PRACTICE EXAM

Difficulty: MEDIUM

Questions: 10

Algorithm Analysis Exam - Medium Difficulty

Instructions: Please answer all questions to the best of your ability. Show your work where applicable.

Section 1: Multiple Choice Questions (4 points each, 40 points total)

Instructions: Choose the best answer for each question and indicate your choice (A, B, C, or D).

Question 1: What is the time complexity of Insertion Sort in the worst-case scenario?
A) O(n)
B) O(log n)
C) O(n^2)
D) O(n log n)

Question 2: In the provided Bellman-Ford algorithm example, after relaxing vertex A, what is the updated distance to vertex B (d[B])?
A) 2
B) 5
C) 6
D) 9

Question 3: Based on the recursion tree method, what is the approximate time complexity of T(n) = T(n-1) + lg(n)?
A) O(lg n)
B) O(n)
C) O(n lg n)
D) O(n^2)

Question 4: In the example of merging two sorted arrays, what are some of the initial values in the arrays?
A) Both arrays start with 12 and 20
B) The first array is in descending order.
C) One array contains 1, 2, 7, 9, 11
D) One array contains 12 and 20 repeated.

Section 2: Short Answer Questions (6 points each, 30 points total)

Instructions: Answer each question in 2-3 sentences.

Question 5: Briefly describe how Insertion Sort works.

Question 6: Explain the purpose of relaxing an edge in the context of the Bellman-Ford algorithm.

Question 7: Explain what substitution method is used for and what the general approach is.

Section 3: Problem-Solving Questions (10 points each, 30 points total)

Instructions: Provide detailed solutions and justifications for each problem.

Question 8: Given the initial array [9, 8, 2, 4, 9, 3, 6], trace the first three iterations (j=2, j=3, j=4) of the outer loop of the Insertion Sort algorithm. Show the state of the array after each iteration.

Question 9: In the provided Bellman-Ford algorithm example, assume that the edge weight between nodes C and D has been changed to -10. How would it affect the distances to all the other nodes?