

Course Number	CS 280	Course Title	Computational Statistics I			
Semester Hours	3	Course Coordinator	Chun-Hsi Huang			
		SP20				
Catalog Description	<p>This course provides a basic introduction to probability and statistics as well as related computational approaches. Topics include basic probability models, combinatorics, random variables, discrete and continuous probability distributions, statistical estimation and hypotheses testing, confidence intervals and linear regression. Some selected computational approaches for statistical problems such as simulation of random variables from probability distributions, the visualization of multivariate data, Monte Carlo integration and methods in inference will also be discussed. The R language will be used for programming assignments.</p>					
Textbooks						
SP20						
Blitzstein, Joseph K. (2014). Introduction to Probability. Chapman and Hall (CRC), ISBN 978-1466575578.						
References						
Course Learning Outcomes						
<ul style="list-style-type: none"> • Develop analytical and computational skills for statistical inference • Write software in R language to implement statistical procedures • Implement a combination of statistical toolkits for analyzing real data sets 						
Assessment of the Contribution to Student Outcomes						
SP20						
Outcome →	1	2	3	4	5	6
Assessed →	X	X				X
Prerequisites by Topic						
MATH 108 with a grade of C or better						

Major Topics Covered in the Course

1. Course overview {1 class}
2. Distribution with numbers {3 classes}
 - a. Mean, median quartiles
 - b. Standard deviation
3. Normal distribution {2 classes}
4. Probability {5 classes}
 - a. Probability models and rules
 - b. Discrete probability models
 - c. Continuous probability models
5. Estimation {4 classes}
 - a. Degree of freedom
 - b. Confidence interval
6. Hypothesis test {6 classes}
 - a. P value and significance testing
 - b. Type I and Type II error
 - c. One and two-tail tests
 - d. Results interpretation
7. Linear Regression {4 classes}
8. Analysis of Variance {3 classes}
 - a. Analysis of variance design
 - b. ANOVA test
9. Introduction to R {2 classes}
 - a. Overview of R, Vectors, matrices and data frames
 - b. Data manipulation and summarization and visualization
 - c. Basic graphics
10. Visualization of Multivariate data {4 classes}
 - a. Surface plots and 3D scatter plots
 - b. Contour plots
 - c. Other 2D representations of data
11. Simulation {3 classes}
 - a. Generating random variables
12. Monte Carlo integration and methods in inference {3 classes}
 - a. Monte Carlo integration
 - b. Monte Carlo method for estimation
 - c. Monte Carlo method for hypothesis test