



APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIRST SEMESTER M.TECH DEGREE EXAMINATION, DECEMBER 2015

Computer Science and Engineering

08CS 6021 Advanced Data Structures

Max. Marks : 60

Duration : 3 Hours

Answer ALL six questions. Part (a) of each question is compulsory. Answer
EITHER part (b) or part (c) of each question.

Q.No.	Marks
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Module I

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|---|---|
| 1a. A heap can be a better structure for implementing priority queues. Justify. | 3 |
|---|---|

Answer b or c

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|---|---|
| b. Given a binary tree, write an algorithm to convert it to a Binary Search Tree. The conversion must be done in such a way that keeps the original structure of Binary Tree. | 6 |
| c. An $m \times n$ matrix a is said to have a saddle point if some entry $a[i][j]$ is the smallest value in row i and the largest value in column j . Write an algorithm that determines the location of a saddle point if one exists. What is the time complexity of your algorithm? | 6 |

Module 2

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|---|---|
| 2a. Suggest an application in which a Splay tree can be a better search structure over an AVL Tree. | 3 |
|---|---|

Answer b or c

- | | |
|---|---|
| b. What is the advantage of an AVL tree over a binary search tree? Create an AVL tree for the sequence 29, 44, 12, 53, 23, 98, 32, 5, 49, 63, 24, 96, 33, 2, 43, 76, 64. Delete the elements in the same sequence. | 6 |
| c. Choice of order is a deciding factor when we select B+ tree for database indexing. Justify? Consider a database indexing mechanism with search field is $V = 9$ bytes long, the disk block size is $B = 512$ bytes, a record (data) pointer is $P_r = 7$ bytes, and a block pointer is $P_b = 6$ bytes. Calculate the best suited value for order of internal nodes P and leaf nodes P_{leaf} for a B+ tree for the given specification. | 6 |

Module 3

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|---|---|
| 3a. Define Treaps with suitable examples. | 3 |
|---|---|

Answer b or c

- | | |
|---|---|
| b. What is the difference between amortized analysis and average case analysis? Perform amortized analysis on insert operation of dynamic tables. | 6 |
|---|---|

- c. Suppose we perform a sequence of n operations on a data structure in which the i^{th} operation costs i if i is an exact power of 2, and 1 otherwise. Which is the method you will use for finding the amortized cost per operation? Explain that method and find the amortized cost per operation. 6

Module 4

- 4a. What is the merit of a skew heap over a leftist tree? 3
- Answer b or c**
- b. Consider that the set of jobs in a computer system are placed in two separate queues waiting for the use of two resources. If one of the resources fail, we need to merge the two queues to a single queue. Select a suitable data structure for this system and develop algorithms for the same. 6
- c. Consider a queuing system in which the elements are queued up according to their priority. The system supports operation which will either remove elements with highest priority or elements with least priority. Select a suitable data structure for this system and develop algorithms for the same. 6

Module 5

- 5a. What are the properties of a binomial tree? 4
- Answer b or c**
- b. Analyse and justify why a Fibonacci heap can be considered as a better structure than arrays and binary heaps for implementing dijkstra's algorithm. 8
- c. Write an implementation of Dijkstra's algorithm for single source shortest path problem using Fibonacci heap. Analyse your algorithm. 8

Module 6

- 6a. Suggest any one application of R tree structure. 4
- Answer b or c**
- b. Develop algorithms for insertion, find minimum and delete nodes from a K-D tree. Insert into a 2-D tree the following elements in sequence (30,40), (5,25), (10,12), (70,70), (50,30), (35,45), (45,66), (2,44), (43,69), (22, 35). 8
- c. Write applications of MX-Quad trees and point quad trees. 8