



**BRAINWARE UNIVERSITY**  
**Ph.D. Course Work Examinations**

Programme – Ph.D. in Computer Science and Engineering  
 Course Name – Emerging Trends Machine Learning and Soft Computing  
 Course Code – PHD – CSE01A  
 (Semester – 1)

Time allotted: 4 hrs.

Full Marks: 100

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

**Group –A**

(Multiple Choice Type Questions)

1 x 10 = 10

1. Choose the correct alternative from the following :
  - i) Name the algorithm that uses known input-output pairs to make predictions on new, unseen data.
 

a Decision Trees	b Unsupervised Learning
c Semi-Supervised Learning	d Supervised Learning
  - ii) Identify the basic building blocks of Artificial Neural Networks.
 

a Neurons	b Algorithms
c Sensors	d Variables
  - iii) Predict the primary purpose of a genetic algorithm.
 

a Solving optimization problems	b Classifying data
c Speech recognition	d Image processing
  - iv) Select the term that best describes discovering hidden patterns.
 

a Clustering	b Regression
c Classification	d Unsupervised Learning
  - v) Select the learning type that is not concerned with labeled data.
 

a Unsupervised Learning	b Supervised Learning
c Semi-Supervised Learning	d Reinforcement Learning
  - vi) Choose the goal of a regression problem.
 

a Predict numerical values	b Predict categories
c Group data points	d Optimize rewards
  - vii) Choose the term that best describes grouping data points based on similarity.
 

a Regression Problem	b Classification Problem
c Clustering Problem	d Reinforcement Problem

- viii) Choose the term associated with identifying patterns in data.
- |                       |                           |
|-----------------------|---------------------------|
| a. Regression Problem | b. Classification Problem |
| c. Clustering Problem | d. Reinforcement Problem  |
- ix) Select the type of problem where the output is a category or label.
- |                       |                           |
|-----------------------|---------------------------|
| a. Regression Problem | b. Classification Problem |
| c. Clustering Problem | d. Reinforcement Problem  |
- x) Decide the problem type that aims to divide data into clusters.
- |                            |                            |
|----------------------------|----------------------------|
| a. Predicting stock prices | b. Identifying spam emails |
| c. Customer segmentation   | d. Clustering Problem      |

### Group – B

(Short Answer Type Questions)

5 x 6 = 30

Answer the following questions :

2. Define Supervised Learning and provide a brief description of its key characteristic.
3. Select one real-world problem and suggest whether Supervised, Unsupervised, or Semi-Supervised Learning would be the most suitable approach, providing reasoning.
4. Consider a situation where you have a dataset with imbalanced classes. Explain the challenges this imbalance may pose for a classification problem and suggest potential solutions.
5. Justify the importance of feature selection or feature engineering in improving the performance of classification and regression models.
6. Apply the Random Forest algorithm to a real-world classification problem and explain the steps involved in the process.
7. Apply a fuzzy logic system to a real-world problem scenario and explain the steps involved in designing and implementing the fuzzy rules and membership functions.

### Group – C

(Long Answer Type Questions)

10 x 6 = 60

Answer the following questions :

8. Differentiate between Supervised, Unsupervised, and Semi-Supervised Learning algorithms in terms of their fundamental principles and applications.

9. Explain how unsupervised clustering algorithms work and discuss their applications in real-world scenarios, providing examples.
  10. Evaluate the importance of feature selection in the context of both classification and regression, and justify its significance.
  11. Evaluate the ethical implications of using machine learning models for sensitive tasks in both classification and regression, such as predictive policing or healthcare outcomes prediction.
  12. Compare and contrast the training processes of supervised learning and unsupervised learning in the context of Artificial Neural Networks. Describe the key differences, challenges, and applications associated with each approach.
  13. Apply Fuzzy Logic in a real-world context, such as a smart traffic control system, and write a detailed explanation of how fuzzy sets, fuzzy rules, and fuzzy inference are used to make intelligent decisions in this system.
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