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Vellore Institute of Technology

Reg. No. :

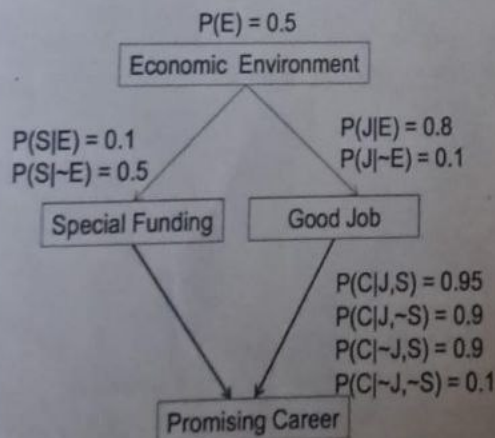| Programme	B.Tech.	Semester	WINTER SEMESTER 2023 - 24
Course Title	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	Course Code	BECE309L
Faculty Name	Prof. Kavitha J C	Slot	F1+TF1
		Class Nbr	CH2023240502703
Time	3 Hours	Max. Marks	100

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 (5 X 10 Marks = 50 Marks)

01. For an AI-driven intelligent irrigation system deployed on a sizable agricultural estate, the primary objective is to maximize water efficiency, minimize waste, and boost crop yield through precise irrigation management that responds dynamically to both environmental variables and the specific needs of cultivated plants. **[10]**

    a) Discuss in detail the PEAS description of the given agent application (4 marks)

    b) Justify all the properties of task environment for the Auto-Agri irrigation system (6 marks)

02. Consider the below Bayesian Belief Network and answer the following questions. **[10]**

P(E) = 0.5

Economic Environment

P(S|E) = 0.1
P(S|~E) = 0.5

P(J|E) = 0.8
P(J|~E) = 0.1

Special Funding   **Good Job**

P(C|J,S) = 0.95
P(C|J,~S) = 0.9
P(C|~J,S) = 0.9
P(C|~J,~S) = 0.1

Promising Career

a) Determine the probability of having a promising career given the economic environment is positive? (5 marks)

b) Determine the probability of having a promising career when there is special funding and good job? (5 marks)

(0). A college student, keen on exploring factors influencing academic performance, decided to [10] investigate whether there's a connection between the number of hours spent on sports activities and their test scores. The student gathered data reflecting their test scores and the corresponding hours devoted to sports before each assessment. The objective is to assess if there exists any correlation between the hours dedicated to sports and the test scores. Below is the dataset collected for the analysis:

Hours Played Sport	Test Score
3	74
1	68
1	66
3	72
4	80
2	68
4	78

By analyzing this dataset, the student aims to unveil any potential relationship between the time allocated to sports activities and academic performance among college students.

04. Given four training samples with two attributes (arousal and valance) to classify a person's [10] emotion into 2 classes (happy or sad).

Person	Arousal	Valance	Class Label
1	3	3	Happy
2	-1	-4	Sad
3	2	3	Happy
4	0	-5	Sad

Now, unknown person's arousal and valance is given as (3, 4). Apply 3-NN classification technique for the above problem to find class label for given unknown instance. (10 marks)

05. Consider the given dataset, apply Naïve Baye's algorithm, and predict the fruit if it has the [10] following properties: {Yellow, Sweet, Long}. Also write its steps of execution

Fruit	Yellow	Sweet	Long	Total
Mango	350	450	0	650
Banana	400	300	350	400
Others	50	100	50	150
Total	800	850	400	1200

Section - II
Answer all questions (2 X 15 Marks = 30 Marks)

06. Consider the following network of interconnected nodes representing a city's layout, a delivery [15] drone is tasked with reaching its destination, ("J"). The drone systematically explores paths, considering both the cost incurred and the heuristic estimate of the remaining distance to the goal state.

a) Write suitable algorithm describing the search strategy (6 marks)

b) Apply the most optimal search algorithm and compute the shortest path between B to J by considering both edge and heuristic costs. (9 marks)
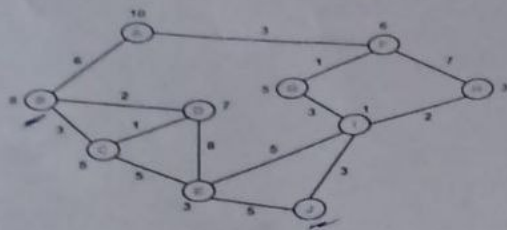
[15]

07. a) Convert the following sentences into conjunctive normal form. [6 Marks]

    i) $(P \rightarrow (Q \rightarrow R)) \rightarrow (P \rightarrow (R \rightarrow Q))$

    ii) $(P \rightarrow Q) \rightarrow ((Q \rightarrow R) \rightarrow (P \rightarrow R))$

    iii) $((A \rightarrow B) \rightarrow C) \vee (A \rightarrow (B \rightarrow C))$

b) Consider the following axioms and Prove that, Every loon eats fish, using resolution with refutation. [9 Marks]

    i) Every bird sleeps in some tree.

    ii) Every loon is a bird, and every loon is aquatic.

    iii) Every tree in which any aquatic bird sleeps is beside some lake.

    iv) Anything that sleeps in anything that is beside any lake eats fish.

Section - III
Answer all questions (1 X 20 Marks = 20 Marks)

[20]

08. Explain the Convolutional Neural Network (CNN) architecture for classifying 50 x 50 RGB images of cats into either "dog" or "cat" categories using a dataset of 12,500 images. Describe the layered procedure used to achieve effective image classification and include a diagram to visually represent architecture for the above scenario (15 marks). Additionally, justify in detail how hyperparameter tuning is performed for this CNN architecture (5 marks)

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