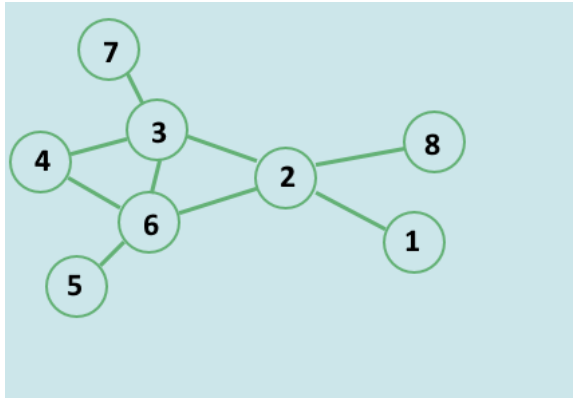


ADA

1. The number of articulation points in the graph below is:



ANSWER: 3

2. Which type of traversal outputs the nodes of a BST in a sorted order?
ANSWER: IN ORDER
3. Breadth-first search can be used to find the shortest paths in unweighted graphs
ANSWER: TRUE
4. Depth first search can be used to determine shortest paths in unweighted graphs
ANSWER: FALSE
5. We have calculated the shortest path from a source to all other vertices in a graph. If we modify the graph by adding 1 to the weights of all edges, then the shortest paths trajectories remained the same only the total weights of paths change.
ANSWER: FALSE
6. The following values are inserted in an AVL tree in this order 1, 2, 8, 6, 3. How many rotations are performed in total?
ANSWER: TWO SIMPLE ROTATIONS
7. The following keys are inserted in a binary search tree 3, 6, 5, 2, 4, 7, 1. Which node is the deepest?
ANSWER: 4
8. A binary search tree contains integer numbers. A search operation is performed, searching for key value free 363. Which of the following sequences cannot be the search sequence of the examined nodes?
ANSWER: 925, 202, 911, 240, 912, 245, 258, 363
9. Breadth-first search can be used to find shortest paths in weighted graphs.

ANSWER: FALSE

10. The number of edges in a tree with N nodes is equal with...

ANSWER: $N - 1$

11. Depth-first search is similar to which kind of tree work? Hint think about a graph that has a tree topology.

ANSWER: PRE-ORDER

12. For a graph with V vertices and E edges the time complexity of depth-first search is

ANSWER: $O(V + E)$

13. The Huffman encoding of the text Mississippi has the length

ANSWER: 21 BITS

14. For sparse graphs, Prim's algorithm can be efficiently implemented using a data structure of

ANSWER: MIN-HEAP

15. What is the asymptotic complexity to search for a key in a AVL tree with N nodes?

ANSWER: $O(\log N)$

16. We have calculated the shortest paths from a source to all other vertices in a graph. If we modified the graph by multiplying the weights of all edges by 2, then the shortest paths trajectories remain the same only the total weights of paths change.

ANSWER: TRUE

17. When a binary search tree is traversed in pre order the sequence of values obtained is 6, 4, 3, 2, 5, 9, 7, 8. If the binary search tree is traversed in post order , the sequence obtained would be:

ANSWER: 2, 3, 5, 4, 8, 7, 9, 6.

18. Into an initially empty binary search tree we insert N values. What is the worst time complexity for the whole process of an insertions?

ANSWER: N^2

19. In a weighted graph where all edges have unique weights (no two edges have equal weights), then between any two nodes there is a unique shortest path.

ANSWER: FALSE

20. A weighted undirected graph has only positive edge weights. There are two nodes A and B with an edge between them. We know that the shortest path from the node S to node A has total weight 43 and the shortest path from node S to node the B has total weight 55. Which of the following statements is always true?

ANSWER: $WEIGHT(A, B) \geq 12$

21. A binary search tree T is perfectly balanced when for every node N in the tree:

ANSWER: N'S LEFT AND RIGHT SUBTREES HAVE SIZES (NUMBER OF NODES) THAT DIFFER BY AT MOST 1

22. What is the maximum possible number of levels in an AVL tree with 7 nodes? The root is numbered level 1

ANSWER: 4

23. The Floyd-Warshall algorithm defines the matrix of numbers dkj , where i and j are graph vertices satisfying $1 \leq i, j \leq n$ and k belongs $\{0, 1, \dots, n\}$. Moreover, dkj represents

ANSWER: THE DISTANCE FROM I TO J WHEN RESTRICTED TO PATHS WHOSE INTERMEDIATE VERTICES MUST LIE WITHIN THE SET $\{1, \dots, k\}$

24. In a weighted graph where all edges have unique weights (no two edges have equal weight), then there is a unique minimum spanning tree for that graph.

ANSWER: TRUE

25. A binary search tree is AVL balanced when for every node N in the tree

ANSWER: N 'S LEFT AND RIGHT SUBTREES HAVE HEIGHTS THAT DIFFER BY AT MOST 1

26. Which of the following statements about a spanning tree of a graph is false?

ANSWER: IT CAN BE CYCLIC OR ACYCLIC

27. The following values are inserted in an AVL tree in this order 1, 2, 3, 8, 6. How many rotations are performed in total?

