United International University (UIU)

Dept. of Computer Science & Engineering (CSE)

Mid Exam: Spring 2023

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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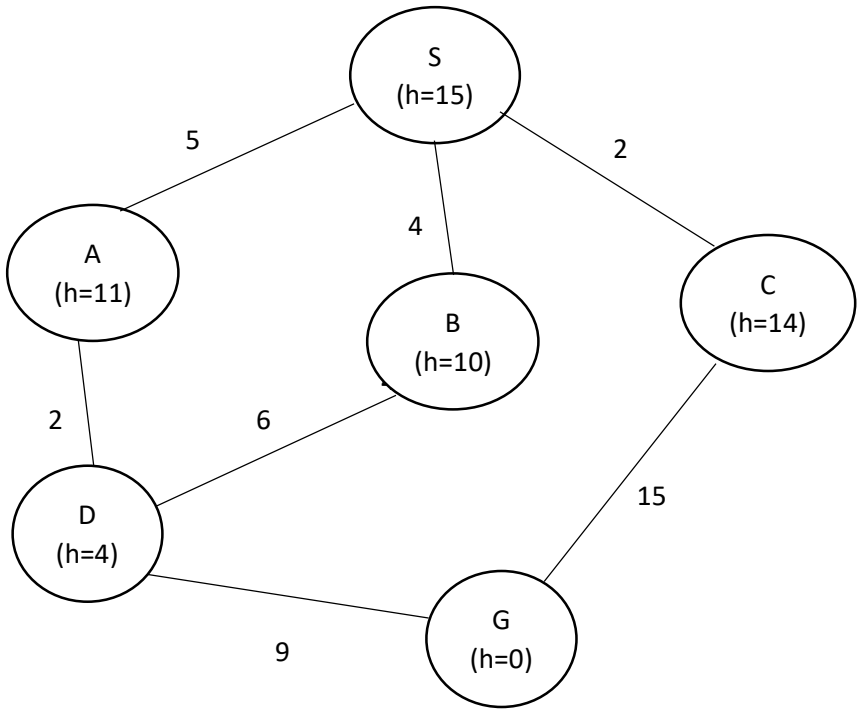
1. Suppose you are designing an artificially intelligent Medical Diagnosis System. The system is designed to receive information like symptoms, medical history etc. from the patient and doctor and after interactive Q and A session the system can provide a possible diagnosis for the patient. Determine the PEAS specification for the agent and also characterize the agent's environment as static vs. dynamic and discrete vs. continuous. **[2+1]**

2. a. Consider the following undirected search space. S is the initial state. G is a state that satisfy the goal test. Find out the solution paths and costs returned by the following search algorithms: **[1+2.5+2.5]**

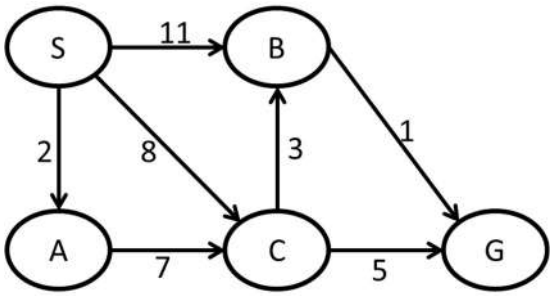
   i. Greedy Best First Search
   ii. A* Tree Search
   iii. A* Graph Search



b. Determine if the following statements are true or false: **[1]**

   i. Uniform cost search is the same as Breadth first search if all step costs are equal.
   ii. Greedy best first search is optimal when the heuristic function is admissible.

