



**BITS Pilani**  
**DIGITAL**

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# Probability & Statistics

Presented by : **Dr. YVK Ravi Kumar**

Unit : **3 Credits**

**Dr. Kota Venkata Ratnam**



## Course Description

Welcome to the Probability and Statistics course! This course provides an elementary introduction to probability and statistics with applications. In this course, you will be introduced to data sets, Chebyshev's inequality, and descriptive statistics. You will learn about the axioms of probability, Bayes' formula, random variables, mathematical expectations, and types of distribution and coverage of estimation with confidence intervals. You will also be introduced to hypothesis testing. After completing this course, you will be able to use probability and statistics effectively and apply the concepts and methods learned to real-world problems.

## Week 1

# Introduction to Statistics



- ★ Introduction to Statistics
- ★ Histogram, Ogives, Stem, and Leaf Plots
- ★ Measures of Variability
- ★ Normal Data Set and Skewness of Data
- ★ Data Visualization Using Frequency Tables
- ★ Measures of Central Tendency
- ★ Chebyshev's Inequality
- ★ Two Quantitative Variables on Scatter Plot



Discussion Prompt



Reading



Practice Quiz

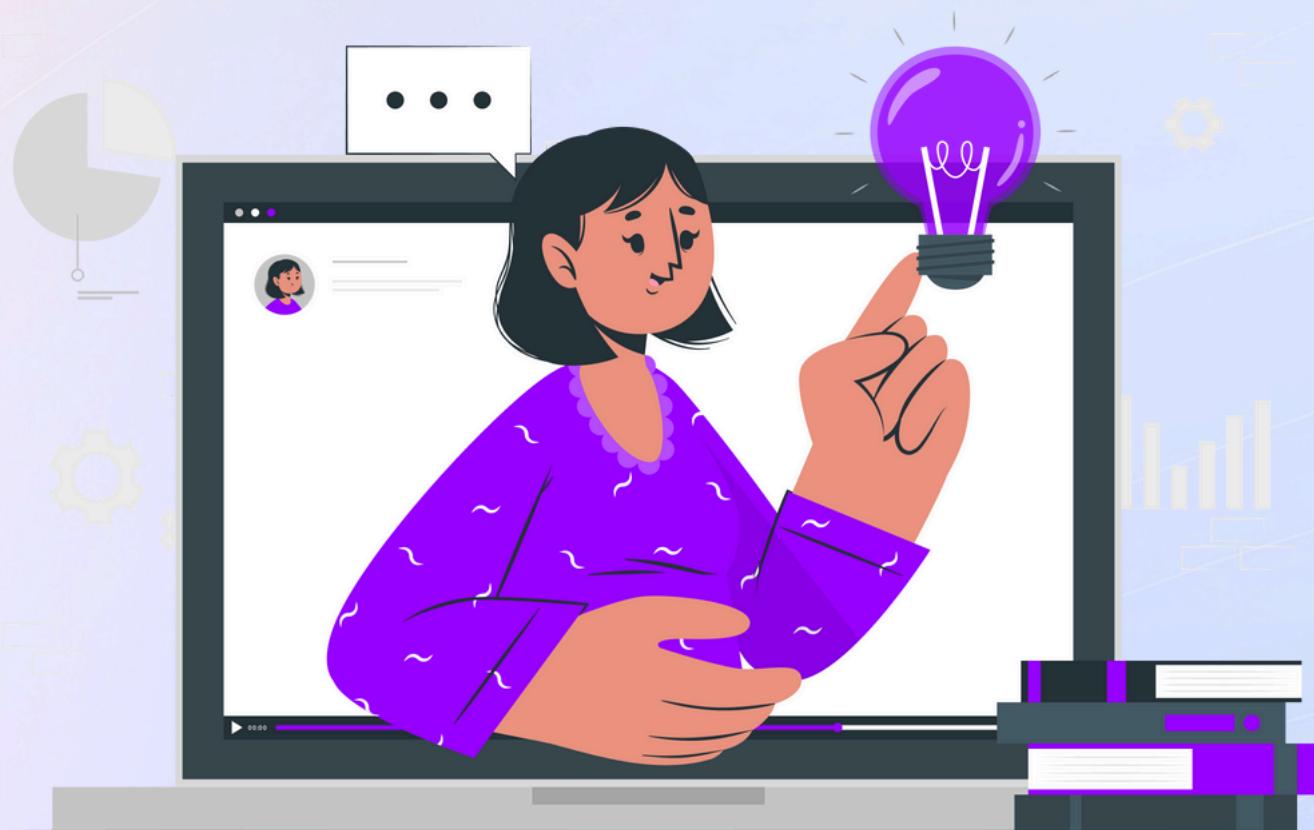
## ((●)) Live Session

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- <to be filled>

## Week 2

# Applications of Statistics

- ★ Quartile Deviation and IQR
- ★ Five point summary
- ★ Measures of Variability
- ★ Box plot
- ★ Outlier detection
- ★ Statistical Summary



