Subject Title: Statistics for Economics (232203)

Course Teacher: Hasina Aktar Banu and Md. Ali Ahsan

Chapter No & Chapter Title	Number of Classes with Class Title	Learning Outcomes At the end of the class the students would be able to
1 Probability (T-10)	1. Introduction to Probability	1. Define the fundamental concepts of probability, including sample space and events. 2. Explain the basic probability laws, including addition and multiplication rules. 3. Apply probability rules to solve real-world problems. 4. Differentiate between independent and dependent events.
	2. Combinations and Conditional Probability	1. Explain the use of combinations in probability calculations. 2. Solve problems involving permutations and combinations. 3. Define conditional probability and Bayes' theorem. 4. Apply conditional probability to decision-making scenarios.
	3. Probability Functions and Mathematical Expectations	1. Differentiate between discrete and continuous probability functions. 2. Compute expected values and variance for probability distributions. 3. Interpret the significance of expected values in decision-making. 4. Solve real-world problems using probability functions and expectations.
	4. Theoretical Probability Distributions	1. Define and explain the importance of theoretical probability distributions. 2. Identify the characteristics of Binomial, Poisson, Exponential, and Normal distributions. 3. Compare and contrast different probability distributions. 4. Apply probability distributions to solve practical problems.
	5. Normal Distribution and Its Applications	1. Explain the properties and importance of the normal distribution. 2. Calculate probabilities using the standard normal table. 3. Apply the area under the normal curve to probability calculations. 4. Solve real-world problems using the normal distribution.

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	6. Normal Approximation and Central Limit Theorem	1. Explain the concept of normal approximation to the binomial distribution. 2. Apply normal approximation to estimate probabilities in binomial distributions. 3. Define the Central Limit Theorem and its significance in probability theory. 4. Use the Central Limit Theorem to approximate sample distributions.
	7. Applications for Probability Distributions in Real-World Scenarios	1. Apply probability distributions to real-world problems in business, healthcare, and engineering. 2. Interpret statistical results from probability applications. 3. Analyze how probability theory is used in risk assessment and decision-making. 4. Evaluate case studies that utilize probability models for practical decision-making.
2 Sample Methods and Sample Survey (T-4)	8. Advantages and Types of Sampling	1. Define sampling and explain its importance in research. 2. Identify and describe different types of sampling methods. 3. Compare probability and non-probability sampling techniques. 4. Understand the advantages and limitations of using sampling in research. 5. Select appropriate sampling methods for different research
	9. Sampling Error and Non-Sampling Error	1. Differentiate between sampling error and non-sampling error. 2. Identify the sources of sampling errors and how to minimize them. 3. Explain various types of non-sampling errors. 4. Analyze the impact of errors on research findings. 5. Apply techniques to reduce errors in data collection and analysis.
	10. Objectives and Importance of Sample Survey	1. Define sample surveys and their role in research and decision-making. 2. Explain the key objectives of conducting sample surveys. 3. Analyze the advantages of sample surveys over full population studies. 4. Understand how sample surveys contribute to policymaking and business decisions. 5. Evaluate real-world examples of sample surveys and their outcomes.

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	11. Appropriateness of Data to Be Collected and Designing a Questionnaire	1. Identify the types of data required for different research objectives. 2. Assess the relevance and appropriateness of data collection methods. 3. Explain the principles of questionnaire design. 4. Construct effective survey questions to minimize bias and improve response accuracy. 5. Evaluate and test a questionnaire for reliability and validity.
	12. Choice of the Sample Unit, Sample Size, Sample Design, and Sample Selection (Internal and External Validity of Sample Selection)	1. Define and select appropriate sample units based on research needs. 2. Determine the optimal sample size using statistical techniques. 3. Understand the importance of internal and external validity in sample selection. 4. Choose the right sample design for different types of studies. 5. Apply best practices for ensuring sample representativeness and minimizing bias.
3 Sampling and Sampling Distribution (T-10)	13. Population and Sampling Distributions	1. Differentiate between population distribution and sampling distribution. 2. Explain the concepts of mean and standard deviation of a sample (X) and their relation to population parameters. 3. Describe the sample distribution of sample mean and sample proportion. 4. Apply sampling distribution concepts to estimate population parameters.
	14. Sampling Methods and Applications	1. Explain the process of sampling from normally and non-normally distributed populations. 2. Use the Central Limit Theorem to justify the normality assumption in sampling distributions. 3. Determine appropriate sample sizes for different statistical analyses. 4. Apply sampling distribution concepts to real-world decision-making and statistical inference.
4 Analysis of Variance (T-4)	15. Meaning and Assumptions of Variance	1. Define variance and explain its role in statistical analysis. 2. Identify and discuss the key assumptions of variance. 3. Differentiate between population variance and sample variance. 4. Analyze the impact of variance on data interpretation and hypothesis testing. 5. Apply variance concepts to real-world datasets using statistical tools.

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	16. Computation of Analysis of Variance (ANOVA)	1. Understand the concept of ANOVA and its applications. 2. Explain the assumptions necessary for performing ANOVA. 3. Compute ANOVA manually and using statistical software. 4. Interpret ANOVA tables, including F-statistics and p-values. 5. Evaluate the significance of differences between group means.
	17. One-Way Classification Model	1. Define the one-way classification model and understand its applications. 2. Explain the assumptions required for one-way ANOVA. 3. Compute one-way ANOVA and interpret the results. 4. Distinguish between treatment and error variances. 5. Conduct post-hoc tests to analyze group differences.
	18. Two-Way Classification Model	1. Explain the concept and importance of two-way classification models. 2. Identify and verify the assumptions of two-way ANOVA. 3. Compute two-way ANOVA, including main and interaction effects. 4. Interpret ANOVA results for multiple factors. 5. Use graphical tools to visualize interaction effects.
	19. Multiple Regression Model	1. Define multiple regression and its real-world applications. 2. Explain the assumptions required for multiple regression analysis. 3. Compute multiple regression models and estimate coefficients. 4. Assess model fit using R-squared and adjusted R-squared values. 5. Perform diagnostic tests for multicollinearity, heteroscedasticity, and normality
5 Test of Hypothesis (T-10)	20. Introduction to Statistical Estimation	1. Define statistical estimation and explain the importance of estimators in statistical inference. 2. Identify and explain the properties of a statistical estimator (unbiasedness, consistency, efficiency). 3. Differentiate between unbiased and biased estimators and understand their implications. 4. Discuss the concept of an efficient vs. inefficient estimator and how to assess efficiency.

