SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF COMPUTER APPLICATIONS

QUESTION BANK

II SEMESTER

MC4263- ADVANCED DATA SCIENCE

Regulation – 2024

Academic Year 2024 – 2025 (EVEN Semester)

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<u>**QUESTION BANK**</u>

SUBJECT : MC4263- ADVANCED DATA SCIENCE

SEM / YEAR: II/I

	UNIT - I: INTRODUCTION TO DATA SCIENCE			
Introduction to Data Science-Concept of Data Science-Traits of Big data-Web Scraping- Analysis vs Reporting			
	PART - A			
Q. No	**Questions**	**BT Level**	**Competence**	**CO's**
1.	Define the term Data Science.	BTL1	Remembering	CO1
2.	What are the primary characteristics of Big Data?	BTL1	Remembering	CO1
3.	Differentiate Business Intelligence (BI) and Data Science.	BTL2	Understanding	CO1
4.	What is the difference between structured and unstructured data?	BTL2	Understanding	CO1
5.	What does the "Five Vs" of Big Data stand for?	BTL1	Remembering	CO1
6.	Mention any two common types of data storage technologies used in Big Data.	BTL2	Understanding	CO1
7.	Define the term "Data Wrangling."	BTL1	Remembering	CO1
8.	What does "ETL" stands for in data preprocessing?	BTL1	Remembering	CO1
9.	How does Big Data impact decision-making in business?	BTL2	Understanding	CO1
10.	why data cleaning is essential before data analysis	BTL2	Understanding	CO1
11.	What is descriptive analytics?	BTL1	Remembering	CO1
12.	What is the role of an API in web scraping?	BTL2	Understanding	CO1
13.	Define the term Predictive Analytics.	BTL2	Understanding	CO1
14.	Define Web Scraping in a few words.	BTL1	Remembering	CO1
15.	How does Web Scraping help gather data for analysis? .	BTL2	Understanding	CO1
16.	Justify the traits of Big Data.	BTL2	Understanding	CO1
17.	What is the role of an API in web scraping?	BTL1	Remembering	CO1
18.	Define data analysis and reporting,	BTL1	Remembering	CO1

19.	List out the purpose of data visualization in Data Science	BTL2	Understanding	CO1
20.	Name any two types of data visualizations.	BTL1	Remembering	CO1
21.	Mention of the significance of data ethics in Data Science	BTL2	Understanding	CO1
22.	What are the key Aspects of Analysis in Data Science ?	BTL1	Remembering	CO1
23.	List out the Tools commonly used in data analysis	BTL2	Understanding	CO1
24.	Differentiate between analysis and reporting in the context of data	BTL1	Remembering	CO1
PART-B				
1.	Outline the following i. Characteristics of Big Data. (8) ii. Features of a Big Data in detail. (8)	BTL4	Analyzing	CO1
2.	Sketch the life cycle of Data Science with neat diagram. (16)	BTL3	Applying	CO1
3.	Categorize the types of data formats used in Data Science? Explain their importance in detail. (16)	BTL4	Analyzing	CO1
4.	i. List and explain the traits of Big Data (Volume, Velocity, Variety, Veracity, Value). (8) ii. Give detail description of applications of data. (8)	BTL4	Analyzing	CO1
5.	i. Compare Traditional Business Intelligence (BI) versus Big Data. (8) ii. Critically assess the role of data ethics in Data Science and how it impacts the accuracy and fairness of analysis. (8)	BTL5	Evaluating	CO1
6.	Explain the significance of data prepossessing (ETL) in Data Science and its key steps. (16)	BTL4	Analyzing	CO1
7.	Explain the following. i. Hadoop Distributed File System (HDFS). (8) ii.YARN. (8)	BTL5	Evaluating	CO1
8.	i. Compare the Key differences between structured, semi-structured, and unstructured data. (10) ii. How Data Science can impact decision-making in business organizations. Justify. (6)	BTL5	Evaluating	CO1
9.	Compare and contrast the use of machine learning versus traditional statistical methods in data analysis. (16)	BTL4	Analyzing	CO1
10.	Explain how to collect data from a website using web scraping techniques. . (16)	BTL3	Applying	CO1
11.	How would you apply data wrangling techniques to clean a dataset with missing values? (16)	BTL3	Applying	CO1
12.	Analyze the importance of data ethics and how it can affect data science projects. (16)	BTL4	Analyzing	CO1
13.	How can you use Big Data technologies to enhance the decision-making process in a retail business? (16)	BTL3	Applying	CO1

