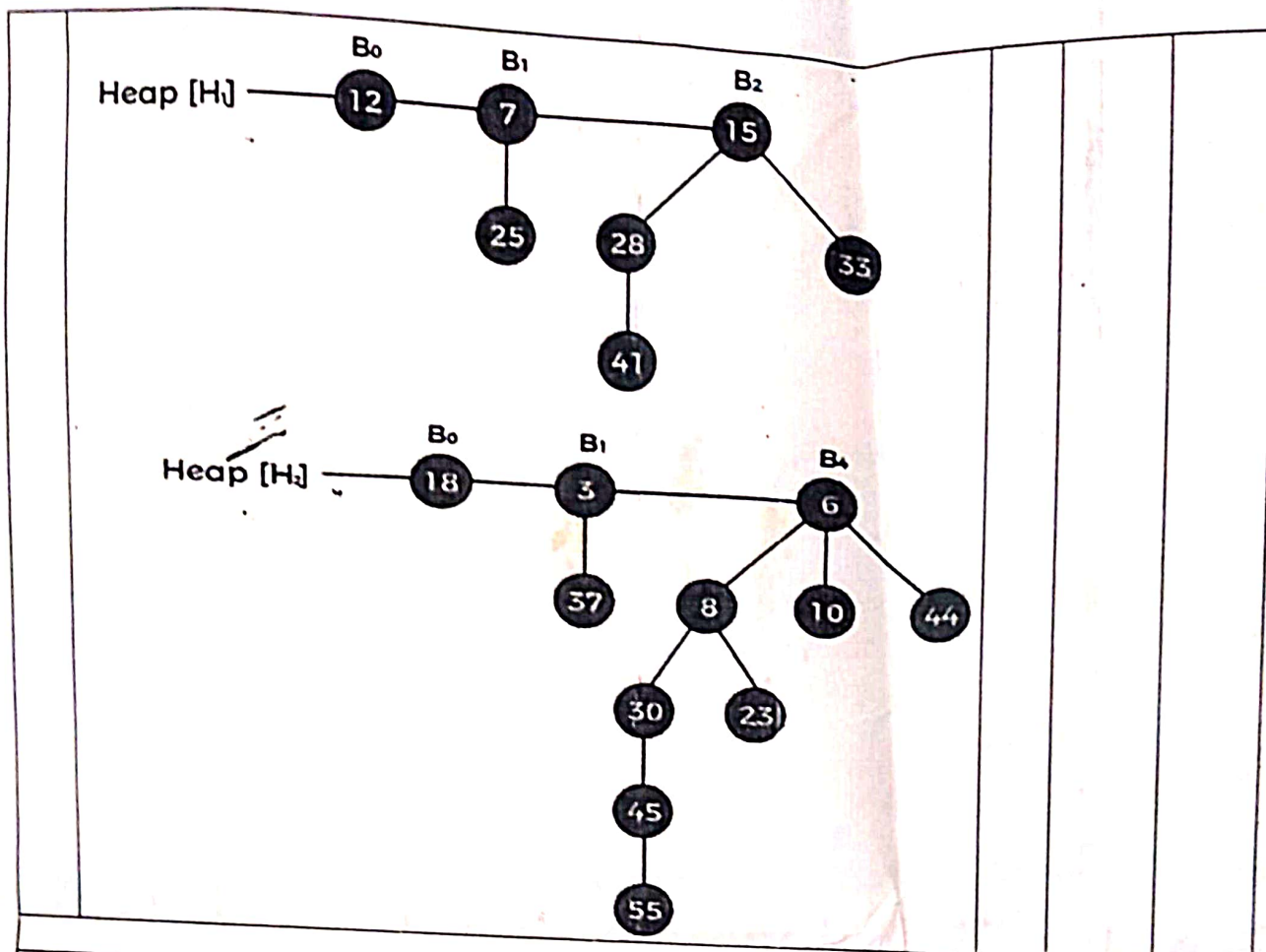


Part - B (3×6 = 18 Marks)

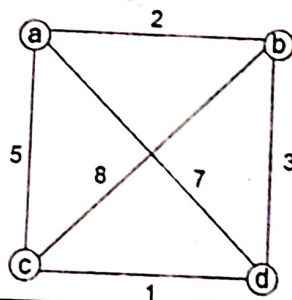
		KL	CO	PI
5.	In a hospital, patient records are stored and maintained. In this scenario, there is a need for recent patients records to be accessed in the near future. Choose an appropriate data structure to maintain the patient records. Write the algorithm for inserting and searching a patient's record.	K3	CO1	1.4.1
6.	The 4-Queens problem is a classic example of the n-Queens problem where n queens have been placed on an n x n chessboard such that no two queens attack each other (no 2 queens should be placed in the same row/column/diagonal). The state space of the problem can be represented as a tree where each node represents a configuration of the chessboard and each edge represents the placement of a queen. Apply iterative deepening algorithm to find the minimum number of queens that need to be moved to reach the goal state.	K3	CO2	2.1.3 2.2.3
7.	Does the closest pair algorithm assume that the x coordinates of the points are distinct? Is there a problem with the $O(n \log n)$ performance if they are not distinct?	K3	CO3	1.1.2 2.1.3 2.2.3

Part - C (2 × 12 = 24 Marks)

		KL	CO	PI
8.	a. Show the result of inserting 12, 10, 15, 4, 1, 17, 3, 13, 25, 82 and 8 into an initially empty B+ tree with $M = 3$. b. Show the result of deleting 12, 13, and 15. Find the time complexity for insertion and deletion.	K3	CO1	1.4.1 2.1.3
(Or)				
9.	Consider the following two binomial heaps. Explain in detail with the algorithm and pseudocode to perform the union of two heaps and to delete any element from the heap.	K3	CO1	1.4.1 2.1.3



10 Apply a suitable state space search strategy to solve the below instance of travelling salesman problem.



(Or)

11 A city's **skyline** is the outer contour of the silhouette formed by all the buildings in that city when viewed from a distance. Given the locations and heights of all the buildings, devise an algorithm to return the **skyline** formed by these buildings collectively. Illustrate its working with an example.