**AP Statistics Syllabus**

**COURSE DESCRIPTION:**

AP Statistics is the high school equivalent of a one semester, introductory college statistics course. In this course, students develop strategies for collecting, organizing, analyzing, and drawing conclusions from data. Students design, administer, and tabulate results from surveys and experiments. Probability and simulations aid students in constructing models for chance behavior. Sampling distributions provide the logical structure for confidence intervals and hypothesis tests. Students use a TI-83/84 graphing calculator, excel spreadsheet software, and Web-based java applets to investigate statistical concepts. To develop effective statistical communication skills, students are required to prepare frequent written and oral analyses of real data.

**COURSE GOALS:**

In AP Statistics, students are expected to learn

*Skills*

* To produce convincing oral and written statistical arguments, using appropriate terminology, in a variety of applied settings.
* When and how to use technology to aid them in solving statistical problems

*Knowledge*

* Essential techniques for producing data (surveys, experiments, observational studies), analyzing data (graphical & numerical summaries), modeling data (probability, random variables, sampling distributions), and drawing conclusions from data (inference procedures – confidence intervals and significance tests)

*Habits of mind*

* To become critical consumers of published statistical results by heightening their awareness of ways in which statistics can be improperly used to mislead, confuse, or distort the truth.

## Primary Text:

*The Practice of Statistics (for AP\*)*, Fifth Edition; Daniel S. Yates, David S. Moore, Daren S. Starnes, Josh Tabor; W. H. Freeman and Company New York, 2015

## Grading:

|  |  |
| --- | --- |
| A: 90-100  B: 80-89  C: 70-79  D: 60-69 | Homework: 10%  Classwork: 20%  Quiz: 20%  Test/Project: 50% |

## Technology:

Students have access to the TI­83 Plus or TI-84 to use in class, at home, and on the AP Exam. Students will use their graphing calculator extensively throughout the course. Each unit that is covered includes instruction on calculator and computer technology use to give the students instruction and practice with the statistical capabilities of the calculator. For example, in the data exploration chapters, students are taught to calculate the relevant statistics and use the List features of their calculators. This school is a one-to-one technology school. Students will have access to laptops and can take them home for their academic endeavors. Students are shown and able to use Excel spreadsheet software so they can correctly know how to use statistical software.

**Course Outline:**

Each chapter is opened with an introductory activity from the text meant to peak interest and aid in understanding in a hands-on atmosphere. Pertaining to topics such as methodology and inferences, discussion is supported by students often working together in small groups.

Both graphing calculators and computer software are used regularly to expand the students’ ability to perform statistical operations.

Our classes are run on a yearlong schedule. The pacing guide is given below.

**Projects**:

Projects are a significant part of the course. Students must complete two projects throughout the year. Both projects will require formal, written reports, and oral presentations. The goal is allow students to actually practice, demonstrate, and communicate the statistical knowledge (such as design, collecting data, analysis, statistical inference, and conclusions) that they are learning. These projects require work both in and outside of the classroom.

The students are required to use computer software and/or graphing calculators to complete these projects, and access to that program and graphing calculators is available. These projects require students to design surveys and experiments, gather data, analyze the data numerically and graphically, and apply inferential statistics to draw conclusions for a population. For the formal, written reports on their projects, students must use statistical language and vocabulary describing methods, results, and interpretations.

As a culminating project, students will design an experiment or survey, plan a sampling procedure, gather data, use descriptive and inferential statistics, interpret their results in context, and present their results. The project is to be written in a formal style. It includes: good sampling techniques and data collection; appropriate statistical analyses; and includes suggestions for further research. Students present their projects to the class as part of the project grade. This project requires that students engage in all stages of the research process.

***Chapter 4 Project****:* Students work in teams of 2 to design and carry out an experiment to investigate response bias, write a summary report, and give a 10 minute oral synopsis to their classmates.