14.	Analyze the potential risks of web scraping and the legal or ethical challenges associated with it. (16)	BTL3	Applying	CO1
15.	Develop the different stages of web scraping, from data collection to data storage. (16)	BTL3	Applying	CO1
16.	Evaluate the effectiveness of different machine learning algorithms for predictive Analytics in data science. (16)	BTL4	Analyzing	CO1
17.	i. Compare and contrast analysis vs reporting in the context of data usage in businesses. (8) ii.How do the above two differ in terms of outputs and their applications? (8)	BTL4	Analyzing	CO1

UNIT II MATHEMATICAL FOUNDATIONS

Linear Algebra: Vectors, Matrices- Statistics: Describing a Single Set of Data, Correlation, Simpson′s Paradox- Correlation and Causation- Probability: Dependence and Independence, Conditional Probability, Bayes′s-Theorem, Random Variables-Continuous Distributions- The Normal Distribution-The Central Limit Theorem..

PART - A

1.	List out the applications of vectors.	BTL1	Remembering	CO2
2.	Mention the rules for dot product of two vectors.	BTL1	Remembering	CO2
3.	What is an eigenvector?	BTL2	Understanding	CO2
4.	Define independent events. Provide an example	BTL1	Remembering	CO2
5.	What is the probability of two independent events occurring together?	BTL1	Remembering	CO2
6.	What is the geometric interpretation of the dot product of two vectors?	BTL2	Understanding	CO2
7.	State the multiplication rule for independent events.	BTL2	Understanding	CO2
8.	How eigenvalues are related to a matrix's determinant?	BTL2	Understanding	CO2
9.	Define a scalar multiplication of a vector.	BTL1	Remembering	CO2
10.	Differentiate between variance and covariance.	BTL2	Understanding	CO2
11.	List some applications of conditional probability.	BTL1	Remembering	CO2
12.	What way we can think of probability with respect to Data Science?	BTL2	Understanding	CO2
13	What does Simpson's Paradox refer to in statistics?	BTL1	Remembering	CO2
14.	What is mean by correlation?	BTL1	Remembering	CO2
15.	Why normal distribution is important?	BTL2	Understanding	CO2
16.	What does the correlation coefficient indicate in terms of data relationship?	BTL2	Understanding	CO2
17.	What is the purpose of a scatter plot in statistics?	BTL1	Remembering	CO2
18.	Complete a routine to display a histogram for sample number people and	BTL1	Remembering	CO2

	respective number of friends for them.			
19.	What is correlation and how is it different from causation?	BTL2	Understanding	CO2
20.	Define Bayes's Theorem.	BTL2	Understanding	CO2
21.	What is the role of a normal distribution in hypothesis testing?	BTL1	Remembering	CO2
22.	How is Bayes's Theorem used in probability analysis?	BTL2	Understanding	CO2
23.	What is the z-score and what does it tell you about a data point?	BTL2	Understanding	CO2
24.	List out the significance of the Central Limit Theorem	BTL1	Remembering	CO2
PART-B				
1.	Explain vectors and various operations on vectors with routines and illustrate with example code. (16)	BTL5	Evaluating	CO2
2.	Explain matrices with respect to Data Science along with its applications (16)	BTL4	Analyzing	CO2
3.	Evaluate the impact of changing the elements of a matrix on its determinant and eigenvalues. (16)	BTL5	Evaluating	CO2
4.	Create a real-world scenario where Simpson's Paradox might occur, and explain the paradox in context. (16)	BTL6	Creating	CO2
5.	Analyze the significance of Simpson's Paradox in a study and explain how it could lead to misleading conclusions. (16)	BTL4	Analyzing	CO2
6.	Justify, how correlation and causation differ and evaluate the importance of each in real-world data analysis. (16)	BTL5	Evaluating	CO2
7.	i. Write a simple Python routine to display a histogram. (8) ii. Asses on Dependence and Independence. (8)	BTL5	Evaluating	CO2
8..	Calculate the mean, median, and mode for a given data set, and analyze the differences. Suppose we have the following data set of exam scores for 15 students: 45,56,67,45,78,89,67,56,45,90,72,45,67,56,90. (16)	BTL4	Analyzing	CO2
9.	Use Bayes's Theorem to solve a conditional probability problem and explain the significance of the result. (16)	BTL3	Applying	CO2
10.	Explain a routine to plot a Histogram that compares Binomial Distribution and Normal Distribution. (16)	BTL4	Analyzing	CO2
11.	i. Write a Python routine to plot Probability Density Function with an example. (8) ii.Write the mathematical equation of Normal Distribution with its Key Characteristics in detail. (8)	BTL3	Applying	CO2
12.	Construct a probability distribution for a given data set and solve for the expected value and variance. (16)	BTL6	Creating	CO2
13.	Analyze and write a routine to implement various Probability Functions with example. (16)	BTL4	Analyzing	CO2
14.	Explain the following i. Conditional probability. (8)	BTL5	Evaluating	CO2

