## Uninformed Search Algorithms:

### 1- Breadth-first Search:

o Breadth-first search is the most common search strategy for traversing a tree or graph. This algorithm searches breadthwise in a tree or graph, so it is called breadth-first search.

o BFS algorithm starts searching from the root node of the tree and expands all successor node at the current level before moving to nodes of next level.

o The breadth-first search algorithm is an example of a general-graph search algorithm.

o Breadth-first search implemented using FIFO queue data structure.

### Advantages:

o BFS will provide a solution if any solution exists.

o If there are more than one solutions for a given problem, then BFS will provide the minimal solution which requires the least number of steps.

### Disadvantages:

o It requires lots of memory since each level of the tree must be saved into memory to expand the next level.

o BFS needs lots of time if the solution is far away from the root node.

Example:

In the below tree structure, we have shown the traversing of the tree using BFS algorithm from the root node S to goal node K. BFS search algorithm traverse in layers, so it will follow the path which is shown by the dotted arrow, and the traversed path will be:

## Breadth First Search
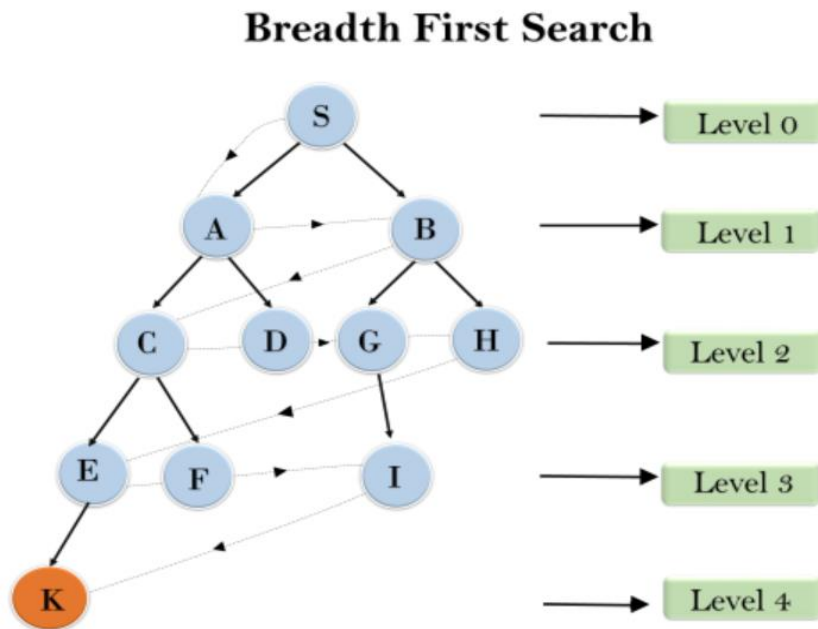


S---> A--->B---->C--->D---->G--->H--->E---->F---->I---->K

## 2. Depth-first Search

- o Depth-first search isa recursive algorithm for traversing a tree or graph data structure.
- o It is called the depth-first search because it starts from the root node and follows each path to its greatest depth node before moving to the next path.
- o DFS uses a stack data structure for its implementation.
- o The process of the DFS algorithm is similar to the BFS algorithm.

### Advantage:

- DFS requires very less memory as it only needs to store a stack of the nodes on the path from root node to the current node.
- It takes less time to reach to the goal node than BFS algorithm (if it traverses in the right path).

### Disadvantage:

- There is the possibility that many states keep re-occurring, and there is no guarantee of finding the solution.
- DFS algorithm goes for deep down searching and sometime it may go to the infinite loop.

### Example:

In the below search tree, we have shown the flow of depth-first search, and it will follow the order as:

Root node--->Left node ----> right node.