**TPS 5e Pacing Guide (Block Schedule: 68 days)**

| **Class Number** | **DATE** | **Section in TPS 5e** | **Topics/Activities** |
| --- | --- | --- | --- |
|  |  | **Chapter 1** | **Exploring Data** |
| **1** | 8/29 | 1.0 Introduction  1.1 Analyzing Categorical Data | Individuals, Variables, Bar Graphs, Proportions  1.0 Data Collection Sheet  1.1 Analyzing Categorical Data |
| **2** | 8/31 | 1.1 Analyzing Categorical Data | Two-way tables  1.1 Analyzing Categorical Data |
| **3** | 9/2 | 1.2 Displaying Quantitative Data with Graphs | Dotplots, Stemplots, Histograms  1.2 Displaying Quantitative Data with Graphs |
| **4** | 9/7 | 1.3 Describing Quantitative Data with Numbers | Mean/Median, 5# Summary, IQR, SD, Outliers, Boxplots 1.3 Describing Quantitative Data with Numbers |
| **5** | 9/9 | Ch.1 Review | FRAPPY! |
| **6** | 9/13 | Ch.1 Test | Ch.1 Test |
|  |  | **Chapter 2** | **Modeling Distributions of Data** |
| **7** | 9/15 | 2.1 Describing Location in a Distribution | Percentiles, Standardized Scores, Transformations |
| **8** | 9/19 | 2.2 Density Curves | Density Curves, 68–95–99.7 Rule, Standard Normal Dist., Normal Distribution Calculations |
| **9** | 9/21 | 2.2 The Normal Distributions | Normal Distribution Calculations, Assessing Normality |
| **10** | 9/23 | Ch.2 Review | FRAPPY! |
| **11** | 9/27 | Ch.2 Test | Ch.2 Test |
|  |  | **Chapter 3** | **Describing Relationships** |
| **12** | 9/29 | 3.1 Scatterplots and Correlation | Scatterplots and Correlation |
| **13** | 10/3 | 3.2 Least-Squares Regression | Least-Squares Regression Model, Interpreting Coefficients, Predictions, Residuals |
| **14** | 10/5 | 3.2 Least-Squares Regression | Calculating the Regression Equation, Assessing Fit (Residual Plots, *s*, *r*2) |
| **15** | 10/7 | 3.2 Least-Squares Regression | Computer Output, Regression Wisdom, Outliers |
| **16** | 10/11 | Ch.3 Review | FRAPPY! |
| **17** | 10/13 | Ch.3 Test | Ch.3 Test |
|  |  | **Chapter 4** | **Designing Studies** |
| **18** | 10/17 | 4.1 Sampling and Surveys | Simple Random Sampling, Stratified Random Sampling, Cluster Sampling |
| **19** | 10/19 | 4.1 Sampling and Surveys | AP® Free Response Questions |
| **20** | 10/21 | 4.2 Experiments | Activity: Get your heart beating |
| **21** | 10/25 | 4.3 Using Studies Wisely | Response Bias Project Proposal |
| **22** | 10/27 | Ch.4 Review | FRAPPY! |
| **23** | 11/1 | Ch.4 Test | Ch.4 Test |
|  |  | **Chapter 5** | **Probability: What are the Chances?** |
| **24** | 11/3 | 5.1 Randomness, Probability, and Simulation | Probability, Simulation  Activity: 1-in-6 Wins (and Fathom) |
| **25** | 11/7 | 5.2 Probability Rules | Probability Models, Basic Rules, Two-Way Tables & Venn Diagrams |
| **26** | 11/9 | 5.3 Conditional Probability and Independence | Conditional Probability, Tree Diagrams, Independence |
| **27** | 11/14 | Ch.5 Review | FRAPPY! |
| **28** | 11/16 | Ch.5 Test | Ch.5 Test |
|  |  | **Chapter 6** | **Random Variables** |
| **29** | 11/18 | 6.1 Discrete and Continuous Random Variables | Discrete RVs, Means/Variances of Discrete RVs, Continuous RVs |
| **30** | 11/22 | 6.2 Transforming Random Variables | Linear Transformations, Sums and Differences of RVs |
