CBCS Syllabus as per NEP 2020 for S.Y.B.Sc. (Computer Science) (2023 Pattern)

Name of the Programme	**:** B.Sc. Computer Science
Programme Code	**:** USCOS
Class	**:** S.Y.B.Sc.(Computer Science)
Semester	**:** IV
Course Type	**:** Minor (Theory)
Course Code	**:** COS-261-MN(A)
Course Title	**:** Continuous Probability Distributions and Testing of Hypothesis
No. of Credits	**:** 02
No. of Teaching Hours	**:** 30

Course Objectives:

1. To understand the concept of continuous probability distributions and their importance in real-life scenarios.
2. To analyze the characteristics of Chi-square, t, and F-distributions.
3. To understand the use of probability tables for normal, chi-square, t, and F distributions.
4. To understand the concept of hypothesis testing and estimation.
5. To study the properties and applications of parametric and non-parametric tests.
6. To gain proficiency in large sample tests for means and proportions.
7. To understand the relationships among various statistical distributions.

Course Outcomes:

By the end of the course, students will be able to:

CO1 define and calculate p.d.f., mean, and variance for distributions.

CO2 apply the Exponential and Uniform distributions to solve real-life problems.

CO3 demonstrate knowledge of the normal distribution and its applications.

CO4 interpret and use the Chi-square, t, and F-distributions effectively.

CO5 perform hypothesis tests for population means, variances, and proportions.

CO6 analyze data using parametric and non-parametric statistical methods.

CO7 apply large sample tests for population means and proportions.

Topics and Learning Points

UNIT 1: Standard Continuous Probability Distributions (7L)

1.1 Uniform Distribution: statement of p.d.f., mean, variance, nature of probability curve. Theorem (without proof): The distribution function of any continuous r.v. if it is Invertible follows U(0, 1) distribution

1.2 Exponential Distribution: statement of p.d.f. of the form $f(x) = (1/\theta)\, e(-x/\theta)$, mean, Variance, nature of probability curve, lack of memory property.(with proof)

1.3 Normal Distribution: statement of p.d.f., identification of parameters, nature of Probability density curve, standard normal distribution, symmetry, distribution of aX+b, aX+bY+c where X and Y are independent normal variables, computations of Probabilities using normal probability table, normal approximation to binomial and Poisson distribution, central limit theorem (statement only), normal probability plot.

1.4 Numerical problems related to real life situations.

Unit 2: Introduction to Testing of Hypothesis (3 L)

Parameter, random sample from a distribution as i.i.d. r.v.s. $X_1, X_2, \ldots,$ Xn, statistic, estimator, estimate, critical region. Statistical hypothesis, null and alternative hypothesis, one sided and two sided alternative hypothesis, p-value. Confidence interval.

Unit 3: Large Sample Tests (Tests based on Normal distribution) : (5L)

3.1 Z-tests for population means:

3.1.1 One sample and two sample tests for one-sided and two-sided alternatives

3.1.2 Confidence Interval for Population Mean:100(1- α)% two sided confidence interval for single population mean (μ) and difference of population means $(\mu_1 - \mu_2)$ of two independent normal populations.

3.2 Z-tests for population proportions:

3.2.1 One sample and two sample tests for one-sided and two-sided alternatives

3.2.2 Confidence Interval for Population Proportion: 100(1- α)% two sided confidence interval for single population proportion (P) and difference of population proportions $(P_1 - P_2)$ of two independent normal populations.

Unit 4: Small Sample Tests (Tests based on Normal distribution) : (9L)

4.1 Tests based on Chi-square distribution:

4.1.1 *Test for independence* of two attributes

4.1.2 *Test for Goodness of Fit* (Without rounding off the expected frequencies) (Problems are not expected)

4.1.3 *Test for* $H_0 : \sigma^2 = \sigma_0^2$ against one-sided and two-sided alternatives when mean is known, mean is unknown.

4.2 Tests based on t-distribution: *t-tests for population means*:

4.2.1 One sample and two sample tests for one-sided and two-sided alternatives

4.2.2 Confidence Interval for Population Mean: 100(1- α) % two sided confidence interval for single population mean (μ) and difference of population means ($\mu_1 - \mu_2$) of two independent normal populations.

4.3 *Paired t-test* for one-sided and two-sided alternatives.

