BFS and DFS

# BFS

* graph traversal algorithm used to explore all the vertices of a graph in breadth-first order.
* BFS uses a queue data structure to keep track of the vertices that need to be visited.
* Time complexity - O(V + E)
* Space complexity - O(V)

Here's a step-by-step explanation of the BFS algorithm:

1. Start by initializing a queue and a visited set.
2. The queue will store the vertices to be visited, and the visited set will keep track of the vertices that have already been visited.
3. Enqueue the source vertex into the queue and mark it as visited.
4. Repeat the following steps until the queue becomes empty:
   1. Dequeue a vertex from the queue and process it.
   2. Visit all the neighbors of the dequeued vertex that have not been visited.
   3. Enqueue each unvisited neighbor into the queue and mark it as visited.
5. If there are no unvisited vertices left, the BFS algorithm is complete.

# DFS

* graph traversal algorithm used to explore all the vertices of a graph.
* Explores the vertices in depth-first order. It starts at a given source vertex and visits as far as possible along each branch before backtracking.
* It's important to note that the DFS algorithm does not guarantee that it will visit all the vertices in the graph, especially if the graph is disconnected.
* Time complexity - O(V + E)
* Space complexity - O(V)

Here's a step-by-step explanation of the DFS algorithm:

1. Start by initializing a stack and a visited set.
2. The stack will store the vertices to be visited
3. Visited set will keep track of the vertices that have already been visited.
4. Push the source vertex onto the stack and mark it as visited.
5. Repeat the following steps until the stack becomes empty:
   1. Pop a vertex from the stack and process it.
   2. Visit all the neighbours of the popped vertex that have not been visited.
   3. Push each unvisited neighbour onto the stack and mark it as visited.
6. If there are no unvisited vertices left, the DFS algorithm is complete.

A\* algorithm

* Popular pathfinding algorithm commonly used in artificial intelligence and game development.
* Applied to graph-based problems, such as finding the shortest path in a maze, it can also be adapted for other domains.

# Heuristic function

* A function that calculates an approximate cost to a problem
* If there are no specific answers to a problem or the time required to find one is too great, a heuristic function is used to solve the problem.

Prim’s spanning tree

* A greedy algorithm is an algorithmic strategy that makes the best optimal choice at each small stage
* This means that the algorithm picks the best solution at the moment without regard for consequences.
* with the goal of this eventually leading to a globally optimum solution.
* Popular greedy algorithm used to find the Minimum Spanning Tree
* MST is a tree that connects all vertices of the graph with the minimum possible total edge weight.

We start from one vertex and keep adding edges with the lowest weight until we reach our goal.

The steps for implementing Prim's algorithm are as follows:

1. Initialize the minimum spanning tree with a vertex chosen at random.
2. Find all the edges that connect the tree to new vertices, find the minimum and add it to tree
3. Keep repeating step 2 until we get a minimum spanning tree

## Difference between kruskal’s and prims

Kruskal's algorithm sorts all the edges from low weight to high and keeps adding the lowest edges, ignoring those edges that create a cycle.

Time complexity - O(E log V).

## Applications

* Laying cables of electrical wiring
* In network designed
* To make protocols in network cycles

Branch and Bound

* The N queens puzzle is the problem of placing N chess queens on an N×N chessboard so that no two queens threaten each other.
* Thus, a solution requires that no two queens share the same row, column, or diagonal.
* Optimes solution found
* BFS wise performed
* The branch and bound algorithm create branches and bounds for the best solution.

Backtracking

* very important skill set to solve recursive solutions.
* Backtracking is a systematic method of trying out various sequences of decisions until you find out that works.
* Backtracking can be defined as a general algorithmic technique that considers searching every possible combination in order to solve a computational problem.

BOT

Characteristics of bot

1. Understandable information about the customer.
2. Can be called a selling partner by making and sending the products information.
3. Provides 24hrs services
4. Satisfy the need of clients as the customer will not go on waiting for your call. They need the
5. action quickly or will turn to another brand.
6. Most of the customer prefers sending messages, text, SMS to the company for information.
7. Marketing Bot can result or give your Business growth by making higher sales and satisfying
8. the needs. Facebook Messenger is one of the widely used messengers in the U.S.
9. Recently chatbots were used by World Health Organization for providing information by
10. ChatBot on Whatsapp.
11. Facebook Messenger, Slack, Whatsapp, and Telegram make use of ChatBot.
12. The modern need is there for Bot Building for growth of Business to make progress.
13. Another example of making use of ChatBo is Google Assistant and Siri.
14. Bots, for the most part, operate on a network. Bots that can communicate with one another will
15. use internet-based services like IRC.

Expert System

* An expert system is a computer program that is designed to solve complex problems and to provide decision-making ability like a human expert.
* It performs this by extracting knowledge from its knowledge base using the reasoning and inference rules according to the user queries.
* The performance of an expert system is based on the expert's knowledge stored in its knowledge base. The more knowledge stored in the KB, the more that system improves its performance.

## Characteristics of Expert System

* 1. High Performance
  2. Understandable
  3. Reliable
  4. Highly Responsive

## Components

1. User Interface
2. Interface Engine
3. Knowledge base

## Participants to build expert system

1. Expert
2. Knowledge engineer
3. End user

## Advantages

1. Highly reproducible.
2. Used for risky places where the human presence is not safe.
3. Error possibilities are less if the KB contains correct knowledge.
4. Performance of these systems remains steady as it is not affected by emotions, tension.
5. Provide a very high speed to respond to a particular query.

## Applications

1. In designing and manufacturing domain
2. In the knowledge domain
3. In the finance domain
4. In the diagnosis and troubleshooting of devices
5. Planning and Scheduling