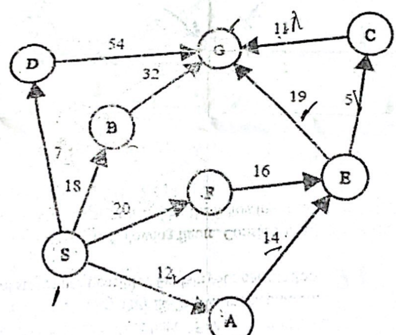
CSE 3811 Artificial Intelligence (Section C))
Class Test 1, Spring 2022
Total Marks: 20 Time: 30 minutes

1. Suppose there are five coins on the table, all facing head. You have to pick a coin at random and toss it. You have to keep repeating this action until at least three of the five coins are facing tails. Now answer the following: [6]

   a. How many variables are required to represent a state? 5
   b. How many successors does a state have? Explain your calculation.
   c. What is the size of the state space? Explain your calculation. 2× 2× 2× 2× 2 =
   d. How many goal states are possible? Explain your calculation. = 15

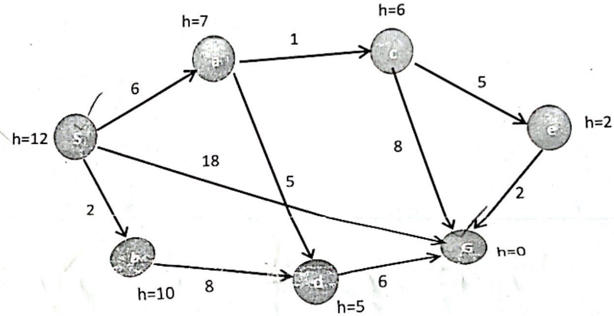
2. Consider the state-space graph in the following figure. Considering **S** as the start node and **G** as the goal node, find out the solution paths and costs returned by the following tree-search algorithms. In case of ties, use alphabetical order to choose nodes. [2+2+4+6]

   a. BFS b. DFS c. IDS d. UCS

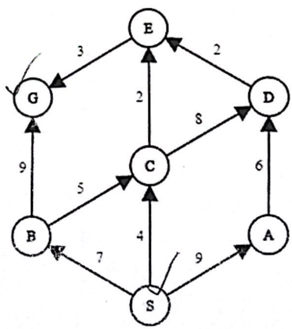


Department of Computer Science and Engineering
CSE 3811 Artificial Intelligence (Section C),
Class Test 2, Spring 2022
Total Marks: 20, Time: 30 minutes

1. Consider the state-space graph in the following figure. Find out the solution paths and costs returned by the following tree-search algorithms. [4+6=10]
   a. Greedy Search
   b. A* Tree Search



2. Consider the following graph and assign heuristic values to the nodes so that the heuristic function is admissible and consistent.[5]



3. Is Greedy Search [illegible] in your answer with example.[illegible]

Department of Computer Science and Engineering
CSE 3811 Artificial Intelligence (Section C),
Class Test 3, Spring 2022
Total Marks: 20, Time: 20 minutes

1. Suppose you are using simulated annealing to solve a problem with the following schedule function:

$$T_k = T_{k-1} - 0.5 \times \alpha$$

   You have two values of α to choose from: 0.5 and 0.9. Which value will you choose and why?[5]

2. Discuss all the variants of hill climbing algorithm along with their advantages over the greedy version. [10]

3. "As the value of T approaches zero, simulated annealing starts to behave like first choice hill climbing search."- justify this statement as either true or false with proper *reasoning. [5]*

United International University
Department of Computer Science and Engineering
CSE 3811 Artificial Intelligence (Section C)
Class Test 4, Spring 2022
Total Marks: 20, Time: 30 minutes

1. Imagine the following scenario: You are trying to make a schedule for 5 different Tasks. Each task requires 2 hours to finish. There is a deadline of 7 hours to finish all the tasks. The schedule is subject to the following constraints:

   Task 1 must be done before Task 3 and Task 4.
   Task 2 and Task 5 cannot be done simultaneously.
   Task 5 must be done before Task1.

   Formulate this problem as a CSP. Draw the constraint graph. Provide a solution using backtracking algorithm and show all the steps. [6+3+7]

2. Suppose you want to use local search to solve the Problem given in question 1. Show a valid start state and one step of simulation for local search. [4]

CSI 381 Artificial Intelligence,

Class Test 5, Spring 2022

Section C

Total Marks: 20, Time: 30 minutes

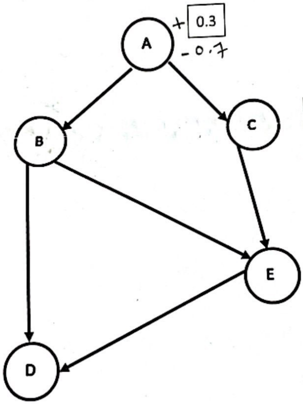
1. From the Bayesian network at the following figure with all Boolean variables, determine the following probability information. At each query, +x denotes X = true, and -x denotes X = false. [4+6+10=20]

   i. Pr(+a, +b, -c, -d, +e)
   ii. Pr(-c);
   iii. Pr(+b | -d, +c)

P(A)

0.3

+ 0.3
- 0.7



+B 0.3

A	P(B)
T	0.7
F	0.5

+A +B 0.7
-A +B 0.5
-B 0.5

A	P(C)
T	0.4
F	0.3

+A +C 0.4 = 0.
-A +C 0.3 = 0.
+A
-A

B	C	P(E)
T	T	0.4
T	F	0.5
F	T	0.75
F	F	0.15

+B +C +E
+B -C +E
-B +C +E
-B -C +E

B	E	P(D)
T	T	0.15
T	F	0.35
F	T	0.7
F	F	0.25

-d 0.85
0.65
0.3
0.75

United International University

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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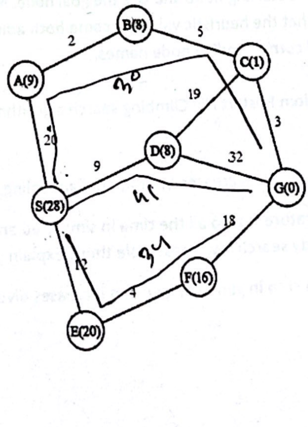
1. Suppose, you are going to design an intelligent AI gardener that can water your rooftop plants and clear the weeds. The AI gardener needs to water the plants in the right amount without wetting the rooftop. It also needs to identify and then pluck out the weeds when necessary. Determine the PEAS specification 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



I. Greedy Best First search with co... solution.

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

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

[1+1+1]

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:

48 8 2×4=8

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

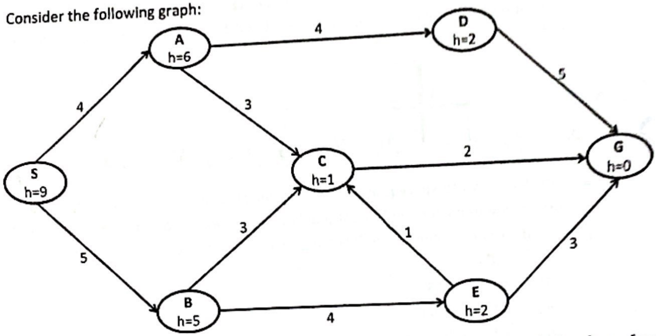
4 ≤ 8 < 2×8=16

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]

Max Min

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