4.4 Test based on F-distribution: Test for H_0: $\sigma_1^2 = \sigma_2^2$ against one-sided and two-sided alternatives when means are known and means are unknown.

UNIT-5. Non-parametric Test **(6L)**

5.1 Introduction to Non-Parametric tests

5.2 sign test

5.3 run test

5.4 Kolmogrove – Smirnov test

5.5 Mann whitney test

References:

1. A First course in Probability, Sheldon Ross. Pearson Education Inc.
2. Statistical Methods (An Introductory Text), Medhi J. 1992, New Age International.
3. Modern Elementary Statistics, Freund J.E. 2005, Pearson Publication.
4. Probability, Statistics, Design of Experiments and Queuing Theory with Applications of Computer Science, Trivedi K.S. 2001, Prentice Hall of India, New Delhi.
5. Gupta S. C. and Kapoor V. K.1987 Fundamentals of Mathematical Statistics(3rd Edition) S.Chand and Sons, New Delhi
6. Common Statistical Tests Kulkarni M.B., Ghatpande, S.B.,Gore S.D.1999 Satyajeet Prakashan,
7. Sinha S. K.: Reliability and Life Testing, Second Edition, Wiley Eastern Publishers, New Delhi.
8. Hogg R. V. and Craig R. G.: Introduction to Mathematical Statistics Ed.4.
9. Gupta and Kapoor : Fundamentals of Mathematical Statistics, Sultan Chand and Sons,New Delhi.
10. Meyer P.L.(1970): Introductory Probability and Statistical Applications, Edition

Wesley.

11. Freedman D., PisaniR., Purves R. (2007), Statistics, Fourth Edition, W. W. Nortan and Company, New York

Programme Outcomes and Course Outcomes Mapping:

CO-PO Mapping Table

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	2	1	1	2	2	1	2	1	1	1	1	1	1
CO2	2	3	2	3	3	1	2	1	2	1	1	2	1
CO3	2	3	1	3	3	1	2	1	2	1	1	2	1
CO4	2	3	1	3	3	1	2	1	2	1	1	2	1
CO5	2	3	1	3	3	1	2	1	2	1	1	2	1
CO6	2	3	2	3	3	1	2	1	2	1	1	2	1
CO7	2	3	2	3	3	1	2	1	2	1	1	2	1

This mapping table and the justifications show how each Course Outcome (CO) aligns with the Program Outcomes (POs) and the extent of their relationship.

Justification for Mapping PO and CO

PO1: Comprehensive Knowledge and Understanding

- **CO1:** (2) The ability to define and calculate p.d.f., mean, and variance requires a solid understanding of foundational statistical concepts.
- **CO2:** (2) Applying the Exponential and Uniform distributions builds on a foundational understanding of probability theory and distribution properties.
- **CO3:** (2) Understanding the normal distribution and its applications is a core component of statistical theory.
- **CO4:** (2) Using Chi-square, t, and F-distributions requires comprehensive knowledge of statistical methods.
- **CO5:** (2) Hypothesis testing is rooted in deep theoretical knowledge of statistics.
- **CO6:** (2) Analyzing data using parametric and non-parametric methods involves a strong grasp of statistical principles.
- **CO7:** (2) Applying large sample tests and F-tests also requires a solid understanding of underlying statistical theories.

PO2: Practical, Professional, and Procedural Knowledge

- **CO1:** (1) Defining and calculating p.d.f., mean, and variance are fundamental skills that have practical applications in various fields.
- **CO2:** (3) Applying distributions like Exponential and Uniform in real-life scenarios demonstrates practical professional knowledge.
- **CO3:** (3) The normal distribution is widely used in professional statistical analysis, making this CO strongly related to practical knowledge.
- **CO4:** (3) The application of Chi-square, t, and F-distributions is a key practical skill in statistical testing.
- **CO5:** (3) Performing hypothesis tests is a critical professional procedure in data analysis and research.
- **CO6:** (3) The use of parametric and non-parametric methods is essential for practical data analysis in many industries.
- **CO7:** (3) Applying large sample tests and F-tests has direct professional and procedural applications in statistical analysis.

