Module 1: Probability and Statistics

1 Difference between Statistical and Probabalistic Domain.
2 Difference between Sample and Population.
3 Deterministic and Random Variables.
4 Random Variables : Qualitative and Quantitative.
5 **Statistical Domain**
- 5.1 What is Statistics ?
- 5.2 Different Statistics of sample data of Quantitative Random Variables.
- 5.3 **Sample Python code demonstration along with detailed explanation for Coding Assignment**
- 5.4 **Coding Assignment 1.**
- 5.5 Frequency and Relative Frequency.
- 5.6 Frequency and Realtive Frequency Distribution of Random Variables.
- 5.7 First, Second and Third Quartile of a sample of data.
- 5.8 **Sample Python code demonstration along with detailed explanation for Coding Assignment**
- 5.9 **Coding Assignment 2.**

6 **Probabalistic Domain**
- 6.1 Mathematical definition of probability of occurance of an event.
- 6.2 Conditional Probability.
- 6.3 Independent Events.
- 6.4 Types of Quantitative Random Variables : Continous and Discrete.
- 6.5 Univariate Probability Distributions.
- 6.6 Individual Univariate Probability Distribution Functions.
- 6.7 Some Continuous Random Variable Probability Distributions : Normal, Standard Normal, Rayleigh.
- 6.8 Cummulative Probability and the Distribution Functions.
- 6.9 Z-score in Standard Normal Probability Distribution.
- 6.10 **Sample Python code demonstration along with detailed explanation for Coding Assignment**
- 6.11 **Coding Assignment 3.**
- 6.12 Multivariate Probability Distributions.
- 6.13 Different Multivariate Joint Probability Distributions.
- 6.14 Joint Multivariate Normal Probability Distribution.
- 6.15 Joint Multivariate Normal Probability Distribution Function.

7 **Frequentist Inferential Statistics**
- 7.1 Sampling Distributions and CLT.
- 7.2 **Sample Python code demonstration along with detailed explanation for Coding Assignment**
- 7.3 **Coding Assignment 4.**
- 7.4 First, Second, Third and Forth order moments, Skewness and Kurtosis of Distributions.
- 7.5 Likelihood Functions.
- 7.6 Point Estimation of Population Parameters.
- 7.7 Confidence Interval Estimation of Population Parameters.
- 7.8 Large Sample Hypothesis Testing for means of one and two populations.
- 7.9 Student-t Distribution.
- 7.10 Small Sample Hypothesis Testing for means of one and two populations.
- 7.11 Chi-Square Distribution.
- 7.12 Small Sample Hypothesis Testing for variance of one population.
- 7.13 F Distribution.
- 7.14 Small Sample Hypothesis Testing for variance of two populations.

7.15 ANNOVA : Small Sample Hypothesis Testing for variance of multiple populations.
7.16 **Sample Python code demonstration along with detailed explanation for Coding Assignment**
7.17 **Coding Assignment 5.**
7.18 Pearson Correlation Analysis.
7.19 Pearson's Chi-Square statistic for analysis of catagorical data.
7.20 **Non Parametric Inferential Statistics**
7.20.1 Frequentist Inferential Statistics for Qualitative Data.
7.20.2 Converting Qualitative Data into rank.
7.20.3 Wilcoxon Rank Sum Test.
7.20.4 Wilcoxon Rank Sum Test for a paired experiment.
7.20.5 Kruskal Wallis H-test for completely randomized design.
7.20.6 Friedmann Fr Test for Randomized Block Designs.
7.20.7 Rank Correlation Coefficient.
7.20.8 **Sample Python code demonstration along with detailed explanation for Coding Assignment**
7.20.9 **Coding Assignment 6.**

8 **Bayesian Inferential Statistics**
8.1 Bayes Theorem.
8.2 Prior and Posterior Probabilities.
8.3 Different Interprettations of Bayes Theorem.
8.4 Applications of Bayes Theorem.

9 **Portfolio Project 1 on Probability and Statistics.**