Exercise: Search

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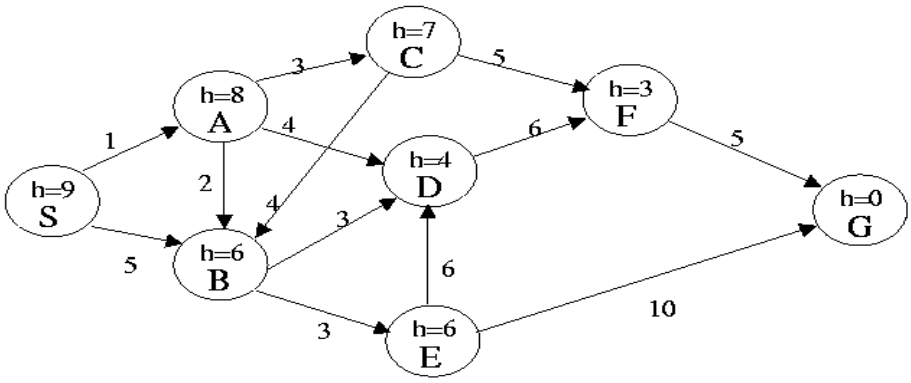
1 Search Algorithms

In the problem shown in the figure below, the start state is S, and the goal state is G. The transition costs are next to the edges, and the heuristic estimate, h, of the distance from the state to the goal is in the states node. Assume ties are always broken by choosing the state which comes first alphabetically.



Answer the following questions:

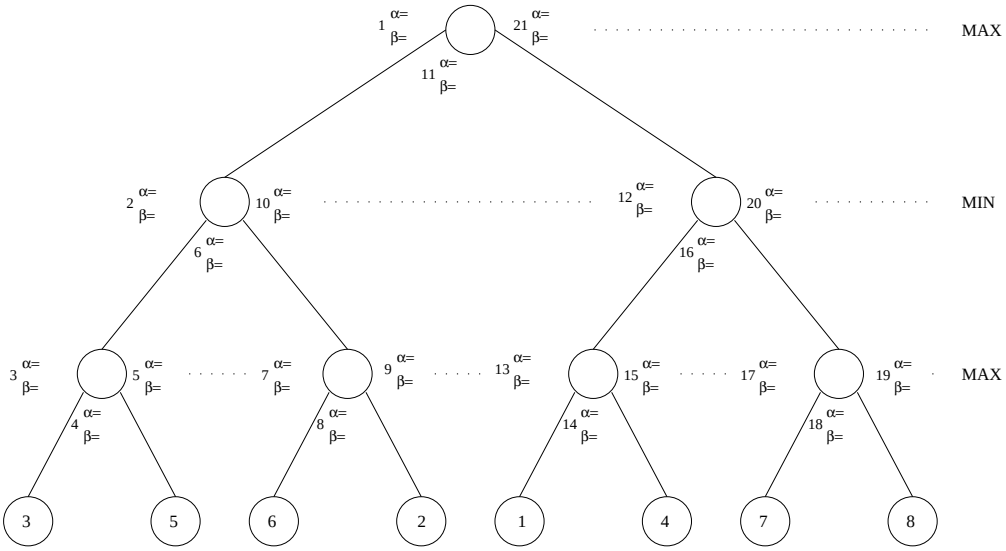
1. What is the order of states expanded using Depth First Search? Assume DFS terminates as soon as it reaches the goal state.
2. What is the order of states expanded using Breadth First Search?
3. What is the order of states expanded using Best First Search? Assume BFS terminates as soon as it reaches the goal state.
4. What is the order of states expanded using $A*$ search?
5. What is a least cost path from S to G?

2 Adversarial Search

Perform the alpha-beta algorithm on the following tree, searching left before right:

- Record to the left of a node the alpha and beta values upon first visiting the node.
- Record under a node the alpha and beta values after visiting the left child of the node.
- Record to the right of a node the alpha and beta values upon visiting both children.
- Circle any nodes (including leaves) that are not visited.
- Alpha and beta values need not be written for unvisited nodes nor for leaf nodes.
- Write in the game-theoretic value of the root node in the circle.
- Describe the path that would result if both players made optimal decisions.

Note that the numbers on the figure now are just identifiers of the $\alpha - \beta$ values at that stage of the algorithm. They have no numerical meaning.



Note also that the value of β never changes at a MAX node, since MIN has no control. Likewise, the value of α never changes at a MIN node, since MAX has no control.