PO3: Entrepreneurial Mindset and Knowledge

- **CO1:** (1) Understanding basic statistical measures can support data-driven decision-making in entrepreneurial contexts.
- **CO2:** (2) Solving real-life problems using distributions can aid in risk assessment and market analysis.
- **CO3:** (1) Knowledge of the normal distribution can support quality control and operational decisions.
- **CO4:** (1) Using statistical distributions in decision-making processes can enhance an entrepreneurial approach.
- **CO5:** (1) Hypothesis testing can support innovation by validating business strategies and processes.
- **CO6:** (2) Analyzing data effectively is crucial for identifying market trends and opportunities.
- **CO7:** (2) Applying large sample tests can assist in making informed business decisions and understanding market dynamics.

PO4: Specialized Skills and Competencies

- **CO1:** (2) Calculating statistical measures develops technical and analytical skills.

- **CO2:** (3) Applying distributions to solve problems enhances problem-solving and analytical competencies.
- **CO3:** (3) Mastery of the normal distribution demonstrates specialized statistical skills.
- **CO4:** (3) Proficiency in using Chi-square, t, and F-distributions is essential for specialized statistical analysis.
- **CO5:** (3) Hypothesis testing requires a high level of analytical reasoning and specialized skills.
- **CO6:** (3) The ability to analyze data using various methods is a key technical competency.
- **CO7:** (3) Conducting large sample tests and F-tests reflects advanced problem-solving skills.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning

- **CO1:** (2) Calculating p.d.f., mean, and variance involves applying mathematical concepts to solve problems.
- **CO2:** (3) Applying distributions directly correlates with solving real-world problems.
- **CO3:** (3) The normal distribution is fundamental to many analytical processes.
- **CO4:** (3) Interpreting statistical distributions requires strong analytical reasoning.
- **CO5:** (3) Hypothesis testing is central to solving data-related problems.
- **CO6:** (3) Analyzing data using statistical methods exemplifies the application of analytical reasoning.
- **CO7:** (3) Applying large sample tests and F-tests involves problem-solving at an advanced level.

PO6: Communication Skills and Collaboration

- **CO1:** (1) Explaining statistical concepts and results improves communication skills.
- **CO2:** (1) Solving real-life problems can require collaboration with others to interpret results.
- **CO3:** (1) Knowledge of the normal distribution helps in communicating statistical findings.
- **CO4:** (1) Effective interpretation of statistical tests requires clear communication.
- **CO5:** (1) Hypothesis testing often involves collaboration in research or business environments.

- **CO6:** (1) Analyzing data and reporting findings requires strong communication skills.
- **CO7:** (1) Large sample tests and F-tests may require collaboration to interpret and report results.

PO7: Research-related Skills

- **CO1:** (2) Calculating p.d.f., mean, and variance is foundational for statistical research.
- **CO2:** (2) Applying distributions in research settings demonstrates the ability to conduct data-driven inquiries.
- **CO3:** (2) Understanding the normal distribution is crucial for many research methodologies.
- **CO4:** (2) Interpreting statistical distributions is a key research skill.
- **CO5:** (2) Hypothesis testing is fundamental to research design and analysis.
- **CO6:** (2) Analyzing data using statistical methods is central to conducting research.
- **CO7:** (2) Applying large sample tests and F-tests supports research-related data analysis.

PO8: Learning How to Learn Skills

- **CO1:** (1) Learning to calculate statistical measures fosters self-directed learning.
- **CO2:** (1) Applying distributions in new contexts encourages continuous learning.
- **CO3:** (1) Mastering the normal distribution involves learning new statistical techniques.
- **CO4:** (1) Interpreting and using statistical tests requires ongoing learning.
- **CO5:** (1) Hypothesis testing involves adapting to new information and techniques.
- **CO6:** (1) Analyzing data using various methods supports the development of self-learning skills.
- **CO7:** (1) Applying large sample tests and F-tests requires continuous adaptation and learning.

PO9: Digital and Technological Skills

- **CO1:** (1) Calculating statistical measures can involve the use of software tools.
- **CO2:** (2) Applying distributions often requires technological tools for data analysis.
- **CO3:** (2) The normal distribution is frequently analyzed using digital tools.
- **CO4:** (2) Statistical tests are commonly conducted using software.

