

King Fahd University of Petroleum and Minerals  
 Department of Mathematics  
 Dhahran, Saudi Arabia  
**STAT-310: Linear Regression** (Term 211)

**Instructor:** Nasir Abbas

**Phone:** 013-860-4485

**Office Hours:** To be announced

**Office:** 5-333

**E-mail:** [nasirabbas@kfupm.edu.sa](mailto:nasirabbas@kfupm.edu.sa)

**Course Objectives:** Present the basics of regression analysis

**Textbook:** *Introduction to Linear Regression Analysis* by Montgomery, Peck and Vinning, 6<sup>th</sup> edition, Wiley (2021).

**Learning Outcomes:** At the end of the term a student should be able to

- Find and interpret least square estimates of parameters
- Thoroughly understand and use the single linear regression model
- Thoroughly understand, build and use the multiple linear regression
- Perform hypothesis tests and construct confidence intervals in linear regression models
- Test the appropriateness of models, and analyze data

**Assessment\***

| Activity  | Weight |
|---|--------|
| Class Participation (home works, quizzes, attendance, project etc.) | 15%    |
| First Major Exam  | 25%    |
| Second Major Exam   | 25%    |
| Final Exam <i>(Comprehensive)</i>                                   | 35%    |

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

**Cheating and Plagiarism:** This course is composed of individual assignments. It is important that your individual assignment be completed with your own efforts instead of copying it from your fellow student. KFUPM instructors follow “*zero tolerance*” approach with regard to cheating and plagiarism. During examinations (quizzes and major 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.

**Important Notes:**

- ✓ Only University issued excuses will be accepted.
- ✓ **Attendance** on time is *very* important.
- ✓ Use of **mobile** is *banned* during the class.
- ✓ **Homework** problems will be assigned later.

## Weekly Schedule

| Date   | Section                           | Topics (Tentative)  |
|--------|-----------------------------------|---|
| Week 1 | Chapter 1<br><i>Sections 1-4</i>  | Chapter 1: INTRODUCTION<br><br>Regression and model building, data collection, uses of regression, role of the computer   |
| Week 2 | Chapter 2<br><i>Sections 1-5</i>  | Chapter 2: SIMPLE LINEAR REGRESSION<br><br>Simple linear regression model, least - squares estimation of the parameters, hypothesis testing on the slope and intercept, interval estimation in simple linear regression, prediction of new observations |
| Week 3 | Chapter 2<br><i>Sections 6-12</i> | Coefficient of determination, a service industry application of regression, some considerations in the use of regression, regression through the origin, estimation by maximum likelihood, case where the regressor X is random                         |
| Week 4 | Chapter 3<br><i>Sections 1-4</i>  | Chapter 3: MULTIPLE LINEAR REGRESSION<br><br>Multiple regression models, estimation of the model parameters, hypothesis testing in multiple linear regression, confidence intervals in multiple regression  |
| Week 5 | Chapter 3<br><i>Sections 5-8</i>  | Prediction of new observations, a multiple regression model for the patient satisfaction data, hidden extrapolation in multiple regression  |
| Week 6 | Chapter 3<br><i>Sections 9-11</i> | Standardized regression coefficients, multicollinearity, why do regression coefficients have the wrong sign?  |
| Week 7 | Chapter 4<br><i>Sections 1-3</i>  | Chapter 4: MODEL ADEQUACY CHECKING<br><br>Introduction, residual analysis, press statistic  |
| Week 8 | Chapter 4<br><i>Sections 4-5</i>  | Detection and treatment of outliers, lack of fit of the regression model  |

|         |   |  |
|---------|---|--|
| Week 9  | Chapter 5<br><i>Sections 1-5</i>        | Chapter 5: TRANSFORMATIONS AND WEIGHTING TO CORRECT MODEL INADEQUACIES<br><br>Introduction, variance - stabilizing transformations, transformations to linearize the model, analytical methods for selecting a transformation, generalized and weighted least squares  |
| Week 10 | Chapter 6<br><i>Sections 1-7</i>        | Chapter 6: DIAGNOSTICS FOR LEVERAGE AND INFLUENCE<br><br>Importance of detecting influential observations, leverage, measures of influence: cook's D, measures of influence: DFFITS and DFBETAS, a measure of model performance, detecting groups of influential observations, treatment of influential observations |
| Week 11 | Chapter 7<br><i>Sections 1, 2 and 4</i> | Chapter 7: POLYNOMIAL REGRESSION MODELS<br><br>Introduction, polynomial models in one variable, models in two or more variables  |
| Week 12 | Chapter 8<br><i>Sections 1-2</i>        | Chapter 8: INDICATOR VARIABLES<br><br>General concept of indicator variables, comments on the use of indicator variables   |
| Week 13 | Chapter 9<br><i>Sections 1-5</i>        | Chapter 9: MULTICOLLINEARITY<br><br>Introduction, sources of multicollinearity, effects of multicollinearity, multicollinearity diagnostics, methods for dealing with multicollinearity  |
| Week 14 | Chapter 10<br><i>Sections 1-4</i>       | Chapter 10: VARIABLE SELECTION AND MODEL BUILDING<br><br>Introduction, computational techniques for variable selection strategy for variable selection and model building, case study: Gorman and Toman asphalt data   |
| Week 15 |   | Catchup and Project Presentations  |