Mathematics Department
Brooklyn College, City University of New York
Math 4501 (Probability and Statistics II)
4 hours, 4 credits

Suggested Textbooks:
- An Introduction to Mathematical Statistics and Its Applications, by Richard Larsen and Morris Marx
- Probability and Statistical Inference, by Robert Hogg, Elliot Tanis and Dale Zimmerman

1. Probability preliminaries
    - Overview of multivariate distributions
    - Multinomial distribution
    - Bivariate Normal distribution
    - Order Statistics

2. Point estimators
    - Method of moments
    - Maximum likelihood estimators
    - Unbiased estimators
    - Consistent estimators
    - Sufficient statistics
    - Efficient and asymptotically efficient estimators
    - The Cramér-Rao inequality

3. Confidence intervals
    - Confidence intervals for means
    - Confidence intervals for proportions
    - Confidence intervals for differences of means
    - Confidence intervals for differences of proportions
    - Confidence intervals for standard deviations
    - Confidence intervals for ratios of standard deviations

4. Theory of Statistical Tests
    - Notion of statistical test and its critical region
    - Neyman-Pearson theorem for the best critical region of a given size
    - Uniformly most powerful tests
    - Likelihood ratio tests
    - One sample inference (mean, proportion and standard deviation)
    - Two samples inference (equality of means, proportions and standard deviations)
    - Chi-square tests (goodness of fit and independence)

5. Regression
    - The method of least squares
    - The linear model
    - Estimating the linear model parameters
    - Drawing inferences about the linear model
    - Inference for covariance and correlation