- **CO5:** (2) Hypothesis testing is often performed with the help of technological tools.
- **CO6:** (2) Analyzing data using parametric and non-parametric methods requires digital proficiency.
- **CO7:** (2) Conducting large sample tests and F-tests involves using statistical software.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy

- **CO1:** (1) Understanding statistical concepts can enhance communication across diverse settings.
- **CO2:** (1) Applying statistical methods can aid in addressing issues in multicultural contexts.
- **CO3:** (1) Knowledge of statistics can support decision-making in diverse environments.
- **CO4:** (1) Interpreting statistical results can foster understanding in multicultural settings.
- **CO5:** (1) Hypothesis testing can be applied to studies involving diverse populations.
- **CO6:** (1) Analyzing data can help address issues related to inclusivity and diversity.
- **CO7:** (1) Large sample tests and F-tests can be used to study diverse populations and issues.

PO11: Value Inculcation and Environmental Awareness

- **CO1:** (1) Statistical knowledge can be applied to study environmental data.
- **CO2:** (1) Applying distributions can support sustainability studies.
- **CO3:** (1) Understanding the normal distribution can aid in environmental data analysis.
- **CO4:** (1) Using statistical tests can help in environmental research.
- **CO5:** (1) Hypothesis testing can be applied to environmental studies.
- **CO6:** (1) Analyzing data can support environmental conservation efforts.
- **CO7:** (1) Large sample tests and F-tests can be used in environmental research.

PO12: Autonomy, Responsibility, and Accountability

- **CO1:** (1) Calculating statistical measures fosters independent problem-solving.
- **CO2:** (2) Applying distributions to solve problems requires accountability and responsibility in data analysis.

- **CO3:** (2) Understanding and applying the normal distribution requires independent analysis.
- **CO4:** (2) Using statistical tests involves responsibility in interpreting results.
- **CO5:** (2) Hypothesis testing requires careful and accountable analysis.
- **CO6:** (2) Analyzing data using statistical methods demonstrates autonomy in research.
- **CO7:** (2) Applying large sample tests and F-tests requires responsibility and accountability in data interpretation.

PO13: Community Engagement and Service

- **CO1:** (1) Understanding statistics can support community-based research and services.
- **CO2:** (1) Applying statistical methods can address community issues.
- **CO3:** (1) Statistical knowledge can be used to benefit community projects.
- **CO4:** (1) Interpreting data can inform community decisions and services.
- **CO5:** (1) Hypothesis testing can support community research initiatives.
- **CO6:** (1) Data analysis can be applied to improve community services.
- **CO7:** (1) Large sample tests and F-tests can

CBCS Syllabus as per NEP 2020 for S.Y.B.Sc. (Computer Science) (2023 Pattern)

Name of the Programme	**:** B.Sc. Computer Science.
Programme Code	**:** USCOS
Class	**:** S.Y.B.Sc.(Computer Science)
Semester	**:** IV
Course Type	**:** Minor (Practical)
Course Code	**:** COS-262-MN(A)
Course Title	**:** Minor Statistics Practical (CS) -II
No. of Credits	**:** 02
No. of Teaching Hours	**:** 30

Course Objectives:

1. To understand the process of fitting an exponential distribution.
2. To learn how to fit a normal distribution and compute expected frequencies
3. To comprehend the concept of moments in probability distributions.
4. To analyze the nature of discrete probability distributions.
5. To explore the nature of continuous probability distributions.
6. To compute probabilities for exact sampling distributions.
7. To perform large sample tests.

Course Outcomes:

By the end of the course, students will be able to:

Students are expected to be able to,

CO1 apply normal and exponential distributions to practical problems.

CO2 interpret moments of distributions.

CO3 analyze data distribution characteristics, such as skewness and kurtosis.

CO4 interpret large sample tests

CO5 perform non-parametric tests and analyze results

CO6 compute probabilities for exact sampling distributions

CO7 describe the nature of discrete and continuous probability distributions.

Topics and Learning Points

Sr. No.	Title of the experiment
1	Fitting of exponential distribution.
2	Fitting of normal distribution and computation of expected frequencies.
3	Applications of normal and exponential distributions.
4	Model sampling from continuous uniform distribution.
5	Model sampling from exponential distribution.
6	Model sampling from normal distribution.
7	Moments
8	Identifying Data Distribution Characteristics: Skewness and Kurtosis Analysis
9	Nature of probability distribution. (Discrete distributions).
10	Nature of probability distribution. (Continuous distributions).
11	Computations of probabilities of continuous probability distributions.
12	Large sample tests.
13	Small Sample tests - I
14	Small Sample tests - II
15	Non-parametric tests.
	*Note : Experiments are expected to solve using MS- EXCEL/ R- Software

Note:

1. Every practical is equivalent to four hours per batch per week
2. Practical batch should be of 12 students
3. Students must complete all the practicals to the satisfaction of the teacher concerned.
4. Students must produce at the time of practical examination, the laboratory journal along with the completion certificate signed by the Head of the Department.

