

CS 2501: DSA2 Quiz Booklet

Name _____

This booklet contains question pools for the quizzes for this course. You should use this resource to study potential questions that will be asked on the quizzes.

There are 3 pages to this quiz booklet.

*A crash reduces
Your expensive computer
To a simple stone.*

Graphs - Basic

Short Answer Questions

1. Given an undirected graph with V nodes (no loops allowed). What is the maximum number of edges the graph can have?
2. Given a directed graph with V nodes (no loops allowed). What is the maximum number of edges the graph can have?
3. Name one advantage and one disadvantage of storing a graph as an adjacency matrix.
4. Name one advantage and one disadvantage of storing a graph as an adjacency list.
5. Describe one way we can handle storing costs of graph edges. Make sure to answer for an adjacency list AND an adjacency matrix.
6. Does breadth-first search always find the shortest path between two nodes for an undirected, unweighted graph?
7. Which has better time-complexity? BFS or DFS?
8. Which has better space-complexity? BFS or DFS?
9. What is the run-time of BFS? Explain your answer.
10. What is the run-time of DFS? Explain your answer.
11. Briefly describe how you might use DFS to count the number of disconnected components (disconnected sub-graphs) in a graph.
12. What is the run-time of topological sort?
13. What is the run-time of Dijkstra's Algorithm?
14. Dijkstra's Algorithm may not work if given negative cost edges. Provide a counter-example to illustrate this.

Coding Questions

1. Pseudo-code a method that performs a breadth-first search on a graph. Assume each node stores a number num. Print out each num as you visit each node.
2. Pseudo-code a method that performs a depth-first search on a graph. Assume each node stores a number num. Print out each num as you visit each node.
3. Pseudo-code the topological sort algorithm.
4. Pseudo-code Dijkstra's Algorithm.

Graphs - Advanced

Short Answer Questions

1. Given a flow network and current flow values, produce the residual graph. A network to use will be drawn on the board.
2. When discussing flow networks, what is backflow? Explain why it is necessary.
3. Describe how the Ford-Fulkerson algorithm uses depth-first search. What purpose does it serve? Why not use breadth-first search?
4. What is the run-time of the Ford-Fulkerson Algorithm? Explain your answer.
5. Define the following terms regarding flow networks: Cut, capacity of a cut, and net-flow of a cut.
6. What does the max-flow, min-cut theorem state? What does this say about algorithms for the two problems?
7. What is a reduction? Why is it useful when comparing algorithms?

Coding Questions

1. Psuedo-code the Ford-Fulkerson Algorithm.
2. Prove the flow-value lemma: The the net-flow across any cut is always equal to the flow f
3. Psuedo-code an algorithm that solves the Bipartite matching problem.
4. Describe how you would solve for the maximum-flow of a network that has multiple sources and multiple sinks.