|  | Thanks  Break | 6.2 Combining Random Variables | Sums and Differences of RVs, Combining Normal RVs |
|  | Thanks  Break | 6.3 Binomial Random Variables | Binomial RVs |
| **31** | 11/29 | 6.3 Binomial & Geometric Random Variables | Normal Approximation to Binomial, Geometric RVs |
| **32** | 12/1 | Ch.6 Review | FRAPPY! |
| **33** | 12/5 | Ch.6 Test | Ch.6 Test |
|  |  | **Chapter 7** | **Sampling Distributions** |
| **34** | 12/7 | 7.1 What is a Sampling Distribution? | Activity: German Tanks |
| **35** | 12/9 | 7.1 What is a Sampling Distribution? | Bias, Variability, Shape |
| **36** | 12/13 | 7.2 Sample Proportions | Activity: Sampling Reese’s Pieces |
| **37** | 12/15 | 7.3 Sample Means | Activity: Sampling Pennies |
| **38** | 12/19 | Ch. 7 Review | FRAPPY! |
| **39** | 12/21 | Ch.7 Test | Ch.7 Test |
|  |  | **Chapter 8** | **Estimating with Confidence** |
| **40** | 1/4 | 8.1/8.2 Estimating a Population Proportion | Activity: Flipping Hershey Kisses  C.I. for p, Margin of Error |
| **41** | 1/6 | 8.1/8.2 Estimating a Population Proportion | Conditions, Determining Sample Size, Interpreting the Confidence Level |
| **42** | 1/10 | 8.3 Estimating a Population Mean | Activity: Estimating the Mean Mass of a Fun Size Snickers Bar |
| **43** | 1/12 | 8.3 Estimating a Population Mean | Limit of t is z, robustness of t procedures, Paired Data |
| **44** | 1/19 | Ch. 8 Review | FRAPPY |
| **45** | 1/24 | Ch.8 Test | Ch.8 Test |
|  |  | **Chapter 9** | **Testing a Claim** |
| **46** | 1/26 | 9.1/9.2 Tests about a Population Proportion | Activity: Testing a Reese’s Pieces claim |
| **47** | 1/30 | 9.2 Tests about a Population Proportion |  |
| **48** | 2/1 | 9.1/9.2 Tests about a Population Proportion | Types of Errors & Power |
| **49** | 2/3 | 9.3 Tests about a Population Mean | Activity: Testing a Snicker’s claim |
| **50** | 2/7 | Ch. 9 Review | FRAPPY |
| **51** | 2/9 | Ch.9 Test | Ch.9 Test |
|  |  | **Chapter 10** | **Comparing Two Populations or Groups** |
| **52** | 2/13 | 10.1 Comparing Two Proportions | Activity: M&Ms plain vs. peanut |
| **53** | 2/15 | 10.1 Comparing Two Proportions | Inference for Experiments |
| **54** | 2/17 | 10.2 Comparing Two Means |  |
| **55** | 2/22 | 10.2 Comparing Two Means |  |
| **56** | 2/24 | Ch.10 Review | FRAPPY! |
| **57** | 2/28 | Ch.10 Test | Ch.10 Test |
|  |  | **Chapter 11** | **Inference for Distributions of Categorical Data** |
| **58** | 3/2 | 11.1 Chi-Square Goodness-of-Fit Tests | Chi-Square GOF Test |
| **59** | 3/6 | 11.2 Inference for Two-Way Tables | Test of Homogeneity |
| **60** | 3/8 | 11.2 Inference for Two-Way Tables | Test of Independence |
| **61** | 3/10 | Ch.11 Review | FRAPPY! |
| **62** | 3/14 | Ch.11 Test | Ch.11 Test |
|  |  | **Chapter 12** | **More about Regression** |
| **63** | 3/16 | 12.1 Inference for Linear Regression | Inference for Linear Regression |
| **64** | 3/20 | 12.1 Inference for Linear Regression |  |
| **65** | 3/22 | 12.2 Transforming to Achieve Linearity | Known Models – Powers/roots |
| **66** | 3/24 | 12.2 Transforming to Achieve Linearity | Unknown Models – Logarithms |
| **67** | 3/28 | Ch.12 Review | FRAPPY! |
| **68** | 3/30 | Ch.12 Test | Ch.12 Test |