Programme Outcomes and Course Outcomes Mapping:

CO-PO Mapping Table

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**
CO1	2	1	1	2	3	1	2	1	2	1	1	1	1
CO2	2	3	1	2	3	1	2	1	2	1	1	1	1
CO3	2	3	1	2	3	1	2	1	2	1	1	1	1
CO4	2	3	1	2	3	1	2	1	2	1	1	1	1
CO5	2	3	1	2	3	1	2	1	2	1	1	1	1
CO6	2	3	1	2	3	1	2	1	2	1	1	1	1
CO7	2	3	1	2	3	1	2	1	2	1	1	1	1

Justifications

PO1: Comprehensive Knowledge and Understanding

- **CO1**: (2) – Applying distributions requires understanding foundational concepts in probability and statistics.
- **CO2**: (2) – Interpreting moments involves knowledge of statistical theory.
- **CO3**: (2) – Analyzing distribution characteristics requires understanding of statistical concepts.
- **CO4**: (2) – Interpreting large sample tests requires theoretical knowledge.
- **CO5**: (2) – Non-parametric tests involve understanding statistical theory.
- **CO6**: (2) – Computing probabilities needs foundational knowledge.
- **CO7**: (2) – Describing probability distributions involves understanding theoretical concepts.

PO2: Practical, Professional, and Procedural Knowledge

- **CO1**: (3) – Applying distributions is a practical application of statistical theory.
- **CO2**: (2) – Interpreting moments is practical but less industry-specific.

- **CO3**: (3) – Analyzing data distribution characteristics is crucial for practical data analysis.
- **CO4**: (3) – Large sample tests are a practical skill in statistical analysis.
- **CO5**: (3) – Performing and analyzing non-parametric tests is essential in practice.
- **CO6**: (3) – Computing probabilities is a fundamental practical skill.
- **CO7**: (2) – Describing distributions is practical but less applied.

PO3: Entrepreneurial Mindset and Knowledge

- **CO1**: (1) – Basic understanding of distributions is not directly related to entrepreneurship.
- **CO2**: (1) – Interpreting moments does not directly relate to entrepreneurial skills.
- **CO3**: (1) – Analyzing distribution characteristics is less relevant to entrepreneurial mindset.
- **CO4**: (1) – Large sample tests have limited direct application to entrepreneurship.
- **CO5**: (1) – Non-parametric tests are not directly tied to entrepreneurial activities.
- **CO6**: (1) – Computing probabilities has minimal entrepreneurial relevance.
- **CO7**: (1) – Understanding distributions does not directly impact entrepreneurial skills.

PO4: Specialized Skills and Competencies

- **CO1**: (2) – Applying distributions requires specialized statistical skills.
- **CO2**: (2) – Interpreting moments involves specialized analytical skills.
- **CO3**: (2) – Analyzing characteristics needs specialized knowledge.
- **CO4** (2) – Large sample tests require specialized statistical techniques.
- **CO5**: (2) – Non-parametric tests need specialized understanding.
- **CO6**: (2) – Computing probabilities requires specific skills.
- **CO7**: (2) – Describing distributions involves specialized statistical competencies.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning

- **CO1**: (3) – Applying distributions involves problem-solving and analytical reasoning.
- **CO2** (3) – Interpreting moments requires analytical reasoning.
- **CO3**: (3) – Analyzing characteristics is a key problem-solving skill.

- **CO4**: (3) – Large sample tests involve significant problem-solving.
- **CO5**: (3) – Performing non-parametric tests requires analytical skills.
- **CO6**: (3) – Computing probabilities involves complex problem-solving.
- **CO7**: (3) – Describing distributions requires analytical reasoning.

PO6: Communication Skills and Collaboration

- **CO1**: (1) – Applying distributions has minimal impact on communication skills.
- **CO2**: (1) – Interpreting moments is not closely tied to communication.
- **CO3**: (1) – Analyzing characteristics does not directly affect communication skills.
- **CO4**: (1) – Interpreting large sample tests has limited communication relevance.
- **CO5**: (1) – Performing non-parametric tests does not involve significant communication skills.
- **CO6**: (1) – Computing probabilities is a technical skill with limited communication impact.
- **CO7**: (1) – Describing distributions has minimal relation to communication skills.

