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Text Book:
Introduction to the Design and Analysis of Algorithms
Author: Anany Levitin
2nd Edition

Important Problem Types

- sorting
- searching
- string processing
- graph problems
- combinatorial problems
- geometric problems
- numerical problems

Sorting

The sorting problem is to rearrange the elements of a given list in non-decreasing (ascending) or decreasing order (descending) order.

- Examples of sorting algorithms
    - Selection sort
    - Bubble sort
    - Insertion sort
    - Merge sort
    - Heap sort …

Number of key comparisons is used to determine time complexity of sorting algorithms

Two properties related to sorting algorithms

- Stability: A sorting algorithm is called stable if it preserves the relative order of any two equal elements in its input.

- In place: A sorting algorithm is in place if it does not require extra memory, except, possibly for a few memory units.

Searching

Find a given value, called a search key, in a given set.

Examples of searching algorithms

- Sequential searching
- Binary searching…

String Matching

A string is a sequence of characters from an alphabet.

Text strings: letters, numbers, and special characters.

String matching: searching for a given word/pattern in a text.

Text: I am a computer science graduate

Pattern: computer

Graph problems

A graph is a collection of points called vertices and edges

Examples of graph problems are graph traversal, traveling salesman problem, shortest path algorithm, topological sort,and the graph-coloring problem

Combinatorial problems

These are problems for which it is required to generate permutations, a combinations, or a subset that satisfies certain constraints.

A desired combinatorial object may have an associated cost that needs to be minimized or maximized

In practical, the combinatorial problems are the most difficult problems in computing.

The traveling salesman problem and the graph coloring problem are examples of combinatorial problems.

Geometric problems

Geometric algorithms deal with geometric objects such as points, lines, and polygons.

Geometric algorithms are used in computer graphics, robotics etc.

Examples: closest-pair problem and the convex-hull problem

Numerical problems

Numerical problems are problems that involve computing definite integrals, evaluating functions, mathematical equations, systems of equations, and so on.