Quiz-3
Data Structures

Set 1-A

28th March Time Allowed: **45** minutes

INSTRUCTIONS

1. This paper contains **Multiple choice questions** .
2. Marking Scheme

   Marking scheme for each question written besides the question in format (correct , incorrect , not attempted) .
3. Answers have to be written in the space provided besides the question .

Roll No : _____
Seat No: _____

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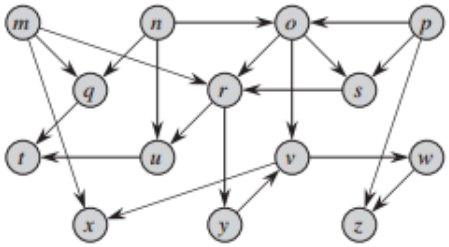
1. Consider the following DAG - directed acyclic graph . Write its topological sorting below assuming that adjacency list has nodes in ascending order and new dfs (if required) always starts with the smallest unvisited node. (+5,0,0)



(a) _____

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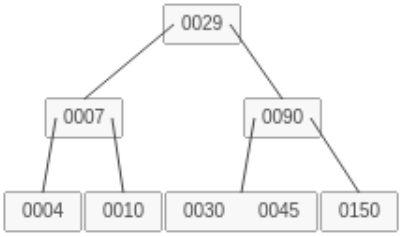
2. Assume the following intermediate state of a 2-3 tree .Draw the new tree after inserting value 30 into the tree .(+5,0,0)

(a)

3. For the following 2-3 tree draw the final tree after deleting value 15 followed by deleting value 10 from the tree.(+5,0,0)

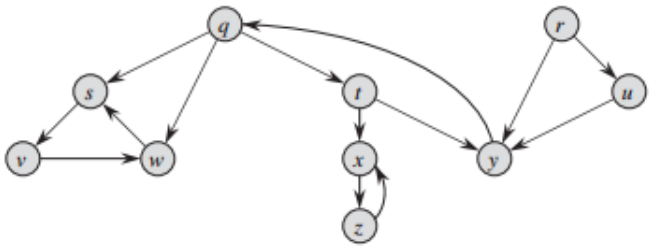


(a)

4. Which of the following is correct for space complexity of segment tree build over N values . (+3,-1,0)

   (a) (a) $O(logN)$ (b) $O(N)$ (c) $O(NlogN)$ (d) $O(N^2)$ Ans : _____

5. List the nodes in the increasing order of finish time while running DFS on the directed graph below. Assume that adjacency list of each node is sorted and new DFS call (if required) always starts with the smallest unvisited node (+5,0,0) .



   (a) _____

6. State whether the following statements are True of False : (+2,-1,0) (marking scheme for each individual question below)

   (a) Let G be an undirected connected graph with distinct edge weight. Let emax be the edge with maximum weight and emin the edge with minimum weight. MST will contain emin but will never contain emax.
   _____

   (b) Depth first search of a undirected graph gives no forward edges . _____

   (c) The following algorithm gives correct Minimum Spanning tree of a graph _____

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c. MAYBE-MST-C(G, w)
1  T = ∅
2  for each edge e, taken in arbitrary order
3      T = T ∪ {e}
4      if T has a cycle c
5          let e' be a maximum-weight edge on c
6          T = T − {e'}
7  return T
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   (d) Compressing all connected components of a graph to a single node converts the resultant graph to a directed graph which is of linear structure
   _____

