Name: _____ **Date:** _____

Wrangle Algorithmic Complexity: Your Senior-Level CS Challenge

Synthesize advanced data structures and evaluate amortized cost analysis during this rigorous review of non-linear problem-solving strategies.

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1. When designing a memory-efficient system for an autocomplete feature on a mobile device, which data structure provides the best balance of prefix search speed and space optimization compared to a standard Hash Map?

A. Adjacency Matrix
B. Compressed Trie (Radix Tree)
C. Splay Tree
D. Red-Black Tree

2. In the context of the Master Theorem, if the work done at the root of a recursive sub-problem grows significantly faster than the work done by the leaves, the overall complexity is dominated by the cost of the initial split/combine step.

A. True
B. False

3. During the synthesis of a network routing protocol, you decide to use Dijkstra's algorithm. To achieve an optimal time complexity of O(E + V log V), you must implement the priority queue using a _____.

A. Binary Heap
B. Fibonacci Heap
C. Balanced BST
D. Circular Linked List

4. Which algorithmic design paradigm is most appropriate for a problem that exhibits both 'optimal substructure' and 'overlapping subproblems' but does not necessarily satisfy the 'greedy choice property'?

A. Divide and Conquer
B. Greedy Approximation
C. Dynamic Programming
D. Backtracking

5. Consider the Ford-Fulkerson method for finding maximum flow. The efficiency of the implementation depends heavily on the choice of the path-finding strategy. Using Breadth-First Search (BFS) transforms it into the _____ algorithm.

A. Bellman-Ford
B. Edmonds-Karp
C. Prim's
D. Kruskal's

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6. Adding a heuristic to a Uniform Cost Search consistently guarantees that the search will explore fewer nodes, regardless of whether the heuristic is admissible or consistent.

A. True
B. False

7. In a distributed system where you need to check if a specific element exists across massive datasets with limited memory and can tolerate a small percentage of false positives, which would you implement?

A. B-Tree
B. Skip List
C. Bloom Filter
D. AVL Tree

8. When solving the 'All-Pairs Shortest Path' problem on a graph that may contain negative edge weights (provided there are no negative cycles), the most robust algorithm to apply is _____.

A. Dijkstra's
B. Floyd-Warshall
C. A* Search
D. Depth-First Search

9. NP-Complete problems are a subset of NP-Hard problems that can be solved in polynomial time if any other NP-Complete problem is also solved in polynomial time.

A. True
B. False

10. You are tasked with optimizing a recursive algorithm that evaluates game states in Chess. To prune the search tree without affecting the final result, which technique is most effective?

A. Memoization
B. Alpha-Beta Pruning
C. Tabulation
D. Linear Probing