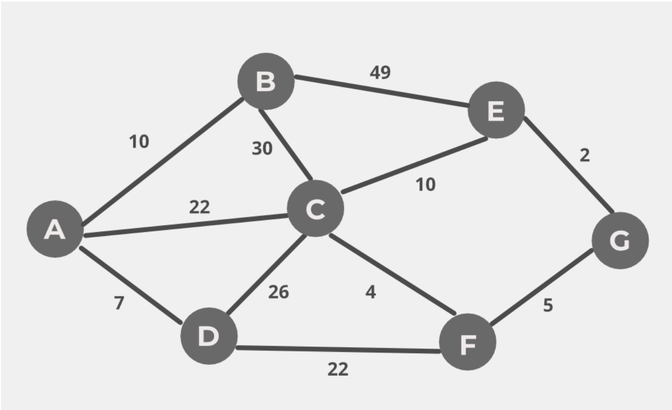
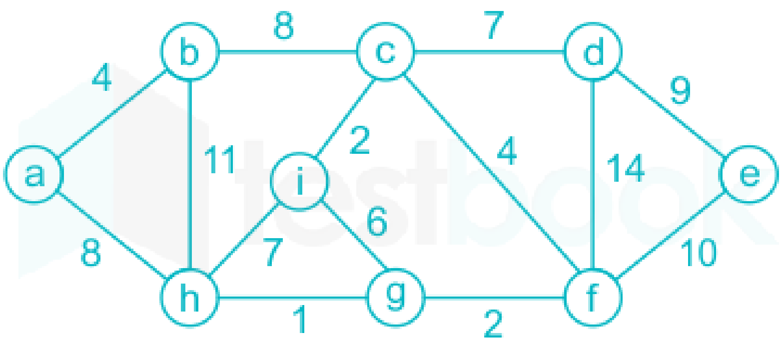
PRIMS ALGORITHM

Q1)



Using Prim’s algorithm to construct a minimum spanning tree starting with node A, which one of the following sequences of edges represents a possible order in which the edges would be added to construct the minimum spanning tree?
(A) (E, G), (C, F), (F, G), (A, D), (A, B), (A, C)
(B) (A, D), (A, B), (A, C), (C, F), (G, E), (F, G)
(C) (A, B), (A, D), (D, F), (F, G), (G, E), (F, C)
(D) (A, D), (A, B), (D, F), (F, C), (F, G), (G, E)
Answer: (D)
Explanation: A. False The idea behind Prim’s algorithm is to construct a spanning tree – means all vertices must be connected but here vertices are disconnected

Q2)



Using Prim's algorithm to construct a minimum spanning tree starting with node a, which one of the following sequences of edges represents a possible order in which the edges would be added to construct the minimum spanning tree?

The final sequence will be (a, b), (b, c), (c, i), (c, f), (f, g), (g, h), (c, d), (d, e) with a cost 37.

Q3) Worst case is the worst case time complexity of Prim’s algorithm if adjacency matrix is used?
a) O(log V)
b) $O(V^2)$
c) $O(E^2)$
d) O(V log E)
Answer: b

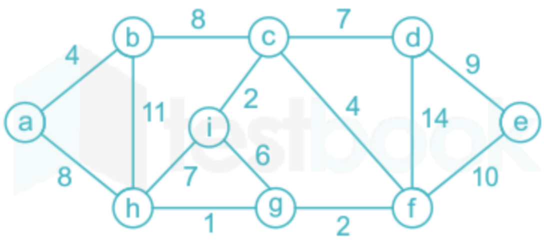
Q4) In Prim's algorithm, which data structure is commonly used to keep track of the minimum edge weights?

- A) Queue
- B) Stack
- C)Heap (Priority Queue)
- D) Array

Answer: C

Q5) Option 3 : (a, b), (b, c), (c, i), (c, f), (f, g), (g, h), (c, d), (d, ean

Consider the undirected graph below:

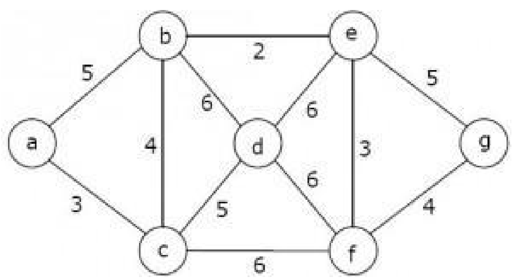


Using Prim's algorithm to construct a minimum spanning tree starting with node a, which one of the following sequences of edges represents a possible order in which the edges would be added to construct the minimum spanning tree?