	ii. Justify the need for normal distribution. (8)			
15.	Develop a routine to demonstrate Binomial Distribution and Normal Distribution. (16)	BTL3	Applying	CO2
16.	Design an experiment where Bayes's Theorem would be applicable, and demonstrate its use with a probability scenario. (16)	BTL6	Creating	CO2
17.	Evaluate the role of the Central Limit Theorem in simplifying probability calculations for large data sets. (16)	BTL5	Evaluating	CO2

UNIT - III: MACHINE LEARNING

Overview of Machine learning concepts –Types of Machine learning - Linear Regression- model assumptions-Classification and Regression algorithms- Naïve Bayes, K-Nearest Neighbors, logistic regression- support vector machines (SVM), decision trees, and random forest.	

PART-A

1.	Define the term Machine Learning	BTL1	Remembering	CO3
2.	How does reinforcement learning differ from supervised learning.	BTL2	Understanding	CO3
3.	What is the role of a training set in machine learning?	BTL2	Understanding	CO3
4.	Create a chart that demonstrates overfitting.	BTL1	Remembering	CO3
5.	How supervised models differ from unsupervised models?	BTL2	Understanding	CO3
6.	Define overfitting in the context of machine learning models.	BTL1	Remembering	CO3
7.	List the major categories of Machine Learning.	BTL1	Remembering	CO3
8.	Mention the difference between classification and regression in machine learning?	BTL2	Understanding	CO3
9.	How does reinforcement learning differ from supervised learning?	BTL2	Understanding	CO3
10.	In which type of machine learning would you typically use clustering?	BTL2	Understanding	CO3
11.	List out the role of a training set in machine learning	BTL1	Remembering	CO3
12.	What is the role of "feature randomness" in the construction of trees in a Random Forest?	BTL1	Remembering	CO3
13.	How does Random Forest handle missing data in a dataset?	BTL2	Understanding	CO3
14.	What is the objective of linear regression?	BTL1	Remembering	CO3
15.	How we get random trees in Random Forest classification?	BTL2	Understanding	CO3
16.	What is the objective of linear regression?	BTL2	Understanding	CO3
17.	List out various regression models under supervised learning.	BTL2	Understanding	CO3
18.	What is the primary difference between classification and regression algorithms?	BTL2	Understanding	CO3
19.	What assumption does the Naïve Bayes classifier make about the features in the datasets?	BTL1	Remembering	CO3
20.	In which type of problems would you use Naïve Bayes classifier?	BTL1	Remembering	CO3

21.	What is meant by K-Nearest Neighbors (KNN) algorithm?	BTL2	Understanding	CO3
22.	How an API can be used to fetch data from a remote server.	BTL2	Understanding	CO3
23.	How is the Naïve Bayes classifier used for classification?	BTL2	Remembering	CO3
24.	How does the K-Nearest Neighbors algorithm classify data points?	BTL2	Remembering	CO3

