E/L/TX

Reg. No: 22BCE3725

VIT
Vellore Institute of Technology

Final Assessment Test – November 2024

Course: **BCSE306L - Artificial Intelligence**

Class NBR(s): **1422/1426/1432/1436/1439/1444/1456/1461/1466/1469/1474/1477/1479/1481/1483/1486/1490/1493/1496/1501/2058**

Slot: **E1+TE1**

Time: **Three Hours**

Max. Marks: **100**

- **KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE**
- **DON'T WRITE ANYTHING ON THE QUESTION PAPER**

Answer ALL Questions

(10 X 10 = 100 Marks)

1. Explain the classifications of AI based on functionality and technology. Provide examples for each type.

2. Represent the following assertions using propositional logic:

   i. If Rahul has fever then Rahul has cough.
   ii. If Rahul has cough and fever then Rahul is fatigued.
   iii. If Rahul has headache and fatique then Rahul has migrane.
   iv. If Rahul has migrane and fever then Rahul should not look at bright lights.
   v. If Rahul has cough and migrane then Rahul should rest.
   vi. Rahul has fever.
   vii. Rahul has headache.

   Prove: Rahul should rest using forward and backward chaining techniques.

3. Represent the following sentences in First-Order Logic (FOL). Use Resolution to infer the conclusion:

   i. Every member attends every event hosted by the club.
   ii. Anyone who misses an event is not an active member.
   iii. Anyone who volunteers at an event is an active member.
   iv. Anyone who registers for an event either attends it or misses it.
   v. Emma registers for an event. "Coding Hackathon" is an event.
   vi. Emma is a member.

   (Conclusion): **Emma attends the event.**

4. Write the naïve Bayesian classification algorithm and apply naïve Bayesian classification for the following dataset. Compute the conditional probabilities and predict the class for the new instance (A=0, B=1, C=0).

Record	A	B	C	Class
1	0	0	0	+
2	0	0	1	−
3	0	1	1	−
4	0	1	1	−
5	0	0	1	+
6	1	0	1	+
7	1	0	1	−
8	1	0	1	−
9	1	1	1	+
10	1	0	1	+

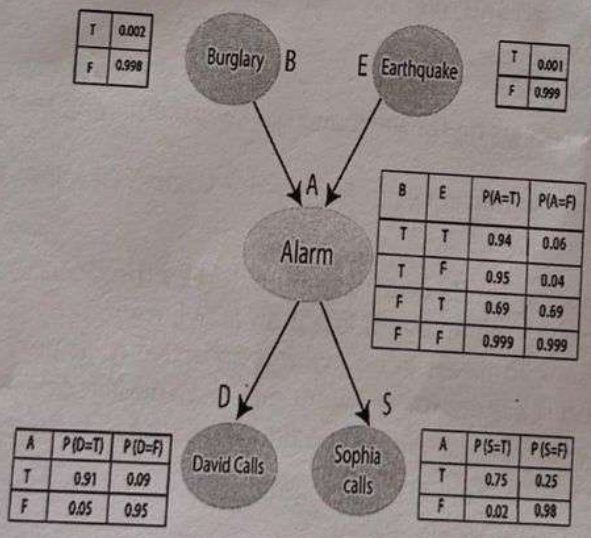
5. To prevent break-ins, Harry put a brand-new burglar alarm at his house. The alarm consistently reacts to a break-in, but it also reacts to little earthquakes. Harry has two neighbors David and Sophia, who have taken a responsibility to inform Harry at work when they hear the alarm. David always calls Harry when he hears the alarm, but sometimes he got confused with the phone ringing and calls at that time too. On the other hand, Sophia likes to listen to high music, so sometimes she misses to hear the alarm. Here Compute the probability of Burglary Alarm.

   i. Calculate the probability that alarm has sounded, but there is neither a burglary, nor an earthquake occurred, and David and Sophia both called the Harry.

   ii. Calculate probability of burglary given alarm.

List of all Events occurring in a Bayesian Network

- Burglary(B)
- Earthquake(E)
- Alarm(A)
- David Calls(D)
- Sophia Calls(S)



