##  Lecture 11-shortest paths

1. What is the main focus of this lecture?
a) Sorting algorithms
b) Shortest paths problems
c) Graph coloring
d) Maximum flow
Answer: b) Shortest paths problems
2. Which of the following is NOT a variant of the shortest path problem mentioned?
a) Single source
b) Source-sink
c) All pairs
d) Minimum spanning tree
Answer: d) Minimum spanning tree
3. What data structure is used to implement the edge-weighted digraph in the lecture?
a) Matrix
b) Linked list
c) Adjacency list
d) Hash table
Answer: c) Adjacency list
4. In the DirectedEdge class, what method returns the weight of the edge?
a) getWeight()
b) weight()
c) edgeWeight()
d) getEdgeWeight()
Answer: b) weight()
5. What is the purpose of the EdgeWeightedDigraph class?
a) To represent individual edges
b) To represent the entire graph structure
c) To find shortest paths
d) To implement Dijkstra's algorithm
Answer: b) To represent the entire graph structure
6. What data structure is used to represent the shortest-paths tree (SPT) solution?
a) A single array
b) A linked list
c) Two vertex-indexed arrays
d) A binary tree
Answer: c) Two vertex-indexed arrays
7. What does the distTo[] array in the SPT representation contain?
a) The number of edges in the shortest path
b) The length of the shortest path
c) The vertices in the shortest path
d) The edges in the shortest path
Answer: b) The length of the shortest path
8. What is edge relaxation?
a) Removing an edge from the graph
b) Adding a new edge to the graph
c) Updating the shortest known path if a better one is found
d) Changing the weight of an edge
Answer: c) Updating the shortest known path if a better one is found
9. Which of the following is NOT mentioned as an efficient implementation of the generic shortest-paths algorithm?
a) Dijkstra's algorithm
b) Topological sort algorithm
c) Bellman-Ford algorithm
d) Prim's algorithm
Answer: d) Prim's algorithm
10. What is a requirement for Dijkstra's algorithm to work correctly?
a) The graph must be acyclic
b) Edge weights must be nonnegative
c) The graph must be undirected
d) There must be no negative cycles
Answer: b) Edge weights must be nonnegative
11. In Dijkstra's algorithm, how are vertices chosen to be added to the tree?
a) Randomly
b) In alphabetical order
c) In increasing order of distance from the source
d) In decreasing order of distance from the source
Answer: c) In increasing order of distance from the source
12. What type of graph is required for the topological sort algorithm to work for shortest paths?
a) Any graph
b) Undirected graph
c) Edge-weighted DAG
d) Graph with negative cycles
Answer: c) Edge-weighted DAG
13. Can the topological sort algorithm for shortest paths handle negative edge weights?
a) Yes
b) No
c) Only in certain cases
d) The lecture doesn't specify
Answer: a) Yes
14. How is the longest path problem in a DAG solved?
a) By using a separate algorithm
b) By negating all weights and finding the shortest path
c) It cannot be solved efficiently
d) By using Dijkstra's algorithm
Answer: b) By negating all weights and finding the shortest path
15. What is the Critical Path Method used for?
a) Finding the shortest path in any graph
b) Solving the parallel job scheduling problem
c) Implementing Dijkstra's algorithm
d) Detecting negative cycles
Answer: b) Solving the parallel job scheduling problem
16. Why doesn't Dijkstra's algorithm work with negative edge weights?
a) It causes an infinite loop
b) It may not consider all possible paths
c) It violates the triangle inequality
d) It requires more memory
Answer: b) It may not consider all possible paths
17. What is a negative cycle?
a) A cycle where all edges have negative weights
b) A directed cycle whose sum of edge weights is negative
c) A cycle that cannot be reached from the source
d) A cycle that makes the graph disconnected
Answer: b) A directed cycle whose sum of edge weights is negative
18. Under what condition does a shortest-paths tree (SPT) exist?
a) Always
b) Only in DAGs
c) If there are no negative cycles
d) If all edge weights are positive
Answer: c) If there are no negative cycles
19. How many times does the Bellman-Ford algorithm repeat its main loop?
a) V times
b) E times
c) V-1 times
d) E-1 times
Answer: c) V-1 times
20. According to the lecture, which factor makes the shortest path problem intractable?
a) Directed cycles
b) Negative weights
c) Negative cycles
d) Large number of edges
Answer: c) Negative cycles