3. Consider the following graph where **S** is the start state and **G** is the goal state. The values of three different heuristic functions h1, h2 and h3 are given. Label the three functions as "inadmissible", "admissible but inconsistent" or "admissible and consistent". Explain your reasoning very briefly. **[6]**



	S	A	B	C	G
h1	12	12	1	3	0
h2	11	4	1	2	0
h3	10	8	1	3	0

4. Consider the following two tables for **Simulated Annealing** for a **maximization problem** with two different temperature(T) values. The neighbors are generated sequentially according to their Sequence Number. Find which neighbor will be selected given the values of the Random Generator for every neighbor:

[1.5 + 1.5 + 2]

[*Hint: Probability for taking a **bad move** is* $e^{\Delta E/T}$*. The Random Generator generates values between 0 and 1 inclusive. We accept a bad move only if the value provided by the Random Generator is less than the calculated probability for that bad move.*]

a. For T=10

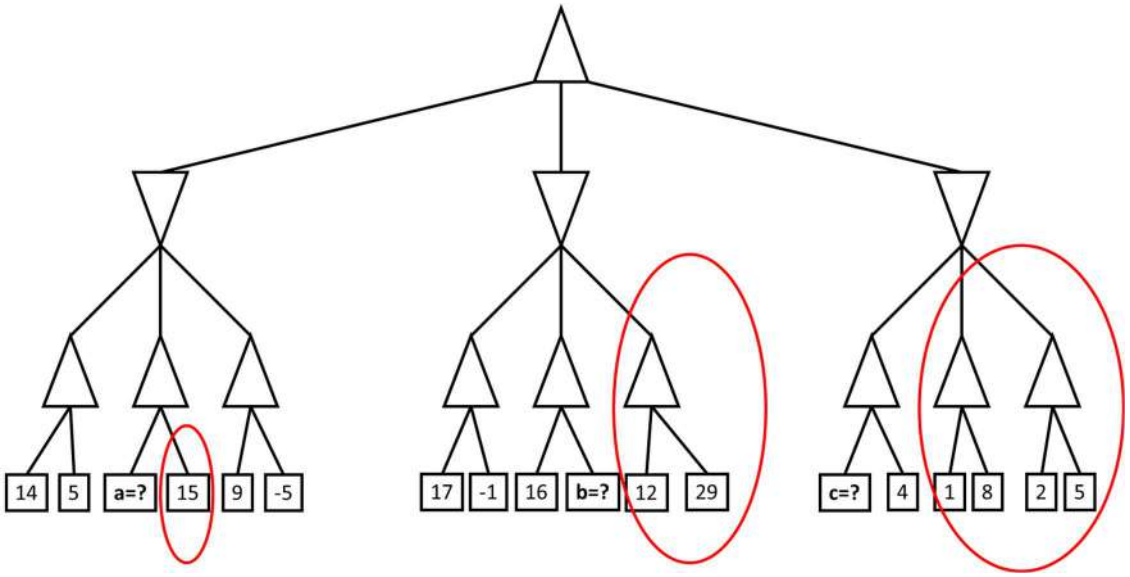
Neighbor Generation Sequence Number	**Energy/Utility Gap between Neighbor and Current State E(Neighbor) - E(Current)**	**Value provided by Random Generator**
1	-5	0.65
2	-3	0.8
3	-6	0.5
4	2	0.2
5	-4	0.4

b. For T=3

Neighbor Generation Sequence Number	Energy/Utility Gap between Neighbor and Current State E(Neighbor) - E(Current)	Value provided by Random Generator
1	-5	0.25
2	-3	0.5
3	2	0.1
4	-1	0.6
5	3	0.95

c. What will happen if we set **T=0** for a **maximization problem** in simulated annealing?

5. Find the values of **a**, **b**, **c** so that the marked branches are pruned when the minimax algorithm with **alpha-beta pruning** is applied on this search tree? **[4]**



6. There are 6 students in the cultural club of a community who are preparing for a show. They are to be sorted in any of the four categories – drama, dance, singing, poetry. They have some conditions:

   Student 1 and student 4 want to be in the same group.

   Student 3 wants to perform in the drama group.

   Student 2 and student 5 don't like each other and want different groups.

   Student 4 doesn't like poetry and will not be in that group.

   Student 5 want to choose from either dance or drama.

   Student 6 will be in the same group as student 3 but in a different group from student 5.

   Now formulate the problem as CSP and solve the problem using backtracking search algorithm must applying both Minimum Remaining Values(MRV) and Least Constraining Value(LCV) heuristics. **[2.5+2.5]**