Discussion Prompt



Practice Quiz

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## Week 3

# Elements of Probability

- ★ Basics of Probability
- ★ Basics of Set Theory
- ★ Introduction to Probability\_Sections
- ★ Axioms of Probability
- ★ Probabilities of Equally Likely Outcomes
- ★ Principle of Counting: Example 1



- ★ Principle of Counting: Example 2



Discussion Prompt



Reading



Practice Quiz

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## Week 4

# Bayes theorem and Applications

- ★ Conditional Probability
- ★ Conditional Probability: Example
- ★ Bayes' Formula
- ★ Bayes' Formula: Examples
- ★ Independent Events
- ★ Independent Events: Example



Discussion Prompt



Reading



Practice Quiz

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### Graded Quiz



## Week 5

# Random Variables

- ★ Random Variable: Definition
- ★ Random Variable: Examples
- ★ Random Variable: Types
- ★ Probability Distribution Function
- ★ Probability Distribution Function: Examples
- ★ Mean of a Discrete Random Variable
- ★ Variance and Standard Deviation of Discrete Random Variable
- ★ Mean and Variance: Example 1
- ★ Mean and Variance: Example 2
- ★ Mean and Variance: Example 3
- ★ Probability Density Function
- ★ Probability Density Function: Examples
- ★ Mean and Standard Deviation of a Continuous Random Variable
- ★ Continuous Random Variables: Examples



Discussion Prompt



Reading



Practice Quiz



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## Week 6

# Discrete Probability Distributions

- ★ Binomial distribution
- ★ Properties of Binomial distribution
- ★ Mean of Binomial Distribution
- ★ Variance of Binomial Distribution
- ★ Binomial Distribution: Example 1
- ★ Binomial Distribution: Example 2
- ★ Poisson Distribution: Definition
- ★ Poisson Distribution: Properties
- ★ Mean of Poisson Distribution



- ★ Variance of Poisson Distribution
- ★ Relation Between Binomial and Poisson Distributions
- ★ Module Summary



Discussion Prompt



Reading



Practice Quiz

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## Week 7

# Continuous Probability Distributions

- ★ Probability Density Function
- ★ Normal Distribution
- ★ Standard Normal Distribution and Normal Curve
- ★ Normal Distribution Table
- ★ Normal Distribution: Example 1
- ★ Normal Distribution: Example 2
- ★ Normal Distribution: Example 3
- ★ Mean of Normal Distribution
- ★ Variance of Normal Distribution
- ★ Gaussian Mixtures
- ★ Module Summary



Discussion Prompt



Reading



Practice Quiz

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## Week 8

# Joint Probability Distributions



- ★ Joint probability distribution function
- ★ Marginal probability distribution functions
- ★ Independent Random Variables - Discrete
- ★ Joint probability density function
- ★ Marginal probability density functions

- ★ Independent random variables - Continuous
- ★ Example 1
- ★ Module Summary



Discussion Prompt



Reading



Practice Quiz

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- Date :
- <to be filled>



## Graded Quiz



## Week 9

# Sampling and Estimation

- ★ Introduction to Sampling
- ★ Populations and Samples
- ★ Types of Sampling
- ★ Sampling Distribution
- ★ Central Limit Theorem
- ★ Sampling Distribution: t-Distribution
- ★ Sampling Distribution: Chi-Square Distribution
- ★ Estimation: Introduction
- ★ Point Estimation
- ★ Interval Estimation
- ★ Confidence Interval
- ★ Interval Estimation: Example 1
- ★ Interval Estimation: Example 2
- ★ Interval Estimation: Example 3
- ★ Module Summary



Discussion Prompt



Reading



Practice Quiz

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## Week 10

# Testing of Hypothesis - 1



- ★ Introduction to Testing of Hypothesis
- ★ Null and Alternate Hypothesis  
Formulation with Examples
- ★ Type I and Type II Errors
- ★ Level of Significance
- ★ Hypothesis: Examples
- ★ Testing of Hypothesis: One Mean—Large Sample
- ★ Testing of Hypothesis: One Mean—Small Sample
- ★ Testing of Hypothesis: Two Means—Large Sample
- ★ Testing of Hypothesis: Two Means—Small Sample
- ★ One Mean—Large Sample: Example 1
- ★ One Mean—Small Sample: Example 2
- ★ Two Means—Large Sample: Example 3
- ★ Two Means—Small Sample: Example 4
- ★ Module Summary



