NORTH SOUTH UNIVERSITY

Centre of Excellence in Higher Education

DEPARTMENT OF MATHEMATICS AND PHYSICS

School of Engineering and Physical Sciences

Course Title	Probability and Statistics
Course Code	MAT 361
Semester	Fall 2025
Course Coordinator	Dr. Md. Alamin (md.alamin06@northsouth.edu)

Instructor & Department Information	
Instructor's Name	Dr. Mahbub Latif (MLM)
Office Room	**SAC1135**
Office Hours	RA (08:40 - 9.40 AM), RA (12:50 - 1:50 PM)
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Links	North South University (NSU) Website: http://www.northsouth.edu Department Website: http://www.northsouth.edu/academic/seps/mp.html

Course & Section Information	
Prerequisites	MAT250
Class Time	
Course Credit Hours	3.0
Text Books	Probability and Statistics for Engineers and the Scientists (4th edition, 2012), Anthony J. Hayter (Brooks/Cole, Cengage Learning). Introduction to Probability and Statistics for Engineers and Scientists, Sheldon M. Ross (Cengage Learning)

Course Assessment System:

Category	*Weight*
Attendance	5%
Assignments (Minimum 2)	10%
Quizzes (Minimum 3)	20%
Mid-Term	30%
Final Exam	35%
Total	100%

Grading Policy:

Numerical Scores	Letter Grade	Grade Points
93 & above	A	4.0
90 - 92	A-	3.7
87 – 89	B+	3.3
83 – 86	B	3.0
80 – 82	B-	2.7
77 – 79	C+	2.3
73- 76	C	2.0
70 – 72	C-	1.7
67 - 69	D+	1.3

	60 - 66	D	1.0

Course Short Description: This course introduces probability theory and statistical inference for undergraduates in engineering and the sciences. This course provides fundamental concepts of set theory, central tendency, dispersion, and different approaches to conceptualizing probability. It discusses useful laws of probability, Bayes' rule, random variables, and their distribution. It also covers discussions on certain operators like mathematical expectation, the variance of random variables, and probability distributions such as Binomial, Geometric, Negative Binomial, Poisson, Uniform, Normal, and Exponential, and their applications. It focuses on sampling distribution, single mean tests, and preliminary ideas for the hypothesis tests.

Course Objectives:

1. To apply basic concepts of sets, sample space, and randomness of data.
2. To acquaint students with probability and its laws.
3. To develop skills in probability and sampling distributions.
4. To analyze generating functions and their application in real-life data.
5. To become familiar with hypothesis tests and decision-making troubleshooting.

Course Learning Outcomes: Upon completion of this course, students should be able to:

CLOs	Description
CLO1	Apply basic probability concepts such as conditional probabilities, independence, Bayes'
	Rule, and combinations and permutations to calculate probabilities of events of practical
	interest.
CLO2	Analyze and conceptualize random variables, single and multivariate distributions,
	conditional distributions, and independence of random variables.
CLO3	Identify and apply Binomial, Negative Binomial, Geometric, Hyper-geometric, Poisson,
	Exponential, and Normal probability models to find mean, variance, and associated
	probabilities.
CLO4	Develop skills in the representation of sample data with graphs and numerical summaries.
CLO5	Derive the sampling distribution of statistics and estimate point estimators for various
	parameters using the method of moments and the method of maximum likelihood.
CLO6	Evaluate the performance of various estimators using properties such as unbiasedness,
	efficiency, and minimum variance.
CLO7	Build confidence intervals for means and interpret the results. Find and perform
	statistical tests on means.
CLO8	Perform a hypothesis test to make a decision.

