C, C++, DSA in depth

# Types of Algorithms

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# Agenda

1. Algorithms
2. Types of Algorithms

# Algorithms

An algorithm is a step by step procedure to solve a programming problem.

Time and space are two major factors in deciding about the efficiency of an algorithm to accomplish a task.

Different types of problems require different types of algorithmic techniques to be solved in the most optimized manner.

# Types of algorithms

## 1. Brute Force Algorithm

exploring every possibility available

example

① Finding height of the tree

② Find 4 digit pin number

# 2. Recursive Algorithms

A problem is solved by breaking it into sub-problems of the same type and calling itself again and again until a base case reached.

Example

1. Factorial
2. Fibonacci
3. Binary Search
4. Quick sort
5. Merge sort

Recursive approach can be further categorized as:

a. Divide and Conquer

In this approach problem is solved in two steps. In the first step, problem is divided into smaller chunks of subproblems of same type. In the second step, each smaller sub problem is solved and combine the results of subproblems.

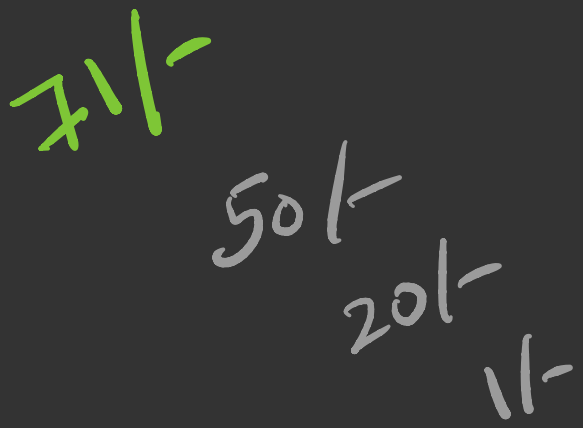
example: Quicksort, binary search, merge sort