Discussion Prompt



Reading



Practice Quiz

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## Week 11

# Testing of Hypothesis - 2



- ★ Testing of Hypothesis: Introduction
- ★ Testing of Hypothesis: One Proportion—Large Sample
- ★ Testing of Hypothesis: Example 1
- ★ Testing of Hypothesis: One Proportion—Small Sample
- ★ Testing of Hypothesis: Two proportions—Large Sample
- ★ Testing of Hypothesis: Example 2
- ★ Testing of Hypothesis: Several Proportions
- ★ Chi-Square Test
- ★ Testing of Hypothesis: Several Proportions—Example 1
- ★ Testing of Hypothesis: Several Proportions—Example 2
- ★ Testing of Hypothesis: Several Proportions—Example 3
- ★ Testing of Hypothesis: Example 4
- ★ Testing of Hypothesis: Example 5
- ★ Testing of Hypothesis: Example 6
- ★ Module Summary



Discussion Prompt



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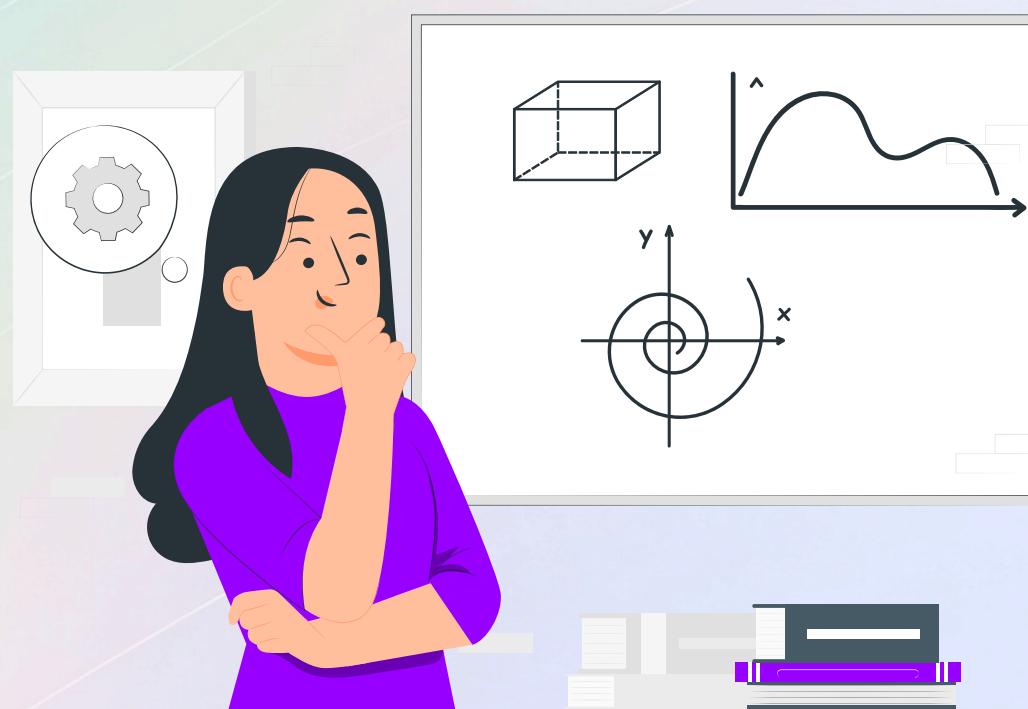
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## Week 12

# Correlation

- ★ Correlation: Introduction
- ★ Covariance
- ★ Covariance: Example
- ★ Correlation: Types
- ★ Coefficient of Correlation
- ★ Coefficient of Correlation: Example
- ★ Rank correlation
- ★ Rank correlation coefficient
- ★ Rank correlation coefficient - Example
- ★ Module Summary



Discussion Prompt



Reading



Practice Quiz



Staff/Auto-graded Programming Assignment

## ((●)) Live Session

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- <to be filled>

## Graded Quiz



## Week 13

# Regression

- ★ Module Introduction
- ★ Simple Linear Regression: Introduction
- ★ Simple Linear Regression: Sum of Squared Errors
- ★ Normal Equations
- ★ Matrix Form
- ★ assumptions
- ★ Multiple Linear Regression: Introduction
- ★ Multiple Linear Regression with Two Independent Variables
- ★ Multiple Linear Regression with More Independent Variables
- ★ Multiple Linear Regression: Example 1
- ★ Multiple Linear Regression: Example 2
- ★ Module Summary



Discussion Prompt



Reading



Practice Quiz

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- <to be filled>