Aim Academy Online

AP Statistics

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- Sampling & Experimentation
- Statistical Inference
- Anticipating Patterns
- Exploring Data

Course Overview

This course is designed to prepare students for the AP Statistics exam. Through technology, investigations, problem solving, and writing, students will develop skills to collect, analyze, and draw conclusions from data. Goals for the course also include developing skills in selecting statistical methods, data analysis, finding probability, using simulation, and statistical argumentation.

Required Materials:

- Graphing Calculator - TI-84
- Scanner or smart phone
- Computer (not tablet) with Web cam, sound card, and microphone

***No text is necessary. All instructional materials will be provided. However, the following text is recommended for an aditional resource: Advanced High School Statistics. 3rd edition. by David Diez, Mine Cetinkaya-Rundel, and Leah Dorazio. OpenIntro, Inc. ISBN13: 978-1943450152**

Evaluation & Grading

Homework 15%	Quizzes 15%	Tests 30%
Projects 30%	Participation 10%	

Please note that assignments will be reduced by 15% upon being late 7 days past the due date.

Assignments & Participation

Homework: The course includes many homework assignments that provide practice in multiple choice and free response questions.

Quizzes: Each module will include one quiz. Although there is only one attempt allowed for quizzes, they are open-note assignments.

Tests: All are closed book and closed notes. These are taken through Canvas, however, handwritten work is still expected. At the end of each exam, there is a place to upload that work.

Projects: There will be numerous project assignments throughout the course. Special care should be taken to follow instructions for these assignments. Rubrics will be given so that expectations for the projects are clear.

Be prepared: Come to class ready to discuss the topics of the day, to ask questions about problems you do not understand, and to help others if they need it.

Be respectful: Have your webcam turned on and noise in the background turned off. Pay close attention to those speaking in class, including fellow students.

Be responsible: Your participation grade will reflect your contribution to answering questions, asking questions, and class tone.

AP Exam Information

The AP Statistics Exam is a two-part test.

Section 1

- Multiple Choice Questions
- 40 Single Response Questions
- Choices A - E

- Time Allowed: 90 minutes
- 50% of AP Score

Section 2: Part A

- 5 Free Response Questions (Handwritten)
- 37.5% exam weight
- Takes about 65 minutes

Section 2: Part B

- 1 Investigative Task (Handwritten)
- 12.5% exam weight
- Takes about 25 minutes

- Time Allowed: 90 minutes
- 50% of AP Score

- All students are expected and strongly encouraged to take the AP exam. Students scoring 3 or higher on the AP exam may qualify for a college course exception, dependent upon the college or university. Even if you do not score "well" on the exam, research shows that those students who take an AP exam, in addition to the course, are more likely to remain in college.

Course Sequencing

We will be utilizing the AP Statistics CED.

Unit 1: Exploring One Variable Data: VAR, UNC

Material Covered	*CED Topics*	*CED Skills*
Notes 1 – Representing Categorical Variables with Graphs ○ Vocab: Individuals, variables, categorical, quantitative, discrete, continuous ○ Creating one-way and two-way tables ○ Bar graphs	1.1, 1.2, 1.3, 1.4	1.A, 2.A, 2.B, 2.D
Notes 2 – Representing Quantitative Variables with Graphs ○ Histograms ○ Stem and Leaf (regular, back-to-back, and split stem) ○ Dotplots ○ Cumulative Relative Frequency Graphs (ogives)	1.5, 1.6	2.A, 2.B
Notes 3 – Describing and Summarizing Quantitative Variables ○ SOCS: Shape, outliers, center, spread ○ Mean, Median, Mode ○ Range, IQR, Standard Deviation ○ Percentiles and 5 number summary ○ Boxplots and modified boxplots	1.7, 1.8	2.A, 2.B, 2.C, 4.B
Notes 4 – Comparing Distributions ○ SOCS ○ AP Free Response Problem Practice	1.9	2.D
Notes 5 – The Normal Distribution ○ Z-Scores ○ Density Curves ○ Standard Normal Distribution	1.10	2.D, 3.A

Unit Assessments:

- Unit 1 Quiz: 10 multiple choice questions and 1 free response question
- Unit 1 Test: 20 multiple choice questions and 1 free response question

