



Course Syllabus

General Information

Course Number: InIn4010
Course Title: **Probability and Statistics for Engineers**
Credit-Hours: Three

Course Description

Descriptive statistics. Probability theory. Discrete and continuous random variables and distributions and their applications in engineering. Sample statistics and their distributions. Applications to engineering problems. Hypothesis testing and confidence intervals. Emphasis on the use of statistical computer packages and their use in Engineering.

Prerequisites

Mate 3032 or Mate 3184 - Calculus II
InGe 3016- Algorithms and Computer Programming.

Textbook and References

- Montgomery, D. C., and Runger, G. C., 2006, **Applied Statistics and Probability for Engineers**, 4th Edition. John Wiley and Sons, Inc.
- Devore, J. L., 2004, Probability and Statistics for Engineers and the Sciences, 6th Edition, Brooks/Cole Publishing Co.
- Walpole, R. E., and Myers, R. H., 1998, Probability and Statistics for Engineers and Scientists, 6th. Edition MacMillan Co.
- Vardeman, S. B., 1994, Statistics for Engineering Problem Solving, 1st Edition. PWS Publishing Company.
- Miller, I., and Freund, J., 1994, Probability and Statistics for Engineers, 5th Edition. Prentice Hall.
- Hines, W. W., and Montgomery, D. C., Goldsman, D. M., and Borror, C. M. 2003, Probability and Statistics in Engineering, 4th Edition, John Wiley.
- Lapin, L. L., 1997, Modern Engineering Statistics. 1st Edition. Duxbury Press.

Purpose

This course is designed for engineering students who need to understand the basic theory of probability and statistics for explaining or modeling randomness in engineering problems. The purpose is to teach engineering students (i) how to summarize and describe data; (ii) draw practical conclusions on the basis of engineering data; and (iii) the theoretical and applied background needed to understand and effectively use probability and statistical models. This course is a requirement in the B.S. in IE and it is a prerequisite for the following required courses in the IE curriculum: InIn 4015 Engineering Economic Analysis, InIn 4020 Applied Industrial Statistics, InIn 4021 Deterministic Models in Operations Research, InIn 4077 Work Systems Design, and InIn 4078 Statistical Quality Control.

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Course Goals

After completing the course, the student should be able to:

- Interpret and understand the fundamental concepts of probability and statistics: sample space and events, random variables and their distributions, independent vs. dependent events, the central limit theorem, hypothesis testing, and confidence intervals.
- Recognize applications and develop skills to use distributions: geometric, binomial, Poisson, hyper geometric, normal, and exponential to engineering problems.
- Recognize when to use test of hypothesis to solve engineering problems.
- Work in teams to solve engineering problems.
- Use statistical software to perform data analysis and statistical plots, to identify probability distributions, to estimate parameters to test, and to present results.
- Present statistical analyses concisely, using appropriate statistical graphs, in written reports.

Requirements

All students are expected to come to class on time, and prepared; do all assigned readings and related homework; actively participate in class discussions; and satisfy all assessment criteria to receive credit for the course.

Department and Campus Policies

Class attendance: Class attendance is compulsory. The University of Puerto Rico, Mayagüez Campus, reserves the right to deal at any time with individual cases of non-attendance. Professors are expected to record the absences of their students. Frequent absences affect the final grade, and may even result in total loss of credits. Arranging to make up work missed because of legitimate class absence is the responsibility of the student. (Bulletin of Information Undergraduate Studies).

Absence from examinations: Students are required to attend all required examinations. If a student is absent from an examination for a justifiable reason acceptable to the professor, he or she will be given a special examination. Otherwise, he or she will receive a grade of zero or "F" in the examination missed. (Bulletin of Information Undergraduate Studies)

Final examinations: Final written examinations must be given in all courses unless, in the judgment of the Dean, the nature of the subject makes it impracticable. Final examinations scheduled by arrangements must be given during the examination period prescribed in the Academic Calendar, including Saturdays. (See Bulletin of Information Undergraduate Studies).

Partial withdrawals: A student may withdraw from individual courses at any time during the term, but before the deadline established in the University Academic Calendar. (See Bulletin of Information Undergraduate Studies).

Complete withdrawals: A student may completely withdraw from the University of Puerto Rico, Mayagüez Campus, at any time up to the last day of classes. (See Bulletin of Information Undergraduate Studies).

Disabilities: After introducing and identifying himself/herself to the instructor and the institution as a student with disability, the student will receive reasonable accommodations in his/her courses and evaluations. For additional information, contact Services to Students with Disabilities at the office of the Dean of students (Q-019), 787 – 265 – 3862 ó 787 – 832 – 4040 exts. 3250, 3258.

Ethics: Any academic fraud is subject to the disciplinary sanctions described in article 14 and 16 of the revised General Student Bylaws of the University of Puerto Rico contained in Certification 018- 1997-98 of the Board of Trustees. The professor will follow the norms established in articles 1-5 of the Bylaws.

Course Syllabus

General Topics

Lecture	Topic	Reading
1	Introduction. The role of statistics in engineering	Chap. 1
2	Sample spaces and events. Interpretations, axioms, and addition rules of probability.	Sec. 2-1 to 2-3
3-4	Conditional probability. Multiplication rules	2-4, 2-5
5-6	Independence. Bayes theorem. Random variables.	2-6 to 2-8
7	Discrete random variables. Probability distributions for discrete random variables. Cumulative distribution functions.	Sec. 3-1 to 3-3
8-9	Mean and Variance of discrete random variables.	3-4
10-12	The discrete uniform distribution. The binomial probability distribution The hypergeometric and geometric distributions. The Poisson probability distribution	3-5 to 3-9
13-15	Continuous random variables and probability density functions. Cumulative distribution functions. Mean and Variance of continuous random variables.	Sec. 4.1 to 4-4
16-18	The Continuous uniform distribution. The normal distribution.	4-5, 4-6
19	Exponential Distribution	Sec. 4-8
20-21	Using statistical software, the following topics are to be covered: descriptive statistics. Graphical representation of data. Measures of location and variability. Probability Plots.	Chap. 6
22-25	Sampling distributions of means and Central Limit Theorem.	7-1 and 7-2
26-27	Parameter estimation. Statistical inference. Random sampling. Properties of estimators. The method of maximum likelihood.	Sec. 7-3 and 7-4 (7-4.2 only)
28-31	Introduction to confidence intervals. Statistical inference for a single sample. Hypothesis testing. Inference on the mean of a population (variance known)	Sec. 8-1 and 8-2, Sec. 9-1 and 9-2
32	Inference on the mean of a population (variance unknown)	Sec. 8-3 and 9-3
33	Inference on the variance of a normal population.	Sec. 8-4 and 9-4
34	Inference on a population proportion.	Sec. 8-5 and 9-5
35-37	Inference for a difference in means.	Sec. 10-1 and 10-3
38	Paired t-test	Sec. 10-4
39-40	Hypothesis testing and confidence intervals using statistical software	Chap. 8-10
41-42	Inference on the variance of two normal populations	Sec. 10-5

*All readings from Montgomery, D. C., and Runger, G. C., 2006.

Coordinator: Prof. Mercedes Ferrer-Alameda