AP® Statistics Syllabus

Course Philosophy

- Mathematics is the language of science. This course is designed to teach new mathematical skills, reinforce old skills, and expand the ability to integrate multiple concepts throughout the problem solving process. Students are expected to use correct mathematical notation and terminology throughout the course.
- Memories fade, so this course will focus on the understanding of mathematical concepts.
- Math is not a spectator sport, you must *do* math to *fully understand* math. Students will work in groups at the boards on a daily basis. Students will present their solutions orally to the class and be asked to find errors in the reasoning of others.

Course Materials

Primary Text: Peck, Roxy, Chris Olsen, and Jay Devore. *Introduction to Statistics and Data Analysis*, 5th ed. Boston, MA: Cengage Learning, 2016.

Graphing Calculator: TI-nspire CX CAS calculators are available for daily in-class use. Students may also rent a TI-84 calculator from the school. Students will be taught how to explore / analyze data and assess models on both these tools to deepen their understanding of statistical concepts throughout the course.

Statistical Software: Students will have access to laptaps with Minitab, Microsoft Excel, and Google Sheets. Students will not be required to master a particular software package, but will be required to interpret output from several different statistical software packages.

Portfolio: Students are required to maintain an organized portfolio of their work. At a minimum it will contain class notes, daily board problems, quizzes, projects, and tests.

Pencil and Eraser: Problems in this course will be challenging, so errors and mistake are expected. These inevitable mistakes are easier to correct if they are in pencil.

Auxiliary Materials: Released exams, study guides, old textbooks and other materials available on the internet will be used throughout the year to prepare students for free response and multiple choice style questions.

Evaluation notes:

- Multiple evaluations will require a response in written sentences. For example “Your friend claims ‘As long as the sample size is large enough, all distributions become normal.’ In your own words, explain why your friend is correct or incorrect.”
- Students must show all work for full credit. For problems solved using a calculator, only the setup and output is required.
- Three notation errors or more will result in a reduced grade.

Course Outline Times are approximate and vary based on student mastery

Chapter 1: The Role of Statistics and the Data Analysis Process (total time: 3 days)

- Variability
- Data Analysis
- Bar Charts
- Dotplots
- Activity: Sexual Discrimination / current news article

Chapter 2: Collecting Data Sensibly (total time: 14 days)

- Types of data
- Planning and Conducting a Study
- Sampling
  bias in sampling, simple random samples, stratified random samples, cluster sampling
- Designing Experiments
  control groups, treatments, blocking, random assignment, replication
- Designing Surveys

Chapter 3: Graphical Methods for Describing Data (total time: 6 days)

- Displaying Categorical Data: Pie and Bar charts
- Dotplots
- Stem and Leaf Displays
- Frequency Distribution and Histograms (Google Sheets training)
- Describing the Shape of a Distribution
- Displaying Bivariate Numerical Data
- Interpreting and Communication the Results of Statistical Analyses

Chapter 4: Numerical Methods for Describing Data (total time: 9 days)

- Describing Center: mean and median
- Describing Spread: range, interquartile range, standard deviation, and variance
- Visually Summarizing a Data Set with Boxplots (Outliers and Modified Boxplots)
- Chebyshev's Rule, The Empirical Rule, and Standardized Scores
- Communicating and Interpreting the Results of Statistical Analyses

Chapter 5: Summarizing Bivariate Data (total time: 16 days)

- Scatterplots and the Correlation Coefficient
- Least Squares Regression
- Assessing the Fit of a Regression Curve
  Outliers, Residuals, Coefficient of Determination, and Influential Points
- Activity: Matching Scatterplots and Correlations
- Activity: Regression on the TI-nspire, Microsoft Excel, and Google Sheets
- Nonlinear Relationships and Transformations

Chapter 6: Probability (total time: 13 days)

- Chance Experiments and Events
- Definition of Probability and the Law of Large Numbers
- Fundamental Properties of Probability and Addition Rule for Mutually Exclusive Events
- Conditional probability, Independent Events, and the Multiplication Rule
- General Probability Rules
- Estimating Probabilities Using Simulation
- Activity: Housing Lottery Simulation

Chapter 7: Random Variables and Probability Distributions (total time: 18 days)

- Random Variables (Discrete and Continuous)
- Properties of Discrete Random Variables
- Properties of Continuous Random Variables
- Expected Value (mean) and Standard Deviation of a Random Variable
- Linear Functions and Linear Combinations of Random Variables
- The Binomial and Geometric Distributions
- The Normal Distribution (Finding Probabilities Using Tables and Calculators)
- Checking for Normality
- Normal approximation to the binomial

Chapter 8: Sampling Variability and Sampling Distribution (total time: 9 days)

- Sampling Distributions
- Sampling Distribution of the Sample Mean and the Central Limit Theorem
- Sampling Distribution of the Sample Proportion

Chapter 9: Estimation Using a Single Sample (total time: 10 days)

- Properties of Point Estimates: Bias and Variability
- Confidence Interval for a Population Proportion
- Confidence Interval for a Population Mean
- The t-distribution (Checking conditions)
- Communicating and Interpreting the Results
- What Does It Mean to Be 95 Percent Confident?
- Finding sample size

Chapter 10: Hypothesis Testing Using a Single Sample (total time: 13 days)

- Hypotheses and Test Procedures – Logic of hypothesis testing
- Type I and Type II errors
- Large Sample Hypothesis test for a Population Proportion (Test statistic and P-values)
- Hypothesis Test for a Population Mean (Test statistic and P-values)
- Power and the Probability of a Type II Error
- Interpreting and Communicating Results

Chapter 11: Comparing Two Populations or Treatments (total time: 11 days)

- Hypothesis Test for the Difference of Two Means (independent/unpaired)
- Confidence Interval for the Difference of Two Means (unpaired)
- Hypothesis Test for the Difference of Two Means (paired)
- Confidence Interval for the Difference of Two Means (paired)
- Hypothesis Test for the Difference of Two Proportions
- Confidence Interval for the Difference of Two Proportions
- Choosing the Correct Test

Chapter 12: The Analysis of Categorical Data and Goodness-of-Fit Tests (total time: 10 days)

- Activity: M&M's
- The Chi-Square Test for Univariate Data and the Goodness-of-Fit Test
- Tests for Homogeneity and Independence of proportions
- Test of Independence
- Choosing the Correct Test:

Chapter 13: Simple and Linear Regression and Correlation: Inferential Methods (total time: 5 days)

- A Simple Linear Regression Model
- Hypothesis Test for the Slope of a Least Squares Regression Line
- Confidence Interval for the Slope of a Least Squares Regression Line
- Checking Model Adequacy – Residual Analysis

Course Projects

Course projects are formal oral or written assignments where both form and technical correctness are evaluated. The main purpose of these assignments is to draw connections between the many concepts presented in AP® Statistics.

Post chapter 4 project – Students create and conduct a survey on a topic of their choice. Using any statistical software package, they produce both graphical and numerical summaries of the collected data. Students present their survey methodology and summary results to the class. Classmates are encouraged to challenge both the survey methodology and data analysis with a focus on correct statistical vocabulary.

Final project – Students select a hypothesis, design an experiment or survey, plan a sampling procedure, gather data, use descriptive and inferential statistics, interpret their results, and present their results in the form of a written report.