VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

[Central Technological Institute, Maharashtra State]

Matunga, Mumbai-400 019

SEMESTER EXAMINATION: ESE April 2014 — DATE OF EXAM: 28/04/14

SEMESTER & PROGRAM: *S Y B Tech Computer Engg (Sem IV)* — TIME: 1:30 to 4:30pm

TIME ALLOWED: *3 HRS.* — MARKS: *100*

COURSE (CourseCode) : *Data Structures and Algorithms (CO0208)*

Instructions
1. **Q 1 is compulsory. Solve any four from remaining.**
2. Figures to the right indicate full marks.
3. Write algorithms stepwise, neat and clean. Avoid writing algorithm as descriptive sentences and paragraphs to maintain clarity in steps.

Q 1	A	Define O-Notation and Θ-Notation with example.	04
	B	Find post-order of a binary tree from given in-order and pre-order sequence. Explain it step by step. In Order = G, D, H, B, E, A, C, I, F, J Pre-order = A, B, D, G, H, E, C, F, I, J	04
	C	Write non-recursive pseudo code for in-order traversal of a binary tree.	04
	D	Write an algorithm to perform parenthesis matching using stack	04
	E	Take the following list of functions and arrange them in ascending order of growth rate. That is, if function $g(n)$ immediately follows function $f(n)$ in your list, then it should be the case that $f(n)$ is $O(g(n))$. $f_1(n) = \sqrt{2n}$, $f_2(n) = n+10$, $f_3(n) = 10^n$ $f_4(n) = 100^n$, $f_5(n) = n^{2.5}$	04
Q 2	A	Explain queue and queue operations.	05
	B	Write an algorithm that reverses given single linked list in Θ(n) time and uses constant storage beyond that needed for the list itself	05
	C	Write and explain algorithm for insertion sort to be performed on given single linked list. Every node contains integer data. (Note: you have to swap the nodes of linked list to get it to proper position)	10
Q 3	A	Write recursive pseudo code to delete all existing leaf nodes from the given binary tree represented with linked representation.	05
	B	Write an algorithm to find smallest element from the any given binary tree represented with linked representation	05
	C	Write algorithm to perform sorting in descending order using heap sort. Show sorting on following values: 25, 57, 48, 37, 12, 92, 86, 33	10
Q 4	A	The ***transpose*** of a directed graph $G = (V, E)$ is the graph $GT = (V, ET)$, where $ET = \{(v, u) \in V \times V : (u, v) \in E\}$. Thus, GT is G with all its edges reversed. Describe efficient algorithms for computing GT from G, for both the adjacency-list and adjacency-matrix representations of G. Analyze the running times of your algorithms.	10

	B	Write and explain Prim's Minimum Spanning tree algorithm with example. Explain its time complexity.	10
Q 5	A	A directed graph $G = (V, E)$ is ***singly connected*** if u ->> v implies that there is at most one simple path from u to v for all vertices $u, v \in V$. Give an efficient algorithm to determine whether or not a directed graph is singly connected and specify its time complexity.	10
	B	Let G = (V, E) be an (undirected) graph with costs $c_e >_ 0$ on the edges e ε E. Assume you are given a minimum-cost spanning tree T in G. Now assume that a new edge is added to G, connecting two nodes v, w ε V with cost c. Give an efficient algorithm to test if T remains the minimum-cost spanning tree with the new edge added to G (but not to the tree T). Make your algorithm run in time O(|E|). Can you do it in O(|V|) time? Please note any assumptions you make about what data structure is used to represent the tree T and the graph G. Justify your answer with proper reasoning	10
Q 6	A	Write and explain algorithm to find whether given graph is bipartite or not.	10
	B	Explain merge sort with example. Write time complexity in every case.	10