Institute of Information Technology
Jahangirnagar University
Professional Masters in IT

Trimester Final Examination, Fall 2022
Duration: 3.0 Hours
Course Code: PMIT – 6107

Full Marks: 60

Course Title: Artificial Intelligence and Neural Network

Do not write anything on the question paper.
There are **7 (seven)** questions. Answer any **5 (five)** of them.
Figures in the right margin indicate marks.

Question 1:

(a) Draw a functional block diagram of a Goal based Agent and explain its all component using a real-life example. [04]

(b) Distinguish between supervised and unsupervised learning algorithms. Give some practical examples where you can use supervised and unsupervised algorithms. [04]

(c) Explain reinforcement learning algorithm with example. [04]

Question 2:

(a) Maze shown in Figure 2 where square S is the initial position and G is the goal position. The goal of our agent is to find a way from the initial position to final position. The possible actions are move up, down, left, and right to an adjacent square. The shaded squares are obstacles. No state is visited twice and label the start state as '1', the next state as '2', etc. [06]
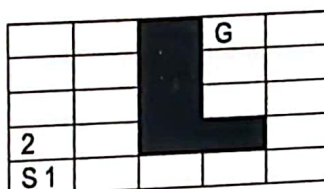

Starting from S node how to reach goal G node by BFS and DFS using illustration. [03]

(b) Distinguish between DLS and BFS algorithms. [03]

(c) Translate the following to Predicate Logic
   1. Every house is a physical object
   2. Some physical objects are houses
   3. Peter does not own a house

Question 3:

(a) Consider the following tree, what is the minimax value for the root? Use minimax to determine the best strategy for both players and give the actions that would be chosen and their values. How would you re-order the nodes to get maximal pruning when using the alpha-beta algorithm? Feel free to use the figure to show the re-ordering [05]
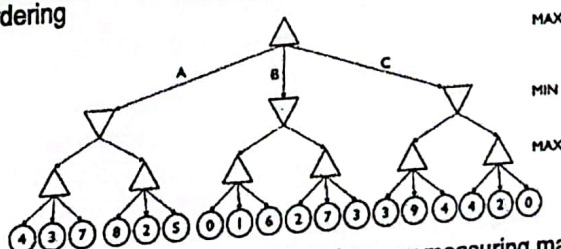
(b) There are two jugs of volume A litre and B litre. Neither has any measuring mark on it. There is a pump that can be used to fill the jugs with water. How can you get exactly x litre of water into the A litre jug. Assuming that we have unlimited supply of water. Let's assume we have A=4 litre and B= 3 litre jugs. And we want exactly 2 Litre water into jug A (i.e 4 litre jug) how we will do this. Write the rule, state and process of this problem [05]

(c) How can you overcome the infinite loop problem of Bidirectional searching algorithm? [02]

Question 4:

(a) We have studied the Wumpus World game in the class. A different version is presented here. Find how to reach the square where the Gold is located. Also prove that Wumpus is in (1,4) square of the cave. [06]

4	Wumpus	Stench	Breeze	
3	Stench	Breeze	Pit	Breeze
2	Agent		Breeze/Gold	
1		Breeze	Pit	Breeze
	1	2	3	4

(b) $X = \{x_1, x_2\}$, $Y = \{y_1, y_2\}$, and $Z = \{z_1, z_2, z_3\}$. Consider the following fuzzy relations: **[06]**

$$R = \begin{array}{c} \\ x_1 \\ x_2 \end{array} \begin{array}{cc} y_1 & y_2 \\ \left[\begin{array}{cc} 0.7 & 0.6 \\ 0.8 & 0.3 \end{array} \right] \end{array}$$

$$S = \begin{array}{c} \\ y_1 \\ y_2 \end{array} \begin{array}{ccc} z_1 & z_2 & z_3 \\ \left[\begin{array}{ccc} 0.8 & 0.5 & 0.4 \\ 0.1 & 0.6 & 0.7 \end{array} \right] \end{array}$$

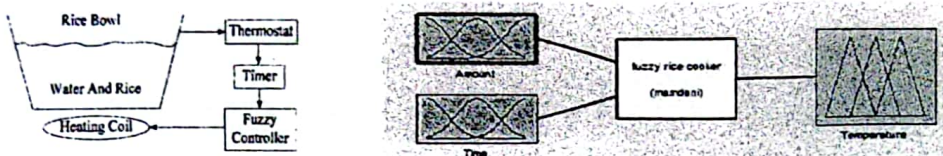Relation R   Relation S

Using **Max-min** composition, find $T = R \circ S$

Question 5:

Create a fuzzy control system which models how you might choose the heating temperature of the rice cooker. Please consider amount of rice and time, rated between 0 and 10.

We would formulate this problem as:

Antecednets (Inputs)

Amount Fuzzy set : low, medium, high; *Time* Fuzzy set: small, medium, high

Consequents (Outputs)

Temperature Fuzzy set: low, medium, high

(a) Design a rule base system **[04]**

(b) Draw membership functions (use illustrations) **[04]**

(c) Show that if the service and food quality are great, the tip will be high **[04]**

Question 6:

(a) Solve the following Knapsack problem by Genetic Algorithm. Find which item should be kept in the knapsack so as it will maximizes knapsack value without breaking it. **[08]**

Item	Weight (Kg)	Value (Tk)
A	5	12
B	3	5
C	7	10
D	2	7

K=14

(b) Write GA using a flow chart **[04]**

Question 7:

(a) Implementing NOR Logic Gate using Neural Networks. If the initial value of $x1=x2=1$, and $b=0.5$, then find the final value of weight and bias for your model. **[06]**

(b) RNN is widely used for image captioning. How can you create an RNN model for captioning the following images? Explain in details. **[06]**

Two dogs play in the grass.	A dog swims in the water.	A little girl in a pink shirt is swinging.