

Identification	Subject	MATH 217, Probability Theory and Mathematical Statistics (6 ECTS)
	Department	Mathematics
	Program	Undergraduate
	Term	Fall 2026
	Instructor	Orkhan Ashrafov
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	Lecture hours	Tuesday: 13:40 – 15:10, 15:20 – 16:50
Prerequisites	MATH 215, Linear Algebra and Mathematical Analysis	
Language	English	
Compulsory/Elective	Compulsory	
Required textbooks and course materials	Core textbooks: 1. Newbold, P., Carlson, W. L., & Thorne, B. M. (2013). <i>Statistics for Business and Economics</i> (8th edition). Pearson. 2. Ross, S. (2010). <i>A First Course in Probability</i> (8th edition). Pearson Prentice Hall. Supplementary book: 1. Montgomery, D. C., & Runger, G. C. (2018). <i>Applied Statistics and Probability for Engineers</i> (7th edition). Wiley.	
Course outline	The aim of this course is to provide a rigorous foundation in probability theory and mathematical statistics, equipping students with the tools to analyze data and build probabilistic models. The first half of the course focuses on the mathematical framework of chance, covering probability rules, Bayes' theorem, and both discrete and continuous random variables. The second half transitions to applied data analysis, teaching students how to describe data graphically and numerically before moving into advanced statistical inference—including confidence intervals, one- and two-population hypothesis testing, and linear regression. These subjects form the core quantitative basis for data-driven, probabilistic decision-making.	
Course objectives	• To introduce the fundamental concepts, postulates, and axioms of probability theory. • To develop problem-solving skills using combinatorial mathematics and probability models across both discrete and continuous sample spaces. • To understand joint probabilities, conditional probability, statistical independence, and Bayes' theorem. • To study random variables, probability distributions, expected value, and variance. • To develop practical skills in summarizing, visualizing, and interpreting data using graphical and numerical descriptive statistics. • To explain sampling distributions and the application of the Central Limit Theorem. • To introduce the core mechanics of statistical inference, including point estimation, confidence intervals, and hypothesis testing for single and dual populations. • To apply two-variable linear regression techniques for modeling relationships between variables and interpreting predictive data.	
Learning outcomes	Upon successfully completing this course, students will be able to:	

	• Apply basic counting principles and calculate the probability of simple, compound, and complementary events. • Solve complex probability problems utilizing conditional probability rules, total probability, and Bayes' theorem. • Calculate and interpret the expected value, variance, and standard deviation for a variety of discrete and continuous random variables. • Summarize and visualize raw datasets using appropriate graphical representations and numerical descriptive measures. • Apply the Central Limit Theorem to solve practical problems involving the distributions of sample statistics. • Calculate and properly interpret confidence intervals for population parameters. • Formulate, conduct, and interpret hypothesis tests for both single populations and two-population comparisons. • Perform two-variable linear regression analysis and interpret the resulting coefficients to make predictive, data-driven decisions.		
Teaching methods	Lecture	x	
	Assisted work	x	
	Assisted lab work	x	
	Others		
Evaluation	Methods	Date/deadlines	Percentage (%)
	Midterm Exam	Week 9	30
	Class Attendance		5
	Quizzes	Week 4, 7, 11, 14	20 (four quizzes of equal weight)
	Activity		5
	Final Exam	TBA	40
	Total		100
Policy	▪ Use of Generative AI Tools The use of generative artificial intelligence (GenAI) tools is strictly prohibited in this course. The primary aim of the course is to develop students' independent mathematical reasoning, problem-solving skills, and creative thinking. While GenAI tools are a great way to learn the topics that a student is falling behind on, students are expected to complete all assignments and assessments independently without any use of GenAI tools. If any usage of GenAI tools (e.g., LLMs) is suspected while completing the assignments, one of the following measures will be applied: • Issuing an oral or written warning; • Requiring the resubmission of the assignment; • Reducing the grade for the assignment or assigning a zero (0) grade. ▪ Preparation for class The structure of this course makes your individual study and preparation outside the class extremely important. The lecture material will focus on the major points introduced in the text. Reading the assigned chapters and having some familiarity with them before class will greatly assist your understanding of the lecture. After the lecture, you should study your notes and work relevant problems and cases from the end of the chapter and sample exam questions.		