Unit Project: Misleading Graphs Activity

- Students find data to represent visually, both correctly and incorrectly.
- CED Skills: 2.A, 2.B, 2.D

Unit 2: Exploring Two Variable Data: VAR, UNC, DAT

Material Covered	*CED Topics*	*CED Skills*
Notes 1 – Two Categorical Variables ○ Compare numerical and graphical representations for two categorical variables. ○ Calculate and compare statistics for two categorical variables.	2.1, 2.2, 2.3	1.A, 2.C, 2.D
Notes 2 – Scatterplots and Correlation ○ Represent bivariate quantitative data using scatterplots ○ Describe the characteristics of a scatterplot. ○ Determine the correlation for a linear relationship. ○ Interpret the correlation for a linear relationship.	2.4, 2.5	2.A, 2.B, 2.C, 4.B
Notes 3 – Linear Regression ○ Calculate a predicted response value using a linear regression model. ○ Estimate parameters for the least-squares regression line model. ○ Interpret coefficients for the least-squares regression line model. ○ Represent differences between measured and predicted responses using residuals plots. ○ Describe the form of association of bivariate data using residual plots.	2.6, 2.7, 2.8	2.A, 2.B, 2.C, 4.B
Notes 4 – Influential Points and Departure from Linearity ○ Identify influential points in regression. ○ Calculate a predicted response using a least-squares regression line for a transformed data set.	2.9	2.A, 2.C

Unit Assessments:

- Unit 2 Quiz: 10 multiple choice questions and 1 free response question
- Unit 2 Test: 20 multiple choice questions and 1 free response question

Unit Project: COVID Vaccination Project

- Students explore two claims made about COVID vaccination data and use a linear regression analysis to analyze these claims.
- CED Skills: 2.A, 2.B, 2.C, 4.B

Unit 3: Collecting Data: VAR, UNC

Material Covered	*CED Topics*	*CED Skills*
Notes 1 – Planning a Study o Observational Study Vocab o Sampling Methods	3.1, 3.2, 3.3	1.A, 1.C, 4.A
Notes 2 – Potential Problems with Sampling o Sources of Bias o Sampling vs Non-sampling Error	3.4	1.C
Notes 3 – Selecting Random Samples and Introduction to Experiments o Table of Random Digits o Observational study vs Experiment	3.3, 3.5	1.B, 1.C
Notes 4 – Experimental Design o Principles of Experimental Design o Experimental Terms o Lurking vs Confounding o Experimental Design o Scope of Inference	3.6, 3.7	1.C, 4.B

Unit Assessments:

- Unit 3 Quiz: 10 multiple choice questions and 1 free response question
- Unit 3 Test: 20 multiple choice questions and 1 free response question

Unit Project: Sample Survey Project

- Students will design a survey to test a bias of their choosing. They will describe how they randomly select people to complete their survey and will then report their results in a visual aid.
- CED Skills: 4.A, 4.B, 1.B, 1.C

Unit 4: Probability, Random Variables, and Probability Distributions: VAR, UNC

Material Covered	*CED Topics*	*CED Skills*
Notes 1 – Simulations and Basic Probability Rules ○ Randomness Vocab ○ Simple Probability Formula ○ Probability Definition and Basic Probability Rules ○ Myth of "Law of Averages" ○ Simulations ○ Mutually Exclusive ○ General Addition Rule	4.1, 4.2, 4.3, 4.4	1.A, 3.A, 4.B
Notes 2 – Conditional Probability and Independence ○ Venn Diagrams ○ Union and Intersection Notation ○ Multiplication Rule ○ Conditional Probability for Independent and Dependent Events ○ Proving Independence	4.5, 4.6	3.A
Notes 3 – Discrete and Continuous Random Variables ○ Random Variables and Probability Distributions ○ Discrete Random Variables ○ Continuous Random Variables ○ Mean (Expected Value) and Standard Deviation of a Discrete Random Variable	4.7, 4.8	2.B, 3.B, 4.B
Notes 4 – Combining Random Variables ○ Combining Two Random Variables ○ Linear Transformation of a Random Variable	4.9	3.B, 3.C
Notes 5 – Binomial and Geometric Probability Distributions ○ The Binomial Setting ○ Calculating Binomial Probabilities ○ Mean and Standard Deviation of Binomial Distributions ○ The Geometric Setting ○ Calculating Geometric Probabilities ○ Mean and Standard Deviation of Geometric Distribution	4.10, 4.11, 4.12	3.A, 3.B, 4.B