CO/PO Mapping:

CLOs	Description	Bloom's taxonomy domain/level (**C:** Cognitive, **P**: Psychomotor, **A**: Affective)	Delivery methods and activities	Assessment tools
CLO1	Apply basic probability concepts such as conditional probabilities, independence, Bayes Rule, and combinations and permutations to calculate probabilities of events of practical interest.	**C3, P2**	Lectures, notes	Quiz, Exam
CLO2	Analyze and conceptualize random variables, single and multivariate distributions, conditional distribution, and independence of random variables.	**C3, C4, P2**	Lectures, notes	Quiz, Exam
CLO3	Identify and apply Binomial, Negative Binomial, Geometric, Hypergeometric, Poisson, Exponential, and Normal probability models to find mean, variance, and associated probabilities.	**C3, C4**	Lab class/ Discussion	Lab work/ Assignment
CLO4	Develop skills in the representation of sample data with graphs and numerical summaries.	**C4, P2**	Group discussion	Presentation/ Assignment
CLO5	Derive the sampling distribution of statistics, and estimate point estimators for various parameters using the method of moments and the method of maximum likelihood.	**C3, C4, C5, P3**	Lectures, notes	Quiz, Exam
CLO6	Evaluate the performance of various estimators using properties such as unbiasedness, efficiency, and minimum variance.	**C5, P3**	Lab class/ Discussion	Lab work/ Assignment
CLO7	Build confidence intervals for means and interpret the results. Find and perform statistical tests on means.	**C3**	Group discussion	Presentation/ Assignment

CLO8	Perform a hypothesis test to make a	**C4, P2**	Demonstration	Quiz, Exam
	decision.			

Examination Dates: These will be announced in class. The Controller of Examinations will declare the final exam.

Tentative Syllabus for MAT-361

Chapter 1: Probability Theory (2 lectures)

1.1 Probabilities
1.2 Events
1.3 Combinations of events
1.4 Conditional probability
1.5 Probabilities of event intersections
1.6 Posterior probabilities
1.7 Counting techniques

Chapter 2: Random Variables (3 lectures)

2.1 Discrete random variables
2.2 Continuous random variables
2.3 The expectation of a random variable
2.4 The variance of a random variable
2.5 Jointly distributed random variables
2.6 Combinations and functions of random variables

Chapter 3: Discrete Probability Distributions (3 lectures)

3.1 The Binomial distribution
3.2 The Geometric and Negative Binomial Distributions
3.3 The Hypergeometric distribution
3.4 The Poisson distribution

Chapter 4: Continuous Probability Distribution (2 lectures)

4.1 The Uniform distribution
4.2 The exponential distribution

Chapter 5: The Normal Distribution (2 lectures)

5.1Probability calculations using the normal distribution
5.2Linear combinations of normal random variables
5.3Approximating distributions with the normal distribution
5.4Distributions related to the normal distribution

Chapter 6: Descriptive Statistics (3 lectures)

