Backtracking Algorithm

In this tutorial, you will learn what a backtracking algorithm is. Also, you will find an example of a backtracking approach.

A backtracking algorithm is a problem-solving algorithm that uses a **brute force approach** for finding the desired output.

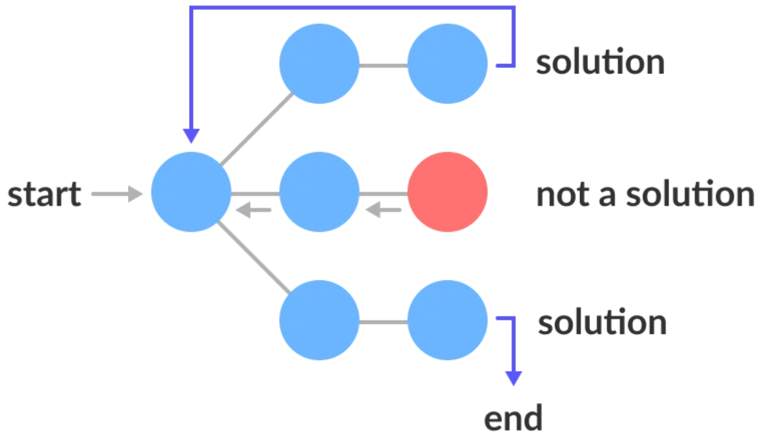
> The Brute force approach tries out all the possible solutions and chooses the desired/best solutions.

The term backtracking suggests that if the current solution is not suitable, then backtrack and try other solutions. Thus, recursion is used in this approach.

This approach is used to solve problems that have multiple solutions. If you want an optimal solution, you must go for dynamic programming.

State Space Tree

A space state tree is a tree representing all the possible states (solution or nonsolution) of the problem from the root as an initial state to the leaf as a terminal state.



State Space Tree

Backtracking Algorithm

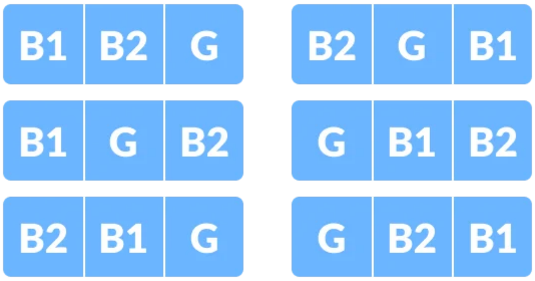
```
Backtrack(x)
    if x is not a solution
        return false
    if x is a new solution
        add to list of solutions
    backtrack(expand x)
```

Example Backtracking Approach

Problem: You want to find all the possible ways of arranging 2 boys and 1 girl on 3 benches. Constraint: Girl should not be on the middle bench.

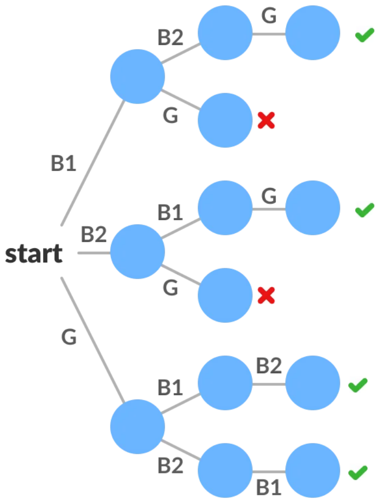
Solution: There are a total of 3! = 6 possibilities. We will try all the possibilities and get the possible solutions. We recursively try all the possibilities.

All the possibilities are:



All the possibilities

The following state space tree shows the possible solutions.



State tree with all the solutions

Backtracking Algorithm Applications

1. To find all Hamiltonian Paths present in a graph.
2. To solve the N Queen problem.
3. Maze solving problem.
4. The Knight's tour problem.