



VIT[®]

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

Reg. No. :

21BLC1122

Final Assessment Test (FAT) - May 2024

Programme	B.Tech.	Semester	WINTER SEMESTER 2023 - 24
Course Title	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	Course Code	BECE309L
Faculty Name	Prof. Lekshmi K	Slot	F2+TF2
		Class Nbr	CH2023240502711
Time	3 Hours	Max. Marks	100
General Instructions:			
Write only Register Number in the Question Paper where space is provided (right-side at the top) & do not write any other details.			

Section - I

Answer all questions (4 X 10 Marks = 40 Marks)

- An AI-intelligent agent is being developed to assist doctors in surgical operations. The robot needs to perform its tasks during surgery, with the main goal being to achieve the best performance. For this purpose, the AI agent needs to recall its past memories to understand how to perform optimally. After recalling its past experiences, the AI agent realizes that proper preparation for assistance is essential to achieve the best results. [10]
 - Identify and briefly describe a suitable AI agent for the given scenario. (4 Marks).
 - Illustrate a neat diagram and algorithm for the identified AI agent. (6 Marks)
- Imagine you are working as a data scientist for a retail company that is aiming to improve its sales forecasting model using machine learning. The company has provided you with a dataset containing historical sales data for various products across different regions. However, upon initial inspection, you notice several data quality issues, such as missing values, outliers, and inconsistent formatting across columns. Discuss the data processing techniques to deal with the missing and inconsistent data with a suitable example. (10 Marks) [10]
- The following table consists of training data. Find the best feature at the root and draw the final decision tree. Use impurity measures of Entropy and Information gain to find the best feature. [10]



ID	Fever	Cough	Breathing issues	Infected (Target)
1	No	No	No	No
2	Yes	Yes	Yes	Yes
3	Yes	Yes	No	No
4	Yes	No	Yes	Yes
5	Yes	Yes	Yes	Yes
6	No	Yes	No	No
7	Yes	No	Yes	Yes
8	Yes	No	Yes	Yes
9	No	Yes	Yes	Yes
10	Yes	Yes	No	Yes
11	No	Yes	No	No
12	No	Yes	Yes	Yes
13	No	Yes	Yes	No
14	Yes	Yes	No	No

04. Imagine you are a data scientist working for a high-end fashion retailer. Your task is to analyze customer data for targeted marketing strategies. You have a dataset of eight customers' locations, represented by (x, y) coordinates: [10]

$A1=(2,10)$, $A2=(2,5)$, $A3=(8,4)$, $A4=(5,8)$, $A5=(7,5)$, $A6=(6,4)$, $A7=(1,2)$, $A8=(4,9)$.

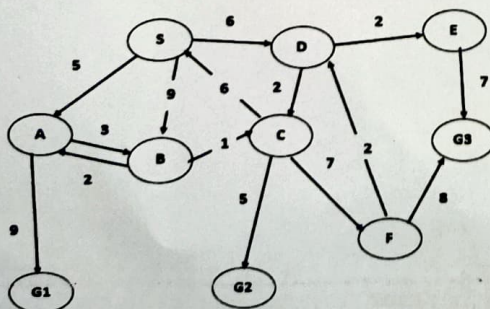
The goal is to cluster the customer's locations into three segments based on their geographical distribution using Euclidean distance. Consider $A1$, $A4$, and $A7$ as the initial centers of the clusters to represent potential high-value customer locations. Perform two epochs, for each epoch:

- Describe how the customer locations are grouped into clusters at the end of epoch and update coordinates of the cluster centers after each epoch which represents prime marketing locations. (6 Marks)
- Draw a graph and plot the cluster points after each epoch. (4 Marks)

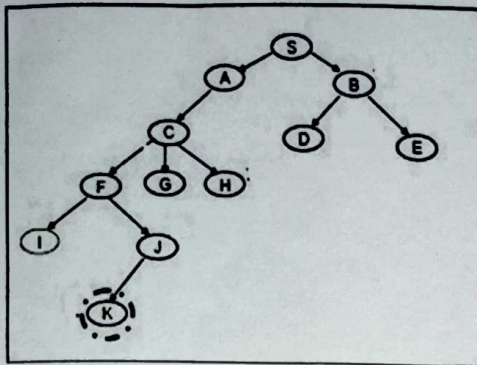
Section - II

Answer all questions (4 X 15 Marks = 60 Marks)

05. a) Consider the below example and define an appropriate algorithm that is used to move around a directed weighted search space to go from a start node S to one of the destination nodes $\{G1, G2, G3\}$ and its labelling represents the minimum cumulative cost. Using a priority queue, determine the optimal path cost by assigning the lowest cost the highest priority. (8 Marks) [15]



b) Given the following tree, use the hill climbing procedure to climb up the tree. S is the start state and K is the goal state. The values given in the table are the heuristic distance to the goal. Analyze the challenges encountered in hill climbing and apply them to the given graph. (7 Marks)



S	10
A	9
B	11
C	7
D	9
E	12
F	7
G	7
H	7
I	7
J	5
K	0

06. a) Consider the following axioms.