ANSWER: 1 SIMPLE ROTATION AND 1 DOUBLE ROTATION

28. For dense graphs, Prim's algorithm can be efficiently implemented using a data structure of

ANSWER: ARRAY

29. Which data structure is used in the standard implementation of breadth-first search?

ANSWER: QUEUE

30. The sequence produced by a depth-first search started from a given node in a connected undirected graph is unique.

ANSWER: FALSE

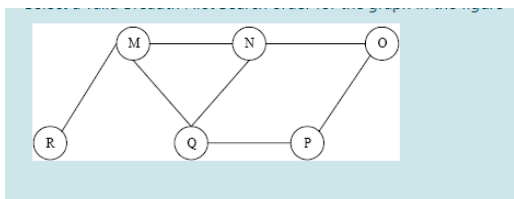
31. What is the asymptotic complexity to search for a key in a binary search tree with N nodes?

ANSWER: $O(N)$

32. The following keys are inserted in a binary search tree 3, 6, 5, 1, 4, 7, 8. Which node is the deepest?

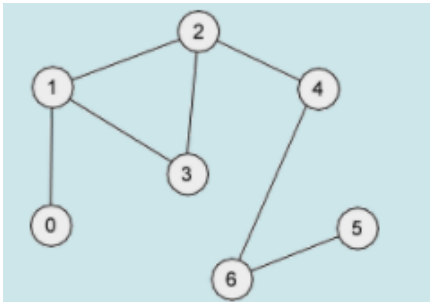
ANSWER: THERE ARE MORE THAN 1 NODE AT THE BIGGEST DEPTH

33. Select a valid breadth-first search order for the graph in the figure:



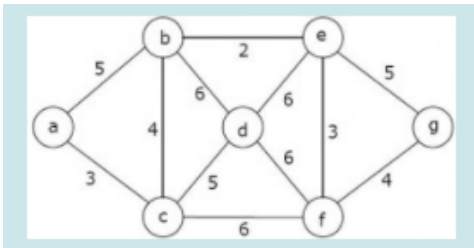
ANSWER: Q, M, N, P, R, O.

34. The number of articulation points in the graph below is:



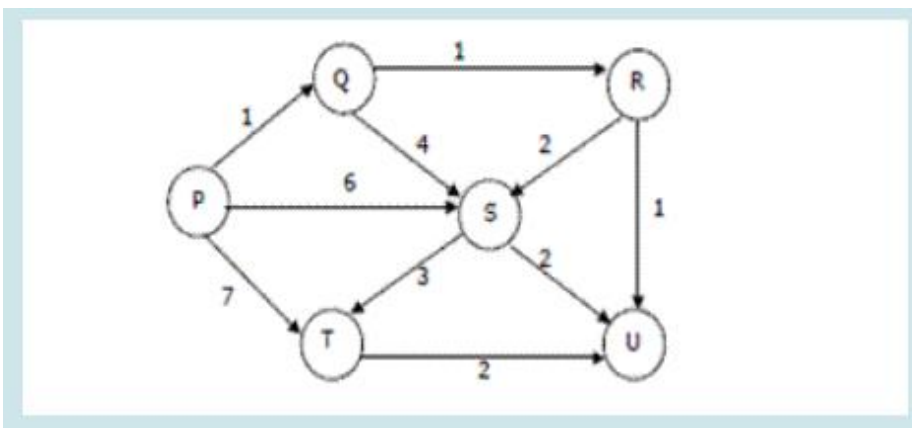
ANSWER: 4

35. For the graph depicted below, which one of the following can NOT be the sequence of edges added to the MST by Kruskal's algorithm.



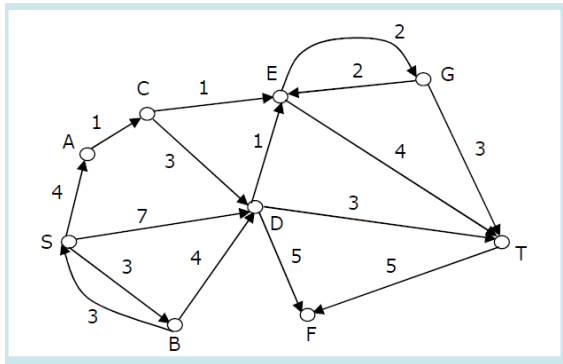
ANSWER: (B, E), (E, F), (B, C), (A, C), (F, G), (C, D)

36. Dijkstra's algorithm is executed on the graph depicted below, starting from node P. In which order does the algorithm finalize the computation of the shortest paths on all nodes?



ANSWER: P Q R U S T

37. For the graph in the figure below, which shortest path from S to T is the one found by running Dijkstra's algorithm? (assume that in any iteration, the shortest path to a node is updated only when a strictly shorter path to that node is discovered)



ANSWER: S A C E T