OPIFUDRIRA TIMOTHY

S23B23/086

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Assignment for Design and Analysis of Algorithms

1.1-1: Real-world examples

Sorting example: Imagine you're a chef preparing a meal for a large event. You might need to sort your ingredients by their cooking times to ensure everything is ready to serve at the same time. By organizing them from the longest to the shortest cooking times, you can streamline your workflow and create a perfectly timed dish.

1.1-2: Other measures of efficiency

- **Memory usage:** When working with large databases, it's crucial to monitor how much memory an algorithm utilizes to avoid crashes and slowdowns.
- **Scalability:** Evaluate how well the algorithm performs as data size increases—this is especially important for web applications with growing user bases.
- **Power consumption:** In mobile apps, optimizing for lower energy use can extend battery life significantly, which is essential for user satisfaction.
- **Ease of implementation and maintenance:** An efficient algorithm should not only perform well but also be straightforward to implement and easy to debug.

1.1-3: Data structure example

Arrays:

- **Strengths:** Arrays allow for fast access to elements by index and are efficient for storing fixed-size datasets.
- **Limitations:** Inserting or deleting elements can be time-consuming due to the need to shift other elements. Their static size can also be limiting when flexibility is required.

1.1-4: Similarities and differences between shortest-path and traveling-salesperson problems

- **Similarities:** Both problems aim to minimize total distance or cost between points and involve evaluating multiple paths to find the optimal one.
- **Differences:** The shortest-path problem seeks the minimum route between two specific locations, while the traveling salesperson problem (TSP)

involves visiting multiple locations exactly once and returning to the starting point. TSP is more complex due to its requirement to visit all points.

1.1-5: Real-world problem examples

- **Best solution required:** A fire department might use algorithms to prioritize responses based on the severity and location of incidents. The most critical emergencies must be addressed first for optimal outcomes.
- **Approximate solution acceptable:** When encoding images for social media, slight quality loss is acceptable to significantly reduce file size, balancing quality and upload speed.

1.1-6: Problem where input availability varies

- **Available input:** Planning a wedding requires all details (venue, guest list, schedule) to be known in advance, allowing for thorough preparation.
- **Unavailable input:** A ride-sharing service must adapt to new ride requests in real-time, as passengers may request rides while drivers are already en route, requiring dynamic route adjustments.