KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
DEPARTMENT OF MATHEMATICS & STATISTICS

STAT 561 - Time Series

Course Outline

Instructor: Muhammad Riaz **Office**: (5-332)
Telephone: 013-860-7622 **Email**: riazm@kfupm.edu.sa
Office Hours: TBA

Course Description (3-0-3):
Examples of simple time series. Stationary time series and autocorrelation. Autoregressive moving average processes. Modeling and forecasting with ARMA processes. Maximum likelihood and least squares estimator. Nonstationary time series.

Textbooks: Cryer, J. D. and Chan, K. (2009). Time Series Analysis with Applications in *R*, 2nd Edition, Springer, New York, USA.

References: Diebold, F. X. (2007). Elements of Forecasting. 4th Edition, Thomson, South-Western, Mason OH, USA.

Software: *R* statistical language and MINITAB.

Assessment

Activities	Weight
Class Activities (Assignments, Quizzes and participation)	15%
Mid Term	30%
Final exam (comprehensive)	40%
Project	15%

Grades: The letter grades will assigned based on relative performance of the registered students.

Notices:
Any notice about the course will be communicated to the students through blackboard.

Project Description
The project should be based on a real problem (with complete description) and a detailed analysis using the skills developed in the course. There should be some concluding remarks that refer to the real implications of your chosen problem, preferably in your major area. You may use online sources in your project with proper citation/reference.

Project Requirements:

- Each group should contain a maximum of 5students.
- Each group should submit the following:
  - a formal report (pdf)
  - a power point presentation

Deadline: The end of semester (before the last day of classes)

Submission: email submission to riazm@kfupm.edu.sa + A Hard copy

Syllabus:

Introduction to Time Series

- Types of data
- Components of Time Series
- Real life examples

Smoothing techniques

- Moving average
- Exponential weighted moving average

Trends

- Modeling and forecasting deterministic trend

Seasonality

- Modeling and forecasting deterministic seasonality

Stationary, non-stationary, and heteroscedastic time series

a) Models for Stationary Time series
   - Random walk
   - MA models, AR models, ARMA models
   - Invertibility
   - Forecasting ARMA models
b) Models for Non-stationary Time series
   - Stationary through differencing
   - ARIMA models
   - Forecasting ARIMA models
c) Models for Heteroscedastic Financial Time series
   - ARCH models
   - GARCH models

Model Specification

- Properties of Auto Correlation Function
- Properties of partial autocorrelation function
- Specification of some actual time series

Parameter Estimation

- Least square estimation
- Maximum Likelihood estimation

Model Diagnostics

- Residual Analysis
- Checking Assumptions
- Model fit evaluation

Forecasting

Forecast errors and confidence intervals