Course Outline

Topic - Handout

1. Introduction to Statistics - HO 1 (1.5 lectures)
      A. Role of statistics in scientific investigations
      B. Research Process - Scientific Method
      C. Applications of Statistics in Real World Problems
      D. Communication - Key to Effective Consulting
      E. Preparation of Data/Writing Final Report

2. Types of Statistical Studies - HO 2 (2 lectures)
      A. Experimental vs observational study
      B. Retrospective vs Prospective Studies
      C. Case Control Studies
      D. Sampling Designs
      E. Probability vs Statistics
      F. Design of Experiments

3. Describing Population Distributions - HO 3 (4 lectures)
      A. Discrete vs Continuous Distributions
      B. Functions Which Describe distributions: pmf, pdf, cdf, quantile
      C. Location/Scale Families of Distributions
      D. Interrelationships between Distributions
      E. Simulating Data from Distributions
      F. Functions Associated with Reliability

4. Sample Estimators of pdf, pmf, cdf, quantile - HO 4 (2 lectures)
      A. Estimators of cdf
      B. Estimators of quantile function
      C. Estimators of pmf and pdf

5. Parametric Summaries of Population Distributions - HO 5 (2 lectures)
      A. Measures of Location
      B. Measures of Dispersion/Spread
      C. Measures of Skewness and Kurtosis
      D. Measures of Dependency

6. Sample Estimators of Population Summaries - HO 6 (2 lectures)
      A. Graphical Estimators of Location and Scale
      B. MLE and MOM Estimators
      C. Distribution-free Estimators of Summaries

7. Censored Data - HO 7 (2.5 lectures)
      A. Type I, Type II, and Random Censoring
      B. Parametric Estimation with Censored Data
      C. Distribution-free Estimation with Censored Data

Exam 1 - MONDAY, March 1, 5pm (Texas Time)

8. Graphical Summaries/Comparisons - HO 8 (2 lectures)
      A. Reference distribution probability plot
      B. Box Plots
      C. Quantile-Quantile plots
      D. Reference distribution plots for location-scale family of distributions
      E. normal and Weibull reference distribution plots
      F. Time Series Plots
      G. Matrix and Draftsman Plots
      H. Stacked Bar Plots
      I. Scatter Plots

9. Goodness of Fit Statistics - HO 9 (2 lectures)
      A. Chi-squared test for discrete data
      B. Kolmogorov-Smirnov, Cramer-von-Mises, Anderson-Darling tests
      C. Shapiro-Wilk test for Normality
      D. Correlation test for Normality
      E. Box-Cox transformation to Normality

10. Sampling Distributions and Their Application - HO 10 (2 lectures)
      A. Relationship between samples and populations
      B. Central limit theorem for sample mean, sample quantiles, median, sample standard deviations
      C. Extreme Value Distributions
      D. Bootstrap methods for estimating sampling distribution

11. Interval Estimators of population parameters - HO 11 (5.5 lectures)
      A. Confidence intervals for population parameters
      B. Determine sample sizes for estimating μ and π to a certain level of precision
      C. Tolerance interval for processes and populations
      D. Prediction intervals
      E. Transformations and Bootstrapping Techniques

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Exam 2 - TUESDAY, April 6, 5pm (Texas Time)

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12. Basics of Hypotheses Testing - HO 12 (5.5 lectures)
      A. Selection of Null and Alternative Hypotheses
      B. Type I and Type II errors
      C. Power-curves
      D. Sample Size Determination for achieving specified power or P(Type II error)
      E. Test Statistics for Hypotheses about Population Parameters
      F. p-values
      G. Distribution-free tests of hypotheses

13. Test Statistics for Comparing Several Populations - HO 13 (7 lectures)
      A. Tests for Population Means $\mu_1, \mu_2, \ldots, \mu_k$
      B. Tests for Population Standard Deviations: $\sigma_1, \sigma_2, \ldots, \sigma_k$
      C. Tests for Population Proportions: $\pi_1, \pi_2, \ldots, \pi_k$
      D. Exact Tests for Proportions
      E. Distribution-free procedures and their relative performance vs parametric procedures
      F. Evaluation of required conditions in inference procedures

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Final Exam (Comprehensive) - MONDAY, May 3, 2pm (Texas Time)

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