SM339 Syllabus Spring Semester AY2011-2012

Course coordinator: G.O. Fowler

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The textbook is *Statistical Modeling: A Fresh Approach*, 2nd Edition, Daniel Kaplan (2011). It table of contents follows. The first fifteen chapters will be covered this semester. The remaining three chapters are optional. The course will use R for statistical computations.

Chapter 1 Introduction: Models and their Purposes, Observation and Knowledge, Introduction to Computation with R.

Chapter 2 Data: Cases, Variables, Samples, Kinds of Variables, Data Frames and the Unit of Analysis, Populations and Samples, Longitudinal and Cross-Sectional Samples, Computational Technique.

Chapter 3 Describing Variation: Coverage Intervals, The Variance and Standard Deviation, Displaying Variation, Categorical Variables, Computational Technique.

Chapter 4 Group-wise Models: Grand and Group-wise Models, Accounting for Variation, Group-wise Proportions, Precision, Misleading Group-wise Models, Computational Technique.

Chapter 5 Confidence Intervals: The Sampling Distribution, The Resampling Distribution and Bootstrapping, The Confidence Level, Interpreting Confidence Intervals, Confidence Intervals from Census Data, Computational Technique.

Chapter 6: The Language of Models: Models as Functions, Multiple Explanatory Variables, Reading a Model, Choices in Model Design, Model Terms, Standard Notation for Describing Model Design, Computational Technique.

Chapter 7 Model Formulas and Coefficients: The Linear Model Formula, Linear Models with Multiple Terms, Formulas with Categorical Variables, Coefficients and Relationships, Model Values and Residuals, Coefficients of Basic Model Designs, Coefficients have Units, Untangling Explanatory Variables, Computational Technique.

Chapter 8 Fitting Models to Data: The Least Squares Criterion, Partitioning Variation, The Geometry of Least Squares Fitting, Redundancy, Computational Technique.

Chapter 9 Correlation and Partitioning of Variation: Properties of R^2, Simple Correlation, The Geometry of Correlation, Nested Models, The Geometry of R^2, Computational Technique.

Chapter 10 Total and Partial Relationships: Total and Partial Relationships, Explicitly Holding Covariates Constant, Adjustment and Truth, The Geometry of Covariates and Adjustment, Computational Technique.

Chapter 11 Modeling Randomness: Describing Pure Randomness, Settings for Probability Models, Models of Counts, Common Probability Calculations, Continuous Probability Models, The Normal Distribution, Computational Technique.

Chapter 12 Confidence in Models: The Sampling Distribution and Model Coefficients, Standard Errors and the Regression Report, Confidence Intervals, Confidence in Predictions, Confidence and Collinearity, Confidence and Bias, Computational Technique.

Chapter 13 The Logic of Hypothesis Testing: An Example of a Hypothesis Test, Inductive and Deductive Reasoning, The Null Hypothesis, The p-value, Rejecting by Mistake, Failing to Reject, A Glossary of Hypothesis Testing, An Update on Stock Prices.

Chapter 14 Hypothesis Testing on Whole Models: The Permutation Test, R^2 and the F Statistic, The ANOVA Report, Interpreting the p-value, Computational Technique.

Chapter 15 Hypothesis Testing on Parts of Models: The Term-by-Term ANOVA Table, Covariates Soak Up Variance, Measuring the Sum of Squares, ANOVA, Collinearity, and Multi-Collinearity, Hypothesis Tests on Single Coefficients, Non-Parametric Statistics, Sample Size and Power, Computational Technique.

Chapter 16 Models of Yes/No Variables: The 0-1 Encoding, Inference on Logistic Models, Model Probabilities, Computational Technique.

Chapter 17 Causation: Interpreting Models Causally, Causation and Correlation, Hypothetical Causal Networks, Networks and Covariates.

Chapter 18 Experiment: Experiments, When Experiments are Impossible.