VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

[Central Technological Institute, Maharashtra State]

Matunga, Mumbai-400 019

SEMESTER EXAMINATION	ESE (Re-exam)	DATE OF EXAM	21st May 2014
SEMESTER & PROGRAM	*S Y B Tech Computer Engg (Sem IV)*	TIME	1:30 - 4:30 pm
TIME ALLOWED	*3 HRS.*	MARKS	*100*
COURSE (CourseCode) :	*Data Structures and Algorithms (CO0208)*		

Instructions
1. **Q1 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 for clarity in steps.

Q 1	A	Define O-Notation and Ω-Notation with example.	04
	B	Write non-recursive pseudo code for pre-order traversal of a binary tree.	04
	C	Write an algorithm to convert given postfix expression into prefix expression.	04
	D	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 $O(g(n))$. $f_1(n) = n^{2.5}$, $f_2(n) = \sqrt{2n}$, $f_3(n) = n+10$ $f_4(n) = n^2 \log_2 n$, $f_5(n) = 10^n$	04
	E	Find post-order of a binary tree from given in-order and pre-order sequence. Explain it step by step. Inorder = G, D, H, B, E, A, C, I, F, J Preorder = A, B, D, G, H, E, C, F, I, J	04
Q 2	A	What is queue? Write algorithm for operations on queue represented using linked list. All operations should be performed in O(1) Time.	05
	B	Write algorithm to delete node with largest value in the given doubly linked list. Explain your logic properly.	05
	C	Write and explain algorithm for selection 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 an algorithm to insert given node in binary search tree. Specify its time complexity.	05
	B	Write recursive pseudo code to delete all existing leaf nodes from the given binary tree represented with linked representation.	05
	C	Write algorithm to perform sorting in descending order using insertion sort. Show sorting on following values: 25, 57, 48, 37, 12, 92, 86, 33 explain time complexity in all cases.	10
Q 4	A	A directed graph G = (V, E) is said to be *semiconnected* if, for all pairs of vertices u,v ε V , we have u ->> v or v ->> u. (->> ie path between vertices) Give an efficient algorithm to determine whether or not G is *semiconnected*. Prove that your algorithm is correct, and analyze its running time.	10

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	B	Write and Explain BFS with pseudo code which proper example. Analyse time complexity of the same.	10
Q 5	A	When an adjacency-matrix representation is used, most graph algorithms require time $\Omega(V^2)$, but there are some exceptions. Show that determining whether a directed graph G contains a universal sink (it is a vertex with in-degree |V| - 1 and out-degree 0) can be determined in time O(V), given an adjacency matrix for G. Write algorithm to achieve same. Show calculations for time complexity O(V). explain this with example.	10
	B	Write and explain Kruskal's Minimum Spanning tree algorithm with example. Explain its time complexity.	10
Q 6	A	Explain quick sort with example. Analyse and compare of merge sort with quick sort with respect to time and space complexity.	10
	B	In this problem, we give pseudo code for three different algorithms. Each one takes a graph as input and returns a set of edges T. For each algorithm, you must either prove that T is a minimum spanning tree or prove that T is not a minimum spanning tree and explain you answer. MAYBE-MST-A(G, w) 1 sort the edges into nonincreasing order of edge weights w 2 $T \leftarrow E$ 3 for each edge e, taken in nonincreasing order by weight 4 do if T - {e} is a connected graph 5 then $T \leftarrow T$ - e 6 return T MAYBE-MST-B(G, w) 1 $T \leftarrow \emptyset$ 2 for each edge e, taken in arbitrary order 3 do if $T \sqcup$ {e} has no cycles 4 then $T \leftarrow T \sqcup e$ 5 return T MAYBE-MST-C(G, w) 1 $T \leftarrow \emptyset$ 2 for each edge e, taken in arbitrary order 3 do $T \leftarrow T \sqcup$ {e} 4 if T has a cycle c 5 then let e' be the maximum-weight edge on c 6 $T \leftarrow T$ - {e'} 7 return T	10