T	0.002
F	0.998

T	0.001
F	0.999

B	E	P(A=T)	P(A=F)
T	T	0.94	0.06
T	F	0.95	0.04
F	T	0.69	0.69
F	F	0.999	0.999

A	P(D=T)	P(D=F)
T	0.91	0.09
F	0.05	0.95

A	P(S=T)	P(S=F)
T	0.75	0.25
F	0.02	0.98

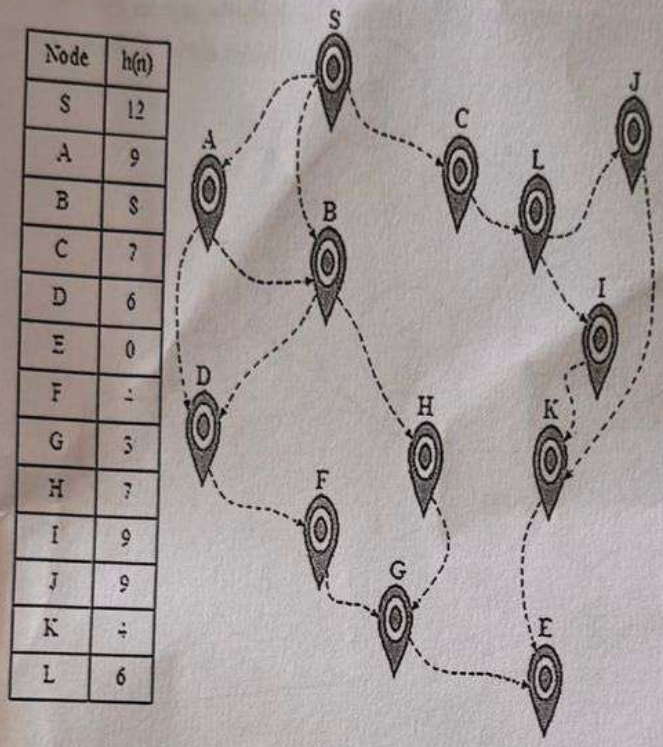
6. Formulate the STRIPS representation for the problem of planning a simple robot's path to move a box from one room to another. Define the initial state, goal state, actions and the preconditions and effects for each action.

7. Explain how hierarchical task network (HTN) planning can be applied in non-deterministic domains. Provide examples to illustrate how HTN planning manages uncertainty and unpredictable outcomes.

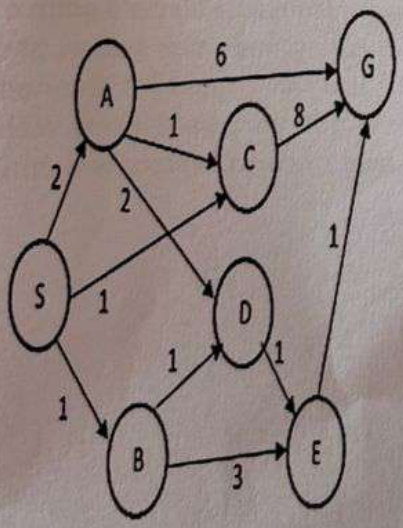
8. Imagine you're searching for information on a complex topic like "climate change". Explain how search engines would identify pages that are most authoritative and informative pages on this topic without repetitive or irrelevant content with suitable example.

9.a) i. Apply greedy best first search on the following graph and find a path from the start mode (S) to the goal node (E).

Node	h(n)
S	12
A	9
B	8
C	7
D	6
E	0
F	4
G	3
H	7
I	9
J	9
K	4
L	6



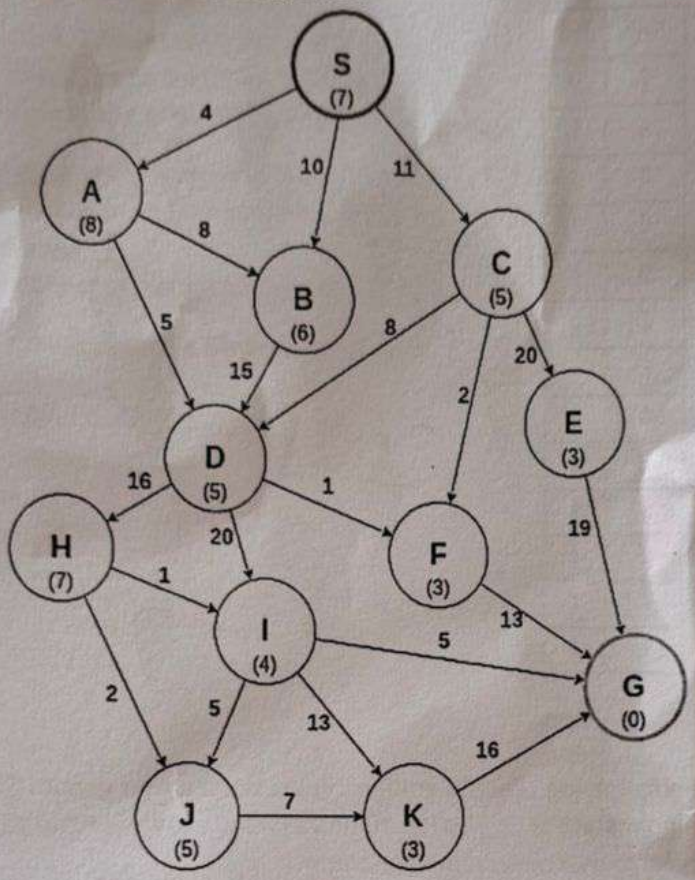
ii. Consider the following search problem, represented as a graph. The start state is S and the goal state is G. The heuristic values are given in the table below. Perform Uniform cost search on the graph.