[15]

- Every investor bought stocks or bonds.
- If the Dow-Jones Average crashes, then all stocks that are not gold stocks fall.
- If the T-Bill interest rate rises, then all bonds fall.
- Every investor who buys something that falls is not happy.

Prove or Disprove that, "If the Dow-Jones Average crashes and the T-Bill interest rate rises, then any investor who is happy bought some gold stock" using resolution graph. (9 Marks)

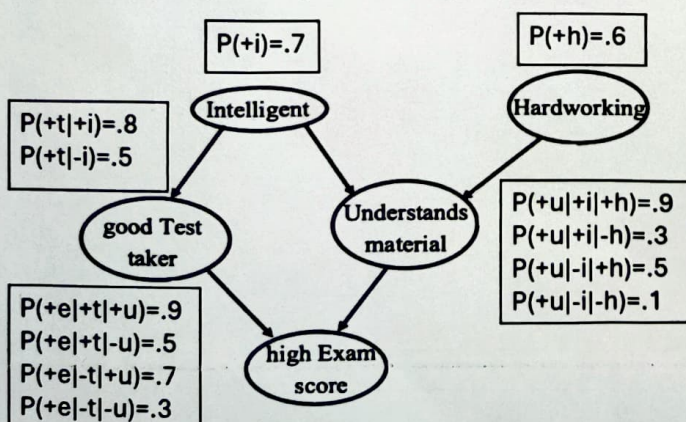
b) Prove that the below arguments are valid by identifying the proper inference rules for each statement by stating the rule. [6 Marks]

- If Sita loves me, then I love Sita. I do not love Sita. Therefore, Sita does not love me.
- If Julie is a woman, then Julie is a human being. If Julie is a human being, then Julie is not an animal. Therefore, if Julie is a woman, then Julie is not an animal.
- William is walking with the dog or Catherine is feeding the cat (or both). Catherine is feeding the cat. Therefore, William is not walking with the dog.
- Either William is walking with the dog or Catherine is feeding the cat. Catherine is not feeding the cat. Therefore, William is walking with the dog.

07. a) It is estimated that 50% of emails are spam emails. Some software has been applied to filter these spam emails before they reach your inbox. If an email is flagged as spam by a certain brand of software, which claims to detect 99% of spam emails and has a false positive rate of 5%, what is the probability that the flagged email is actually not a spam email? (6 Marks)

[15]

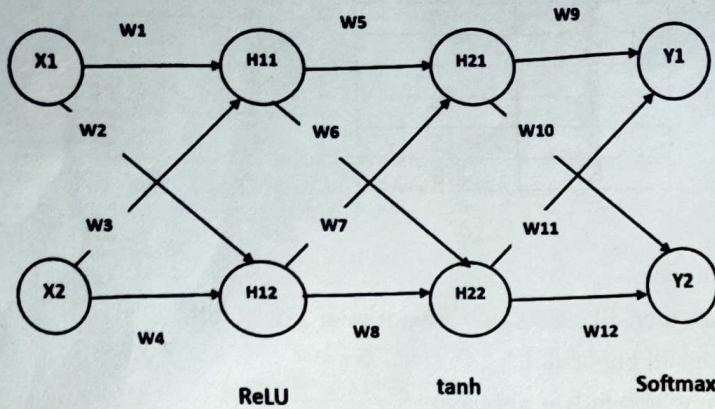
b) Determine the probability that a student is hardworking when they achieve high exam scores using variable elimination by considering Bayesian network provided below (9 Marks)



08. a) Consider the following multilayer feedforward neural network with two inputs [$x_1=0.4$, $x_2=0.4$] and two outputs [$y_1=1$, $y_2=0$] and two hidden layers. The weights associated with the hidden layers are given as follows:

[$w_1=0.4$, $w_2=0.6$, $w_3=0.6$, $w_4=0.4$, $w_5=0.6$, $w_6=0.7$, $w_7=0.7$, $w_8=0.6$, $w_9=0.8$, $w_{10}=0.4$, $w_{11}=0.4$, $w_{12}=0.8$]

For each layer, the associated activation function is given in the figure. Calculate the loss for the network. (9 Marks)



b) Compare and contrast feed forward network and recurrent neural network with a suitable example. (6 Marks)

