

ASSALAMU'ALAIKUM

# Chapter IV

## HEURISTIC SEARCH METHODS

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- ❖ **Heuristic**
- ❖ **Hill Climbing**

- ❖ Designing a heuristic function that can satisfy all requirements for surgery scheduling is a complex task (Blazewicz, Lenstra, & Kan, 1981).
- ❖ As a simple example, consider what a heuristic function might look like for just one of our rules.
- ❖ How could we use a number to reflect the quality of a schedule with respect to the requirement of maximizing room usage?

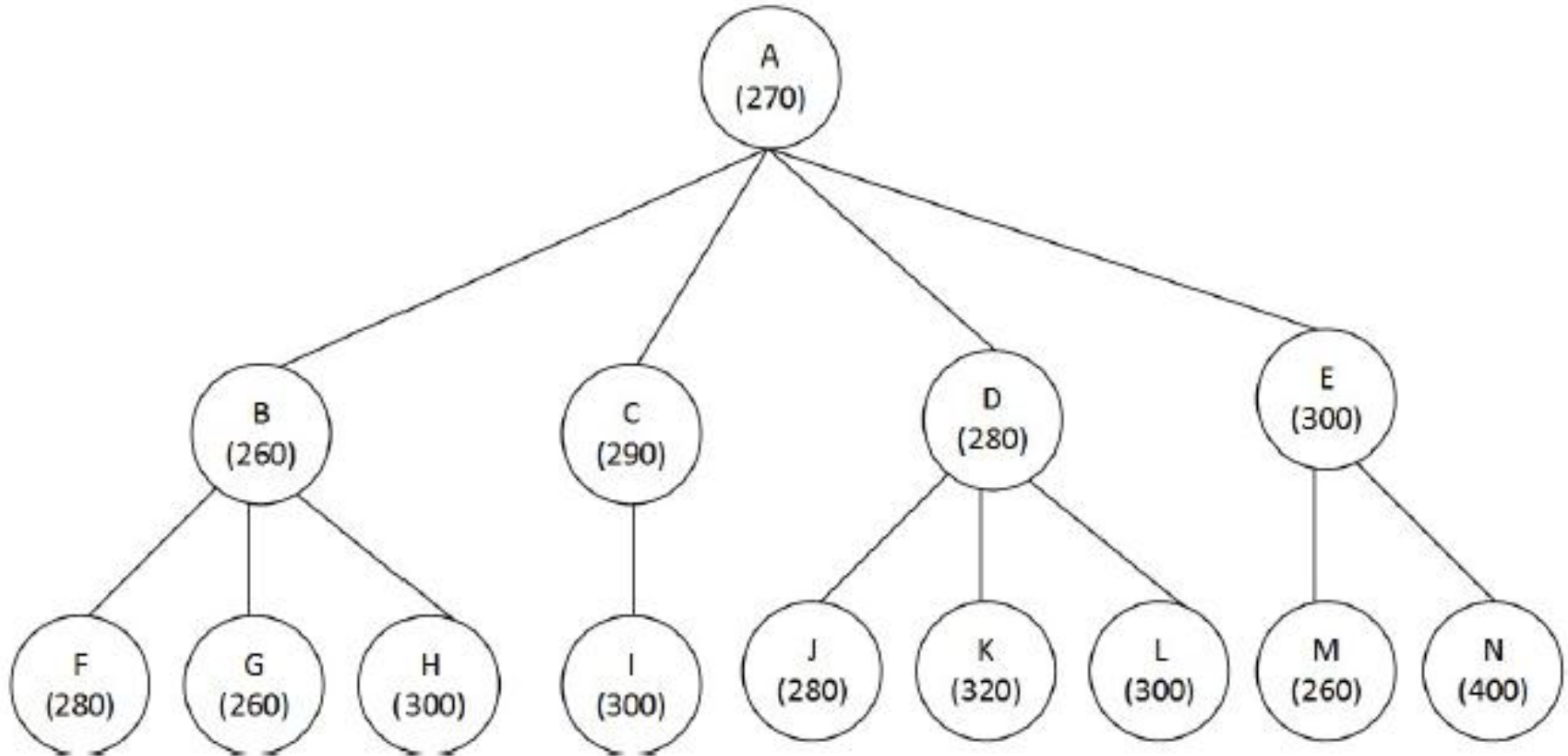
- ❖ For instance, assume the heuristic function's result for the current partial schedule is 360.
- ❖ If the next slot assignment results in a value of 270, we are going away from the goal. On the other hand, if the slot assignment results in a value of 400, we are getting closer to the goal.
- ❖ Having a heuristic function does not make finding a goal state trivial.

- ❖ We can refine our state space searching technique to perform a more intelligent search (Kanal & Kumar, 1988; Nilsson N. J., *Problemsolving methods in Artificial Intelligence*, 1971; Pearl, 1984; Simon & Newell, 1958; Slagle, 1971).
- ❖ Instead of systematically searching each branch of a tree as in depth-first search, we'll choose where to search next based on heuristic knowledge of the schedules in the tree.




# Hill Climbing?

- ❖ **Hill climbing** → a search algorithm that makes use of heuristic values.
- ❖ It involves following a path in the tree that is based on how the current heuristic value changes relative to the value associated with the next node in the path.
- ❖ **Simple hill climbing** → follow the *first* path we find that improves the heuristic value.
- ❖ **Steepest ascent hill climbing**, → look at all paths and pick the *best* one from our current position.



*A tree representing different nodes labeled A through N, each with a heuristic value shown in parentheses.*



*"Hill climbing seems to help us find the best Room schedule quite efficiently. However, in some cases, the technique can lead us astray. As we try to climb the mountain of ever increasing heuristic values, we always go for the steepest path currently available to us. This is known as a greedy approach and can cause us to get stuck with a state that appears to be the best from where we're standing, but isn't really the best overall"*



- Artificial Intelligence Simplified: Understanding Basic Concepts (Binto George and Gail Carmichael, 2016)



❖ **Thank you**