King Fahd University of Petroleum and Minerals
Department of Mathematics
**STAT319: Probability and Statistics for Engineers and Scientists**
**Term 223**

**Instructor**:                                    **Office:**
**Phone:**                                         **E-mail:**
**Office Hours:**

## Course Objectives:

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.

*Learning Outcomes:*

By completing this course, students should acquire/learn

- 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

*Textbook***:**

Applied Statistics and Probability for Engineers by D. Montgomery and G. Runger, 6$^{th}$ Edition, Wiley, 2014
**Software Package**: See STAT-319 Lab syllabus.

**Grading Policy**

| Assessment | Date | Material | Weight |
|---|---|---|---|
| Exam 1 (18 MCQ) | Week4 JULY 16, 2023 Sunday | Chapters 6, 2, 3 | 22.5% (90 points) |
| Exam 2 (18 MCQ) | WEEK6 AUGUST 03, 2023 Thursday | Chapters 4, 7, 8 | 22.5% (90 points) |
| Final Exam (24 MCQ) | TBA Check from Registrar website | Comprehensive | 30% (120 points) |
| Homework | Homework on Blackboard | | 5% (20 points) |
| Quizzes | The average total grade of the quizzes of each section shall be in the interval [14, 15], i.e., [70%, 75%] of 20 points. | | 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) |
| | Total | | 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) |

## Academic Integrity:

All KFUPM policies regarding **ethics** and **academic honesty** apply to this course.

