Faculty of Informatics & Communication Engineering
Department of Software / Communication Engineering

Fall Semester ٢٠٢٤/٢٠٢٥

Course Syllabus

Course Title: Probabilities and Statistics	**Course code: MAT311**
Course Level: 3	**Course prerequisite(s): Math3 and Math4**
Class Day/ Time: Sat. 08:00−11:00	**Credit hours: 3 CHrs (3 T + 0 P)**

Instructor Name(s):	**Prof. Qosai Kanafani**
Office No.:	
Office Hours:	**Saturday: 14:00−17:00**
E-mail Address:	**qosai.kanafani@gmail.com**
Phone No.	**0954887605**

Course description:

The goal of this course is to initialize students to manipulate the probabilistic and statistical concepts. The application of statistical methods in science and engineering makes students learn more and understand better these concepts and pushes them to apply these methods in their work. Emphasis is given to basic concepts and techniques for collecting and analyzing data, drawing conclusions, and making predictions. The major focus of this course is to provide students with experience in using the computer to solve problems which can be set ups some mathematical models.

Course objectives:

Probability:

- Students completing the course will be able to:
- Students completing this course successfully will be able to:
- Use basic counting techniques (multiplication rule, combinations, permutations) to compute probability and odds.
- Use (MINITAB v.16) to run basic simulations of probabilistic scenarios.
- Compute conditional probabilities directly and using Bayes' theorem, and check for independence of events.
- Set up and work with discrete random variables. In particular, understand the Bernoulli, binomial, geometric and Poisson distributions.
- Work with continuous random variables. In particular, know the properties of uniform, normal and exponential distributions.
- Know what expectation and variance mean and be able to compute them.
- Understand the law of large numbers and the central limit theorem.
- Compute the covariance and correlation between jointly distributed variables.
- Use available resources (the internet or books) to learn about and use other distributions as they arise.

Statistics:

- Students completing the course will be able to:
- Create and interpret scatter plots and histograms.

- Understand the difference between probability and likelihood functions, and find the maximum likelihood estimate for a model parameter.
- Do Bayesian updating with discrete priors to compute posterior distributions and posterior odds.
- Do Bayesian updating with continuous priors.
- Construct estimates and predictions using the posterior distribution.
- Find credible intervals for parameter estimates.
- Use null hypothesis significance testing (NHST) to test the significance of results, and understand and compute the p-value for these tests.
- Use specicific significance tests including, z-test t-test (one and two sample), chi-squared test.
- Find confidence intervals for parameter estimates.
- Use bootstrapping to estimate confidence intervals.
- Compute and interpret simple linear regression between two variables.
- Set up least squares fit of data to a model.

Course materials and references:

- MINITAB software.
- SPSS software.
- Excel software.

Teaching methods:

Lectures, discussion groups, problem solving, etc.

Learning outcomes:

Students who successfully complete this course should be able to demonstrate understanding of :

- basic probability axioms and rules and the moments of discrete and continuous random variables as well as be familiar with common named discrete and continuous random variables.
- how to derive the probability density function of transformations of random variables and use these techniques to generate data from various distributions.
- how to calculate probabilities, and derive the marginal and conditional distributions of bivariate random variables.
- discrete time Markov chains and methods of finding the equilibrium probability distributions.
- how to calculate probabilities of absorption and expected hitting times for discrete time Markov chains with absorbing states.
- how to translate real-world problems into probability models.
- how to read and annotate an outline of a proof and be able to write a logical proof of a statement.

Grading:

- Quizzes, Projects, Lab & Homework 20%
- Midterm Exams during the term. 30%
- Final Exam 50%

Course schedule

Week	Date	Basic and support material to be covered	Reading	Hmk/Quiz/ Lab
1		Population and Sample and summary statistics.	1.1-1.2	
2		Graphical summaries.	1.3	
3		Summarizing bivariate Data Correlation Coefficient.	2.1-2.3	
4		Probability and conditional probability and Bayes' Rule.	3.1-3.2	Quiz 01
5		Discrete and continuous random variables.	3.3	
6		Binomial Distribution.	4.1-4.2	
7		Normal Distribution and central limit theorem.	4.3-4.4	
8		**Midterm Exam**		
9		**Midterm Exam**		
10		Exponential Distribution and a review of Expected value and variance.	4.5	
11		Point estimation and interval estimation.	5.1	
12		Confidence intervals for mean and for proportions.	5.2-5.3	Quiz 02
13		Hypothesis tests for a single Sample.	6.1-6.2	
14		Test for a population proportion.	6.3	
15		Inferences for two samples and two proportions.	7.1-7.2	
16		Inferences in Linear models.	8.1-8.2	
17	1/2/2022	**Final Exam**		

Module references

- Principles of Statistics for Engineers and Scientists by William Navidi, 4rd edition, 2014.

Approved By: Dr. Qosai Kanafani