Salisbury University Department of Mathematical Sciences

MATH 316 : Statistical Learning with Applications
Syllabus (Tentative)

Description: The introduction to statistical methods and models for data analysis with applications. Methods and models, such as regression models, time series models, principal components analysis, decision trees, cluster analysis, basic ANOVA, and/or others, are studied. Computer softwares such as R, Excel, Python, or others are used.

4 Hours Credit: Meets four hours per week.

Prerequisites: C or better in MATH 155 or MATH 216.

Intended Audience: Students who need a more advanced course in applied statistics in order to apply statistical methods to their own data and to interpret results of others.

Objective: To study common statistical methods and models for analyzing data and to apply them to solve problems in the field of interest.

Textbooks: *An Introduction to Statistical Learning, with Applications in R, 2nd Edition*, by James, Witten, Hastie, and Tibshirani; Springer, 2021.

R for Everyone: Advanced Analytics and Graphics, 2nd Edition, by Lander; Addison-Wesley, 2017.

Technology: Common statistical packages such as R, Excel, Python, and/or others will be used for all analyses.

Topic	Weeks
Introduction to Statistical Modeling and R	1.5
An introduction to key concepts of statistical modeling, including types of modeling problems and common methods of assessing model accuracy. The statistical programming language R will be introduced as well.	
Regression Models	3
Study key concepts of generalized linear models, including exponential family of distributions and link functions, parameter estimation, diagnostic tests of model fit and assumption checking, model selection, result interpretation, etc.	
Time Series Models	2
Understand key concepts of regression-based time series models, including stochastic time series processes, autoregressive models, moving average models, etc.	
Principal Components Analysis	1
An introduction to key concepts of principal components analysis, including definitions, applications, result interpretations, etc.	
Decision Trees	1.5
Study key concepts of decision tree models, including purpose and uses, models, interpretation, etc.	
Cluster Analysis	1.5
Understand key concepts of cluster analysis, including uses of clustering, K-means clustering, hierarchical clustering, etc.	
Basic ANOVA	1.5
An introduction to key concepts of ANOVA, including single factor designs, factorial designs, etc.	
Projects and Tests	2
Total	**14**

Evaluation

Homework and quizzes	10%
Projects	20%
Tests	30%
Final project	40%

- Clear descriptions of thought processes, evidence of critical thinking, and effective communication must be demonstrated in written work.
- **Writing Across the Curriculum:** Students will be expected to communicate mathematics and mathematical ideas effectively in speech and writing. At the University Writing Center, trained consultants are ready to help you at any stage of the writing process. In addition to the important writing instruction that occurs in the classroom and during professors' office hours, the Center offers another site for learning about writing. **All students are encouraged to make use of these important services.**
- **NOTE:** Once a student has received credit, including transfer credit, for a course, credit may not be received for any course with material that is equivalent to it or is a prerequisite for it.