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Questions

Question 1

The next questions are about the game of tic-tac-toe. It is played on a board of 9 squares, divided into 3 rows and 3 columns. Starting with an empty board, the players in alternating turns place a single piece in an empty square. The starting player places X's, the other player places O's. The first player to line up 3 of their pieces in a line (horizontal, vertical, or diagonal), wins the game. If no more moves are possible the game ends in a draw.

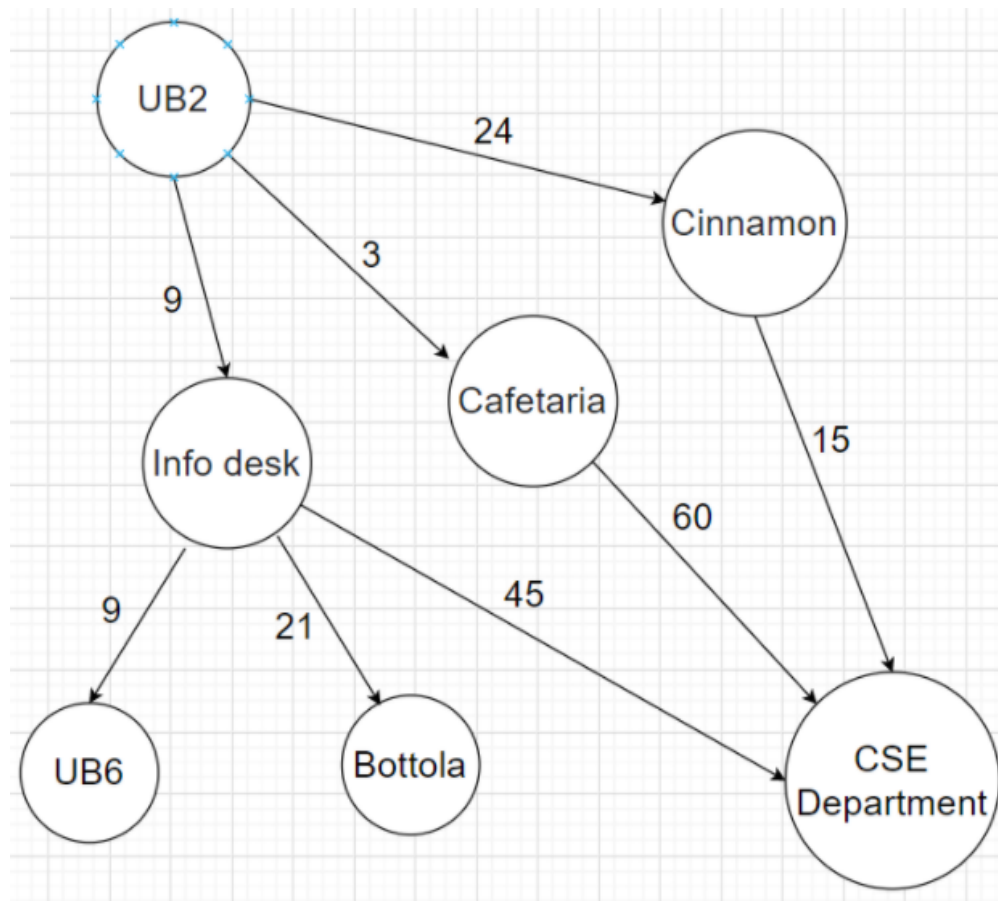
- a)** Give the PEAS description for the starting player in tic-tac-toe. **[3]**
- b)** Classify the tic-tac-toe task environment according to these properties and justify your answer with necessary explanations. **[2]**
- a. Fully observable/partially observable
 - b. Deterministic/stochastic
 - c. Episodic/ sequential
 - d. Static/dynamic/semi-dynamic

e. Discrete/continuous

f. Single Agent/ Multi-agent

Question 2

Visualize a hypothetical and overly simplified map of Brac University such as the graph shown below. You are to help a fresher find his path starting from "UB2" to the "CSE department".



i) Using the most suitable uninformed searching algorithm, find and state the minimum cost path for the fresher to the CSE department. State the algorithm you are using, and each time you expand a node, show the status of the frontier. **[4]**

ii) What is the time complexity of the Uniform Cost Search (UCS) Algorithm? Explain how the answer you have chosen gives us a way to roughly estimate the worst-case time complexity of the algorithm. **[3]**

