Local Heuristic Search General Idea:

- Start with a random or initial state.
- Evaluate the current state using a heuristic.
- Move to a neighbour state that has a **better heuristic value**.
- Repeat until no neighbour is better or when a **local maximum** is reached.

Pseudocode:

```
FUNCTION LocalHeuristicSearch(problem):
    current_state ← problem.initial_state
    LOOP:
        neighbors ← GetNeighbors(current_state)

        IF neighbors is empty:
            RETURN current_state  // No way to move, return
current solution

        next_state ← neighbor in neighbors with highest
heuristic value

        IF heuristic(next_state) ≤ heuristic(current_state):
            RETURN current_state  // No better neighbor, local
maximum

        current_state ← next_state
```

Limitations:

- **Can get stuck** at **local maxima/minima**.
- **Doesn't backtrack** — doesn't remember where it came from.
- **No global guarantee** of best solution.

Global Heuristic Search General Idea:

Global heuristic search algorithms explore the entire or large parts of the state space, using heuristics to guide the search toward the goal state, while avoiding local traps. It remembers paths**,** evaluates multiple paths, and considers the global best using both the cost so far and the estimated cost to goal.

Benefits:

- **Guaranteed optimality** (with admissible heuristic in A*)
- **Finds global best solution**, not just a local improvement
- **Backtracking supported** through came_from map

Limitations:

- **Higher memory usage** — keeps track of many nodes
- **Slower** than local methods for very large spaces
- Depends heavily on the **quality of heuristic**

Examples include Best first search and A* search:

Like the depth-first and breadth-first search, **best-first search** uses two-lists.

1. OPEN: to keep track of the current fringe of the search.
2. CLOSED: to record states already visited.
3. Order the states on OPEN according to some heuristic estimate of their closeness to a goal.
4. Each iteration of the loop considers the most promising state on the OPEN list.
5. Your solution is found in the closed set

With best-first, node is selected for expansion based on evaluation function f(n).
Often, for best-first algorithms, f is defined in terms of a heuristic function, h(n).
Best-First Search algorithms constitute a large family of algorithms, with different evaluation functions.
Each has a heuristic function h(n)

Recall:

- g(n) = cost from the initial state to the current state n.
- h(n) = estimated cost of the cheapest path from node n to a goal node.
- f(n) = evaluation function to select a node for expansion (usually the lowest cost node).

What is Best-First Search?

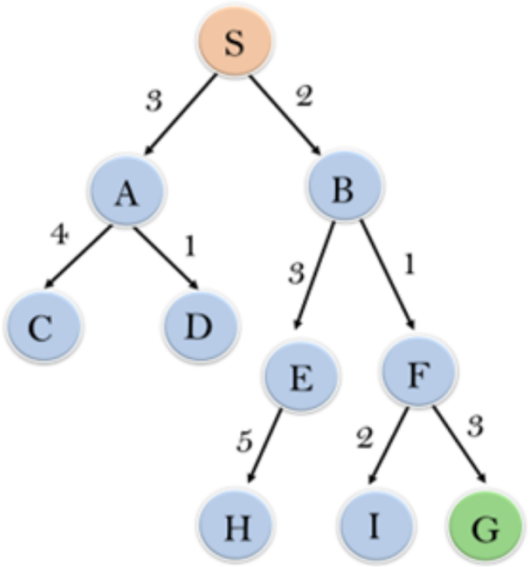
- Best-First Search is a **global heuristic search** strategy.
- It uses a **heuristic function h(n)** to estimate how close a node is to the goal.
- It selects the **next node with the lowest h(n)** from the frontier (priority queue).

Hand-Run Best-First Search:

1. **Start at initial node**, insert it into the frontier.
2. **Repeat:**
    - Remove node with **lowest h(n)** from frontier.
    - If it's the goal, stop!
    - Otherwise, expand its neighbors.
    - Add neighbors to the frontier (skip already explored nodes).
    - Sort the frontier based on heuristic values.
3. **Track the explored nodes** to avoid cycles.
4. (Optional) **Track parent pointers** to reconstruct the path.

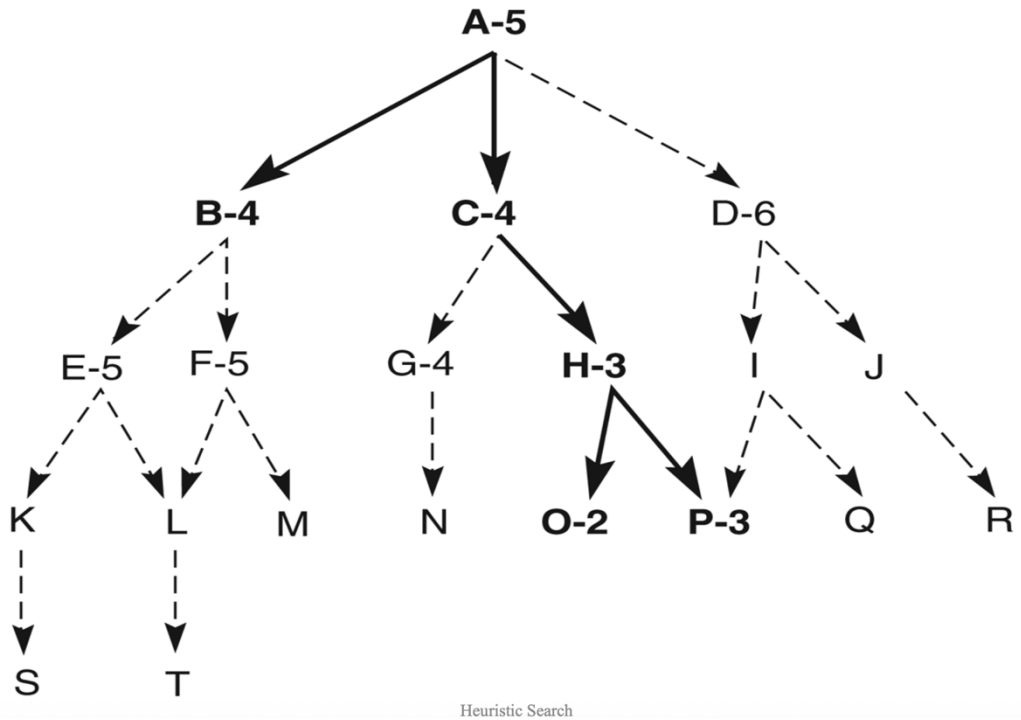
NB: Re-order nodes in the open set by heuristic merit(best leftmost)

1.

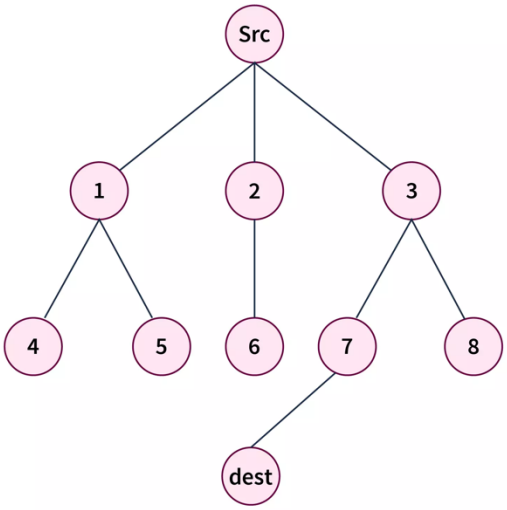


node	H (n)
A	12
B	4
C	7
D	3
E	8
F	2
H	4
I	9
S	13
G	0

2.



3.



Src	20
1	22
2	21
3	10
4	25
5	24
6	30
7	5
8	12
dest	0