



North South University

Department of Mathematics and Physics

School of Engineering and Physical Sciences

North South University, Bashundhara, Dhaka-1229, Bangladesh

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| Instructor | : ijh |
| Course Name (Code) | : Probability and Statistics (MAT361) |
| Office | : 1134 |
| Office Hours | : ST (9.30am-10.30am), MW (8.00am-10.30am), R (9.30am-10.30am) |
| Text book | : Probability and Statistics for Engineers and Scientists (4 th edition, 2012), Anthony Hayter |
| Reference Book | : Probability and Statistical Inference (9 th Edition), Robert V. Hogg, Elliot A. Tanis, Dale L. Zimmerman |

Course Description This course is an introduction to the probability theory and statistical inference for undergraduates in engineering and the sciences. This course attempts to provide basic concepts of set theory, central tendency, dispersion and different approaches of 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, variance of random variables and probability distributions such as Binomial, Geometric, Negative Binomial, Poisson, Uniform, Normal, Exponential and their applications. It focuses on sampling distribution, single mean test and preliminary ideas on test of hypothesis.

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 on probability and sampling distributions.
4. To analyze generating functions and its application in real life data.
5. To make familiar with hypothesis test and decision making troubleshoot.

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, Hyper-geometric, Poisson, Exponential and Normal probability models to find mean, variance and associated probabilities. | C3, C4 | Lab class/ Discussion | Lab work/ Assignment |

| CLOs | Description | Bloom's taxonomy domain/level (C: Cognitive, P: Psychomotor, A: Affective) | Delivery methods and activities | Assessment tools |
|-------------|---|---|--|-----------------------------|
| CLO5 | Derive 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 test on means. | C3 | Group discussion | Presentation/ Assignment |
| CLO8 | Perform hypothesis test to make decision. | C4, P2 | Demonstration | Quiz, Exam |

Prerequisite: MAT250

Grading: The final grade in this course will be determined by the marks earned by a student on a final exam, midterm exam, quizzes, assignment and attendance. The relative weightings of these components towards the final grade are as follows.

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|--------------|------|---|
| Midterm Exam | 30% | Exam date to be announced in class |
| Quizzes | 15% | Quiz dates are to be announced in class |
| Attendance | 10% | |
| Assignment | 10% | |
| | | |
| Final Exam | 35% | Exam date and place to be announced by the Registrar's office |
| Total | 100% | |

The final letter grades will be assigned according to final averages as follows

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|-----------|---------|----------|----------|-----------|---------|
| | | A | 93 – 100 | A- | 90 – 92 |
| B+ | 87–89 | B | 83– 86 | B- | 80 – 82 |
| C+ | 77–79 | C | 73– 76 | C- | 70 –72 |
| D+ | 67 – 69 | D | 60 –66 | F | 0 –59 |

Attendance Policy: Attendance at all classes is mandatory and is a NSU policy. Students are expected to remain in class the *entire* period. This means that students must arrive on time and stay until class is finished. Each student is responsible for all material covered during his/her absence.

Cell Phone Policy : Students are not allowed to use any smart device or phone/texting/email device during class period, test, or final.

Tentative Lecture Plan and Syllabus for MAT-361

| Chapter 1: Probability Theory (4 lectures) | Homeworks |
|--|--|
| 1.1 Probabilities | 1.1.1 to 1.1.6, 1.1.8 to 1.1.11 |
| 1.2 Events | 1.2.1, 1.2.2, 1.2.4, 1.2.5, 1.2.7, 1.2.8, 1.2.10, 1.2.12 |
| 1.3 Combinations of events | 1.3.1, 1.3.2 (a,b,c,d), 1.3.5, 1.3.6, 1.3.7, 1.3.9 |
| 1.4 Conditional probability | 1.4.3, 1.4.6, 1.4.9 |
| Chapter 2: Random Variables (4 lectures) | |
| 2.1 Discrete random variables | 2.1.1 |
| 2.2 Continuous random variables | 2.2.2, 2.2.6 |
| 2.3 The expectation of a random variable | 2.3.1, 2.3.12 |
| 2.4 The variance of a random variable | 2.4.5 |
| 2.5 Jointly distributed random variables | 2.5.3 |
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| Chapter 3: Discrete Distributions (2 lectures) | |
| 3.1 The Binomial distribution | 3.1.4, 3.1.9 |
| 3.2 The Geometric and Negative Binomial distribution | 3.2.5, 3.2.9 |
| 3.3 The Hypergeometric distribution | 3.3.3 |
| 3.4 The Poisson distribution | 3.4.4, 3.4.8 |
| Midterm | |
| Chapter 4 & 5: Continuous Distribution (3 lecture) | |
| 4.2 The exponential distribution | 4.2.2 |
| 5 The Normal distribution | 5.1.1, 5.1.3, 5.1.9 |
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| Chapter 6: Descriptive Statistics (1 lectures) | |
| 6.1 Experimentation | |
| 6.2 Data presentation | 6.2.1, 6.2.3 |
| 6.3 Sample statistics | 6.3.1 |
| Chapter 7: Statistical Estimation & Sampling Distributions (1 lectures) | |
| 7.1 Point estimates (Maximum likelihood method) | |
| Chapter 8: Inferences on a Population Mean and Population variance (3 lectures) | |
| 8.1 Confidence intervals | 8.1.1, 8.1.3, 8.1.5 |
| 8.2 Hypothesis testing | 8.2.1, 8.2.3, 8.2.5, 8.2.7, 8.2.9, 8.2.11, 8.2.13 |
| Chapter 9: Comparing two population mean and two population variance (2 lectures) | |
| 9.2 Analysis of paired samples | |
| 9.3 Analysis of independent samples | |
| Chapter 12: Simple linear regression (2 lectures) | |

Final