CHANDIGARH UNIVERSITY

Discover. Learn. Empower.

UNIVERSITY INSTITUTE OF ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE AND ENGG.

Bachelor of Engineering (Computer Science & Engineering)

Principles of Artificial Intelligence (20CST-258)

DISCOVER . LEARN . EMPOWER

Iterative deepening depth-first search

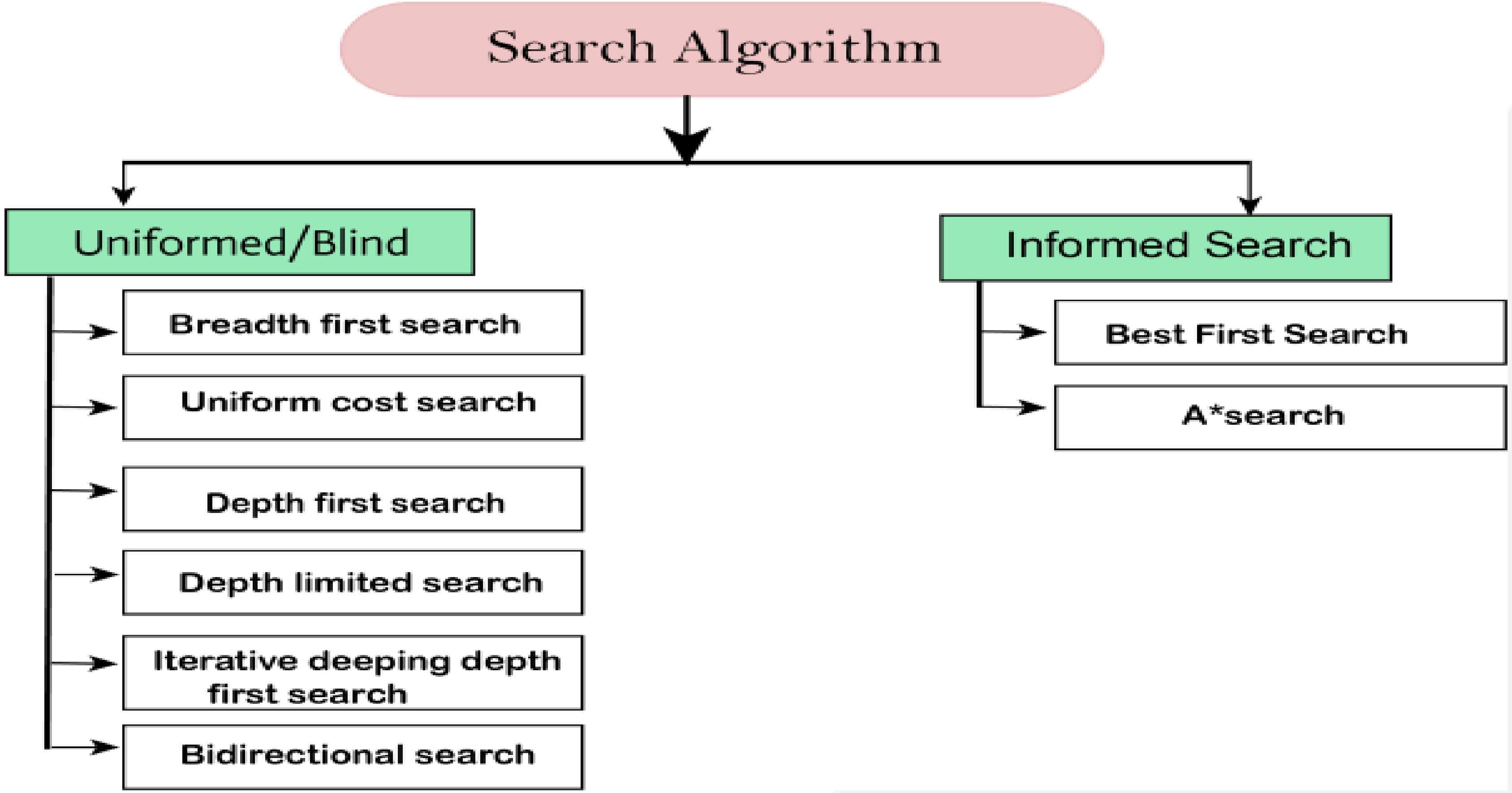
Outline

- Type of Search Strategies
  - Uninformed
    - Depth-first search
    - Breadth-first search
    - Iterative deepening depth-first search
    - Uniform cost search
    - Bidirectional Search
  - Informed

Search Algorithm Terminologies

- **Search:** Searching is a step by step procedure to solve a search-problem in a given search space. A search problem can have three main factors:
  - **Search Space:** Search space represents a set of possible solutions, which a system may have.
  - **Start State:** It is a state from where agent begins the search.
  - **Goal test:** It is a function which observe the current state and returns whether the goal state is achieved or not.
- **Search tree:** A tree representation of search problem is called Search tree. The root of the search tree is the root node which is corresponding to the initial state.
- **Actions:** It gives the description of all the available actions to the agent.
- **Transition model:** A description of what each action do, can be represented as a transition model.
- **Path Cost:** It is a function which assigns a numeric cost to each path.
- **Solution:** It is an action sequence which leads from the start node to the goal node.
- **Optimal Solution:** If a solution has the lowest cost solution among all solutions.

