CHAPTER IV
SCHEDULING WITH SEARCH METHODS

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Outline

- **See how data structures are used for problem solving**
- **Understand blind searches and their limitations**

State Space Search

- One way to approach finding a good schedule is to imagine intelligently working through an interconnected network of related candidate schedules until one that satisfies our rules is found. This is known as **state space search**.

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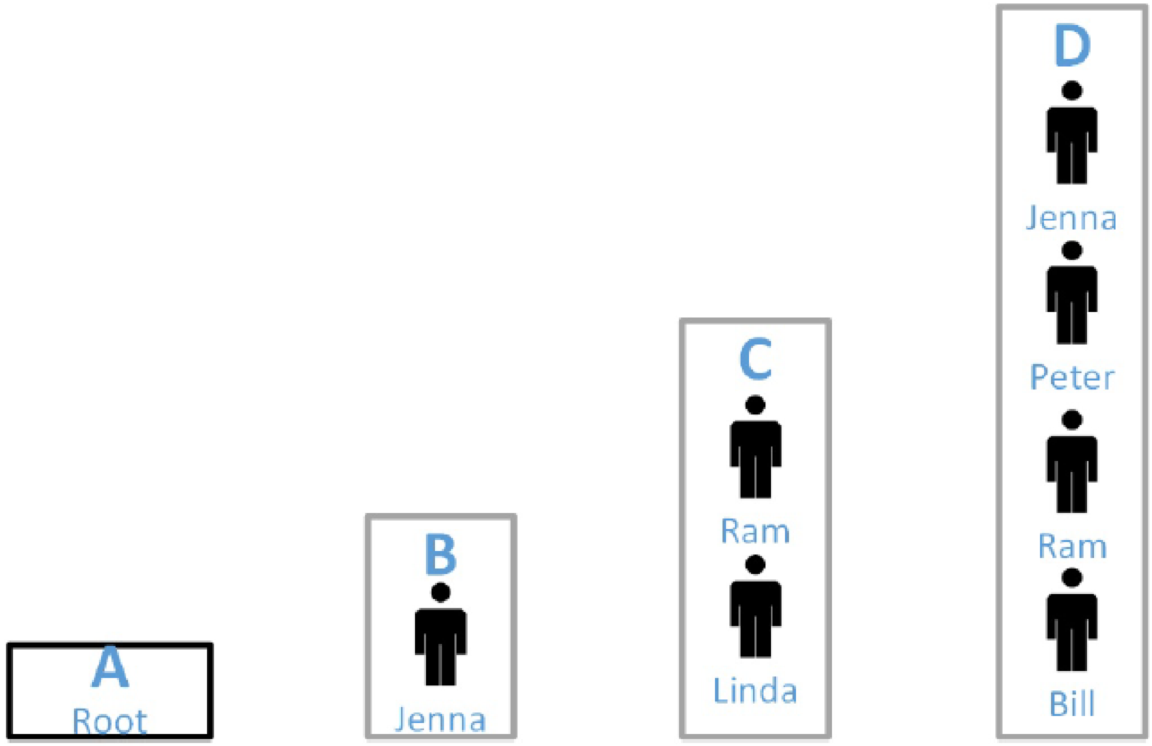

Figure 1: Example schedules as nodes

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- For example, Figure 1 shows four different states:
  - the first (A) represents an empty schedule,
  - the second (B) a schedule with one slot filled in with patients,
  - the third (C) a schedule with two slots filled in with patients and
  - the fourth (D) a schedule with four slots filled in with patients.

Tree

- The represent relationships between schedules using something called a **tree**
- Trees → data structures that are similar to the concept of a family tree
- A tree contains a set of **nodes**, each of which represents one entity
- A node in a tree can have a number of **children** but only one **parent**.
- A node is connected to its parent and children with **edges**.
- The root of the tree is a special node with no parent.

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- In our schedule tree, each node represents one schedule
- The root of the tree will be a node representing the empty schedule.
- The children of nodes will contain a new schedule that has exactly one more patient added to a surgery slot than their parents have.

Blind Search Methods

- **Blind search** (Cormen, Leiserson, Rivest, & Stein, 2009) involves exhaustively looking through all nodes in the search space until we find the schedule that best satisfies all of our rules.
- Blind searching is very inefficient (Aho, Hopcroft, & Ullman, 1974) because we are not using any domain-specific knowledge to be smart about how we search.

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Figure 2: Blind searching is like trying to get to the peak without using knowledge of the mountain's geography; you would be hoping to find the peak by chance.

- Blind searching is only useful when the size of the tree is relatively small.
- With a huge tree, searching for a goal state is like climbing to the peak of Mount Everest with a blindfold on (Figure 2) – in-fact, climbing Mount Everest may turn out to be easier!
- It can search the tree randomly or in a systematic way (Knuth D. E., 1973). For example, with the depth-first search (DFS) technique.

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- Breadth-first search (BFS) (Aho, Hopcroft, & Ullman, 1974) is another example of a blind searching method where the search proceeds level by level.

"With any blind searching strategy, we are not making use of any available knowledge to direct our search to where the goal schedule is likely to be found. As a result, we have to look at every node (i.e., every ***Room schedule****) in our search space. However, if we could use a numerical value to indicate how suitable an* ***Room schedule*** *is, we might be able to find our goal faster. That's what we describe in the next section.*

❖ Thank you