

Indian Institute of Engineering Science and Technology, Shibpur
B.Tech(CST) 3rd Semester Mid Semester Examinations, December 2020
Data Structures CS2103

Time: 45 Minutes

Full Marks: 30

Answer question number 1 and any two from the rest. Credit will be given to precise answer.

1. Answer any five questions

- (a) Write down the postfix form of the expression $(A + B) * D + E / (F + A * D) + C$
- (b) Why do you need the instack and incoming priority of the same operators to be different while converting infix expression to postfix expression?
- (c) How do you prove that an array of number is actually sorted?
- (d) How do you find the k^{th} node from the last in a linked list?
- (e) How do you say whether a binary tree is a binary search tree?
- (f) Write down a procedure to find the maximum element in a binary search tree.
- (g) How many binary search trees with n nodes and height n are possible? Assume that a tree with a single node has height one. [5 × 2]

2. (a) An $n \times n$ square matrix A is said to be symmetric if $A[j, k] = A[k, j]$ for all j and k . Now suppose A and B are two $n \times n$ square symmetric matrices. Describe an efficient way of storing A and B in memory.

- (b) An upper triangular matrix is one where nonzero entries can only occur on or above the main diagonal. Find an efficient way of storing $n \times n$ upper triangular matrix A in a single dimensional array B and hence find the formula that gives us the integer L in terms of j and k such that $B[L] = A[j, k]$. Assume that arrays are stored in row major order. [5+5]

3. (a) Suppose L_1 and L_2 are two sorted singly linked lists. Write down a procedure to merge them together to create another singly sorted linked list L_3 .

- (b) Suppose in a set of elements few are frequently accessed and remaining are less frequently accessed. Suggest a suitable data structure to store the elements so that access time for the frequently accessed elements are improved (i.e. takes lesser time than less frequently accessed elements). Justify your answer with proper explanation [5+5]

4. (a) Write a procedure which takes a binary tree as input and swaps the left and right children of every node.

- (b) Draw the Max-heap by inserting the keys (26, 5, 77, 1, 61, 11, 59, 15, 48, 19) step by step in that order. Draw the tree by deleting the root node. [5+5]