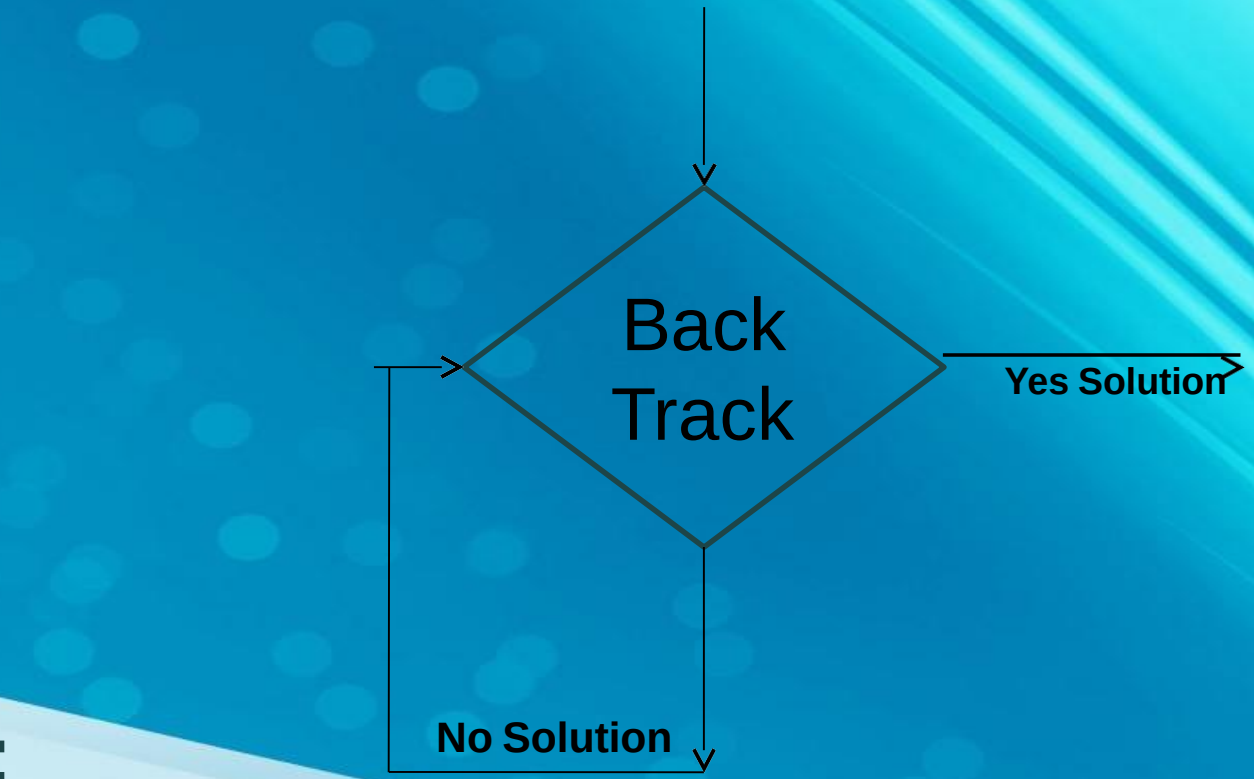

Backtracking:
Technique & Examples

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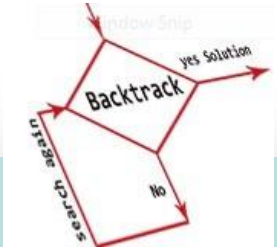
Backtracking

History

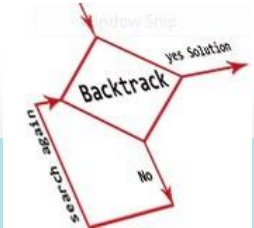
- ‘Backtrack’ the Word was first introduced by Dr. D.H. Lehmer in 1950s.
- R.J Walker Was the First man who gave algorithmic description in 1960.
- Later developed by S. Golamb and L. Baumert.