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	21. Point Estimators, Interval Estimators, and Small Sample Properties	1. Define and differentiate between point and interval estimators in statistical analysis. 2. Understand the small sample properties of estimators and their impact on inferential statistics. 3. Construct confidence intervals and interpret the meaning of interval estimates. 4. Calculate and interpret the standard error and margin of error for constructing confidence intervals.
	22. Hypothesis Testing and Types of Errors	1. Introduce the concept of hypothesis testing and its role in statistical inference. 2. Differentiate between the null hypothesis (H_0) and the alternative hypothesis (H_1). 3. Define Type I and Type II errors and discuss their implications in hypothesis testing. 4. Understand and apply one-tailed and two-tailed tests based on the hypothesis being tested.
	23. Tests of Significance and Large Sample Tests	1. Explain the concept of a test of significance and the process of hypothesis testing. 2. Understand the relationship between confidence intervals and hypothesis testing. 3. Apply the confidence interval approach and the test of significance approach to solve problems. 4. Perform hypothesis tests on large samples, including tests about the population mean (z-tests and t-tests).
6 Statistical Tests (T-10)	24. Chi-Square Test	1. Define the chi-square test and explain its use in testing hypotheses about categorical data. 2. Differentiate between the chi-square goodness-of-fit test and the chi-square test of independence. 3. Perform chi-square tests to assess independence between variables. 4. Interpret the results of chi-square tests, including critical values and p-values.
	25. Normal Test	1. Understand the concept of a normal test and when it is used to assess data normality. 2. Describe the normality assumption and its importance in statistical analysis. 3. Use graphical and statistical methods (e.g., Q-Q plots, Shapiro-Wilk test) to assess normality. 4. Apply the normal test to determine if a dataset follows a normal distribution.

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	26. T-Test	1. Define the t-test and understand its application in hypothesis testing for small samples. 2. Differentiate between one-sample, independent two-sample, and paired t-tests. 3. Perform and interpret the results of t-tests for different sample types. 4. Apply the t-test to compare sample means and make inferences about population parameters.
	27. F-Test	1. Define the F-test and its use in comparing variances of two or more groups. 2. Understand the concept of the null and alternative hypotheses in an F-test. 3. Perform an F-test to assess the equality of variances between groups. 4. Interpret the F-statistics and the results of an F-test in context.
	28. Non-Parametric Tests	1. Explain the concept of non-parametric tests and their use when assumptions for parametric tests are not met. 2. Understand the difference between parametric and non-parametric tests. 3. Apply common non-parametric tests, such as the Wilcoxon signed-rank test and the Kruskal-Wallis test. 4. Interpret the results of non-parametric tests and determine their applicability in real-world situations.
	29. Applications for Statistical Tests	1. Compare and contrast the different types of statistical tests: chi-square, normal, t-test, F-test, and non-parametric tests. 2. Select the appropriate statistical test for various real-world scenarios based on data type and distribution. 3. Conduct hypothesis testing using various tests and interpret the findings. 4. Evaluate the assumptions and limitations of each statistical test and understand when to use them effectively.
7 Time Series Analysis (T-4)	30. Definition and Components of Time Series Analysis	1. Define time series analysis and explain its significance in data analysis. 2. Identify and describe the key components of time series data. 3. Differentiate between trend, seasonal, cyclical, and irregular variations. 4. Understand the role of time series analysis in forecasting. 5. Apply basic time series decomposition techniques to real-world datasets

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	31. Straight Line Method and Method of Least Squares	1. Explain the concept of trend estimation in a time series analysis. 2. Differentiate between the straight-line method and the method of least squares. 3. Compute a trend line using the straight-line method. 4. Apply the method of least squares to estimate trends. 5. Interpret the results and assess the accuracy of trend estimation
	32. Method of Moving Averages and Measurement of Seasonal Variations	1. Understand the concept of moving averages and their application in smoothing time series data. 2. Compute moving averages for different time periods. 3. Explain the importance of seasonal variations in time series analysis. 4. Measure seasonal variations using different methods. 5. Apply time series smoothing techniques to real-world dataset
8 Official Statistics of Bangladesh (T-4)	33. Sources, Characteristics, and Limitations of Official Statistics Class 1: Sources, Characteristics, and Limitations of Official Statistics in Bangladesh	1. Identify the key sources of official statistics in Bangladesh. 2. Explain the main characteristics of official statistical data in Bangladesh. 3. Understand the role of the Bangladesh Bureau of Statistics (BBS) and other data-producing agencies. 4. Analyze the strengths and weaknesses of official statistics in Bangladesh. 5. Critically evaluate the reliability and limitations of official statistical data.
	34. Publishing Agencies and Statistical Publications (Contents and Reliability)	1. Identify the main statistical publishing agencies in Bangladesh. 2. Understand the types and contents of statistical publications. 3. Assess the reliability of official statistical publications. 4. Differentiate between government-released data and international reports on Bangladesh. 5. Utilize statistical publications for research, policymaking, and business decisions.