AP EXAM REVIEW (10 days)

* Practice AP Free Response Questions
* Choosing the Correct Inference Procedure
* Flash cards
* Mock Grading Sessions
* Rubric development by student teams
* Practice Multiple Choice Questions

**Rubric for Chapter 4 Project**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Response Bias Project** | **4 = Complete** | **3 = Substantial** | **2 = Developing** | **1 = Minimal** |
| **Introduction** | * Describes the context of the research * Has a clearly stated question of interest * Provides a hypothesis about the question of interest * Question of interest is of appropriate difficulty | * Introduces the context of the research and has a specific question of interest * Suggests hypothesis OR has appropriate difficulty | * Introduces the context of the research and question of interest OR has question of interest and a hypothesis | * Briefly describes the context of the research |
| **Data Collection** | * Method of data collection is clearly described * Includes appropriate randomization * Describes efforts to reduce bias, variability, confounding * Quantity of data collected is appropriate | * Method of data collection is clearly described * Some effort is made to incorporate principles of good data collection * Quantity of data collected is appropriate | * Method of data collection is described * Some effort is made to incorporate principles of good data collection | * Some evidence of data collection |
| **Graphs and Summary Statistics** | * Raw data is included in a two-way table (categorical) or in lists (quantitative) * Appropriate graphs are included * Graphs are neat, easy to compare, and clearly labeled, including clear identification of treatments * Appropriate summary statistics are included in discussion (e.g., percentages for categorical data, means for quantitative data) | * Appropriate graphs are included * Graphs are neat, clearly labeled, and easy to compare * Appropriate summary statistics or raw data are included | * Graphs and summary statistics are included | * Graphs or summary statistics are included |
| **Conclusions** | * Uses the results of the study to correctly answer question of interest * Discusses what inferences are appropriate based on study design * Shows good evidence of critical reflection (discusses possible errors, limitations.) | * Makes a correct conclusion * Discusses what inferences are appropriate or shows good evidence of critical reflection | * Makes a partially correct conclusion * Shows some evidence of critical reflection | * Makes a conclusion |
| **Poster, Presentation, & Communication** | * Has a clear, holistic understanding of the project * Poster is well organized, neat, and easy to read * Poster included pictures of data collection in progress and is visually appealing * Oral is well organized | * Has a clear, holistic understanding of the project, but poster is unorganized, lacks visual appeal, or oral presentation is not organized | * The poster and oral presentation have several problems | * Commun-ication and organization are poor |

**After the AP® Exam: Final Project** *(See rubric on page 16)*

**Purpose:** The purpose of this project is for you to actually do statistics. You are to formulate a statistical question, design a study to answer the question, conduct the study, collect the data, analyze the data, and use statistical inference to answer the question. You are going to do it all!!

**Topics:** You may do your study on any topic, but you must be able to include all 6 steps listed above. Make it interesting and note that degree of difficulty is part of the grade.

**Group Size:** You may work alone or with a partner for this project.

**Proposal (25 points):** To get your project approved, you must be able to demonstrate how your study will meet the requirements of the project. In other words, you need to clearly and completely communicate your statistical question, your explanatory and response variables, the test/interval you will use to analyze the results, and how you will collect the data so the conditions for inference will be satisfied. You must also make sure that your study will be safe and ethical if you are using human subjects. The proposal should be typed. If your proposal isn’t approved, you must resubmit the proposal for partial credit until it is approved.