		Students are responsible for completing the reading assigned from the textbook for the topics covered and for checking email regularly for important information and announcements related to the course. ▪ Homework and assignments No late assignments will be accepted without prior arrangement with the instructor for acceptable excuses. Medical and family emergencies will be considered on a case-by-case basis. No late homework will be accepted. Homework is to be completed on an individual basis. Students may discuss homework with classmates, but each student is responsible for his or her own work. If a student has consulted classmates, the names of those individuals must be noted at the top of the assignment. ▪ Study group sessions Students will be divided into groups of three individuals for study group sessions and will be assigned some problems to solve together in class. ▪ Quizzes and examinations Quizzes may be given unannounced throughout the term and will count as one homework grade. There will be no make-up quizzes. ▪ Attendance and missed classes If a student misses class due to a personal emergency or medical reasons, the instructor must be notified by email immediately. A doctor's note will be required for make-up work. ▪ Withdrawal (pass / fail) This course strictly follows the grading policy of the School of Science and Engineering. Thus, a student is normally expected to achieve a mark of at least 60% to pass. In case of failure, he/she will be required to repeat the course the following term or year. ▪ Cheating / plagiarism Cheating or any other form of plagiarism during the Quizzes, Midterm and Final Examinations will lead to paper cancellation. In this case, the student will automatically get zero (0) grade without any consideration. University policy on academic honesty concerning exams and individual work will be strictly enforced. ▪ Professional behavior guidelines Students shall behave in a way that creates a favorable academic and professional environment during class hours. Unauthorized discussions and unethical behavior are strictly prohibited. ▪ Ethics Use of any electronic devices is prohibited during lecture and lab sessions. Cell phones must be turned off before entering class — not set to silent or vibrating mode. This is a university policy, and violators will be reprimanded accordingly. Students should not arrive late to class.	
Week	Date/Day (Tentative)	Topics	Textbook/Assignments
1	17.09.26 17.09.26	• Random Experiments, Outcomes, and Events	[1] Chapter 3.1
2	24.09.26 24.09.26	• Probability and Its Postulates	[1] Chapter 3.2, 3.3, 3.4
3	01.10.26 01.10.26	• Discrete Random Variables and Probability Distributions	[1] Chapter 3.5, 4.1, 4.2

4	08.10.26 08.10.26	Expected Value, Variance, and the Binomial Distribution	[1] Chapter 4.3, 4.4 Quiz 1 (5 pts)
5	15.10.26 15.10.26	Poisson, Hypergeometric, and Jointly Distributed Discrete Variables	[1] Chapter 4.5, 4.6, 4.7
6	22.10.26 22.10.26	Continuous Random Variables, Uniform Distribution, and Expectations	[1] Chapter 5.1, 5.2
7	29.10.26 29.10.26	The Normal Distribution and Binomial Approximations	[1] Chapter 5.3, 5.4 Quiz 2 (5 pts)
8	05.11.26 05.11.26	Exponential Distribution & Jointly Distributed Continuous Variables	[1] Chapter 5.5, 5.6
9	12.11.26 12.11.26	Midterm Exam - Using Graphs to Describe data	[1] Chapter 1
10	19.11.26 19.11.26	Using Numerical Measures to Describe data	[1] Chapter 2
11	26.11.26 26.11.26	Distributions of Sample Statistics	[1] Chapter 6 Quiz 3 (5 pts)
12	03.12.26 03.12.26	Confidence Interval Estimation: One Population	[1] Chapter 7
13	10.12.26 10.12.26	Hypothesis Tests of a Single Population	[1] Chapter 9
14	17.12.26 17.12.26	Two Population Hypothesis Tests	[1] Chapter 10 Quiz 4 (5 pts)
15	24.12.26 24.12.26	Two Variable Regression Analysis	[1] Chapter 11
	TBA	Final Exam	

This syllabus is a guide for the course and any modifications to it will be announced in advance. Students are responsible for keeping up with any announced modifications.