King Fahd University of Petroleum and Minerals

Department of Mathematics

STAT 319 Syllabus, Term 231 (2023-2024)

Coordinator: Dr. Jimoh Olawale Ajadi (jimoh.ajadi@kfupm.edu.sa)

Course Code and Title: STAT319, Probability and Statistics for Engineers and Scientists

Course Credit Hours: 2-2-3

Textbook: Applied Statistics and Probability for Engineers by D. Montgomery and G. Runger, 6th Edition, Wiley, 2014

Software Package: R language and R studio.

Course Objective: Introduce the basic concepts of probability and statistics to engineering students. Emphasis will be given on the understanding of the nature of randomness of real world phenomena; the formulation of statistical methods by using intuitive arguments, solving them and thereby making meaningful decisions.

Course Description: Presentation and interpretation of data, elementary probability concepts, random variables and probability distributions, binomial, Poisson, exponential, Weibull, normal and lognormal random variables. Estimation, tests of hypotheses for the one sample problem. Simple and multiple linear regression, application to engineering problems. The lab session will be devoted to problem solving using statistics software.

Prerequisite: MATH 102

Course Learning Outcomes: Upon successful completion of the course, a student should be able to

- ➢ A thorough understanding of descriptive statistics, both graphical and numerical
- ➢ A working knowledge of sample spaces, events, and operations on events
- ➢ Elementary probability concepts
- ➢ A good understanding of random variables and their means and variances
- ➢ Basic discrete and continuous random variables
- ➢ The concept of a sampling distribution, and the central limit theorem
- ➢ Point and interval estimation of means and proportions
- ➢ Basic concepts of hypothesis testing including the hypothesis testing setup, procedure, p-values
- ➢ Correlation
- ➢ Simple and multiple linear regression, including estimation and testing of model parameters

Grading Policy:

	Date	Time	Place	Material	Percentage
Exam I				Chapters 6, 2, 3	22.5% (90 points)
Exam II				Chapters 4, 7, 8	22.5% (90 points)
Final Exam	As per registrar website			Comprehensive	30% (120 points)
Online Homework	through Blackboard				5% (20 points)
LAB Work	The average total grade of the lab of each section shall be in the interval [42, 45], i.e., [70%, 75%] of 60 points.				15% (60 points)
Class Work	▪ It is based on quizzes, class tests, or other class activities determined by the instructor. ▪ The average (out of 20) of the class work of each section has to be in the interval $[y-1, y+1]$, where $$y = \frac{median(Exam\ I)\% + median(Exam\ II)\%}{10}.$$				5% (20 points)
				Total	100% (400)

LAB GRADING POLICY

Activity	Material	Weight
Lab Tests 1	Lab test 1 – Material: From the beginning to the end of section 2.10	5% (20 points)
Lab Tests 2	Lab test 2 – Material: Discrete, Continuous & Sampling Distributions	5% (20 points)
Lab Tests 3	Lab test 3 – Material Covered: Estimation, Testing and Regression.	5% (20 points)
Total		15% (60 points)

Letter Grades: The letter grades will follow a grading curve, which depends on the average of all students enrolled in the course.

Exam Questions: The questions of the exams are similar to the examples and exercises in the textbook.

Cheating in Exams: Cheating or any attempt of cheating by use of illegal activities, techniques and forms of fraud will result in a grade of DN in the course along with reporting the incident to the higher university administration for further action. Cheating in exams includes (but is not restricted to):

➢ Looking at the papers of other students.
➢ Talking to other students.
➢ Using mobiles, smart watches or any other electronic devices.

Other Exam Issues:

- ➤ No student will be allowed to take the exam if he/she does not bring his/her KFUPM ID, or National/Iqama ID, or Driver's License with him/her to the exam hall.
- ➤ Students are not allowed to have their mobiles, smart watches, or any electronic device in the exam hall. A violation of this will be considered an attempt of cheating.
- ➤ A student must sit in the seat assigned to him/her. A violation of this will be considered an attempt of cheating.

Missing an Exam: In case a student misses an exam (Exam I, Exam II, or the Final Exam) for a legitimate reason (such as medical emergencies), he/she must bring an official excuse from Students Affairs. Otherwise, he/she will get a score of zero in the missed exam.

Attendance: Students are expected to attend all lecture and lab classes.

- ➤ If a student misses a class/lab, he/she is responsible for any announcement made in that class/lab.
- ➤ After warned **twice** by the instructor, a DN grade will be awarded to any student who accumulates
  - 9 unexcused absences in lecture and lab classes. (20%)
  - 15 excused and unexcused absences in lecture and lab classes. (33.3%)

The Usage of Mobiles in Class: Students are not allowed to use mobiles for any purpose during class time. Students who want to use electronic devices to take notes must take permission from their instructor. Violations of these rules will result in a penalty decided by the instructor.

Academic Integrity: All KFUPM policies regarding ethics apply to this course. See the Undergraduate Bulletin in the Registrar's website.