PART-B

1.	Describe the steps involved in building a machine learning model from start to finish. (16)	BTL3	Applying	CO3
2.	Compare and contrast supervised and unsupervised learning algorithms with examples of real-world applications for each. (16)	BTL4	Analyzing	CO3
3.	Explain the following with suitable example. i. Simple Linear Regression. (8) ii. Multiple Regression. (8)	BTL5	Evaluating	CO3
4.	Analyze the assumptions of linear regression and explain the consequences if these assumptions are violated. (16)	BTL5	Evaluating	CO3
5.	Evaluate the strengths and weaknesses of Naïve Bayes when used for classification on datasets with correlated features. (16)	BTL5	Evaluating	CO3
6.	Describe K-Nearest predictive model with suitable routine and example. (16)	BTL3	Applying	CO3
7.	i. Compare the performance of decision trees and logistic regression on a binary classification problem. (8) ii Discuss the advantages and limitations of both algorithms. (8)	BTL4	Analyzing	CO3
8.	How to implement logistic regression on a binary classification problem with an example.? (16)	BTL3	Applying	CO3
9.	Describe the advantages and limitations of using Support Vector Machines for classification tasks. (16)	BTL5	Evaluating	CO3
10.	Explain the concept of hyperplane and margins in the context of Support Vector Machines (SVM). (16)	BTL4	Analyzing	CO3
11.	Explain the Support Vector Machine classification for three dimensional data with necessary routine. (16)	BTL6	Creating	CO3
12.	Develop a random forest model and evaluate its performance using cross-validation (Assume your own dataset) (16)	BTL3	Applying	CO3
13.	Construct a decision tree for the following data: Explain various path in the tree that leads to various decisions. (16)	BTL3	Applying	CO3

Outlook	Temp	Humidity	Windy	Play Golf
Rainy	Hot	High	False	No
Rainy	Hot	High	True	No
Over roast	Hot	High	False	Yes
Sunny	Mild	High	False	Yes

Sunny	Cool	Normal	False	Yes				
Sunny	Cool	Normal	True	No				
Over roast	Cool	Normal	True	Yes				
Rainy	Mild	High	False	No				
Rainy	Cool	Normal	False	Yes				
Sunny	Mild	Normal	False	Yes				
Rainy	Mild	Normal	True	Yes				
Overroast	Mild	High	True	Yes				
Overroast	Hot	Normal	False	Yes				
Sunny	Mild	High	True	No				

14.	How to implement a decision tree for classification on a dataset? Discuss how the tree is built, how decisions are made at each node and interpret the results(16)	BTL3	Applying	CO3
15.	Design a K-Nearest Neighbors classifier for predicting whether a loan application will be approved or denied. (Assume your own data).　　　　(16)	BTL6	Creating	CO3
16.	Explain the following 　i.　Random Trees.　　　　　　　　　　　　　　(8) 　ii. Explain random forest with example.　　　　　(8)	BTL6	Creating	CO3
17.	Construct a decision tree for sample data of your own and **evaluate** various decision that can be arrived based on the decision tree.　　(16)	BTL5	Evaluating	CO3

UNIT - IV:　PROGRAMMING TOOLS FOR DATA SCIENCE

Introduction to Programming Tools for Data Science-Toolkits using Python: Matplotlib, NumPy, Scikit-learn, NLTK-Visualizing Data: Bar Charts, Line Charts and Scatterplots-Working with data: Reading Files, Scraping the Web, Using APIs (Example: Using the Twitter APIs).

1.	What is the primary purpose of Python in data science?	BTL1	Remembering	CO4
2.	What is the role of an Integrated Development Environment (IDE) in programming for data science?	BTL1	Remembering	CO4
3.	Mention any four name of the data science tools.	BTL1	Remembering	CO4
4	What does Matplotlib primarily help with in Python?	BTL1	Remembering	CO4
5.	List out the features of Numpy.	BTL2	Understanding	CO4
6.	What is the significance of the NumPy array compared to a Python list?	BTL2	Understanding	CO4
7.	What is the main function of Scikit-learn in data science?.	BTL2	Understanding	CO4
8.	How does NLTK help with text analysis in Python?	BTL2	Understanding	CO4
9.	Define data visualization in machine learning	BTL1	Remembering	CO4

