

Quiz-3 -ADA Rubrics

Q1. Let G be a simple undirected graph. Let T_d be a depth first search tree of G and T_b be a breadth first search tree of G .

Consider the following statements.

(I) For every edge (u,v) of G , if u is at depth i and v is at depth j in T_b , then $|i-j|=1$.

(II) No edge of G is a cross edge with respect to T_d .

Which of the statements above must necessarily be true?

- A. I only
- B. II only**
- C. Both I and II
- D. Neither I or II

Q2. Given the frequency of letters in a string as: B-1, C-6, A-5, D-3. Find the huffman code for character D.

- A. 11
- B. 100
- C. 0
- D. 101**

Q3. Let G be an undirected graph. Consider a depth-first traversal of G , where T is the depth-first search tree that results. Let u be the first new (unvisited) vertex visited in the traversal, and v be its first new (unvisited) vertex visited after u . Which of the assertions below is always true?

- (A) In G , u,v must be an edge, while in T , u is a descendent of v .
- (B) In G , u,v must be an edge, while in T , v is an ancestor of u .
- (C) If u,v in G is not an edge, then u in T is a leaf**
- (D) If u,v in G is not an edge, then u and v in T must have the same parent.

Q4. In Huffman Coding the code length does not depend on the frequency of occurrence of characters.

- a) True
- b) False**

Q5. Which of the following is/are the applications of MST ?

- i. Finding diameter of the graph
- ii. Finding bipartite graph
- iii. Telephone networks
- iv. Sudoku solver

- A. i and ii
- B. iii**
- C. iii and iv
- D. ii and iv

Q6. Breadth First Search(BFS) is started on a binary tree beginning from the root vertex. There is a vertex t at a distance five from the root. If t is the n -th vertex in this BFS traversal, then the maximum possible value of n is _____. (Consider root to be at distance 0)

- A. 63**
- B. 15
- C. 31
- D. 64

Q7. You are given a directed graph $G = (V, E)$ with edge lengths, and a source vertex s . However it is given that all the negative edges are outgoing from s . Say there is also no negative cycle. Then, running Dijkstra from s -

- A. Will always find the shortest path from s to all vertices reachable from s**
- B. Will find the shortest path from s to neighbors of s but not necessarily to other vertices
- C. Will find the shortest path from s to itself but not necessarily to other vertices
- D. None of the above

Q8. You are given an undirected graph $G = (V, E)$ with positive integer distinct edge lengths. Consider a minimum spanning tree (MST) T of G . Consider the shortest path P from a source vertex s to a destination vertex v . Now, suppose we decrease the length of every edge by 1. Then-

- A. T necessarily continues to be an MST and P necessarily continues to be a shortest path from s to v
- B. T necessarily continues to be an MST and P is not necessarily now a shortest path**
- C. T is not necessarily now an MST and P necessarily continues to be a shortest path
- D. None of the above

Q9. Read the following statements -

- I) Strongly connected components are not affected by reversal of all edges in terms of vertex reachability.
- II) Strongly connected components are not affected by reversal of all edges in terms of vertices reachability.

Which of the following statements is/are **correct**?

- A. I only
- B. II only
- C. Both I and II**
- D. Neither I or II

Q10. Read the following statements -

I) A DFS of a directed graph generally produces the exact number of edges of a tree, i.e., not dependent on the order in which vertices are considered for DFS.

II) If the finishing time $f[u] > f[v]$ of DFS for two vertices u and v in a graph G which is directed, and u and v are in the DFS tree same as each other in the DFS forest, then u is an ancestor of v in the depth-first tree.

Which of the following statements is/are **incorrect**?

- A. I only
- B. II only
- C. Both I and II
- D. Neither I or II

Q11. Read the following statements -

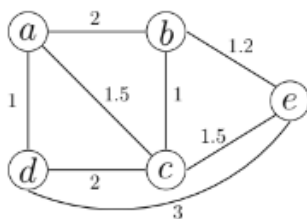
I) Consider an edge weighted undirected connected graph G such that all edge weights are positive and distinct. Let e^* be the edge with smallest weight in G . Then, G has a minimum spanning tree that does not contain the edge e^* .

II) Let G be a directed graph having $s, t \in V(G)$ and positive edge weights. Consider a longest simple path P (i.e. a path P with maximum total edge weight) from s to t in G . Let $u \in P$ be an internal vertex in this path P . Then, the subpath of P from s to u is the longest simple path from s to u in G .

Which of the following statements is/are **correct**?

- A. I only
- B. II only
- C. Both I and II
- D. Neither I or II

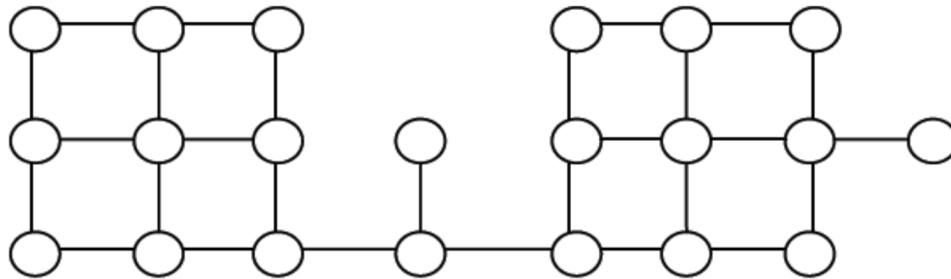
Q12. Consider the following undirected graph G



Which of the following edge(s) is/are necessarily in every MST of G ?

- A. ac, be
- B. ad, ce
- C. bc
- D. dc, eb

Q13. Suppose depth first search is executed on the graph below starting at some unknown vertex. Assume that a recursive call to visit a vertex is made only after first checking that the vertex has not been visited earlier. Then the maximum possible recursion depth (including the initial call) is _____.



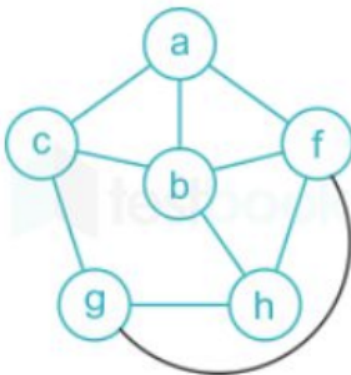
A. 16

B. 19

C. 17

D. 20

Q14. Consider the following graph:



For the above graph, the following sequences of DFS are given -

(A) abcghf

(B) abfchg

(C) abfhgc

(D) afghbc

Which of the following is correct ?

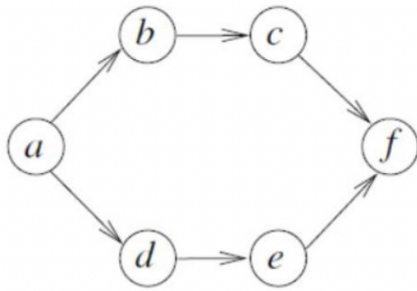
A. (A), (B), (D)

B. (A), (C), (D)

C. (B), (C), (D)

D. (A), (B), (C), (D)

Q15. Consider the following graph -



The number of different topological orderings of the vertices of the graph is:

- A. 4
- B. 5
- C. 6**
- D. 7