

AP Statistics Course Description

AP Statistics is a year-long Desert Vista High School class which corresponds to the one semester Rio Salado college math course MAT206, Elements of Statistics.

1st semester - Descriptive Statistics: The first semester focuses on developing a number of mathematical ‘tools’ which allow us to describe a set of data:

Unit 1 (Exploring and understanding data with one variable):

- Chapter 3: Ways to display categorical (qualitative) data.
- Chapter 4: Ways to display numerical (quantitative) data.
- Chapter 5: Calculating statistics for a data set (single numbers which represent the data set, e.g. mean, standard deviation, interquartile range, etc.), and definitions related to the use of tables (marginal distributions, conditional distributions).
- Chapter 6: The Normal distribution (z-scores, use of normalcdf, invNorm calculator functions) and Normal Probability Plots.

Unit 2 (Exploring relationships between two variables):

- Chapter 7,8,9: Correlation and Linear Regression, including: correlation coefficient, scatterplots, fitting an LSRL to data, interpretation of LSRL parameters, residuals, the effects of outliers and the concept of leverage.
- Chapter 10: Re-expressing (straightening) data which is non-linear, patterns in residuals and other ways of comparing models.

Unit 3 (How we collect data):

- Chapter 11: Using simulations to generate data, and understanding the role of randomness.
- Chapter 12: Sample Surveys, sampling methods, sources of bias, types of bias.
- Chapter 13: Experiment Design and Observational Study Design, including the role of randomization, factors and levels, block designs and experimental design diagrams, confounding vs. lurking variables, and the role of placebos and blinding.

Unit 4 (Probability, Random Variables, and Probability Models):

- Chapter 14,15: Probability Foundations, including law of large numbers, Venn/tree diagrams and tables, AND and OR rules, conditional probability, disjoint/mutually-exclusive and independent events, and Bayes' Formula probabilities.
- Chapter 16: Concept of a random variable, expected value, discrete vs. continuous random variables, rules for transforming one distribution or combining multiple distributions.
- Chapter 17: Probability Models, including: Bernoulli trials, Binomial and Geometry models, and using a Normal model to approximate a Binomial distribution.

2nd semester - Inferential Statistics: The second semester focuses on the idea of inferring conclusions about a population by analyzing a representative sample from the population. We are using the tools we learned first semester in order to do statistical analyses and draw valid conclusion about various types of real-world data.

We also spend a significant part of the end of the semester preparing to take the AP exam (even for those not planning to take the exam, this provides a valuable entire course review):

Unit 5 (The concepts of inferential statistics - using Proportions data):

- Chapter 18: Sampling Distribution Models including how standard deviation is affected by sample size for both means and proportions data, and the Central Limit Theorem.
- Chapter 19: Confidence Intervals and Margin of Error (for single proportions data).
- Chapter 20: Hypothesis Testing (for single proportions data) including null and alternative hypotheses, p-value, 1- vs 2-sided hypothesis tests.
- Chapter 21: Type I/II errors, probability of these errors, and understanding the Power of the Test.
- Chapter 22: Confidence Intervals and Hypothesis tests for comparing two proportions datasets to each other.

Unit 6 (Inferential Statistics for Means data):

- Chapter 23: Confidence Intervals and Hypothesis tests for comparing one numerical data set to an expected value.
- Chapter 24: Confidence Intervals and Hypothesis tests for comparing two numerical data sets to each other (independent datasets).
- Chapter 25: Confidence Intervals and Hypothesis tests for comparing two numerical data sets to each other (matched-pair datasets).

Unit 7 (Inferential Statistics for LSRLs and more than 2 Proportions):

- Chapter 27: Confidence Intervals and Hypothesis tests for the LSRLs fit to bi-variate data, including inference on the slope of regression LSRL.
- Chapter 26: Chi-squared analysis comparing counts for more than 2 datasets, including Chi-squared tests for Goodness-of-fit, Homogeneity, and Independence.

AP/Final Exam Review:

- We spend approximately 5 weeks reviewing the entire course to prepare students to take the AP Statistics Exam (this helps all students also prepare to take the course final exam).

Additional material (not part of the course itself):

The following two topics were not included as part of this AP Statistics course, but are sometimes included in introductory statistics courses, so at the end of the year, I provided summary information in the form of lecture notes with examples so students have a reference for these additional topics to use in the future:

- Analysis of Variance (ANOVA): The summary notes describe comparison of means for more than 2 populations, including the F-statistic and F-distributions, examples of ANOVA, residual standard deviation, and Bonferroni multiple comparisons.
- Multiple Regression: The summary notes describe detailed examples using the open-source 'r' statistics program to conduct multiple regression analysis and inference for multiple regression (hypothesis testing and confidence intervals), as well as understanding r-squared vs. adjusted r-squared.