10.	What is a bar chart used to represent in data visualization ?	BTL1	Remembering	CO4
11.	When would you choose a line chart over a bar chart for data visualization?	BTL2	Understanding	CO4
12.	How to visualize a time series dataset using a line chart.?	BTL2	Understanding	CO4
13.	What does a scatterplot show in data analysis?	BTL1	Remembering	CO4
14.	What is the difference between a bar chart and a histogram**?**	BTL1	Remembering	CO4
15.	What is the purpose of the Panda's library when working with datasets in Python? .	BTL2	Understanding	CO4
16.	Compare various data science languages.	BTL1	Remembering	CO4
17.	How do choose best tool or language for data science and give justification.?	BTL1	Remembering	CO4
18.	How to read a CSV file using Python's pandas library?	BTL2	Understanding	CO4
19.	What is web scraping, and what tool can be used in Python for it?	BTL2	Understanding	CO4
20.	Mention the name of the function of the requests library in Python?	BTL1	Remembering	CO4
21.	How an API can be used to fetch data from a remote server?	BTL2	Understanding	CO4
22.	What is the primary function of the Twitter API?	BTL1	Remembering	CO4
23.	How would you authenticate to use the Twitter API in Python?	BTL2	Understanding	CO4
24.	What kind of data can you retrieve from the Twitter API?	BTL1	Remembering	CO4
PART-B				
1.	Analyze the importance of programming tools like Python for data science compared to other languages like R. Discuss the strengths and weaknesses of each. (16)	BTL4	Analyzing	CO4
2.	How do implement a simple plot using Matplotlib to visualize the relationship between two variables. Explain the code and the output using python. (16)	BTL3	Applying	CO4
3.	Discuss about the importance of libraries like Pandas and Matplotlib in data science. (16)	BTL4	Analyzing	CO4
4.	Explain the significance of NumPy arrays in data processing and how they enhance the performance of algorithms compared to Python lists. (16)	BTL4	Analyzing	CO4
5.	Evaluate how Scikit-learn simplifies the process of training machine learning models. Illustrate its use with a simple classification example. (16)	BTL5	Evaluating	CO4
6.	i.Write a Python script using NLTK to analyze the sentiment of a given text. (8) ii.Explain how sentiment analysis works and how you would interpret the results. (8)	BTL4	Analyzing	CO4
7.	Explain different visualization tools in detail with an example. (16)	BTL4	Analyzing	CO4
8.	Describe various features of Toolkits that can be used with Python. (16)	BTL4	Analyzing	CO4
9.	Evaluate pros and cons of using APIs to gather data compared to web scraping. Discuss the limitations and advantages of each method (16)	BTL5	Evaluating	CO4

10.	Assume a datasets of monthly sales figures, use Matplotlib to create a line chart showing the trend over time. Explain the key insights from the chart. (16)	BTL3	Applying	CO4
11.	Demonstrate how to read and clean data from a CSV file using pandas. Discuss the methods you used to handle missing data. (16)	BTL3	Applying	CO4
12.	Evaluate the strengths and weaknesses of using bar charts and scatterplots for data visualization. Provide an example where one chart type is more suitable than the other. (16)	BTL5	Evaluating	CO4
13.	Write a program by loading the Iris dataset, split it into train and test sets, and compute the accuracy score of a pipeline on the test data. (16)	BTL3	Applying	CO4
14.	Create a bar chart to visualize the distribution of different product categories in a store's inventory. Discuss the process and interpret the results. (16)	BTL6	Creating	CO4
15.	Develop a line chart to visualize a data set of your choice and give the detailed explanation of observations from chart. (16)	BTL4	Analyzing	CO4
16.	Discuss the effectiveness of using the Twitter API for sentiment analysis and the advantages of using Twitter data for real-time insights. (16)	BTL3	Applying	CO4
17.	How to read and clean data from a CSV file using pandas. Discuss the methods you used to handle missing data. 16)	BTL4	Analyzing	CO4

UNIT - V: CASE STUDIES OF DATA SCIENCE APPLICATION

Weather Forecasting-Stock Market Prediction-Object recognition- Real Time Sentiment Analysis.

PART A

1.	Define weather forecasting.	BTL1	Remembering	CO5
2.	List out the type of weather forecasting.	BTL2	Understanding	CO5
3.	How would you use weather data to predict the likelihood of rain?	BTL2	Understanding	CO5
4.	What tools are used in measuring atmospheric pressure during weather forecasting?	BTL1	Remembering	CO5
5.	How to assess the accuracy of weather forecasting in predicting extreme events?	BTL2	Understanding	CO5
6.	What is stock market prediction?	BTL1	Remembering	CO5
7.	How does fundamental analysis differ from technical analysis in predicting stock performance?	BTL2	Understanding	CO5
8.	Mention the relationship between volume and price movements in the stock market.	BTL1	Remembering	CO5
9.	Justify the reliability of machine learning models in stock market predictions.	BTL1	Remembering	CO5
10.	Mention the concepts of technical analysis in stock prediction.	BTL2	Understanding	CO5
11.	Define object recognition in the context of machine learning.	BTL1	Remembering	CO5
12.	List out the applications of object detection	BTL1	Remembering	CO5
13.	Mention the concept of feature extraction in object recognition.	BTL1	Remembering	CO5
14.	How does object recognition differ from image classification?	BTL2	Understanding	CO5

15.	How Overfitting affects the performance of object recognition models?	BTL2	Understanding	CO5
16.	How would you use a CNN to recognize objects in an image?	BTL2	Understanding	CO5
17.	How to assess the ethical implications of object recognition technologies?	BTL2	Understanding	CO5
18.	List any four modules of R-CNN used in object recognition.	BTL1	Remembering	CO5
19.	Define real-time sentiment analysis.	BTL1	Remembering	CO5
20.	Give any two name of common methods used for sentiment analysis.	BTL2	Understanding	CO5
21.	Difference between polarity and subjectivity in sentiment analysis.	BTL1	Remembering	CO5
22.	How does natural language processing (NLP) contribute to sentiment analysis?	BTL2	Understanding	CO5
23.	List out different algorithms perform in sentiment analysis tasks.	BTL1	Remembering	CO5
24.	What impact does sarcasm have on the accuracy of sentiment analysis?	BTL2	Understanding	CO5
PART A				
1.	Compare different weather forecasting techniques such as numerical weather prediction and satellite-based systems in terms of reliability and accuracy. (16)	BTL5	Evaluating	CO5
2.	Analyze the limitations of current weather forecasting methods and propose solutions for improving accuracy. (16)	BTL4	Analyzing	CO5
3.	Discuss various sub processes involved in the complete process of data science for weather prediction. 16)	BTL4	Analyzing	CO5
4.	Design a comprehensive system that combines multiple weather forecasting tools to improve prediction accuracy. (16)	BTL6	Creating	CO5
5.	Compare Satellite Imagery and Sensor Data in weather forecasting. (16)	BTL4	Analyzing	CO5
6.	Analyze the impact of geopolitical events on stock market prediction models. How can these be integrated into predictive algorithms? (16)	BTL4	Analyzing	CO5
7.	Develop a predictive model for stock market trends using a combination of technical indicators, fundamental analysis, and news sentiment. (16)	BTL6	Creating	CO5
8.	i. Discuss the use of various machine learning techniques in predicting stock market trends. (8) ii. What are the advantages and limitations of such approaches? (8)	BTL3	Applying	CO5
9.	Describe the various versions of YOLO Model Family object detection in detail. (16)	BTL4	Analyzing	CO5
10.	Explain about various R-CNN Model Family object detection in detail. (16)	BTL5	Evaluating	CO5
11.	Describe the performance of current object recognition models in various environments. (16)	BTL4	Analyzing	CO5
12.	Develop a code to Prepare the Input for the LSTM Model. (16)	BTL6	Creating	CO5

13.	How to assess the ethical concerns regarding object recognition technologies, including privacy implications and security risks? (16)	BTL5	Evaluating	CO5
14	Explain the following i, Object Localization. (8) ii. Object Detection. (8)	BTL5	Evaluating	CO5
15.	Analyze the challenges and limitations of real-time sentiment analysis in identifying the emotional tone of a large dataset of social media posts. (16)	BTL4	Analyzing	CO5
14..	Describe various computer vision tasks in object recognition. (16)	BTL3	Applying	CO5
15.	Develop a case study of Sentiment Analysis in Twitter. (16)	BTL4	Analyzing	CO5
16.	Describe the following. i. A Twitter NLP chain. (8) ii, NL processor and Ad-hoc NL processor. (8)	BTL3	Applying	CO5
17.	Develop a case study on Google Stock Price Prediction Using LSTM. (16)	BTL6	Creating	CO5