Reg. No: 21BIT0233

I/E/TX

Final Assessment Test – May 2024

VIT® Vellore Institute of Technology (Deemed to be University under section 3 of the UGC Act, 1956)

Course: **BITE308L - Artificial Intelligence**

Class NBR(s): **3931/3932/3933/3935/3937**

Slot: **B2+TB2**

Time: **Three Hours**

Max. Marks: **100**

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

Answer any TEN Questions

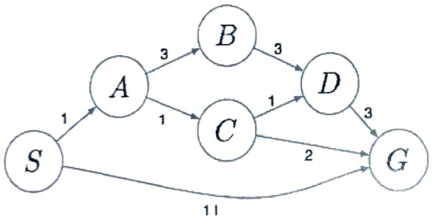
(10 X 10 = 100 Marks)

1. Give a PEAS description of the task environment for the following agents:
   a) Part-picking robot **[2.5]**
   b) Interactive English tutor **[2.5]**
   c) Playing football **[2.5]**
   d) Taxi driver agent **[2.5]**

2. a) Assume an artificial agent that learns how to play a carom board by playing multiple times and receiving feedback from experts. **[5]**
   b) Which type of agent is best for this player? Justify your answer with a illustration and brief explanation of the agent architecture. **[5]**

3. Enumerate the variations of the hill climbing algorithm and how they solve the search space issue -justify your answer with clear illustration with technical explanations **[4+2+4]**

4. Consider the directed graph below, where 'S' is the start node, and 'G' is the goal node.



Which sequences of paths are explored by the following algorithms to this problem? Show the complete intermediate state space.

   a) breadth-first algorithm, **[1]**
   b) uniform cost graph search **[3]**
   c) depth-first graph **[3]**
   d) A* graph search **[3]**

5. Draw an ontological representation of the following scenario and create a collection of production rules that implement the specified problem. **[5+5]**

A man has to ferry a wolf, a goat, and some cabbage over a river. His rowboat can accommodate the man and either the wolf, the goat, or the cabbage. If he takes the cabbage with him, the wolf will devour the goat. If he takes the wolf, the goat will consume the cabbage. Only when the guy is there are the goat and cabbage protected from their foes. However, the man transports wolf, goat, and cabbage across the river.

6. Convert these sentences to First-Order Logic. Using proof by refutation and resolution as the single inference rule, show the resolution proof that proves or disproves the goal.

a) All cannie howls at night. [2]

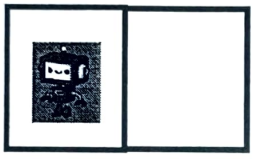
b) Anyone who own cat will not have any mice. [2]

c) Dreamers donot have anything that cries at night. [2]

d) Alice owns either a cat (or) cannie. [2]

e) Conclusion: if Alice is a dreamer she has no mice. [2]

7. Consider the robot functioning in the two-cell grid world depicted below. Assume the robot is originally in cell C1. The robot can choose between two actions: A1 and A2. A1 refers to the command "to move to a neighbouring cell". If the robot is in C1, operation A1 has a probability of 0.9 of moving it to C2 and 0.1 of remaining in C1. If the robot is at C2, action A1 has a probability of 0.8 of successfully moving it to C1 and 0.2 of failing to do so. When the action "to stay in the same cell" is completed, the robot remains in that cell.



C1 C2

a) Develop a Bayes net and probability tables for the robot's first two actions. [5]

b) What is the probability that the robot will appear in cell C1 after it executes close to infinitely many actions? [5]

8. A robotic dog name has Fido in a laboratory, with a toy dangling from the ceiling. A package is provided that allows the Fido to reach the toy if he climbs on it. Initially, Fido is located at A, the toy at B, and the package at C. The Fido and the package are both low in height, however if the Fido climbs onto the package, he will be high, much like the toy. The activities offered to the Fido include moving from one location to another, Push an object from one location to another, climb onto or down from an object, and grip or release an object. A Grasp results in the Fido holding the toy.

a) Write the initial state and the four action schemas of the fido with toy. [6]

b) Fix your action schema to account for heavy objects. [4]

9. a) John finds a specific kind of food appealing chart based on the dish's temperature, size, taste and has the following dataset:

Appealing	Temperature	Taste	Size
No	Hot	Salty	Small
No	Cold	Sweet	Large
No	Cold	Sweet	Large
Yes	Cold	Sour	Small
Yes	H	Sour	Small
No	H	Salty	Large
Yes	H	Sour	Large
Yes	Cold	Sweet	Small
Yes	Cold	Sweet	Small
No	H	Salty	Large

Based on the above date find the following:

diagrammatic representation.

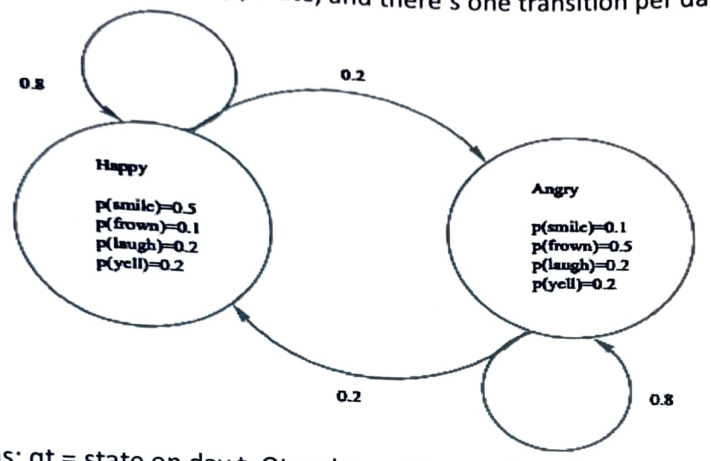
i) What is the initial entropy of Appealing? [1]

ii) Assume that Taste is chosen for the root of the decision tree. [2]

iii) What is the information gain associated with this attribute? Draw the full decision tree learned for this data (without any pruning) [4]

b) John leads a modest life. He has moments of happiness and moments of anger. However, he keeps his emotions hidden, so all you can see is whether he laughs, yells, smiles, or frowns.

We start on day 1 in the Happy state, and there's one transition per day

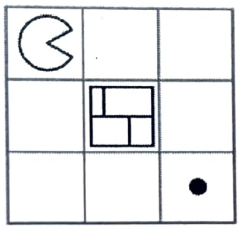


Definitions: qt = state on day t. Ot = observation on day t.

i) Assume that O1 = frown, O2 = frown, O3 = frown, O4 = frown and O5 = frown. What is the most likely sequence of states? [1]

ii) What is P(q2 = Happy|O2 = frown)? [2]

10. In the game ``Tragic Pac-Man'', Pac-Man competes against a moving wall . During Pacman's turn, he must to enter an empty square and go in one of the four cardinal directions. When the wall turns, it must to go into a vacant square and in one of the four cardinal directions. The wall cannot move into a dot-containing square. Staying still is not allowed by either player. Pacman's score is always equal to the number of dots he has eaten. The first game begins in the configuration shown below. Pacman moves first.



a) Draw a game tree with 4 moves for each player. [5]

b) What is the value of the game as computed by mini-max algorithm? [5]

11. What are the component needed for planning and corresponding actions? Explain with your preferred example.

12. Describe the different approaches to knowledge representation with examples.

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