# b. Greedy Algorithm

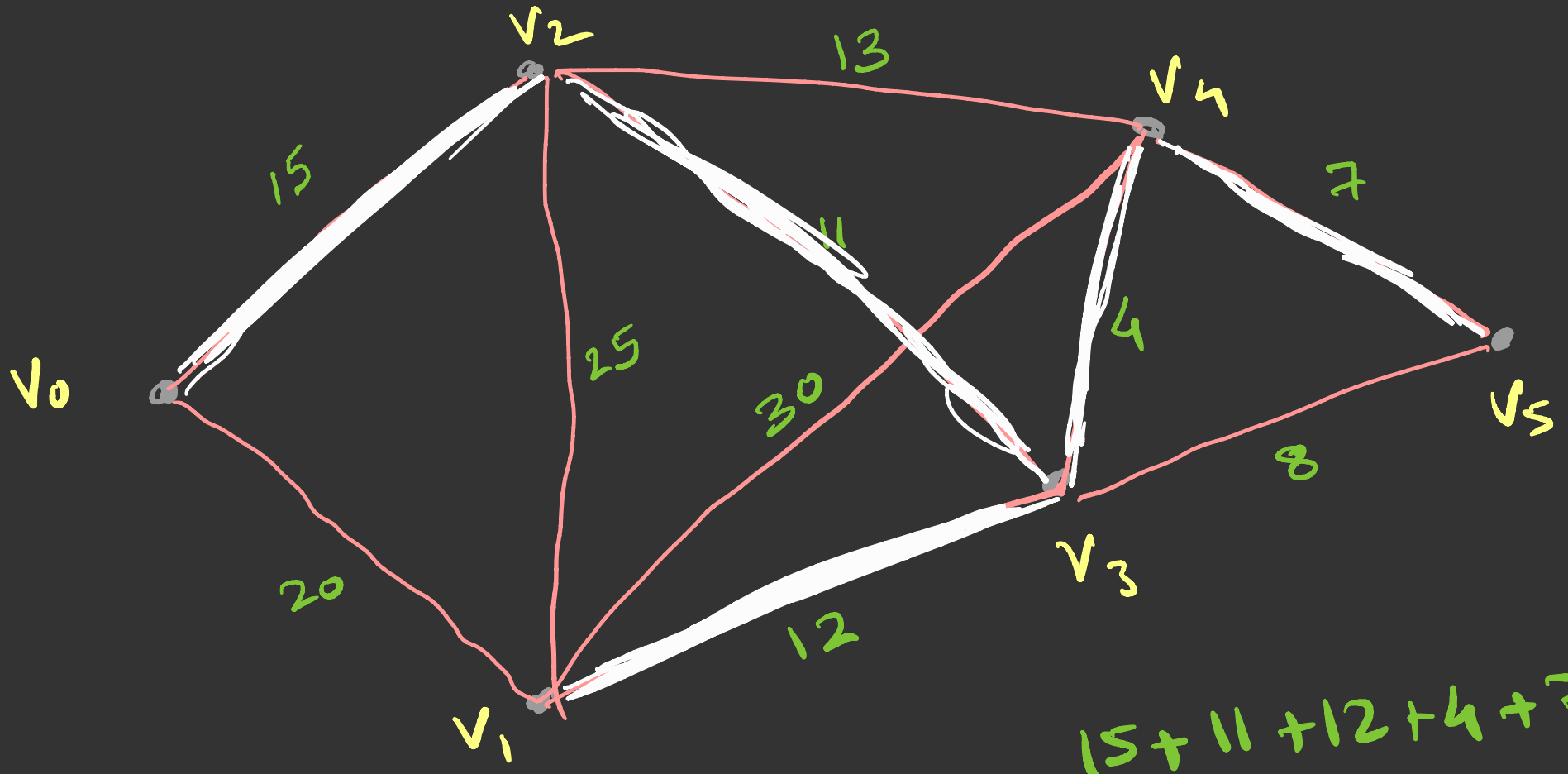
It works in stages. In each stage, a decision is made that is good at that point without bothering about the future consequences. It assumes the local good selection makes the global optimal solution.

Example:

1. prims
2. Kruskal
3. Coin change



$e = \{4, 7, 8, 11, 12, 13, 15, 20, 25, 30\}$




$15 + 11 + 12 + 4 + 7$

$= 49$

$V_0\ V_1\ V_2\ V_3\ V_4\ V_5$

# C. Dynamic Programming

The main idea is to store the previously calculated result to avoid calculating it again and again.

example

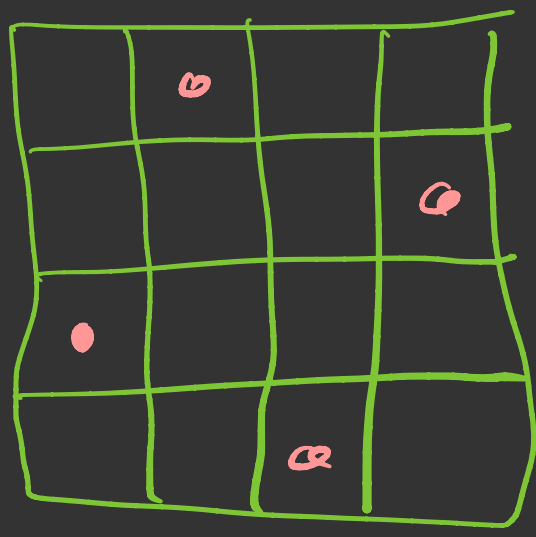
1. Fibonacci
2. knapsack problem
3. factorial
4. Travelling Salseman

# d. Backtracking Algorithm

Exploring all the possibilities using recursion, building a set of solutions **incrementally**. Problem would have constraints, the solutions that fail to satisfy them will be removed.

Example

1. N Queen problem
2. Rat in Maze problem



③ Hashing Algorithm

④ Linear programming