**Digital Presentation (75 points):**

The key to a good statistical presentation is communication and organization. Make sure all components of the presentation are focused on answering the question of interest and that statistical vocabulary is used correctly. The presentation should include:

* Title (in the form of a question).
* Introduction. In the introduction you should discuss what question you are trying to answer, why you chose this topic, what your hypotheses are, and how you will analyze your data.
* Data Collection. In this section you will describe how you obtained your data. Be specific.
* Graphs, Summary Statistics and the Raw Data (if numerical). Make sure the graphs are well labeled, easy to compare, and *help answer the question of interest.* You should include a brief discussion of the graphs and interpretations of the summary statistics.
* Analysis. In this section, identify the inference procedure you used along with the test statistic and *P-*value and/or confidence interval. Also, discuss how you know that your inference procedure is valid.
* Conclusion. In this section, you will state your conclusion. You should also discuss any possible errors or limitations to your conclusion, what you could do to improve the study next time, and any other critical reflections.
* Live action pictures of your data collection in progress.

**Presentation:** You will be required to give a 5 minute oral presentation to the class.

**Rubric for Final Project**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Final Project** | **4 = Complete** | **3 = Substantial** | **2 = Developing** | **1 = Minimal** |
| **Introduction** | * Describes the context of the research * Has a clearly stated question of interest * Clearly defines the parameter of interest and states correct hypotheses (for tests) * Question of interest is of appropriate difficulty | * Introduces the context of the research and has a specific question of interest * Has correct parameter/ hypotheses OR has appropriate difficulty | * Introduces the context of the research and has a specific question of interest OR has question of interest and parameter/ hypotheses | * Briefly describes the context of the research |
| **Data Collection** | * Method of data collection is clearly described * Includes appropriate randomization * Describes efforts to reduce bias, variability, confounding * Quantity of data collected is appropriate | * Method of data collection is clearly described * Some effort is made to incorporate principles of good data collection * Quantity of data is appropriate | * Method of data collection is described * Some effort is made to incorporate principles of good data collection | * Some evidence of data collection |
| **Graphs and Summary Statistics** | * Appropriate graphs are included * Graphs are neat, clearly labeled, and easy to compare * Appropriate summary statistics are included * Summary statistics are discussed and correctly interpreted | * Appropriate graphs are included * Graphs are neat, clearly labeled, and easy to compare * Appropriate summary statistics are included | * Graphs and summary statistics are included | * Graphs or summary statistics are included |
| **Analysis** | * Correct inference procedure is chosen * Use of inference procedure is justified * Test statistic/*P-*value or confidence interval is calculated correctly * *P-*value or confidence interval is interpreted correctly | * Correct inference procedure is chosen * Lacks justification, lacks interpretation, or makes a calculation error | * Correct inference procedure is chosen * Test statistic/*P-*value or confidence interval is calculated correctly | * Inference procedure is attempted |
| **Conclusions** | * Uses *P-*value/confidence interval to correctly answer question of interest * Discusses what inferences are appropriate based on study design * Shows good evidence of critical reflection (discusses possible errors, limitations, alternate explanations, etc.) | * Makes a correct conclusion * Discusses what inferences are appropriate * Shows some evidence of critical reflection | * Makes a partially correct conclusion (such as accepting null). * Shows some evidence of critical reflection | * Makes a conclusion |
| **Overall Presentation/ Communication** | * Clear, holistic understanding of the project * Poster is well organized, neat and easy to read * Statistical vocabulary is used correctly * Poster is visually appealing | * Clear, holistic understanding of the project * Statistical vocabulary is used correctly * Poster is unorganized or isn’t visually appealing, | * Poster is not well done or communication is poor | * Communication and organization are very poor |