PO7: Research-related Skills

- **CO1**: (2) – Applying distributions is part of research methodology.
- **CO2**: (2) – Interpreting moments contributes to research analysis.
- **CO3**: (2) – Analyzing characteristics is relevant for research data.
- **CO4**: (2) – Large sample tests are used in research contexts.
- **CO5**: (2) – Non-parametric tests are applicable in research.
- **CO6**: (2) – Computing probabilities is part of research methodology.
- **CO7**: (2) – Describing distributions is relevant to research analysis.

PO8: Learning How to Learn Skills

- **CO1**:(1) – Applying distributions involves some learning but not extensively.
- **CO2**: (1) – Interpreting moments is less about self-directed learning.
- **CO3**: (1) – Analyzing characteristics involves limited independent learning.
- **CO4**: (1) – Large sample tests require specific learning but not independently driven.
- **CO5**: (1) – Performing non-parametric tests does not significantly involve self-directed learning.
- **CO6**: (1) – Computing probabilities requires specific knowledge but not extensive self-learning.
- **CO7**: (1) – Describing distributions involves basic learning skills.

PO9: Digital and Technological Skills

- **CO1**: (2) – Applying distributions often involves using statistical software.
- **CO2**: (2) – Interpreting moments may require software tools.
- **CO3**: (2) – Analyzing characteristics is often performed using technology.
- **CO4**: (2) – Large sample tests are typically conducted using digital tools.
- **CO5**: (2) – Non-parametric tests are usually performed with technological assistance.
- **CO6**: (2) – Computing probabilities involves using software.
- **CO7**: (2) – Describing distributions often uses digital tools.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy

- **CO1**: (1) – Applying distributions has limited relation to multicultural competence and inclusivity.
- **CO2**: (1) – Interpreting moments does not directly impact multicultural competence.
- **CO3**: (1) – Analyzing characteristics does not significantly relate to inclusivity or empathy.
- **CO4**: (1) – Interpreting large sample tests is more technical and less related to multicultural competence.
- **CO5**: (1) – Performing non-parametric tests has minimal relation to multicultural or inclusive skills.
- **CO6**: (1) – Computing probabilities does not directly involve multicultural competence.
- **CO7**: (1) – Describing distributions is technical and does not directly relate to inclusivity or empathy.

PO11: Value Inculcation and Environmental Awareness

- **CO1**: (1) – Applying distributions is primarily technical with minimal focus on values or environmental awareness.
- **CO2**: (1) – Interpreting moments does not directly relate to value inculcation or environmental awareness.
- **CO3**: (1) – Analyzing characteristics is technical and does not focus on values or environmental issues.
- **CO4**: (1) – Interpreting large sample tests does not incorporate value or environmental aspects.
- **CO5**: (1) – Performing non-parametric tests is primarily technical.

- **CO6**: (1) – Computing probabilities is a technical skill with little connection to values or environmental awareness.
- **CO7**: (1) – Describing distributions does not directly address values or environmental concerns.

PO12: Autonomy, Responsibility, and Accountability

- **CO1**: (1) – Applying distributions involves technical skills but minimal autonomy or responsibility.
- **CO2**: (1) – Interpreting moments requires some level of accountability in analysis.
- **CO3**: (1) – Analyzing characteristics involves individual responsibility in analysis.
- **CO4**: (1) – Large sample tests involve responsibility for correct application but are mainly technical.
- **CO5**: (1) – Performing non-parametric tests involves responsibility for accurate implementation.
- **CO6**: (1) – Computing probabilities requires attention to detail but is primarily technical.
- **CO7**: (1) – Describing distributions involves some responsibility but is more about technical description.

PO13: Community Engagement and Service

- **CO1**: (1) – Applying distributions is technical and does not directly involve community engagement.
- **CO2**: (1) – Interpreting moments does not have direct community service implications.
- **CO3**: (1) – Analyzing characteristics is technical with minimal community engagement relevance.
- **CO4**: (1) – Large sample tests are technical and not related to community service.
- **CO5**: (1) – Performing non-parametric tests does not directly involve community engagement.
- **CO6**: (1) – Computing probabilities is a technical skill with little community service relevance.
- **CO7** (1) – Describing distributions does not directly contribute to community engagement.