End Term (Odd) Semester Examination December 2024

Roll no.....

Name of the Course and semester: MCA, 3rd Sem
Name of the Paper: Artificial Intelligence & Machine Learning
Paper Code: TMC-303
Time: 3 hour

Maximum Marks: 100

Note:

(i) All the questions are compulsory.
(ii) Answer any two sub questions from a, b and c in each main question.
(iii) Total marks for each question are 20 (twenty).
(iv) Each sub-question carries 10 marks.

Q1. (2X10=20 Marks)

a. Define Artificial Intelligence (AI) and explain its four main approaches: acting humanly, thinking humanly, acting rationally, and thinking rationally. Provide an example for each approach. (CO1)

b. Define a rational agent in AI. What are the key components of a rational agent, and how does it differ from a simple reflex agent? (CO1)

c. Explain the state-space search method with an example. How are problems represented in state-space search, and what are the roles of the initial state, goal state, and operators? (CO1)

Q2. (2X10=20 Marks)

a. Define a production system. Discuss its components, and explain how control strategies are used to manage rule execution in production systems. Provide an example to illustrate your explanation. (CO2)

b. Explain Constraint Satisfaction Problem (CSP)? Explain with an example how CSPs can be solved using backtracking. Solve the given problem using CSP: (TOM+NAG=GOAT) (CO2)

c. Describe Depth First Search (DFS). How does it differ from BFS in terms of implementation, time complexity, and applications? Provide an example to demonstrate its working. (CO2)

Q3. (2X10=20 Marks)

a. Define and compare supervised, unsupervised, and reinforcement learning. Analyze real-world scenarios and provide examples where each type of machine learning is implemented. Discuss the differences in the way they learn from data and solve problems. (CO3)

b. Explain the difference between inferential and descriptive models. Use real-world examples to illustrate how each model is applied in data analysis and decision-making processes. Discuss the role of these models in gaining insights from data. (CO3)

c. Identify and evaluate various performance tuning techniques used in model fitting. Discuss methods like cross-validation, regularization, and hyperparameter tuning, and explain how they contribute to improving model performance. Apply these techniques to a given scenario and justify their impact on the model's accuracy. (CO3)

Q4. (2X10=20 Marks)

a. Define regression analysis and differentiate it from classification by comparing their objectives and methodologies. Illustrate the roles of dependent and independent variables in regression with an example. (CO4)

b. The height details of the boys and girls are given in table:

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Height of the Boys (xi)	65	70	75	78
Height of the Girls (yi)	63	67	70	73

Fit a suitable line of best fit for the above data. (CO4)

c. Explain the concept of a Support Vector Classifier (SVC) by evaluating its decision boundary using a dataset with two classes (+1 and -1). Illustrate the process of maximizing the margin with an example of random data points and discuss the significance of support vectors. (CO4)

Q5. (2X10=20 Marks)

a. Explain the Apriori algorithm and its role in association rule mining. Evaluate its application in identifying frequent patterns within a dataset, and provide examples to support your explanation. (CO5)

b. Define dimensionality reduction and analyze its benefits in data processing. Compare dimensionality reduction techniques, explaining how each technique works and its typical use cases. (CO5)

c. Discuss the purpose of hierarchical clustering and the role of linkage criteria in creating clusters. Consider the similarity matrix given below:

	P1	P2	P3	P4	P5	P6
P1	1.00	0.70	0.65	0.40	0.20	0.05
P2	0.70	1.00	0.95	0.70	0.50	0.35
P3	0.65	0.95	1.00	0.75	0.55	0.40
P4	0.40	0.70	0.75	1.00	0.80	0.65
P5	0.20	0.50	0.55	0.80	1.00	0.85
P6	0.05	0.35	0.40	0.65	0.85	1.00

Show the hierarchy of clustering created by single-link technique. (CO5)