

## Lecture 15-minimum spanning trees

1. What is a minimum spanning tree (MST)?

- a) A tree with the least number of edges
- b) A subgraph that is both a tree and includes all vertices with minimum total edge weight
- c) The shortest path between any two vertices
- d) A tree with the maximum number of edges

Answer: b

2. Which of the following is NOT a characteristic of a spanning tree?

- a) Connected
- b) Acyclic
- c) Includes all vertices
- d) Contains loops

Answer: d

3. What is the main goal when finding a minimum spanning tree?

- a) Maximize the number of edges
- b) Minimize the number of vertices
- c) Find the shortest path between two vertices
- d) Minimize the total weight of edges

Answer: d

4. Which of these is an application of minimum spanning trees?

- a) Social network analysis
- b) Laying cable in a new neighborhood
- c) Sorting algorithms
- d) Database indexing

Answer: b

5. What is the first step in Kruskal's algorithm?

- a) Start with a random vertex
- b) Consider edges in descending order of weight
- c) Consider edges in ascending order of weight
- d) Add all edges to the tree

Answer: c

6. In Kruskal's algorithm, when is an edge NOT added to the tree?

- a) When it creates a cycle
- b) When it's the heaviest edge
- c) When it's already in the tree
- d) When it connects two different components

Answer: a

7. How many edges does Prim's algorithm add to create the MST?

- a)  $V$
- b)  $V - 1$
- c)  $E$
- d)  $E - 1$

Answer: b

8. What is a key similarity between Dijkstra's algorithm and Prim's algorithm?

- a) They both find the shortest path
- b) They both use a greedy approach
- c) They both require negative edge weights
- d) They both produce a maximum spanning tree

Answer: b

9. What is a fundamental difference between Dijkstra's and Prim's algorithms?

- a) Dijkstra's uses a priority queue, while Prim's doesn't
- b) Prim's works on undirected graphs, while Dijkstra's doesn't
- c) Dijkstra's finds shortest paths, while Prim's constructs a minimum spanning tree
- d) Prim's is faster than Dijkstra's

Answer: c

10. In Dijkstra's algorithm, how is the distance to a vertex updated?

- a) By adding the weight of the new edge
- b) By subtracting the weight of the new edge
- c) By relaxing to the sum of the edge weight plus the distance to the previous vertex if smaller
- d) By choosing the maximum of the current distance and the new path distance

Answer: c

11. In Prim's algorithm, how is the next vertex chosen?

- a) The vertex with the highest degree
- b) The vertex with the lowest degree
- c) The vertex with the minimum weight edge connecting it to the MST
- d) The vertex farthest from the starting point

Answer: c

12. What property of a graph ensures that a minimum spanning tree exists?

- a) The graph must be directed
- b) The graph must be connected
- c) The graph must have negative edge weights
- d) The graph must be acyclic

Answer: b

13. In the context of MST, what does "greedy" mean?

- a) The algorithm always chooses the largest possible solution
- b) The algorithm makes the locally optimal choice at each step
- c) The algorithm requires the most computational resources

d) The algorithm only works on complete graphs

Answer: b