STAT 242b/542b THEORY OF STATISTICS: DRAFT OF COURSE SYLLABUS, 2009 spring

Instructor: Harrison H. Zhou.
Email: huibin.zhou@yale.edu
Office hours: TBA. Tentatively Tuesday 4:30-6:30pm (RM 204, 24 Hillhouse)

Class Time: MWF 9:30AM-10:20AM.

T.A.: Wei Dou
Email: wei.dou@yale.edu
TA session: TBA. Tentatively Tuesday 6:30pm-7:30pm. (Homework discussion. We meet in 24 Hillhouse Avenue, Room 107. Optional, but strongly recommended.)

Textbook: All of Statistics by Larry Wasserman
We will cover almost all material from chapters 6, 9, 10 and 13, and some from chapters 8 and 11.
Recommended reference: Mathematical Statistics and Data Analysis by John Rice.

Grade:
Weekly Homework: 25%
Midterm: 25%
Final Exam: 40%
Participation: 10%

Course Homepage: http://www.stat.yale.edu/~hz68/242/

Schedule:

WEEK 1: PROBABILITY REVIEW(Ch: 1, 2, 3, 4, 5).
* Overview of this course (Point Estimation, Confidence set, Hypothesis Testing, Linear Model).
* Normal, Chi-square, t, and F distributions for statistics based on samples from a normal. Multinomial. Exponential. Gamma. Poisson. Uniform. Quantile function.
* Expected values and variances of sample means. CLT (Central Limit Theorem). (Ch. 3).

WEEK 2: PRELIMINARIES ON INFERENCE (Ch. 6).
* CLT. Confidence set. Hypothesis Testing
* Point Estimation. Overview of Statistical inference (Examples and Questions: Parametric and Nonparametric, Frequentist and Bayesian, Consistency and Efficiency).

WEEK 3: PRELIMINARIES ON INFERENCE (Ch. 9.1).
* Method of moments.
* Maximum likelihood estimator.
* Comparison of method of moments and Maximum likelihood estimator.

WEEK 4: Parametric Inference. (Sections 9.5, 9.7, 9.8, 9.9, 9.10)
* Log-likelihood Function. Fisher information. Efficiency.
* Asymptotic Normality of the MLE. [Idea based on Taylor expansion, CLT, and Fisher information.]
* Estimation of Standard deviation of MLE.

WEEK 5: PARAMETRIC INFERENCE. (Section 9.5, 9.6. 9.7, 9.8, 11.1, 11.2).

* Delta Method.
* Cramer-Rao inequality.
* Bayes method

WEEK 6: PARAMETRIC INFERENCE. (Section 9.8, 9.9, 9.11, 9.13).
* Bayes method
* Large Sample Properties of Bayes procedure.
* Compare MSE of Bayes estimator and MLE estimator. Posterior interval.
* James-Stein Estimation.

WEEK 7: TESTING STATISTICAL HYPOTHESES (Sec.10.1, 10.2).
* Sufficient statistics and likelihood factorization.
* Notions of simple and composite hypotheses concerning distributions and their parameters. The Wald Test.
* Neyman-Pearson Lemma for optimal tests in simple versus simple cases.

WEEK 8: MORE ON TESTING HYPOTHESES. (Sec. 10.3, 10.4, 10.6)
* Questions about Midterm exam. Neyman-Pearson Lemma.
* MIDTERM EXAM
* Neyman-Pearson Lemma.
* Multiple comparisons.

SPRING BREAK

WEEK 9: MORE ON TESTING HYPOTHESES AND REVIEW (Sec. 10.6, 10.8, 10.5)
* Review
* The Likelihood Ratio test
* p-values.
  -- Accounting for degrees of freedom.
  -- Example.
* The Chi-Square test. The Goodness-of-fit Test.

WEEK 10: Linear Model. (Sec. 13.1, 13.2)
* Simple Linear Regression
* LSE and MLE

WEEK 11: Linear Model. (Sec. 13.3, 13.4)
* LSE.
* Transformation.
* Residual plot. Standard Error. Confidence interval. Testing. R^2.

WEEK 12: Linear Model. (Sec. 13.5)
* Prediction Interval.
* Multiple Regression.
* LSE. Its Properties.

WEEK 13: Linear Model. (Sec. 13.6, 13.7)
* Confidence interval. Testing. Prediction Interval.
* Residual plot. Standard Error. Final Prediction Error. R^2.
* Moe on nonparametric estimation if time permits

WEEK 14: READING WEEK.
* Review.
* Review problems.