1. (a, b), (b, h), (g, h), (f, g), (c, f), (c, i), (c, d), (d, e)
2. (a, b), (b, h), (g, h), (g, i), (c, i), (c, f), (c, d), (d, e)
3. (a, b), (b, c), (c, i), (c, f), (f, g), (g, h), (c, d), (d, e)
4. (a, b), (g, h), (g, f), (c, f), (c, i), (f, e), (b, c), (d, e)

Answer Option 3 : (a, b), (b, c), (c, i), (c, f), (f, g), (g, h), (c, d), (d, e)

Kruskal algorithm



Q) Which one of the following is NOT the sequence of edges added to the minimum spanning tree using Kruskal's algorithm?

a) (b,e)(e,f)(a,c)(b,c)(f,g)(c,d)
b) (b,e)(e,f)(a,c)(f,g)(b,c)(c,d)
c) (b,e)(a,c)(e,f)(b,c)(f,g)(c,d)
d) (b,e)(e,f)(b,c)(a,c)(f,g)(c,d)

Q)

Kruskal’s algorithm for finding a minimum spanning tree of a weighted graph G with n vertices and m edges has the time complexity of:

A. $O(n^2)$
B. $O(mn)$
C. $O(m+n)$
D. $O(m \log n)$
E. $O(m^2)$

Answer: B, D, E.

When Union- Find algorithm is used to detect cycle while constructing the MST time complexity is $O(m \log n)$ where m is the number of edges, and n is the number of vertices. Since $m = O\left(n^2\right)$ in a graph, options B and E are also correct as big-O specifies asymptotic upper bound only.

Q)

2. What is the main approach used in Kruskal’s algorithm?
   - A) Depth-First Search
   - B) Divide and Conquer
   - C) Greedy Method
   - D) Dynamic Programming

   Answer: C

Q)

Which of the following data structures is essential for efficiently implementing Kruskal's algorithm?

- A) Stack and Queue
- B) Hash Map
- C) Priority Queue and Disjoint Set (Union-Find)
- D) Linked List and **Stack**

  Answer: C

Q)

If a graph has multiple minimum spanning trees, how does Kruskal’s algorithm handle this situation?

- A) It finds all possible MSTs.
- B) It finds one of the possible MSTs.
- C) It fails to execute if there are multiple MSTs.
- D) It generates the MST with the maximum weight.

  Answer: B

DJIKSTRA ALGORITHM

1. Dijkstra's algorithm is primarily used to find:
   - A) The minimum spanning tree of a graph
   - B) The shortest path from a single source to all other nodes in a weighted graph
   - C) All pairs shortest paths

- D) The longest path in a directed acyclic graph
  Answer: B

2. Which data structure is most commonly used to implement Dijkstra’s algorithm efficiently?
   - A) Stack
   - B) Queue
   - C) Priority Queue (Min-Heap)
   - D) Linked List
   Answer: C

3. What is the time complexity of Dijkstra’s algorithm when using a priority queue (Min-Heap) and an adjacency list representation of a graph with VV vertices and EE edges?
   - A) O(V2)O(V2)
   - B) O(V+ElogV)O(V+ElogV)
   - C) O(ElogV)O(ElogV)
   - D) O(VlogV)O(VlogV)
   Answer: C

4. In Dijkstra’s algorithm, once a node has been marked as “visited,”
   - A) Its shortest path from the source is finalized.
   - B) It might still get updated if a shorter path is found.
   - C) It is removed from the graph.
   - D) It remains in the unvisited set.
   Answer: A

5. Which of the following is NOT a property of Dijkstra's algorithm?
   - A) It only works for graphs with non-negative weights.
   - B) It can handle both directed and undirected graphs.
   - C) It can detect negative weight cycles.
   - D) It finds the shortest path in terms of the total weight of edges.
   Answer: C