Unit Assessments:

- Unit 4 Quiz: 10 multiple choice questions and 1 free response question
- Unit 4 Test: 20 multiple choice questions and 1 free response question

Unit Project: Simulations Project

- Students complete three simulations, each using a different random tool: coins, a random number generator, and the table of random digits. They will assess a claim and perform a simulation to see if the claim is likely or unlikely.
- CED Skills: 3.A, 4.B

Unit 5: Sampling Distributions: VAR, UNC

Material Covered	*CED Topics*	*CED Skills*
Notes 1 – The Normal Distribution and Combining Normal Random Variables ○ Revisiting the Normal Distribution ○ Combining Normal Random Variables	5.2	3.A, 3.C
Notes 2 – Sampling Distribution of a Sample Proportion ○ Opening Activity ○ Sampling Distributions and Sampling Variability ○ Characteristics of a Sampling Distribution ○ Practice Problems	5.1, 5.4, 5.5	1.A, 3.B, 3.C, 4.B
Notes 3 – Sampling Distribution of a Difference in Sample Proportions ○ Comparing Two Proportions ○ Sampling Distribution of $\hat{p}_1 - \hat{p}_2$	5.6	3.B, 3.C, 4.B
Notes 4 – Sampling Distribution of a Sample Mean ○ Means vs Proportions ○ Sampling Distribution Conditions for Sample Means ○ Central Limit Theorem ○ Practice Problems	5.3, 5.7	3.B, 3.C, 4.B
Notes 5 – Sampling Distribution of a Difference in Sample Means ○ Comparing Two Means ○ Sampling Distribution of $\bar{x}_1 - \bar{x}_2$	5.8	3.B, 3.C, 4.B

Unit Assessments:

- Unit 5 Quiz: 10 multiple choice questions and 1 free response question
- Unit 5 Test: 20 multiple choice questions and 1 free response question

Unit Project: Normal Approximation for the Binomial

- Students explore how we can use the normal distribution as an approximation for the binomial when certain conditions are satisfied.
- CED Skills: 3.A, 3.B, 3.C, 4.B

Unit 6: Inference for Categorical Data: Proportions: VAR, UNC, DAT

Material Covered	*CED Topics*	*CED Skills*
Notes 1 – Confidence Intervals for Population Proportions ○ Opening Activity ○ Confidence Intervals: The Basics ○ Interpreting Confidence Intervals and Levels ○ Confidence Interval for Proportions ○ Sample Size and Margin of Error	6.1, 6.2, 6.3	1.A, 1.D, 3.D, 4.A, 4.B, 4.C, 4.D
Notes 2 – Significance Test for Proportions ○ Significance Tests: The Basics ○ One-Sided vs Two-Sided Test ○ P-Value ○ Significance Level ○ Hypothesis Test for a Population Proportion	6.4, 6.5, 6.6	1.E, 1.F, 3.E, 4.B, 4.C, 4.E
Notes 3 – Errors and Power ○ Type I and Type II Error ○ Factors Affecting Errors and Power	6.7	1.B, 3.A, 4.A, 4.B
Notes 4 – Relationship between Confidence Intervals and Significance Tests ○ Calculator Commands ○ Comparing CI with HT	6.3, 6.6	4.A, 4.B, 4.D, 4.E
Notes 5 – Comparing Population Proportions ○ Difference in Proportions ○ Confidence Interval for a Difference in Proportions ○ Significance Test for a Difference in Proportions ○ Calculator Commands	6.8, 6.9, 6.10, 6.11	1.E, 1.F, 3.D, 3.E, 4.B, 4.C, 4.D, 4.E

Unit Assessments:

- Unit 6 Quiz: 10 multiple choice questions and 1 free response question
- Unit 6 Test: 20 multiple choice questions and 1 free response question

Unit Project: Water vs Land: Understanding Confidence Levels

- Students use an online tool to explore the meaning of confidence levels and how they relate to confidence intervals.
- CED Skills: 1.D, 3.D, 4.A, 4.B, 4.C, 4.D

