APJ ABDULKALAM TECHNOLOGICAL UNIVERSITY

08 PALAKKAD CLUSTER

Q. P. Code: CSE0820121-I (Pages: 2)

Name: .....

Reg. No: .....

FIRST SEMESTER M.TECH. DEGREE EXAMINATION MARCH 2021

Branch: Computer Science and Engineering Specialization: Computer Science and Engineering

08CS6021 ADVANCED DATA STRUCUTRES

(Common to CSE)

Time: 2 hour 15 minutes **Max. Marks: 60**

Answer all six questions.

Modules 1 to 6: Part 'a' of each question is compulsory and answer either part 'b' or part 'c' of each question.

Q. No.	Module 1	Marks
1a	Write a recursive algorithm to compute the depth of a tree and gives its proof of correctness	3
	Answer b or c	
b	Prove or disprove the following statements for asymptotically positive functions:	
	(i) $f(n) = O(g(n))$ implies $2^{f(n)}=o(2^{g(n)})$	3
	(ii) $f(n) = O(f(n/2))$	3
c	Prove that Heap Sort algorithm correctly sorts an array	6

Q. No.	Module 2	Marks
2.a	(i) Prove that the height of an AVL tree of n nodes in O(log(n))	1
	(ii) Insert the following data into an initially empty AVL tree 60,100,20,80,120,70. Draw the final tree.	2
	Answer b or c	
b	Derive the amortized complexity of various splay tree operations.	6
c	Explain the Red Black tree insertion algorithm and prove its correctness	6

Q. No.	Module 3	Marks
3a	Write the search algorithm in a skip list and derive the expected complexity of the algorithm	3
	Answer b or c	
b	Suggest a suitable potential function and perform amortized analysis of a stack with push, pop and multipop operations.	6
c	Consider a version of division method where h(k) = k mod m. If $m == 2^{p-1}$ and k is a character string interpreted in radix 2^p. Show that any string derived from k by permuting its characters will hash to the same value.	6

Q. No.	Module 4	Marks
4a	Define leftist heaps. Where is the data structure used commonly?	3
	Answer b or c	
b	Define Skewed Heaps. Merge the following heaps {3,7,8,14} and {12,5,10}.	6
c	Explain the Merge operation on Leftist Heaps with an example? Derive the worst case complexity of the operation?	6

Q. No.	Module 5	Marks
5a	Explain Union operation on Fibonacci Heaps H1, H2. Suggest a potential function and compute amortized complexity of the operation.	4
	Answer b or c	
b	Construct a Fibonacci Heap from the following set of keys : 10,20,35,1,2,32,11. Perform ExtractMin operation on the heap.	8
c	Write and derive the complexity of Dijkstra's algorithm using Fibonacci Heap.	8

Q. No.	Module 6	Marks
6a	Suggest applications of K-d trees.	4
	Answer b or c	
b	Consider the following set of points in 2d –space (3, 6), (17, 15), (13, 15), (6, 12), (9, 1), (2, 7), (10, 19). Insert them into a 2-d tree.	8
c	Explain MX-Quad trees and its operations. Suggest applications of the data structure.	8