

Randomized Algorithms

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1. Definition

- Algorithms that use random numbers as part of their logic to make decisions, often improving average-case performance or simplifying implementation.

2. Las Vegas Algorithms

- Always produce a correct result, but their running time is random (e.g., randomized Quick Sort with random pivot selection).

3. Monte Carlo Algorithms

- Have a fixed running time but a small probability of producing an incorrect result (e.g., the Miller-Rabin primality test).

4. Why Use Randomization?

- Can avoid worst-case scenarios that deterministic algorithms are vulnerable to, and often simplifies algorithm design for complex problems.

5. Classic Examples

- Randomized Quick Sort, the Miller-Rabin primality test, and randomized algorithms for approximate counting and load balancing.

6. Trade-offs

- Randomized algorithms trade a (usually very small) chance of error or variable runtime for simpler design or better average-case performance.