

ADA

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Task: 1

Algorithm Design Paradigm

Divide - and - Conquer Algorithm:

Divide and conquer used to solve many problems in computer science

- Different ^{than} other algorithm:

- 1) The problem is divided into distinct independent subproblems
- 2) The subproblem are solved separately
- 3) The solution to the subproblem are merged together to obtain solution to main problem.

- Applications

- Quick Sort • Merge Sort • Binary Sort
- Multiplication of large integer
- Common Application areas (Problems)

1- Sorting: Sorting algorithm like Quick sort, mergesort and heap sort use the divide and conquer approach to sort arrays of element.

2- Searching: Binary search is a divide and conquer algo used to search for specific element in sorted array

3 Matrix Multiplication 4 - Closest Pair problem

- Most widely Used Algorithm

- Quick sort

- Merge Sort

- Binary Search

Strassen Algorithm

Advantages and Disadvantages

• Reduce the problem size which reduces

The amount of work required to solve problem
2. More efficient than other algorithm

Disadvantage:

- Difficult to implement and debug because it is implemented using recursive function calls, which is not supported by some programming language

- Utilize computer's memory called heap which may not available on some system.

- It is inefficient when subproblem are not of nearly equal size.

Greedy Algorithm:

Difference: Greedy Algorithm are different from other algorithm in that they make local optimal choices at each step with the hope of finding a global optimum. The key difference between greedy algorithm and other algorithm is that it makes decision based on the current best option without considering the consequences of those decision in the future.

Application:

- Minimum labelling in network
- Shortest route in network
- Huffman coding • optimum job scheduling

Problems:

- It may not always find the optimal solution

Greedy Algorithm may get stuck in local optima.

Greedy Algorithm may be difficult to design
Mostly Used Algorithm.

1- Dijkstra's Algorithm

2) Prim's Algorithm

3- Kruskal Algorithm

4) Huffman Coding.

Advantages.

- Simple to understand & implement

- Efficient in terms of time and space complexity

- Greedy algo can provide good approximation solution to optimization problems

Disadvantages

- Does not always produce global optimal solution (Traveling Salesman)

- Further analysis required

- Requires supplementary data structure such as priority queue

Backtracking algorithm

Difference: is used to construct a feasible solution by making selection from large set of choices. Each subset of choices correspond to a partial solution

Application

n-queen problem

- Playing game.

- sum of subset problem

- Map coloring problem

- Hamiltonian Circuit

Traveling Salesman

Advantages

- Flexibility

- Optimality

- Memory

efficiency

Easy to understand

Disadvantages

- Exponential time complexity
- Analysis of backtracking is difficult
- Implementation depend on ~~search~~ searching method
- Problem difficult finding optimal solution

Dynamic Programming

Difference

- partition problem is partition m
- overlapping subproblem - stored in table
- partition to lowest level
- bottom up fashion

Application

- Shortest path in Network
- Largest Common Sequence
- Matrix chain multiplication

Advantages

- Optimal substructure - Overlapping subproblem

Time Complexity

- Good for approximation

Disadvantages

- Memory usage
- Difficult in defining subproblem

widely used;

Knapsack problem, Longest common subsequence
matrix chain multiplication

Brute force Algorithm

Difference

- explore all possibilities
- if examines all feasible solution one by one and return the one that has min (or max) associated cost
- In search problem it carries all possible comparison of given key with problem data items

Applications:

- Simple sorting
- Selection sort
- bubble sort
- Shell sort
- String Matching

Exhaustive search

Advantages

- Simple and easy to understand
- Guaranteed to find optimal solution
- No prior knowledge of problem required

Disadvantages

- Exponential time complexity
- High memory usage
- Inefficient for some problems such as
widely used string matching, subset sum problem, Traveling

Approximation Algorithm

Difference

- Designed to obtain suboptimal solution

Reasonable close to optimal solution

Application.

- Hamiltonian Circuit
- Graph clique problem
- Traveling Sales person
- Sub-Subset problem

Advantages

- Fast runtime
- Widely applicable
- Guarantee performance

Disadvantages

- Quality of solution
- Limited accuracy
- Difficult in analysis
- Limited guarantee