It will start searching from root node S, and traverse A, then B, then D and E, after traversing E, it will backtrack the tree as E has no other successor and still goal node is not found. After backtracking it will traverse node C and then G, and here it will terminate as it found goal node.
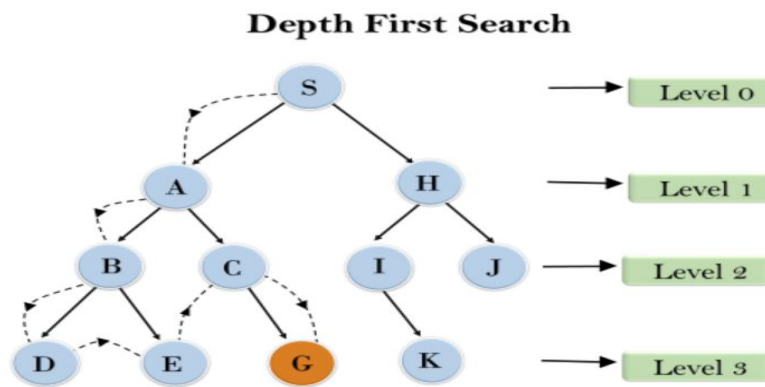
**Depth First Search**

**3. Depth-Limited Search Algorithm:** A depth-limited search algorithm is similar to depth-first search with a predetermined limit. Depth-limited search can solve the drawback of the infinite path in the Depth-first search. In this algorithm, the node at the depth limit will treat as it has no successor nodes further.
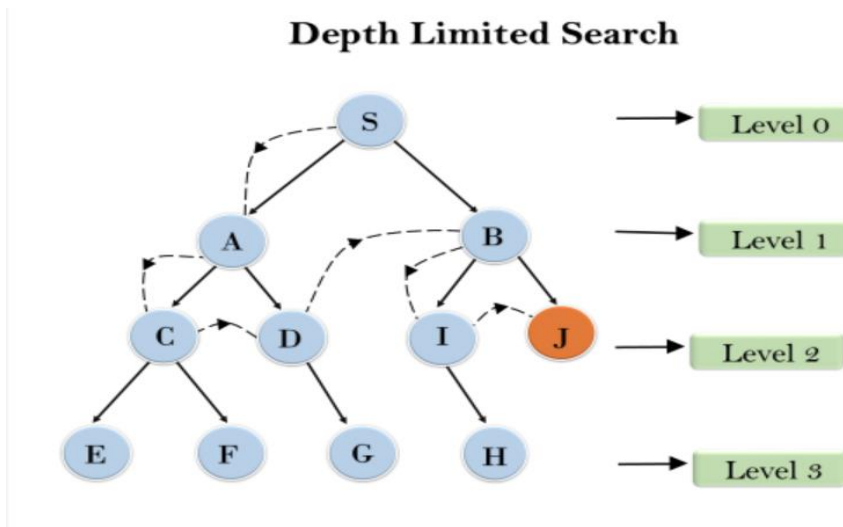
**Advantages:**

Depth-limited search is Memory efficient.

**Disadvantages:**

- o Depth-limited search also has a disadvantage of incompleteness.
- o It may not be optimal if the problem has more than one solution.

Example:

## 4. Uniform-cost Search Algorithm:

Uniform-cost search is a searching algorithm used for traversing a weighted tree or graph. This algorithm comes into play when a different cost is available for each edge. The primary goal of the uniform-cost search is to find a path to the goal node which has the lowest cumulative cost. Uniform-cost search expands nodes according to their path costs form the root node. It can be used to solve any graph/tree where the optimal cost is in demand. A uniform-cost search algorithm is implemented by the priority queue. It gives maximum priority to the lowest cumulative cost. Uniform cost search is equivalent to BFS algorithm if the path cost of all edges is the same.

### Advantages:

- o Uniform cost search is optimal because at every state the path with the least cost is chosen.

### Disadvantages:

- o It does not care about the number of steps involve in searching and only concerned about path cost. Due to which this algorithm may be stuck in an infinite loop.

### Example: