

## **UNIT 1**

Introduction: 3-14

Vector: 19-32

Projection: 33-37

Matrix: 38-64

Linear Regression: 65-77

Rank of a matrix: 78-106

Hyperplanes: 107-109

Eigenvalues and Eigenvectors: 110-124

Diagonalization and Eigen decomposition: 125-128

Singular Value Decomposition: 141-161

Pseudo Inverse Matrix: 162-172

Basic Equation of lines: 173-176

Equation of a plane: 177-183

Equation of hyperplane: 184-188

Equation of Circle: 189-196

Equation of Sphere: 197-207

Equation of hypersphere: 208-211

## **UNIT 2**

Statistics: 3-6

Variable: 7-10

Measurement: 11-12

Data: 13-18

Population: 19

Sample: 20-24

Frequency Distribution: 25-29

Mean, median mode: 30

Mean: 31-32

Median: 33-36

Mode: 37

Variance: 38-43  
Covariance: 44-51  
Standard Deviation: 52-54  
Distribution: 55-58  
Normal Distribution: 59-66, 72-75  
Probability Density: 67-69  
Histogram: 70-72  
Correlation Studies: 76-77  
Experiment: 78-79  
Probability: 82-94  
Types of Statistics: 95-99  
Hypothesis Testing: 100-103

### **UNIT 3**

Exploratory Data Analysis: 4-20  
Types of EDA (Univariate, Multivariate): 11-17  
Data Science Process: 21-42  
Example: 43-49  
Data Visualization: 50-60  
Data Visualization with Python: 61-114  
Example Iris Dataset: 115-156  
Example Titanic Dataset: 157-180  
Data Visualization using Tableau: 181-222

### **UNIT 4**

Introduction: 3-4  
Machine Learning: 5-18  
Supervised Learning: 19-30  
Unsupervised Learning: 31-34  
Reinforcement Learning: 35-40  
Supervised, unsupervised, reinforcement: 41

Dimensionality Reduction: 42-47

Vector Representation: 48-49

Principal Component Analysis: 50-61

PCA Problem: 58-61

Data Normalization: 62-71

Limitations: 72-74

Linear Discriminant Analysis: 75-81

Classification: 82-85

Data Preparation: 86

Classification Technique: 87-111

- Decision Tree: 88-91
- Rule-based classifier: 92-94
- K-Nearest Neighbours: 95-101

Linear Regression: 102-105

Stochastic Gradient, R squared, p squared: 106-111

Tree and Bayesian network: 112-122

Decision Tree Induction: 123-136

Bayesian Network: 137-157

Constructing Bayesian Network: 158-182

Neural Network: 183-193

Feed Forward Network Functions: 194-198

Second Layer: 199-201

Forward Propagation: 202-206

Network Training: 208-214

Testing, Evaluation, Validation of Models: 215-

Training, Validating, Test: 216

Evaluating a model: 217-218

Classification confusion metrics: 219-222

Regression metrics: 225-228

Bias vs Variance: 229-230

Validation Curves: 231-232

Learning Curves: 233-235

## **UNIT 5**

Introduction to data science with python: 2-3

Data Science, python: 2-3

Data Structure: 3-6

Built-in Data Structure (List, Dictionary, Tuple, Sets): 4

User-defined Data Structure (Arrays vs lists, Stack, Queue, Tree, Linked List, graph): 5-6

Functions in python: 7-10

Types of function: 7-8

Function Arguments and it's types: 8-10

Python libraries for data analysis: 10

NumPy: 10-30

Matplotlib: 30-34

Pandas: 35-44

Problems based on computational complexity: 44-48

Time complexity: best case, average case, worst case: 44-45

Big-O Notation: 46-47

Linear Search: 46

Merge Sort: 47

Insertion Sort: 48

Simple Case studies based on python: 48-51

Binary Search: 48-51

Common elements in list: 51-53

Hash Table: 53-54

Dictionary: 54-61

Part A and Part B: 62-63

### **Assignment 1**

Find the Eigen values and eigen vectors for the given matrix  $\begin{bmatrix} -6 & 4 \\ 3 & 5 \end{bmatrix}$  (Use answer sheet)

### **Assignment 2**

Explain about different types of machine learning algorithms with an example? (Use answer sheet)

## CAE 1

Calculate the pseudo inverse for the matrix  $B = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 6 \end{bmatrix}$  (Unit 1, 162-172)

Find out the eigen values and eigen vectors for the given matrix  $\begin{bmatrix} 8 & 7 \\ 2 & 3 \end{bmatrix}$  (Unit 1, 110-124)

Enumerate the different types of normal distributions (mean, median, mode)

<https://corporatefinanceinstitute.com/resources/knowledge/other/normal-distribution/>

Interpret Hypothesis testing and discuss how to test the assumptions made regarding a population parameter. (UNIT 2, 100-103)

<https://www.britannica.com/science/statistics/Experimental-design>

## CAE 2

Explain the steps involved in data science process? (UNIT 3, 21-42)

Explain the following

1. Univariate Non-graphical
2. Multivariate Non-graphical
3. Univariate graphical
4. Multivariate graphical (UNIT 3, 11-17)

Explain the about different machine learning algorithms?

[https://www.sas.com/en\\_gb/insights/articles/analytics/machine-learning-algorithms.html#:~:text=At%20its%20most%20basic%2C%20machine,developing%20'intelligence'%20over%20time.](https://www.sas.com/en_gb/insights/articles/analytics/machine-learning-algorithms.html#:~:text=At%20its%20most%20basic%2C%20machine,developing%20'intelligence'%20over%20time.)

Explain the working of neural network with its architecture

<https://www.upgrad.com/blog/neural-network-architecture-components-algorithms/>