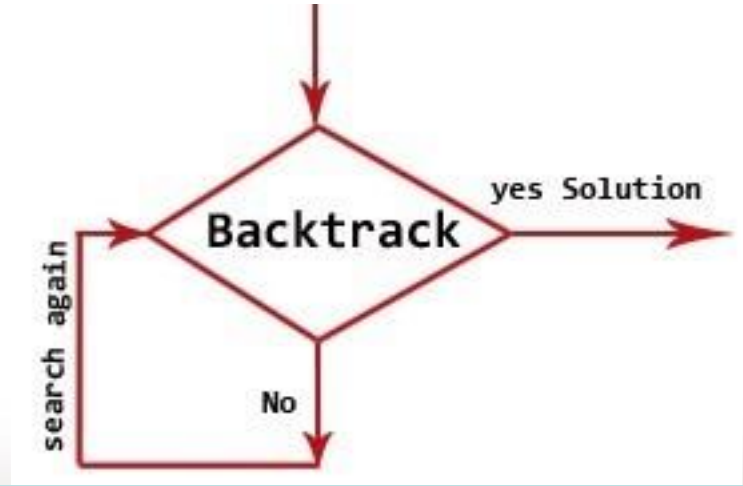


Backtracking

- What is Backtracking?

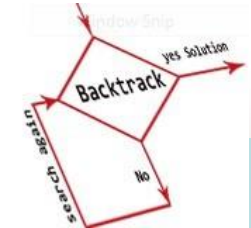
----- Backtracking is nothing but the modified process of the brute force approach. where the technique systematically searches for a solution to a problem among all available options. It does so by assuming that the solutions are represented by vectors (v_1, ..., i_n) of values and by traversing through the domains of the vectors until the solutions is found.





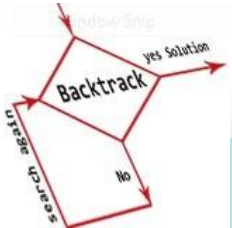
Backtracking

- The Algorithmic Approach
  - Backtracking systematically try and search possibilities to find the solution. Also it is an important process for solving constraint satisfaction problem like crossword, Sudoku and many other puzzles. It can be more continent technique for parsing other combinatorial optimization problem.
  - Basically the process is used when the problem has a number of option and just one solution have to be selected. After having a new option set means recursion, the procedure is repeated over and over until final stage.



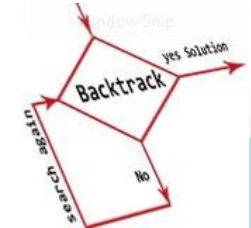
Backtracking

```
Algorithm Backtrack (v1,Vi)
   If (V1,……., Vi) is a Solution Then
                    Return (V1,…, Vi)
   For each v DO
      If (V1,……,Vi) is acceptable vector THEN
         Sol = try (V1,…,Vi, V)
         If sol != () Then
                          RETURN sol
      End
   End
   Return ( )
```



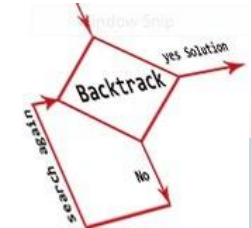
Backtracking

- Advantages
  - Comparison with the Dynamic Programming, Backtracking Approach is more effective in some cases.
  - Backtracking Algorithm is the best option for solving tactical problem.
  - Also Backtracking is effective for constraint satisfaction problem.
  - In greedy Algorithm, getting the Global Optimal Solution is a long procedure and depends on user statements but in Backtracking It Can Easily getable.
  - Backtracking technique is simple to implement and easy to code.
  - Different states are stored into stack so that the data or Info can be usable anytime.
  - The accuracy is granted.



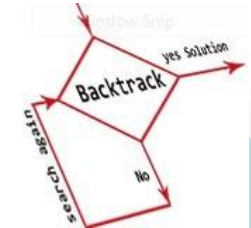
Backtracking

- Disadvantages
  - Backtracking Approach is not efficient for solving strategic Problem.
  - The overall runtime of Backtracking Algorithm is normally slow
  - To solve Large Problem Sometime it needs to take the help of other techniques like Branch and bound.
  - Need Large amount of memory space for storing different state function in the stack for big problem.
  - Thrashing is one of the main problem of Backtracking.
  - The Basic Approach Detects the conflicts too late.



Backtracking

- Application of Backtracking
  - Optimization and tactical problems
  - Constraints Satisfaction Problem
  - Electrical Engineering
  - Robotics
  - Artificial Intelligence
  - Genetic and bioinformatics Algorithm
  - Materials Engineering
  - Network Communication
  - Solving puzzles and path



Backtracking

- **<u>Some Problem Solved with Backtracking Technique</u>**
  - N- Queens Problem
  - Sum of Subset
  - Sudoku Puzzle
  - Maze Generation
  - Hamiltonian Cycle