**Midterm: covered Lectures 1-6**

* Introductory concepts
  + Measurement scales
  + Descriptive vs. inferential statistics
* Descriptive statistics
  + Frequency distributions, histograms, boxplots
  + Symmetric vs skewed distributions
  + Measures of central tendency (mean, median, mode) and how they compare
  + Measures of dispersion (variance, SD, IQR)
  + Quantiles (e.g., percentiles, quartiles)
  + Skewness statistic
  + Linear and nonlinear transformations of variables (and their effects); *z*-scores
* Probability and probability distributions
  + Concepts: sample space, event, discrete vs. continuous outcomes, etc.
  + Basic rules of probability
  + Conditional probability, Bayes’ Rule
  + Independent events
  + Discrete PDFs (e.g., Bernoulli, binomial) – their expected value and variance
  + Continuous PDFs (e.g., uniform, normal)
* Sampling distributions
  + Sampling variability/error, standard error of the sample mean
  + Central Limit Theorem
  + Probabilities of drawing random samples with means that take on certain value
  + Minimum sample size for standard error to be a certain size
  + Unbiased statistics
  + Standard error of a *proportion*
  + Probabilities of drawing random samples with proportions that take on certain values
  + Simulating sampling distributions
* Statistical inference: estimation
  + Point vs interval estimation
  + Calculating a (1-a)% confidence interval; confidence levels and error probabilities
    - Sigma known vs unknown
  + Confidence intervals for proportions
* Statistical inference: significance tests
  + Null and alternative hypotheses; one- versus two-sided hypotheses
  + *P*-values
  + Performing hypothesis tests for the population mean with sigma known or unknown
  + Significance level for a test (a)
  + Performing hypothesis tests for population proportions

**Final: covers Lectures 7-11**

* Statistical power and effect size
  + Type I vs. Type II errors (α and β)
  + Power of the Test for a specific alternative; what affects power
  + Calculate power and probability of a Type II error given necessary information
  + Minimum required sample size to detect a given effect size
  + Statistical vs. practical significance
  + Cohen’s d measure of effect size
  + The value of “precise zeros”
  + Publication bias and *p*-screening; *p-*Hacking
  + Multiple hypothesis testing – implications and corrections
* Hypothesis testing: two groups
  + Independent vs. dependent samples
  + Independent sample tests: standard error and *t*-statistic; required assumptions
    - Equal vs non-equal variance assumptions
  + Confidence interval for a *difference* in population means
  + Confidence interval for a *difference* in population proportions
  + Paired sample test
  + Power calculation for independent samples test
* Bivariate covariance and correlation
  + Population covariance and correlation (definitions)
  + Sample covariance and (Pearson) correlation coefficient
  + Scatter diagrams – interpretation
  + Effects of linear transformation on correlation
  + Spearman rank correlation
* Bivariate regression
  + Prediction equations – getting predicted values and residuals
  + Least squares intercept and slope
  + Interpretation of OLS intercept, slope
  + Relationship of slope to correlation
  + MSE, RMSE
  + R-squared calculation and interpretation
  + Standard error of slope estimator
  + Confidence interval and hypothesis tests for slope estimator
* Multiple regression: introduction
  + Omitted variables bias – identifying potential sources of bias and hypothesizing about direction of bias
  + Multiple regression – interpretation of slope coefficients
* Note: pilot lecture on PCA will not be covered