Coverage Plan

Week	Date (2023)	Sec	Title (# sections)
1	Aug. 27-31		**Ch 6: Descriptive Statistics** 6.1 Numerical Summaries of Data 6.2 Stem-and-Leaf Diagrams 6.3 Frequency Distributions and Histograms 6.4 Box Plots **First lab to cover the Descriptive Statistics**
2	Sep. 3-7		**Ch 2: Probability** 2-1 Random Space and events (2.1.1 - 2.1.3) 2-2 Interpretations and Axioms of Probability 2-3 Addition Rules 2-4 Conditional Probability
3	Sep. 10-14		2-5 Multiplication Rule 2-6 Independence 2-7 Bayes' Theorem **Ch 3: Discrete Probability Distributions** 3-2 Probability Distributions and Probability Mass Functions
4	Sep. 17-21		3-3 Cumulative Distribution Functions 3-4 Mean and Variance of a Discrete Random Variable 3-6 Binomial Distribution 3-7 Geometric Distribution **Second lab to cover the Discrete Probability Distributions**
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Sunday, Sep. 24: National Day Holiday

Week	Date (2023)	Sec	Title (# sections)
5	Sep. 25-28		3-8 Hypergeometric Distribution 3-9 Poisson Distribution **Ch 4: Continuous Probability Distributions** 4-2 Probability Distributions and Probability Density Functions 4-3 Cumulative Distribution Functions

Exam I: Date; Time; Material:

Week	Date (2023)	Sec	Title (# sections)
6	Oct. 1-5		4-4 Mean and Variance of a Continuous Random Variable 4-5 Continuous Uniform Distribution 4-6 The Normal Distribution 4-8 Exponential Distribution 4-10 Weibull Distribution 4-11 Lognormal Distribution
=1`	Oct. 8-12		**Ch 7: Sampling Distribution** 7-1 Point Estimation 7-2 Sampling Distributions and the Central Limit Theorem (**Example 7.1 and 7.2**) **Third lab to cover the Continuous Probability Distributions & Sampling Distribution** Ch 8: Statistical Intervals for a Single Sample 8-1 Confidence Interval for the Mean of a Normal Distribution with Known σ^2 8-1.1 Development of The Confidence Interval and Its Basic Properties

8	Oct. 15-19		8-1.2 Choice of Sample Size 8-1.5 Large-Sample Confidence Interval for μ 8-2 Confidence Interval for the Mean of a Normal Distribution with Unknown σ^2 8-4 Large Sample Confidence Interval for a Population Proportion
9	Oct. 22-26		**Ch 9: Tests of Hypotheses for a Single Sample** 9-1 Hypothesis Testing 9-2.1 Tests on the Mean of a Normal Distribution with Known Variance 9-2.3 Large-Sample Test
10	Oct. 29-Nov. 2		9-3.1 Tests on the Mean of a Normal Distribution with Unknown Variance 9-5.1 Tests on a Population Proportion **Fourth lab to cover the Statistical Intervals & Tests of Hypotheses for a Single Sample**
Exam II: Date; Time; Material:			
11	Nov. 5-9		**Ch 11: Simple Linear Regression and Correlation** 11-1 Empirical Models 11-2 Simple Linear Regression
12	Nov. 12-16		11-3 Properties of the least squares estimators 11-4 Hypothesis Tests in Simple Linear Regression 11-5 Confidence Intervals 11-6 Prediction of New Observations
Nov. 19-23: Midterm Break			
13	Nov. 26-30		11-7 Adequacy of the Regression Model 11-8 Correlation **Fifth lab to cover the Simple Linear Regression and Correlation** **Ch 12: Multiple Linear Regression (based on R output)** 12-1 Multiple Linear Regression Model
14	Dec. 3-7		12-2 Hypothesis Tests in Multiple Linear Regression 12-3 Confidence Intervals in Multiple Linear Regression
15	Dec. 10-14		12-4 Prediction of New Observations 12-5.1 Residual Analysis
16	Dec. 17		A Normal Sunday Class (**Review/ Catching up**)
Final Exam: Comprehensive			

Suggested Practice Exercises

Sr.	Sec	Exercises #
1	Chapter #6	6.8, 6.21 (a only) 6.27,6.31, 6.46, 6.51, 6.65, 6.69, 6.71
2	Chapter #2	8, 25, 37, 42, 55, 63, 77, 88, 102, 108, 125, 141, 149, 153 and 172
3	Chapter # 3	3, 5, 12, 17, 23, 37, 42, 58, 65, 85, 109, 122, and 137.
4	Chapter # 4	4, 10, 14, 23, 35, 43, 49, 51, 53, 61, 68, 70, 83, 87, 99, 105, 131 and 141
5	Chapter #7	3, 7, 10 and 12.
6	Chapter # 8	4, 7, 11, 27, 35, 40 and 58.
7	Chapter# 9	5, 9, 26, 40, 66, 67, 90 and 93.
8	Chapter #11	2, 8, 24, 44 and 70.

Some tips to enhance your problem-solving skills:

- ❖ Do all homework assignments on time.
- ❖ Practice (but not memorize) more problems than those given in the above list.
- ❖ Solve some review exercises available at the end of each chapter.
- ❖ Solve the problems on your own before reading the solution or asking for help.
- ❖ If you find it difficult to handle a certain type of problems, you should try more problems of the same type.
- ❖ Try to make good use of the office hours of your instructor. Always bring your solution trials to discuss them with your instructor.