Roll No											

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING
MID TERM EXAMINATION - OCT 2023

Semester : Semester V- 2021
Course Code : CSE3005
Course Name : Sem V - CSE3005 - Applied Artificial Intelligence
Program : B. TECH

Date : 31-OCT-2023
Time : 11:30AM - 1:00PM
Max Marks : 50
Weightage : 25%

Instructions:
(i) Read all questions carefully and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and non-programmable calculator are permitted.
(iv) Do not write any information on the question paper other than Roll Number.

PART A

ANSWER ALL THE QUESTIONS **(5 X 2 = 10M)**

1. Consider a game tree of depth **m**, with branching factor **b**. Write a recurrence relation for **T(m)**:
(a) Worst ordering, where no nodes are pruned; and
(b) Ideal ordering, where the maximum number of nodes are pruned
Assume that the cost of evaluating a node is a constant time of c.

(CO1) [Knowledge]

2. Mention the data structure which is used to keep track of the frontier nodes in Greedy Best-First Search

(CO1) [Knowledge]

3. Mention the terms used to define:
(a) the set of rules used to define valid sentences in a logic
(b) the meaning that can be inferred from the logic statements

(CO1) [Knowledge]

4. First Order Logic is a superset of Propositional Logic. Hence, all the inference rules which are applicable for propositional logic are also applicable for First Order Logic. However, due to the quantifiers that are present in First Order Logic, it has some more inference rules which are not present in propositional logic. Mention two inference rules in First Order Logic that are NOT there in propositional logic because First Order Logic has the Universal Quantifier.

(CO1) [Knowledge]

5. Mention the equivalence relation needed for converting the following statement into CNF: $\forall x \; P(x) \rightarrow Q(x)$
You can assume that P(x) and Q(x) are atomic statements.

(CO1) [Knowledge]

PART B

ANSWER ALL THE QUESTIONS **(2 X 10 = 20M)**

6. Consider the following situation, where we have the following predicates:

- Wolves, foxes, birds, caterpillars, and snails are animals, and there are some of each of them.

- There are some grains, and grains are plants.
- Every animal either likes to eat all plants or all animals much smaller than itself that like to eat some plants.
- Caterpillars and snails are much smaller than which are much smaller than which are much smaller than wolves.
- Wolves do not like to eat foxes or grains.
- Birds like to eat caterpillars but not snails.
- Caterpillars and snails like to eat some plants.
- Foxes like to eat a grain-eating animal.

For each of the following terms, define an appropriate predicate. Eg,, “child(x): x is a child”:

1. Animal
2. Bird
3. Caterpillar
4. Wolf
5. Eat
6. Fox
7. Grain
8. Plant
9. Snail
10. Smaller

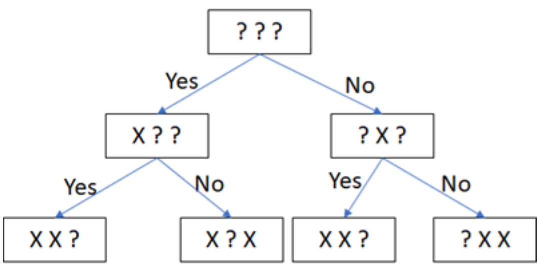
(CO3) [Comprehension]

NOTE: You need not convert any of the above sentences into First Order Logic. Just define suitable predicates for the above terms.

7. The influencer identification problem is described as follows: At a party the host needs to find out if there is an influencer among the guests. An influencer is a guest who is followed by everyone else, but who does not follow any of the other guests. To find that out, he asks one of the guests, “Do you (guest X) follow another guest (guest Y)?” to which the guest replies either “Yes” or “No”. We need to do this using the least number of such questions. One method of finding out who the influencer is by first finding out an ***influencer candidate*** and then verifying if that candidate is indeed an influencer. Algorithmically, it is defined as follows:

1. Store the guests in a list
2. Ask the first unknown guest (guest with ?) whether they follow the next unknown guest (guest with ?)
   - If the first guest replies “Yes”, then the first guest cannot be the influencer
   - If the first guest replies “No”, then the second guest cannot be the influencer
3. This continues till there is only 1 guest which is unknown (guest with ?)

Consider the following situation with **3 guests**. If a guest could be an influencer, we mark the guest with a **?** but if we can conclude that the guest is **NOT** the influencer, we mark the guest with an **X**. The below figure shows the search for 3 guests:



Now, **draw the search tree** for a situation where we have **FOUR guests**. In such a situation, how many questions would be needed to determine who the influencer candidate is. Explain how you came to that answer.

(CO2) [Comprehension]

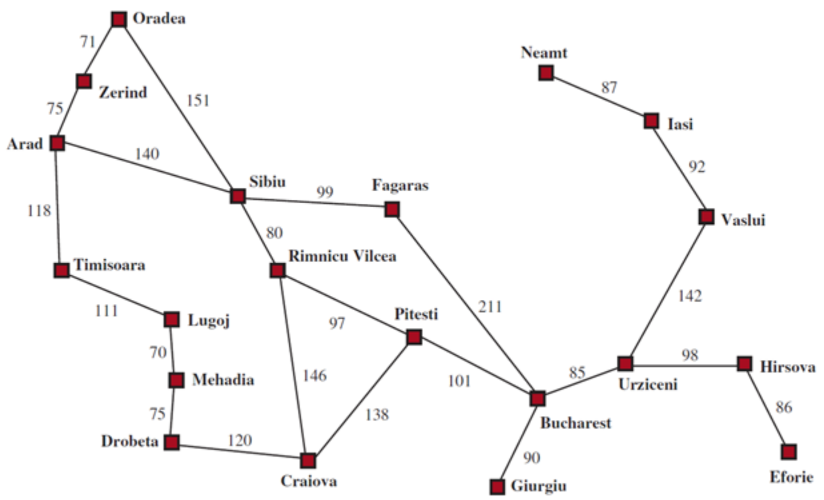
PART C

ANSWER THE FOLLOWING QUESTION **(1 X 20 = 20M)**

8. Dr. DK went to Bucharest to attend the GWC (Global WordNet Conference) a few years ago. After that, he decided to visit different cities in Romania. As he wanted to visit **all** the cities, he decided to use a variant of the **generalized Uniform Cost Search Algorithm** (also known as Dijkstra's SSSP) to find the path from a particular node to **every other node** in the graph. This is done by **starting from the source node** and running the Uniform Cost Search to reach **ALL** the nodes in the graph. With this in mind, find the cost of the shortest paths from Bucharest to reach all the other cities. Also find out the **actual paths**. While reporting the paths, write only the **first letter** of each city (Eg. If you are referring to Rimnicu Vilcea, write it as R, instead of Rimnicu Vilcea) In case of ties, they are broken based on **alphabetical order**. At the end, complete the following table:

City	Path	Path Cost
Arad		
Craiova		
Drobeta		
Eforie		
Fagaras		
Giurgiu		
Hirsova		
Iasi		
Lugoj		
Mehadia		
Neamt		
Oradea		
Pitesti		
Rimnicu Vilcea		
Sibiu		
Timisoara		
Urziceni		
Vaslui		
Zerind		

You can use the following map:



(CO2) [Application]