1. In a Minimax tree with a branching factor of 3 and a depth of 4, how many terminal nodes need to be evaluated in the worst case? If Alpha-Beta pruning eliminates half of the nodes, what is the new number of evaluations? [1]

Solution:

- Minimax tree: Branching factor = 3
- Depth = 4

Total terminal nodes (leaf nodes) in a full tree:

3^4 = 81
With Alpha-Beta pruning removing half of the nodes:
81/2=40.5≈41

Without pruning: 81 evaluations, With pruning: 41 evaluations

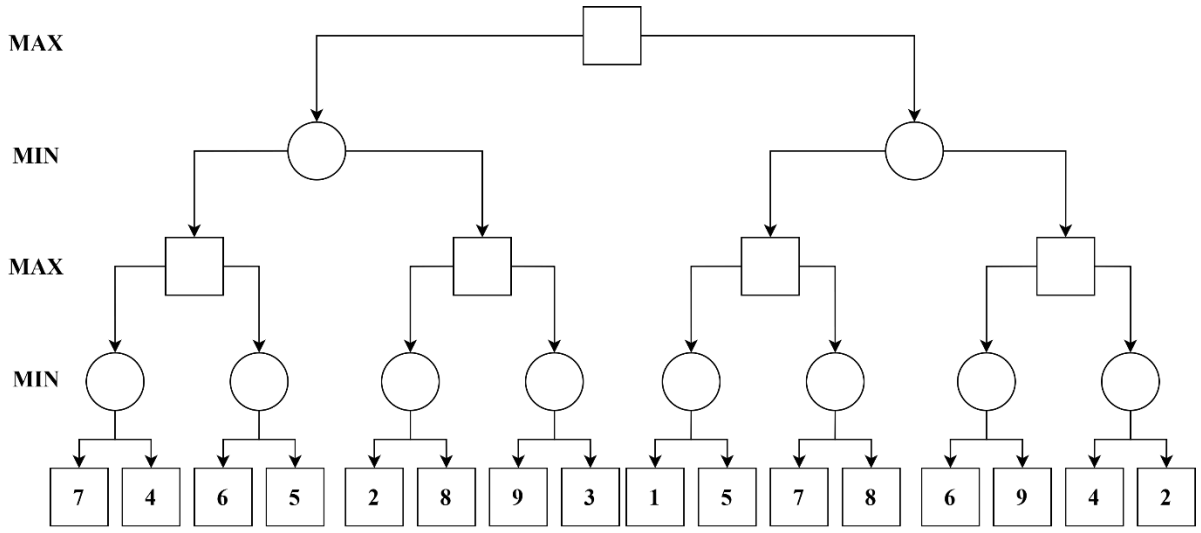
2. A uniform-cost search algorithm is applied to a graph with 100 nodes and edge costs varying between 2 and 10. If the optimal path from the start to the goal node has 6 edges with an average cost of 5, what is the total path cost? [1]

Solution:

- 100 nodes
- Edge costs: [2, 10]
- Optimal path has 6 edges
- Average cost per edge = 5

Total path cost = 6×5=30

3. The 8-Puzzle problem is a classic sliding tile puzzle consisting of a 3x3 grid with eight numbered tiles and one empty space. The goal is to reach a predefined goal state by sliding tiles into the empty space. Analyze the application of the hill climbing algorithm to solve the 8-Puzzle problem. [5]
4. How does alpha-beta pruning work? Define the terms alpha and beta. Solve the following example to demonstrate how alpha-beta pruning optimizes the minimax algorithm by pruning parts of the search tree. Provide a step-by-step explanation of the pruning process. [5]


MAX
MIN
MAX
MIN
7
4
6
5
2
8
9
3
1
5
7
8
6
9
4
2