Assignment 1
CSE422 Spring 2025
BracU
Ipshita Bonhi Upoma

Part 1

1. Consider a 5x5 grid where the top-left corner is the start node (0,0) and the bottom-right corner (5, 5) is the goal node. Obstacles are placed at nodes (1,2), (2,2), and (3,2). Assuming equal cost for all valid moves (up, down, left, right), simulate the A* algorithm and find the path from the start to the goal. Use Manhattan distance as the heuristic function.
2. If diagonal moves were allowed in Q1, would you make any changes in the heuristic function? Justify your answer.

Part 2

1. I have ten courses to select from. The work-load/per week and the expected marks for each course is given below. I would like to find the set of courses so my expected marks are maximum and the work-load per week does not exceed 50 hours.

Course	Work-load per week	Expected Marks
1	7	72
2	16	68
3	12	90
4	7	54
5	16	73
6	3	44
7	16	64
8	4	38
9	4	18
10	19	94

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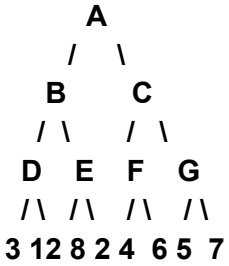
a. Encode the problems. (This means structuring the problem representation, defining the neighborhood. Examples given in lecture notes)
b. Demonstrate the Hill Climbing algorithm up to two iterations. Using the idea of the evaluation function for this problem, explain the problems with the Hill-Climbing algorithm.
c. Using the problem scenario, explain First-choice hill-climbing, Stochastic hill climbing and Random-restart hill climbing algorithm.
d. Let $T = 100$, $\alpha = .5$ and the change of temperature at each iteration be described by $T(k) = T_0 \alpha^k$. Demonstrate simulated annealing up to 3 iterations, find the optimal solution. In case you need it, let the random numbers generated are (0.2, 0.5, 1) Explain the significance of the change of temperature in simulated annealing using this problem as an example. What will happen if the temperature is increasing at each iteration of simulated annealing.
e. Demonstrate the Genetic algorithm up to 1 iteration.
f. What will happen if all the chromosomes in the initial population are the same? Explain why mutation is helpful in finding a better solution. Use the problem scenario as an example.

Part 3

1. For the following search trees, simulate the minimax algorithm and the alpha-beta pruning algorithm. Identify which subtrees are pruned using the alpha-beta pruning algorithm. At each node, show the alpha and beta values.



2. Now consider that the root node is controlled by the minimizing player for the graphs in question. Simulate the results using the minimax and alpha-beta pruning algorithms. Identify the subtrees that are pruned by the alpha-beta algorithm. Display the alpha and beta values at each node.
3. Draw a graph for which alpha-beta pruning will explore the same nodes as the minimax algorithm. Demonstrate the simulation over this graph.
4. Describe the role of maximizing and minimizing players in the minimax algorithm.
5. Discuss the concept of "utility values" in the context of the minimax algorithm. How are they calculated and used?

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