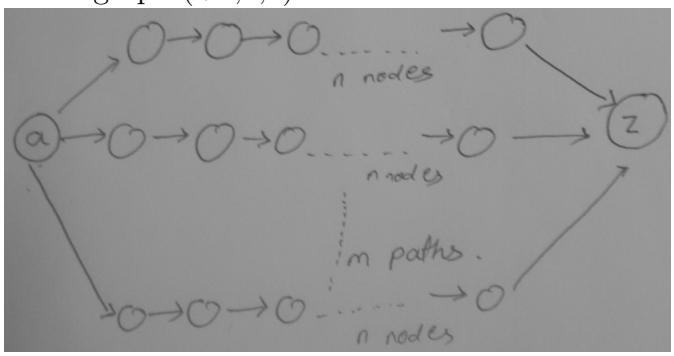
(e) If the DFS finishing time f[u] ¿ f[v] for two vertices u and v in a directed graph G, and u and v are in the same DFS tree in the DFS forest, then u is an ancestor of v in the depth first tree _____

(f) The following is a sufficient and necessary condition to determine whether an edge is a forward edge:: "An edge is a forward edge if it is directed from a grey node G to a black node B such that the starting time of G is smaller than the starting time of B." _____

(g) The shortest path between two nodes will be the same if the weight of each edge in the graph is increased by a positive constant K. _____

(h) The shortest path between two nodes will be the same if the weight of each edge is divided by a positive constant K . _____

7. Consider the following directed graph . There are m paths between node a and z, each path is of length n+2 (including nodes a and z). Write in terms of n and m number the number of different topological orderings of the nodes of the graph (+3,0,0)



(a) _____

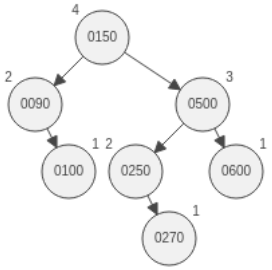
8. Values in the following order are entered into a min heap maintained as an array : 45,13,27,10,29,30,22,1 . Write the resultant array in increasing order of indices after all insertions below . (+4,0,0)

(a) _____

9. what is the maximum height of an AVL tree with 9 nodes ? Assume height of tree with single node is 0 (+2,-1,0)

(a) (a) 2 (b) 3 (c) 4 (d) 5 Ans : _____

10. For the following balanced AVL tree draw the final tree after deleting value 1 from the tree (+5,0,0)



(a)

11. Let G be a graph with n vertices and m edges. What is the tightest upper bound on the running time on Depth First Search of G? Assume that the graph is represented using adjacency matrix. n is number of nodes m is number of edges . (+3,-1,0)

(a) $O(n)$ (b) $O(n+m)$ (c) $O(n^2)$ (d) $O(nm)$ Ans : _____

12. The in-order traversal of some binary tree produced the sequence HFIEJGZ, and the post-order traversal of the same tree produced the sequence HIFJZGE. What will be the total number of nodes in the left sub tree of the given tree? (+3,-1,0)

(a) (a) 2 (b) 3 (c) 4 (d) None of these Ans : _____

13. Let G be an undirected graph. Consider a depth-first traversal of G, and let T be the resulting depth-first search tree. Let u be a vertex in G and let v

be the first new (unvisited) vertex visited after visiting u in the traversal. Which of the following statements is always true? (+3,-1,0)

(a) u,v must be an edge in G, and u is a descendant of v in T .

(b) u,v must be an edge in G, and v is a descendant of u in T .

(c) If u,v is not an edge in G then u is a leaf in T .

(d) If u,v is not an edge in G then u and v must have the same parent in T.

14. Mark all the correct options (+3,-1,0)

(a) Every graph has a unique minimum spanning tree .

(b) A graph may have more than one minimum spanning tree .

(c) A graph with distinct weights has a unique minimum spanning tree .

(d) A graph with distinct weights may have more than one minimum spanning tree .

15. An undirected graph G(V, E) contains n (n ¿ 2) nodes named v1,v2 ,.vn. Two nodes vi, vj are connected if and only if 0 <|i j| <= 2. Each edge (vi, vj) is assigned a weight i + j. What will be the cost of the minimum spanning tree (MST) of such a graph (+3,-1,0)

(a) $1/12(11n^2-5n)$ (b) n^2-n+1 (c) $6n-11$ (d) $2n+1$ Ans : _____