

Walter Payton College Prep
AP Statistics Course Outline

Textbook: Introduction to Statistics and Data Analysis (Peck, Olsen, Devore, 2016)

The Advanced Placement course in statistics will introduce students to the major concepts and tools for collecting, analyzing and drawing conclusions from data. Students will be exposed to four broad conceptual themes: (1) exploring data: observing patterns and departures from patterns; (2) planning a study: deciding what and how to measure; (3) anticipating patterns: producing models using probability theory and simulation; and (4) statistical inference: confirming models and using sample data to make inferences about the entire population. Students will learn to use statistics software both on the computer and on the TI-83 calculator, and the course will not emphasize rote computation, but rather interpretation of the computed output. All students will be expected to take the AP exam in May, for which many colleges will grant credit and placement for freshman statistics.

Quarter 1: Descriptive Statistics & Regression

1. Introduction to Statistics (Chapters 1 & 2)
 - Why we study statistics
 - Types of data and its sources (i.e. types of studies)
 - Collection methods
 - Sources and ramifications of bias
 - Comparative Experiments

2. Describing Data: (Chapters 3 & 4)
 1. Graphical Methods for Describing Data (Chapter 3)
 - Categorical Data (Frequency distributions, pie and bar charts)
 - Quantitative Data (Dot plots, stem plots, frequency distributions, and histograms)
 2. Numerical Methods for Describing Data (Chapter 4)
 - Center (Mean, Median, mode)
 - Variability (standard deviation, range, IQR); define outliers
 - Outliers effects on measures of center and variability (resistance)
 - Graphical summary of quantitative data via box plots
 - Interpreting Center and Variability (Empirical Rule, Standardized (z) scores)
 - Synthesizing written analysis of distributions.

3. Summarizing Bivariate Data (Chapter 5)
 - Graphical analysis via a scatterplot
 - Correlation (calculation and interpretation)
 - Generating the Least Squares Regression Line for linearly related data and assessing the fit of that line
 - Transformations of data when relationship is nonlinear
 - Synthesizing written analysis of bivariate relationships.

Major projects/assessments:

- Ch. 1 & 2 Test, Ch. 3 & 4 Tests
- Abstract Writing & Evaluation (in-class, pairs assignment)
- Various written reflections on study design & bias

Quarter 2: Regression (con't.), Elementary Probability

Topics:

4. Elementary Probability (Chapter 6)
 - Elementary Probability
 - Chance experiments and events
 - Basic properties of probability (addition and multiplication rules)
 - Conditional probability and Independence
 - Probability Rules generalized

5. Random Variables and Probability Distributions (Chapter 7)
 - Random variables defined (discrete v. continuous)
 - Distribution of discrete and continuous random variables
 - Summarizing distributions center (mean) and variability (standard deviation)
 - Binomial and geometric probability and distributions
 - Normal distributions (bringing in standardized (z) scores)
 - Checking for normality of distributions via the normal probability plot
 - Probability estimation using empiricism and simulation (using random number tables and random number generator)

Quarter 3: Sampling Distributions and Statistical Inference

6. Sampling Distributions (Chapter 8)
 - Sampling Variability
 - Sampling distributions of sample means and proportions

7. One Sample Estimation (Chapter 9)
 - Define point estimation (Confidence Intervals)
 - Large sample confidence intervals for a population proportion and mean via the z -distribution
 - Interpreting results of confidence intervals and synthesizing written analysis.

8. Inference/Hypothesis Testing using One Sample (Chapter 10)
 - Formulating hypotheses
 - Test procedures, conditions and assumptions
 - Errors (type 1 and 2) in hypothesis testing and how they related to significance level set for each test
 - Large sample hypothesis test for population proportion and mean
 - Power of hypothesis test
 - Probability of type 2 error
 - Interpreting results of one sample hypothesis tests and synthesizing written analysis.

9. Inference/Hypothesis Testing using Two Samples (Chapter 11)
 - Reasons for two samples: comparing two populations or two treatments (relate to type of study and experimental design)
 - Hypothesis test concerning the difference in *means* for two populations or treatments using *independent* samples
 - Hypothesis test concerning the difference in *means* for two populations or treatments using *paired* samples

- Large sample inference concerning a difference between two population or treatment *proportions*.
 - Define assumptions of each hypothesis test and check for conditions necessary for the validity of the test
 - Interpreting results of two sample hypothesis tests and synthesizing written analysis.
10. Analysis of Categorical Data (Chapter 12)
- Goodness-of-Fit test for univariate categorical data and the chi-squared distribution
 - Characteristics of chi-squared distribution
 - Chi-squared tests for bivariate categorical data (homogeneity and independence) in a two-way table
 - Interpreting results of chi-squared hypothesis tests and synthesizing written analysis.
11. Inference on Slope of Least Squares Regression Line (Chapter 13)
- Review of least squares regression analysis
 - Inference concerning slope of LSRL (and review of sampling distributions of slope)
 - Assessing the model's adequacy via residuals, coefficient of determination, and standard deviation of errors and slope.
 - Interpreting results of hypothesis tests for slope and synthesizing written analysis.

Quarter 4: AP Prep & Two-Way ANOVA Project