Name: _____ **Date:** _____

Abstract Algorithmic Architectures: College Coding Challenges

Formulate optimized logic and analyze asymptotic complexity by applying advanced decomposition strategies to real-word computational constraints.

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1. When designing a content delivery network (CDN), which algorithmic strategy is most effective for selecting the optimal server node to minimize latency for a specific geographically distributed user?

A. Linear search across all global IP addresses
B. Anycast routing combined with a Greedy heuristic
C. Brute-force permutation of all network paths
D. A standard FIFO queue of incoming requests

2. In the context of problem decomposition, 'Bottom-Up' design focuses on building higher-level systems from the base primitive components first.

A. True
B. False

3. A developer is optimizing a social network's 'mutual friends' feature. If the current $O(n^2)$ approach is too slow, implementing a _____ can reduce lookup time to O(1) on average.

A. Linked List
B. Binary Search Tree
C. Hash Set
D. Adjacency Matrix

4. Consider the scheduling of tasks on a single CPU to minimize the average waiting time. Which algorithmic approach is mathematically proven to provide the optimal solution for this problem?

A. First-Come, First-Served (FCFS)
B. Shortest Job First (SJF)
C. Round Robin (RR)
D. Longest Processing Time (LPT)

5. An algorithm that is 'stable' is one that preserves the relative order of records with equal keys after a sorting operation.

A. True
B. False

6. You are analyzing the efficiency of a recursive algorithm. If the recurrence relation is T(n) = T(n-1) + n, what is the resulting Big O time complexity?

A. O(log n)
B. O(n)
C. O(n log n)

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D. $O(n^2)$

7. When debugging a distributed system where components fail independently, designers use _____ to ensure that the algorithm eventually reaches a consistent state across all nodes.

A. Binary Logic
B. Consensus Protocols
C. Quick Sort
D. Linear Regression

8. In the context of space-time trade-offs, what is the primary disadvantage of using Dynamic Programming with a memoization table?

A. Increased runtime for all inputs
B. Higher memory consumption
C. Reduced accuracy of the solution
D. Loss of recursive structure

9. The 'P vs NP' problem asks whether every problem whose solution can be quickly verified can also be quickly solved.

A. True
B. False

10. An algorithm that explores all possible paths in a graph by going as far as possible along each branch before backtracking is known as a _____ search.

A. Breadth-First
B. Depth-First
C. Dijkstra
D. Binary