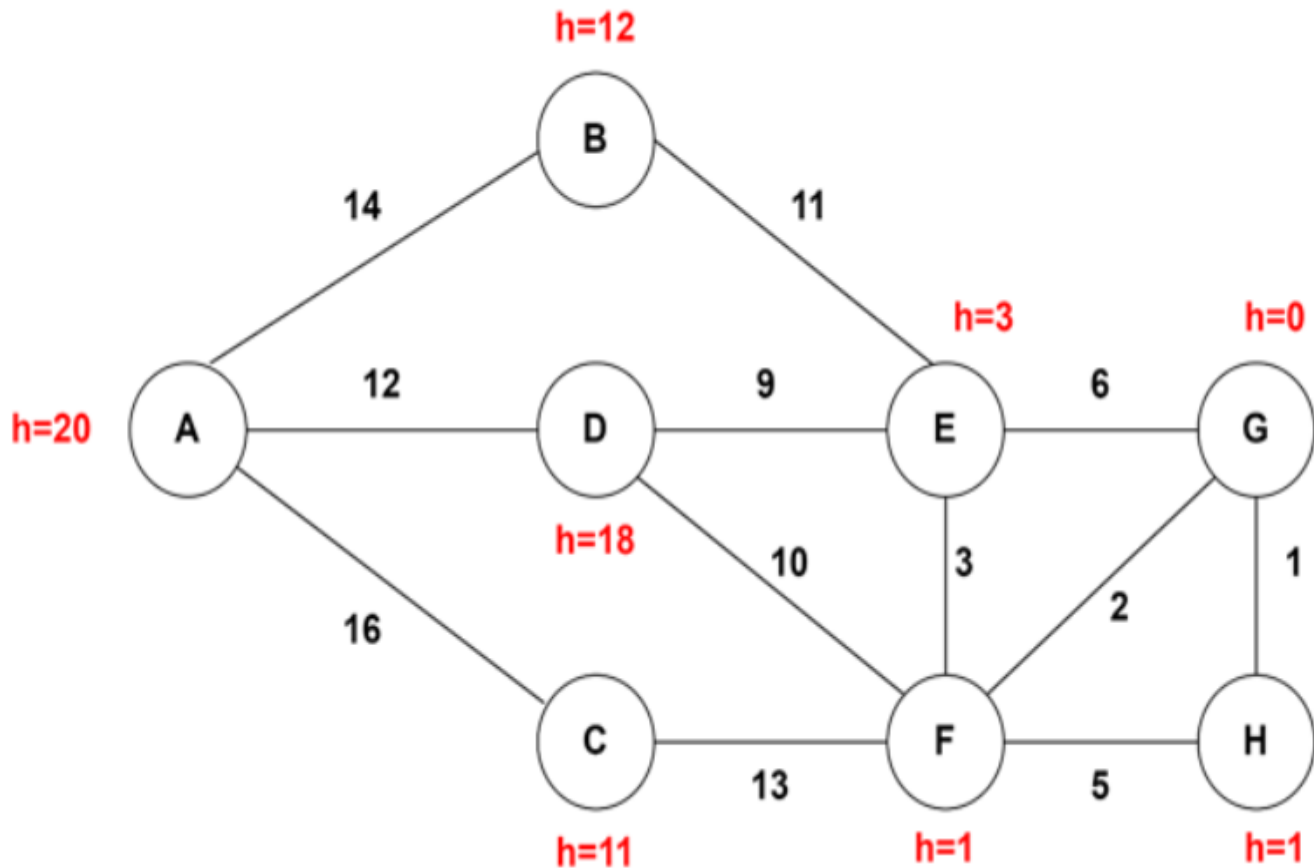
iii) Provide two instances for each:

a) n BFS might outperform DFS,

b) when DFS might outperform BFS. [3]

Question 3

Here, A is the start node and G is the goal node.



i) Run Greedy best-first tree search on this graph and show the cost from A to G (If there is a tie, expand node with lower heuristic value first). How many nodes are expanded? [3]

ii) Run A* tree search on this graph and show the cost from A to G (If there is a tie, expand node with lower heuristic value first). How many nodes are expanded? [4]

iii) Does any of these two algorithms find the optimal solution? Why/why not? [3]

Question 4

The following table consists of the initial population of strings. Note that the string represents a binary encoding of a number n , and that the fitness function is given by

$$F = \pi r^2 \text{ where, } r = n * 6$$

String	n	r	F
010111	23		
100011			
010011			
101011			

Apply the following steps of the Genetic Algorithms **[10]**

i) Generate the initial population

ii) Compute fitness considering the fittest first and the least fit last

iii) Select the first three chromosomes based on fitness

iv) Consider the Crossover using the following crossover operations

a) Cross the fittest two chromosomes using one-point crossover at the middle point

b) Cross the second and third fittest individuals using a two-point crossover (points second and fourth)

v) Apply the Mutation

Question 5

What kind of problem will occur if you apply hill climbing algorithm on the following problem. What are the remedies of those problems? Explain with proper details. **[5]**

	1	2
5	6	3
4	7	8

Start state

1	2	3
4	5	6
7	8	

Goal state

Submission Link

SUBMISSION LINK

Answer the questions in your script and scan it into a PDF file (You can use camscanner or simply make PDF with screenshots). Once you are done, rename the file as **YourSection_YourName_YourID**. For example if a guy from section 4 named Peter Parker has a ID of 14101061, his filename should be **4_Peter Parker_14101061**

Then, submit the PDF file in the follwing link. Make sure that all the information you provide in the form are correct. **You get only once chance to submit. Therefore, double check everything before clicking the submit button.**

<https://forms.gle/r3r9t2vYQnxndWPP8>

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