

Lecture Notes

# Review for the First Exam

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*First Review*

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## 1. Nonparametric Regression

- ▶ Naive Nonparametric Regression (binning and averaging)
- ▶ Local Regression (lowess)

## 2. Examining Data

- ▶ Univariate Displays
  - histograms
  - stem-and-leaf displays
  - density estimates (use *one* of histogram, stem-and-leaf, density estimate)
  - boxplots
  - quantile-comparison plots (if there's a reason to compare, e.g., to the normal distribution)
- ▶ Plotting Bivariate Data
  - scatterplots
  - jittered scatterplots for discrete data
  - parallel boxplots

- ▶ Multivariate Data
  - Scatterplot matrices (all marginal pairs)
  - 3D dynamic scatterplots

### 3. Transforming Data

- ▶ Family of Powers and Roots (including logs)
- ▶ Transforming Skewness (transform on ladder of powers in *opposite* direction of skew)
- ▶ Transforming Nonlinearity ('bulging rule')
- ▶ Transforming Non-Constant Spread (spread-level plot)
- ▶ Transforming Proportions (logit transformation, not covered in class)

### 4. Linear Least-Squares Regression

- ▶ Simple Regression
  - Least-Squares Fit (interpretation of  $A$  and  $B$ )
  - Simple Correlation ( $r$ ,  $r^2$ ,  $S_E$ , analysis of variance for the regression)
- ▶ Multiple Regression
  - Two Explanatory Variables
  - Several Explanatory Variables (interpretation of  $A$  and  $B_j$ 's)
  - Multiple Correlation ( $R$ ,  $R^2$ ,  $S_E$ , analysis of variance for the regression)
  - Standardized Regression Coefficients (caveats)

## 5. Statistical Inference for Regression

- ▶ Simple Regression
  - Simple Regression Model (assumptions of linearity, constant error variance, normality, independence, fixed  $X$  or  $X$  independent of  $\varepsilon$ )
  - Properties of the Least-Squares Estimator
  - Confidence Intervals and Hypothesis Tests for  $\alpha$  and  $\beta$
- ▶ Multiple Regression
  - Multiple Regression Model (and assumptions)
  - Confidence Intervals and Hypothesis Tests (individual coefficients, all slopes, a subset of slopes)
  - Empirical vs. Structural Relations

## 6. Dummy-Variable Regression

- ▶ Dichotomous Explanatory Variable, Additive Model: A 0/1 Dummy Regressor
- ▶ Polytomous Explanatory Variables: Sets of 0/1 Dummy Regressors
- ▶ Modeling Interactions (product regressors)
  - The Principle of Marginality (main effects and interactions)
  - Hypothesis Tests for Main Effects and Interactions (Type-II tests)