Name: _____ **Date:** _____

Answer Key: Debug the Digital Maze: Algorithms for 8th Grade Solvers

Calculate time complexity and apply divide-and-conquer strategies used by software engineers to optimize search systems and network routing.

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1. When designing a system for a logistics company to find the shortest delivery route between twenty cities, which algorithmic approach is most effective for breaking the large map into smaller sections?

Answer: B) Problem decomposition

Problem decomposition involves breaking a complex task, like a multi-city route, into smaller, manageable sub-problems like individual stop-to-stop distances.

2. A search algorithm that checks every single item in an unsorted list one by one is considered more efficient than a search that eliminates half the data at each step.

Answer: B) False

Linear searches are less efficient (O(n)) than algorithms like binary search (O(log n)) which use a divide-and-conquer strategy to find data faster.

3. In the context of algorithm efficiency, the measure of how the running time or memory usage increases as the input size grows is known as _____.

Answer: A) Time Complexity

Time complexity (often expressed in Big O notation) describes the efficiency of an algorithm relative to the size of the input data.

4. If an engineer is 'dry running' a new sorting algorithm by hand with a small sample set of data before writing code, which stage of problem-solving are they practicing?

Answer: C) Algorithm verification

Algorithm verification or testing involves checking the logic of the steps to ensure they produce the correct output for various inputs.

5. A social media platform needs to recommend friends. They use an algorithm that looks at 'friends of friends.' If the algorithm fails to stop and loops forever, what is likely missing?

Answer: A) A base case or termination condition

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Every iterative or recursive algorithm needs a termination condition (base case) to prevent infinite loops and ensure it eventually stops.

6. Heuristics are 'rules of thumb' that help find a 'good enough' solution to a problem quickly when an exact optimal solution would take too much time to calculate.

Answer: A) True

Heuristics are practical approaches to problem-solving that trade accuracy or perfection for speed and efficiency.

7. When a programmer finds a logical error that causes a weather app to report 'Sunny' during a blizzard, the process of finding and fixing this error is called _____.

Answer: B) Debugging

Debugging is the systematic process of identifying, tracing, and fixing errors (bugs) within a computer program or algorithm.

8. You are building a game where an NPC (non-player character) must find the player in a 3D building. Which concept are you using when you define the specific steps the NPC takes to turn corners and open doors?

Answer: B) Algorithm design

Algorithm design is the creation of the specific, logical sequence of steps needed to solve a problem, such as navigation in a game.

9. Pseudocode is a high-level description of an algorithm that uses the structural conventions of programming languages but is intended for human reading rather than machine execution.

Answer: A) True

Pseudocode allows developers to focus on the logic and flow of the algorithm without worrying about the specific syntax of a computer language.

10. An algorithm that solves a problem by breaking it into identical sub-problems and calling itself to solve them is using a technique called _____.

Answer: B) Recursion

Recursion is a fundamental computer science concept where a function calls itself to solve smaller instances of the same problem.