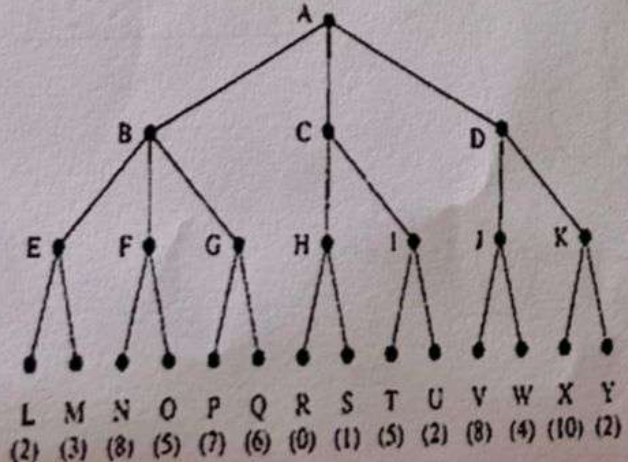
S	A	B	C	D	E	G
10	8	5	5	4	2	0

OR

9.b) Write the A* algorithm and perform it on the following graph to find the most cost-effective path to reach from start state S to final state G using A* Algorithm. The numbers written on edges represent the distance between the nodes. The numbers written inside the nodes represent the heuristic value.

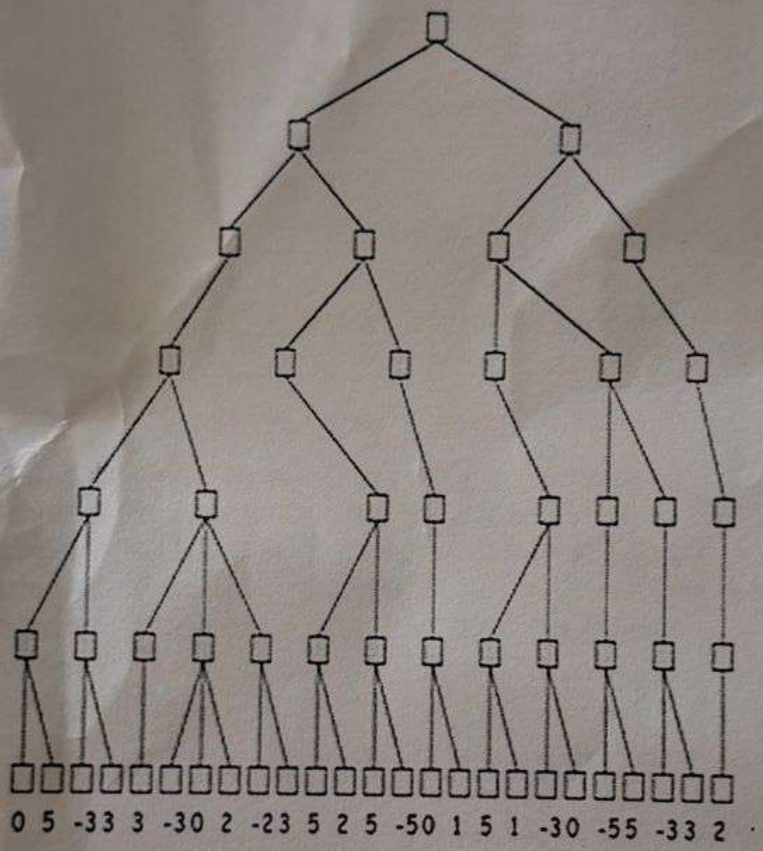


10.a) Consider the game tree in which the static scores are from first player's point of view. Suppose the first player is maximizing player. Applying mini-max search, show the backed-up values in the tree. What move will the MAX choose? If the nodes are expanded from left to right, what nodes would not be visited using alpha-beta pruning? Also explain limitations of Mini-Max search. How to overcome them?



OR

10.b) Explain the steps of alpha beta pruning. In the game tree below, use alpha-beta pruning to compute the minmax value assuming children are visited left to right. Show the alpha or beta values at each node and indicate which branches are pruned. Discuss the effectiveness of alpha beta pruning.



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