Types of Search Algorithms



Search Algorithm

Uniformed/Blind

- Breadth first search
- Uniform cost search
- Depth first search
- Depth limited search
- Iterative deeping depth first search
- Bidirectional search

Informed Search

- Best First Search
- A*search

Uninformed Search Types

- It can be divided into five main types:
    - Depth-first search
    - Breadth-first search
    - Iterative deepening depth-first search
    - Uniform cost search
    - Bidirectional Search

Iterative deepening depth-first search

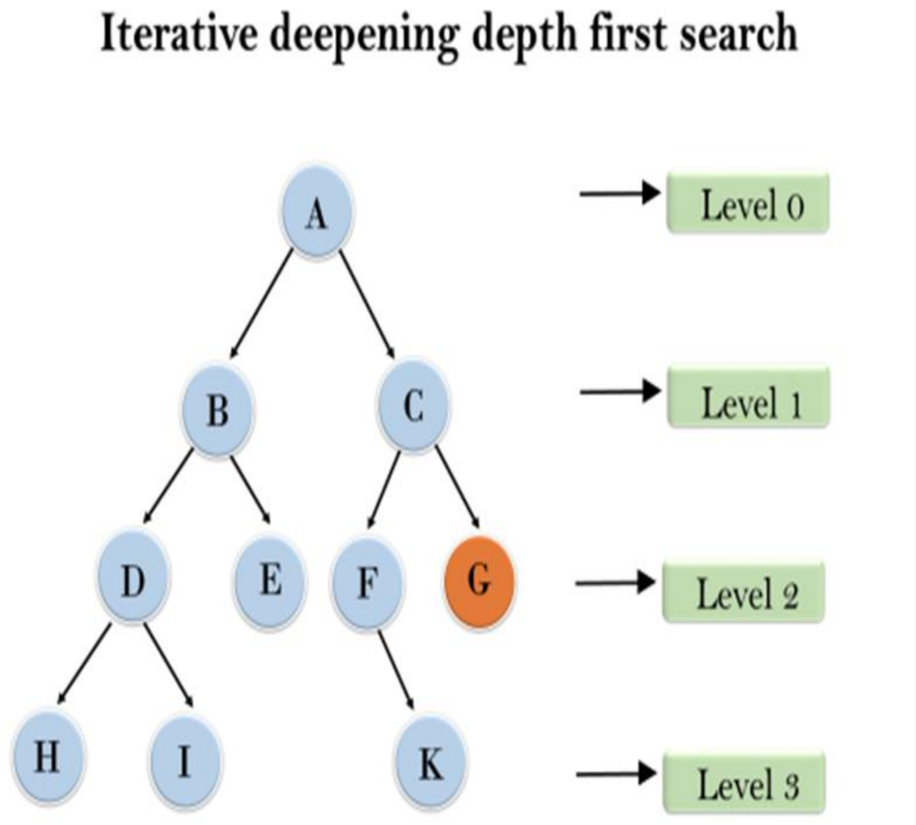
- The iterative deepening algorithm is a combination of DFS and BFS algorithms.
- This search algorithm finds out the best depth limit and does it by gradually increasing the limit until a goal is found.
- This algorithm performs depth-first search up to a certain "depth limit", and it keeps increasing the depth limit after each iteration until the goal node is found.
- This Search algorithm combines the benefits of Breadth-first search's fast search and depth-first search's memory efficiency.
- The iterative search algorithm is useful uninformed search when search space is large, and depth of goal node is unknown.

Iterative deepening depth-first search

- **Advantages:**
  - It combines the benefits of BFS and DFS search algorithm in terms of fast search and memory efficiency.
- **Disadvantages:**
  - The main drawback of IDDFS is that it repeats all the work of the previous phase.

Example

- Following tree structure is showing the iterative deepening depth-first search.
- IDDFS algorithm performs various iterations until it does not find the goal node. The iteration performed by the algorithm is given as:
- 1'st Iteration-----> A
  2'nd Iteration----> A, B, C
  3'rd Iteration------>A, B, D, E, C, F, G
  4'th Iteration------>A, B, D, H, I, E, C, F, K, G
- In the fourth iteration, the algorithm will find the goal node.


Iterative deepening depth first search

Key Points

- **Completeness:**
  - This algorithm is complete is if the branching factor is finite.
- **Time Complexity:**
  - Let's suppose b is the branching factor and depth is d then the worst-case time complexity is **O(b^d)**.
- **Space Complexity:**
  - The space complexity of IDDFS will be **O(bd)**.
- **Optimal:**
  - IDDFS algorithm is optimal if path cost is a non- decreasing function of the depth of the node.

THANK YOU