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**PRESIDENCY UNIVERSITY**

**Bengaluru**

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| **End - Term Examinations – JANUARY 2025** |
| **Date:** 16 – 01- 2025 **Time:** 09:30 am – 12:30 pm |

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| **School:** SOE | **Program:** B. Tech ECE | |
| **Course Code :** ECE3025 | **Course Name :** Artificial Intelligence with Python | |
| **Semester**: V | **Max Marks**: 100 | **Weightage**: 50% |

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| **CO - Levels** | **CO1** | **CO2** | **CO3** | **CO4** |
| **Marks** | **19** | **34** | **26** | **21** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Do not write anything on the question paper other than roll number.*

**Part A**

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| **Answer ALL the Questions. Each question carries 2marks. 10Q x 2M=20M** | | | | |
| **1** | Plotting in Python is a versatile and effective way to visualize data. It enables users to create a wide range of visualizations, including line plots, scatter plots, bar charts, and histograms. What are the commands commonly used for plotting in Python. | **2 Marks** | **L2** | **CO1** |
| **2** | A confusion matrix is a tool used to evaluate the performance of a classification model. Explain the concepts of **precision** and **recall** with a suitable example. | **2 Marks** | **L2** | **CO1** |
| **3** | Unsupervised learning is a type of machine learning algorithm that identifies patterns or structures in data without the need for labeled outputs. Provide some applications for unsupervised learning. | **2 Marks** | **L2** | **CO2** |
| **4** | How does the random forest algorithm, as an extension of the decision tree algorithm, work as both a classifier and a regressor? | **2 Marks** | **L2** | **CO2** |
| **5** | K-Nearest Neighbors (KNN) is a supervised learning algorithm widely used for classification and regression tasks. Despite its effectiveness, it is categorized as a non-parametric model. What aspects of KNN's design and functioning make it non-parametric? | **2 Marks** | **L2** | **CO3** |
| **6** | How does collaborative filtering leverage user and item interactions to make predictions or recommendations, and what are some real-world scenarios where this technique can significantly enhance user experience? | **2 Marks** | **L2** | **CO3** |
| **7** | Why is item-based collaborative filtering often considered more effective than user-based collaborative filtering for recommending similar items, and what metrics would you use to evaluate its performance in terms of accuracy and relevance?" | **2 Marks** | **L2** | **CO3** |
| **8** | Reinforcement learning is a sort of machine learning in which an agent learns to make decisions in an environment through trial and error. Distinguish between reinforcement learning and unsupervised learning. | **2 Marks** | **L2** | **CO4** |
| **9** | How do reward and penalty mechanisms in reinforcement learning influence an agent's learning process, and what impact do they have on shaping optimal behavior in different environments? | **2 Marks** | **L2** | **CO4** |
| **10** | What are some real-world applications of reinforcement learning? | **2 Marks** | **L2** | **CO4** |

**Part B**

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| **Answer the Questions Total 80 Marks** | | | | | |
| **11.** | **a.** | Data preprocessing plays a crucial role in machine learning. Let us assume that this is the data set we are working with ([-1.9, 2.3, 2.1, 0.8], [-2.6, 1.7,-0.9, 1.0], [4.2,-3.5, 2.4, 3.1]). This data set needs to be binarized with a threshold of 1.5 for preprocessing. Then what is binarized data for the given data set? | **15**  **Marks** | **L2** | **CO1** |
| **or** | | | | | |
| **12.** | **a.** | Label encoding refers to the process of transforming the word labels into numerical form. How does label encoding perform if the input labels  i) input\_labels = ['red', 'black','red', 'green', 'black', 'yellow', 'white'] and ii) input\_labels = (2, 3, 1, 4). | **15**  **Marks** | **L2** | **CO1** |
|  |  |  |  |  |  |
| **13.** | **a.** | Use K-Means algorithm to group the following data in the appropriate clusters.  Data points :{2,4,10,12,3,20,30,11,25}. The distance function used is Euclidian distance. The initial cluster centroids are M1 = 4 and M2 = 11 | **15**  **Marks** | **L2** | **CO2** |
| **or** | | | | | |
| **14.** | **a.** | What are the key steps involved in fitting a Gaussian Mixture Model to a dataset, and how does the Expectation-Maximization (EM) algorithm iteratively refine the model parameters to improve the fit? | **15**  **Marks** | **L2** | **CO2** |

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| **15.** | **a.** | Given a dataset of 10 data points: {1.5, 2.1, 2.2, 2.5, 4.9, 5.1, 5.5, 5.9, 6.2, 6.5}, assumed to be generated from two Gaussian distributions with unknown parameters and cluster memberships, how can the Expectation-Maximization (EM) algorithm iteratively estimate the parameters of the Gaussians and assign each data point to the appropriate distribution? What challenges might arise during the process? | **15**  **Marks** | **L2** | **CO2** |
| **Or** | | | | | |
| **16.** | **a.** | Given the 2D data points [(1, 1), (1.5, 1.2), (2, 2), (8, 8), (8.2, 8.1), (9, 9)], how would the Mean Shift algorithm iteratively converge to segregate these points into clusters? Additionally, how does the choice of bandwidth influence the clustering outcome in this scenario? | **15**  **Marks** | **L2** | **CO2** |

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| **17.** | **a.** | In a maze environment, how can reinforcement learning algorithms balance exploration (trying new paths) and exploitation (choosing the most rewarding paths), and what strategies can be implemented to optimize this balance for faster and more efficient navigation?  How does Reinforcement Learning Works | **15**  **Marks** | **L3** | **CO4** |
| **Or** | | | | | |
| **18.** | **a.** | The Markov property is used in reinforcement learning to represent the assumption that the future state of an environment depends solely on the current state and action taken rather than on the entire history of states and actions. How is this model adapted to this property? Explain the elements of this model. | **15**  **Marks** | **L3** | **CO4** |

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| **19.** | **a.** | Consider a matrix that shows four users, Alice, U1, U2, and U3, ratings on different news apps.The rating range is from 1 to 5 on the basis of users’ likability of the news app.The ‘?’ indicates that the user has not rated the app.Calculate the ratings of Alice for BBC(I5).   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **Name** | **Inshorts(I1)** | **HT(I2)** | **NYT(I3)** | **TOI(I4)** | **BBC(I5)** | | **Alice** | 5 | 4 | 1 | 4 | **?** | | **U1** | 3 | 1 | 2 | 3 | 3 | | **U2** | 4 | 3 | 4 | 3 | 5 | | **U3** | 3 | 3 | 1 | 5 | 4 | | **20**  **Marks** | **L3** | **CO3** |
| **Or** | | | | | |
| **20.** | **a.** | Given below is a set table that contains some items and the user who have rated those items.  The rating is explicit and is on a scale of 1 to 5. Each entry in the table denotes the rating given by a i-th User to a j-th Item.  In most cases majority of cells are empty as a user rates only for few items. We need to find the missing ratings for the respective user**.**   |  |  |  |  | | --- | --- | --- | --- | | **User/Item** | **Item\_1** | **Item\_2** | **Item\_3** | | **User\_1** | 2 | - | 3 | | **User\_2** | 5 | 2 | - | | **User\_3** | 3 | 3 | 1 | | **User\_4** | - | 2 | 2 | | **20**  **Marks** | **L3** | **CO3** |

**\*\*\*\*\* BEST WISHES \*\*\*\*\***