Unit 7: Inference for Quantitative Data: Means: VAR, UNC, DAT

Material Covered	*CED Topics*	*CED Skills*
Notes 1 – Confidence Intervals for Means ○ Intro Activity: Pulses ○ One Sample Z-Interval ○ t Distributions ○ One Sample T-Interval	7.1, 7.2, 7.3	1.A, 1.D, 3.C, 3.D, 4.A, 4.B, 4.C, 4.D
Notes 2 – Significance Tests for Means ○ One Sample Z-Test ○ One Sample T-Test ○ Interpreting Errors	7.4, 7.5	1.E, 1.F, 3.E, 4.B, 4.C, 4.E
Notes 3 – Margin of Error and Matched Pairs ○ Margin of Error for Means ○ Matched Pairs Data	7.3, 7.4, 7.5	1.E, 1.F, 3.E, 4.A, 4.B, 4.C, 4.D, 4.E
Notes 4 – Difference Between Two Means ○ Sampling Distribution of a Difference in Means ○ Two-Sample Z Statistic ○ Two-Sample T Statistic ○ Two-Sample T Interval for Means ○ Two-Sample T Test for Means	7.6, 7.7, 7.8, 7.9	1.E, 1.F, 3.D, 3.E, 4.B, 4.C, 4.E
Notes 5 – Choosing Your Inference Method ○ Comparing Inference Methods ○ Summarizing CI and HT for Means ○ Recapping CI and HT for Proportions	7.10	N/A

Unit Assessments:

- Unit 7 Quiz: 10 multiple choice questions and 1 free response question
- Unit 7 Test: 20 multiple choice questions and 1 free response question

Unit Project: Hypothesis Testing Project

- Students choose a claim to investigate. They gather data and perform a one sample or two sample t test, then conclude with their findings in a lab report.
- CED Skills: 1.E, 1.F, 3.E, 4.B, 4.C, 4.E

Unit 8: Inference for Categorical Data: Chi-Square: VAR, UNC, DAT

Material Covered	*CED Topics*	*CED Skills*
Notes 1 – Chi-Square Goodness of Fit Test ○ What is Chi-Square ○ Chi-Square Distribution ○ Chi-Square GOF Test	8.1, 8.2, 8.3	1.A, 1.E, 1.F, 3.A, 3.C, 4.B, 4.C, 4.E
Notes 2 – Chi-Square Test for Homogeneity ○ Chi-Square Test for Homogeneity ○ Follow Up Analysis	8.4, 8.5, 8.6	1.E, 1.F, 3.A, 4.B, 4.C, 4.E
Notes 3 – Chi-Square Test for Association/Independence ○ Chi-Square Test for Association/Independence	8.4, 8.5, 8.6	1.E, 1.F, 3.A, 4.B, 4.C, 4.E
Notes 4 – Comparing Three Chi-Square Tests ○ 2 Examples ○ Recap	8.7	N/A

Unit Assessments:

- Unit 8 Quiz: 10 multiple choice questions and 1 free response question
- Unit 8 Test: 20 multiple choice questions and 1 free response question

Unit Project: Distribution of Colors

- Students explore the formula for the Chi-Square statistics using a goodness of fit test from a bag of M&Ms.
- CED Skills: 1.E, 1.F, 3.A, 3.C, 4.B, 4.C, 4.E

Unit 9: Inference for Quantitative Data: Slopes: VAR, UNC, DAT

Material Covered	*CED Topics*	*CED Skills*
Notes 1 – Sampling Distributions and Confidence Intervals for Slopes ○ Sampling Distribution of b ○ Conditions for Regression Inference ○ Confidence Interval for b ○ Computer Output	9.1, 9.2, 9.3	1.A, 1.D, 3.D, 4.A, 4.B, 4.C, 4.D
Notes 2 – Hypothesis Testing for Slope ○ Significance Test for b ○ Regression Analysis	9.4, 9.5, 9.6	1.E, 1.F, 3.E, 4.B, 4.C, 4.E

Unit Assessments:

- Unit 9 Test: 10 multiple choice questions and 1 free response question

Unit Project: Height vs Chocolate Grab Inference

- Students perform linear regression inference to determine if your height determines how much candy you can grab from a bowl.
- CED Skills: 1.E, 1.F, 3.E, 4.B, 4.C, 4.E