# Schedule

| Week | Topics | Suggested Problems |
|---|---|---|
| **Week 1**<br>June 11 – 15 | **Ch 6: Descriptive Statistics**<br>    6.1 Numerical Summaries of Data<br>    6.2 Stem-and-Leaf Diagrams<br>    6.3 Frequency Distributions and Histograms<br>    6.4 Box Plots<br>    **First lab to cover the Descriptive Statistics**<br>**Ch 2: Probability**<br> 2-1 Random Space and events (2.1.1 - 2.1.3)<br> 2-2 Interpretations and Axioms of Probability<br> 2-3 Addition Rules | **Chapter #6**<br>6.8, 6.21 (a only)<br>6.27, 6.31, 6.46, 6.51,<br>6.65, 6.69, 6.71 |
| **Week 2**<br>June 18 – 22 |  2-4 Conditional Probability<br> 2-5 Multiplication Rule<br> 2-6 Independence<br> 2-7 Bayes' Theorem<br>**Ch 3: Discrete Probability Distributions**<br> 3-1 Discrete Random variables<br> 3-2 Probability Distributions and Probability Mass Functions<br> 3-3 Cumulative Distribution Functions | **Chapter #2**<br>8, 25, 37, 42, 55, 63,<br>77, 88, 102, 108, 125,<br>141, 149, 153 and 172 |
| **Week 3**<br>July 09 – 13 |  3-4 Mean and Variance of a Discrete Random Variable<br> 3-6 Binomial Distribution<br> 3-7 Geometric Distribution<br> 3-8 Hypergeometric Distribution<br> 3-9 Poisson Distribution<br>    **Second lab to cover the Discrete Probability Distributions**<br>**Ch 4: Continuous Probability Distributions**<br> 4-1 Continuous Random Variables<br> 4-2 Probability Distributions and Probability Density Functions<br> 4-3 Cumulative Distribution Functions | **Chapter # 3**<br>3, 5, 12, 17, 23, 37, 42,<br>58, 65, 85, 109, 122,<br>and 137. |
| **Week 4**<br>July 16 – 20 |  4-4 Mean and Variance of a Continuous Random Variable<br> 4-5 Continuous Uniform Distribution<br> 4-6 The Normal Distribution<br> 4-7 Normal Approximation to the Binomial **ONLY**<br> 4-8 Exponential Distribution<br>**Ch 7: Sampling Distribution**<br> 7-1 Point Estimation<br> 7-2 Sampling Distributions and the Central Limit Theorem (**ONLY one mean**)<br>    **Third lab** to cover the Continuous Probability Distributions & Sampling Distribution | **Chapter # 4**<br> 4, 10, 14, 23, 35, 43,<br>49, 51, 53, 61, 68, 70,<br>83, 87, 99, 105, 131 and<br>141 |
| **Week 5**<br>July 23 – 27 | **Ch 8: Statistical Intervals for a Single Sample**<br> 8-1 Confidence Interval for the Mean of a Normal Distribution with Known $\sigma^2$<br>    8-1.1 Development of The Confidence Interval and Its Basic Properties<br>    8-1.2 Choice of Sample Size<br>    8-1.5 Large-Sample Confidence Interval for $\mu$<br> 8-2 Confidence Interval for the Mean of a Normal Distribution with Unknown $\sigma^2$<br> 8-4 Large Sample Confidence Interval for a Population Proportion<br>**Ch 9: Tests of Hypotheses for a Single Sample**<br> 9-1   Hypothesis Testing | **Chapter # 7**<br>3, 7, 10 and 12.<br><br><br>**Chapter # 8**<br>4, 7, 11, 27, 35, 40 and<br>58. |
| **Week 6**<br>July 30 – Aug 03 |  9-2.1 Tests on the Mean of a Normal Distribution with Known Variance<br> 9-2.3 Large-Sample Test<br> 9-3.1 Tests on the Mean of a Normal Distribution with Unknown Variance<br> 9-5.1 Tests on a Population Proportion<br>    **Fourth lab to cover the Statistical Intervals & Tests of Hypotheses for a Single Sample**<br>**Ch 11: Simple Linear Regression and Correlation**<br>  11-1 Empirical Models<br>  11-2 Simple Linear Regression<br>  11-3 Properties of the least squares estimators<br>  11-4 Hypothesis Tests in Simple Linear Regression<br>  11-5 Confidence Intervals<br>  11-6 Prediction of New Observations | **Chapter# 9**<br>5, 9, 26, 40, 66, 67, 90<br>and 93.<br><br>**Chapter #11**<br>2, 8, 24, 44 and 70. |
| **Week 7**<br>Aug 6 – 10 |   11-7 Adequacy of the Regression Model<br>  11-8 Correlation<br>**Fifth lab to cover the Simple Linear Regression and Correlation**<br>**Ch 12: Multiple Linear Regression (based on R output)**<br>  12-1 Multiple Linear Regression Model<br>  12-2 Hypothesis Tests in Multiple Linear Regression<br>  12-3 Confidence Intervals in Multiple Linear Regression<br>  12-4 Prediction of New Observations | |
| **Week 8**<br>Aug 13 – 14 |   12-5.1 Residual Analysis | |

### Remarks:

1. ### Mobiles and Smart Watches
   - 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.
   - **Students are not allowed to carry mobile phones and smart watches to the exam halls**.

2. ### 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 **F** in the course along with reporting the incident to the higher university administration for further action. Cheating in exams includes (but is not limited to):
   - looking at the papers of other students
   - talking to other students
   - using mobiles or any other electronic devices **including smart watch**.

3. ### 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 must bring an official excuse from Students Affairs. Otherwise, he will get zero in the missed exam.

4. ### Attendance:
   Students are expected to attend all lecture classes.
   - If a student misses a class, he is responsible for any announcement made in that class.
   - A DN grade will be awarded to any student who accumulates
     - 20% unexcused absences (7 lectures and labs)
     - 33% excused and unexcused absences (12 lectures and labs)

5. ### Homework:
   - To successfully learn statistics, students need to solve problems and analyze data. The selected assigned problems are specifically designed to help you understand the material.
   - No late homework will be accepted.

6. ### Tips on how to enhance your problem-solving abilities:
   - Do all homework assignments on time.
   - Practice (but not memorize) more problems than those in the above list.
   - Solve review problems 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.
   - Practicing homework problems and reviewing the class lectures will make exam problems easier to tackle.
   - Try to make good use of the office hours of your instructor. Always bring partial solutions of the questions that you want to discuss with your instructor.