United International University (UIU)

Dept. of Computer Science & Engineering (CSE)

Mid Exam: Spring 2022

Course Code: CSE 3811, Course Title: Artificial Intelligence

Total Marks: 30 Duration: 1 hour 45 minutes

Answer all questions. Marks are indicated in the right side of each question.

[Any examinee found adopting unfair means will be expelled from the trimester/program as per UIU disciplinary rules.]

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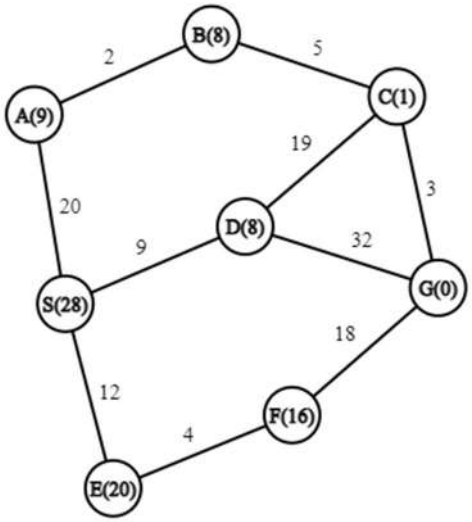
1. Suppose, you are going to design an intelligent AI gardener that can water your rooftop plants and clear the weeds. The AI gardener needs to water the plants in the right amount without wetting the rooftop. It also needs to identify and then pluck out the weeds when necessary. Determine the PEAS specification for the agent. Characterize the agent's environment as Deterministic vs. Stochastic and Static vs. Dynamic. **[2+1]**

2. Following is a 4x4 sudoku. The goal is to fill the 4x4 grids with numbers so that each row, column and 2×2 section contain all of the digits between 1 and 4. Give a formal description of this problem as a search problem. **[2]**

	4		
			1

3. a. Consider the state-space graph in the following figure. S is the start node and G is the goal node. The heuristic value of each node is mentioned inside the bracket beside the node label. Find out the solution paths and costs returned by the following search algorithms. **[2+1+1.5+1.5]**
   i. UCS
   ii. Greedy BFS
   iii. A* Tree Search
   iv. A* Graph Search



b. Briefly explain the reasoning behind the following statements: **[1+0.5+0.5]**

i. Greedy Best First search with consistent heuristic will not always return the optimal solution.

ii. Depth Limited Search is complete only if l>=s(Here, l=depth limit, s=depth of shallowest solution).

iii. Iterative Deepening Search is optimal if all edge costs are equal.

4. a. Consider an **admissible** heuristic for n-puzzle problem is h_1 and another heuristic is h_2 where for any node n the following equation always holds: **[1+1+1]**

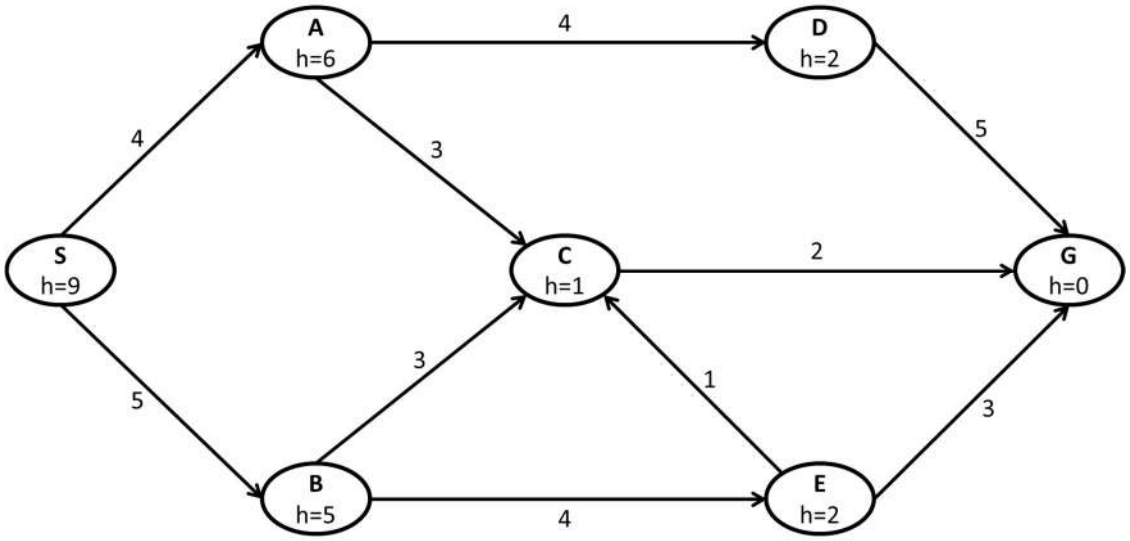
$$\frac{h_1(n)}{2} \leq h_2(n) < 2 * h_1(n)$$

i. Is h_2 admissible?

ii. Can you design another **admissible** heuristic h_3 combining **both** h_1 and h_2. If yes, how?

iii. Will your designed heuristic h_3 dominate h_1?

b. Consider the following graph:



Here ***S*** is the starting node and ***G*** is the goal node. Now change only the **heuristic values** of **any two nodes** so that the heuristic values become **both admissible** and **consistent**. Mention the updated values and corresponding node names. **[4]**

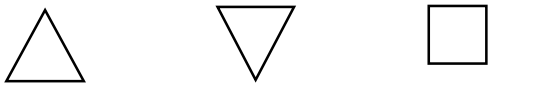
5. a. Define Random Restart Hill Climbing search algorithm. What are the advantages over the greedy version? **[2]**

b. If the temperature decreases in simulated annealing, how the probability of bad moves changes? **[1]**

c. If the temperature is zero all the time in simulated annealing, how the search will behave? Which version of greedy search it will resemble then? Explain your answer. **[2]**

d. The mutation step in genetic algorithm increases diversification – Explain. **[1]**

6. For the following game tree



Max Min Terminal node

Show which nodes will be pruned if you use minimax search algorithm with alpha-beta pruning. Clearly show the values of each node. **[4]**