6.1Experimentation
6.2 Data presentation
6.3 Sample statistics
6.4 Examples

Chapter 7: **Statistical Estimation and Sampling Distributions (3.5 lectures)**

7.1 Point estimates
7.2 Properties of point estimates

7.3 Sampling distributions
7.4 Constructing parameter estimates

Chapter8: **Inferences on a Population Mean (3.5 lectures)**

8.1 Confidence intervals
8.2 Hypothesis testing

HOMEWORK EXERCISES

Chapter 1	1.1	1.1.1, 1.1.3, 1.1.7, 1.1.9
	1.2	1.2.1, 1.2.3, 1.2,7, 1.2.11
	1.3	1.3.2, 1.3.6, 1.3.7, 1.3.11, 1.3.12
	1.4	1.4.1, 1.4.9, 1.4.12, 1.4.16
	1.5	1.5.1, 1.5.2, 1.5.7, 1.5.9, 1.5.16
	1.6	1.6.1, 1.6.3, 1.6.7
	1.7	1.7.4, 1.7.5, 1.7.7, 1.7.13
Chapter 2	2.1	2.1.1, 2.1.7, 2.1.11
	2.2	2.2.1, 2.1.3, 2.2.5, 2.2.9, 2.2.11
	2.3	2.3.5, 2.3.11, 2.3.19
	2.4	2.4.1, 2.4.5, 2.4.11, 2.4.15
	2.5	2.5.1, 2.5.3, 2.5.5, 2.5.8
	2.6	2.6.1, 2.6.2,.2.6.5, 2.6.9, 2.6.11, 2.6.13
Chapter 3	3.1	3.1.4, 3.1.6, 3.1.9, 3.1.11
	3.2	3.2.3, 3.2.4, 3.2.5, 3.2.9
	3.3	3.3.2, 3.3.3, 3.3.7, 3.3.8
	3.4	3.4.3, 3.4.6, 3.4.8, 3.4.7, 3.4.9
Chapter 4	4.1	4.1.1, 4.1.2, 4.1.5
	4.2	4.2.1, 4.2.3, 4.2.5, 4.2.7, 4.2.9, 4.2.11
Chapter 5	5.1	5.l.1, 5.1.3, 5.1.7, 5.1.9, 5.1.11, 5.1.13
	5.2	5.2.1, 5.2.3, 5.2.9, 5.2.11, 5.2.19
	5.3	5.3.5, 5.3.7, 5.3.9, 5.3.13, 5.3.15
Chapter 6	6.2	6.2.1, 6.2.3
	6.3	6.3.1, 6.3.2, 6.3.15
Chapter 7	7.2	7.2.1, 7.2.2, 7.2.3, 7.2.7
	7.3	7.3.3, 7.3.7, 7.3.9, 7.3.8, 7.3.22, 7.3.27, 7.3.34
	7.4	7.4.1, 7.4.3
Chapter 8	8.1	8.1.1, 8.1.3, 8.1.5, 8.1.7, 8.1.11
	8.2	8.2.1, 8.2.3, 8.2.5, 8.2.7, 8.2.9, 8.2.11, 8.2.13

Tentative Lecture Plan

(CLO4) Lecture 1: Introduction, definition and scope of statistics
(CLO4) Lectures 2-3: Population and sample, descriptive and inferential statistics, variables and observations
(CLO4) Lecture 4: Frequency tables and graphs and histograms
(CLO4) Lecture 5: Measures of central tendency
(CLO4) Lectures 6 and 7: Measures of position, measures of dispersion
(CLO1) Lectures 8 and 9: Probability, sample space and events, Properties of Probability, Venn diagrams, algebra of events
(CLO1) Lecture 10: Axioms of probability, calculating probability **(Quiz 1)**
(CLO1) Lecture 11: Counting, Experiments having equally likely outcomes
(CLO1) Lecture 12: Conditional probability, independent events
(CLO1) Lecture 13: Bayes theorem, applications of Bayes theorem
(CLO2) Lectures 14 and 15: Random variables, probability mass and density functions, distribution function
(CLO2) Lecture 16: Joint distribution, independent random variables
(CLO2) Lectures 17 and 18: Expectation and its properties, expectation of the sum of variables
Lecture 19: **Midterm Exam**
(CLO2) Lectures 20 and 21: Variance, covariance, variance of sum of variables
(CLO2) Lecture 22: Chebychev's inequality
(CLO3) Lectures 23 and 24: Bernoulli and binomial random variables **(Quiz 2)**
(CLO3) Lectures 25 and 26: Poisson and hypergeometric random variables
(CLO3) Lecture 27: Uniform and exponential random variables
(CLO3) Lectures 28 and 29: Normal random variables
(CLO5) Lectures 30 and 31: Distribution of sum and mean, Central Limit Theorem
(CLO6) Lecture 32 and 33: Parameter estimation: point estimates, interval estimates **(Quiz 3)**
(CLO7) Lecture 34: Single mean z & t test
(CLO8) Lecture 35: Test of hypothesis I
Lecture 36: Revision on the previous lectures for the final exam

Classroom Rules of Conduct

Please Refer to the NSU Student Handbook, Sections: “Disciplinary Actions” and “Procedures and Guidelines”.

Exams & Make-up Exam Policy

No makeup for quizzes, and NO Formative assessments will be retaken under any circumstances. If a student misses the Midterm and/or Final exams due to circumstances beyond their control (official valid documents are required) and is informed beforehand (if possible), reasonable arrangements may be considered. Please note that the retake exam questions are generally trickier and more critical than the regular exam questions. Students may get to see/recheck their midterm and Final exam scripts.

Cell phones are prohibited in exam sessions.

Attendance Policy: As per NSU policy.