

# AP Statistics Syllabus

## COURSE DESCRIPTION

Statistics is the study of how best to collect, analyze, and draw conclusions from data. In this course, we investigate four broad areas of statistics.

1. *Collecting data and exploring one-variable data:* The statistical process begins with asking a valid statistical question. We then explore ways to collect data and minimize bias so that an appropriate conclusion can be drawn. Once we have a jumble of data, we need to summarize it graphically, numerically, and verbally.
2. *Probability, random variables, and probability:* Probability is the mathematical foundation for statistical inference. We will study basic probability as well as probability distributions and simulations.
3. *Inference for categorical and numerical data:* The heart of statistics. We will study confidence intervals and hypothesis tests, both of which are the basis of statistical arguments in newspapers and journal articles in a wide variety of disciplines.
4. *Regression Analysis:* We use linear correlation and least squares regression models to see trends and make predictions.

Throughout the course, we will use Desmos to analyze data, investigate probability distributions, and carry out statistical calculations. We will also use online applets and simulations to better understand random behavior and sampling distributions. Reading information from graphs and computer output and effective communication and justification of conclusions will be emphasized throughout the course.

## TEXTBOOK

*Advanced High School Statistics*, 4th<sup>st</sup> Edition, by Leah Dorazio, David Diez, and Mine Cetinkaya-Rundel. OpenIntro, 2026. Download free pdf at <https://openintro.org/go/?id=ahss>.

## TECHNOLOGY

Interpreting standard computer output (such as shown in your textbook, or generated by Desmos, stapplet.com, R, etc.) is an important skill that we will practice in class and you will apply in your homework. For example:

- given computer output of summary statistics for univariate data, you will be asked to describe the distribution including shape, center, spread, and testing for outliers and you will use the summary statistics to make a boxplot of the data and identify quartiles (Unit 1).
- given standard computer output for regression models: you will use this information to identify the equation of the least-squares regression line,  $r$ , and  $r^2$  (Unit 5).

Desmos is a powerful tool that you will get to use on the ap exam. You will use Desmos regularly to describe data, determine probabilities, and perform tests. For example, you will use Desmos to:

- create histograms, dotplots, and boxplots of univariate data and calculate summary statistics (Unit 1).
- calculate binomial probabilities and normal probabilities and boundary values; explore how the binomial and normal distributions are affected by changes in their parameters (Unit 2).
- find and visualize p-values using normal, t, and chi-square distributions; use inference shortcuts to quickly carry out calculations needed for the one and two-sample Z-test/interval for proportions, the one and two-sample t-test/interval for means, and the chi-square tests for two-way tables (Units 3 and 4).
- create scatterplots with bivariate data and find the least-squares regression line, the correlation, and the coefficient of determination (Unit 5).

## COURSE TOPICS

We will follow the structure of the AP CED and our textbook. Classwork will involve a variety of activities and investigations, including some from Skew The Script and StatsMedic. Homework will often involve watching videos and doing practice problems on AP Classroom.

| AHSS 4th ed Chapter & AP Stat Updated CED Unit                  | AHSS 4TH ED TEXTBOOK SECTION                                        | AP STATISTICS UPDATED CED TOPIC                                                                                    |
|-----------------------------------------------------------------|---------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| 1: Exploring One-Variable Data and Collecting Data              | 1.1 Introduction to data                                            | TOPIC 1.1 Introducing Statistics: What Can We Learn from Data?                                                     |
| 1: Exploring One-Variable Data and Collecting Data              | 1.1 Introduction to data                                            | TOPIC 1.2 Variables                                                                                                |
| 1: Exploring One-Variable Data and Collecting Data              | 1.2 Representing categorical data                                   | TOPIC 1.3 Tabular Representation and Summary Statistics for One Categorical Variable                               |
| 1: Exploring One-Variable Data and Collecting Data              | 1.2 Representing categorical data                                   | TOPIC 1.4 Graphical Representations for One Categorical Variable                                                   |
| 1: Exploring One-Variable Data and Collecting Data              | 1.3 Representing numerical data with graphs                         | TOPIC 1.5 Graphical Representations for One Quantitative Variable                                                  |
| 1: Exploring One-Variable Data and Collecting Data              | 1.3 Representing numerical data with graphs                         | TOPIC 1.6 Descriptions for One Quantitative Variable Distributions                                                 |
| 1: Exploring One-Variable Data and Collecting Data              | 1.4 Numerical summaries and boxplots                                | TOPIC 1.7 Summary Statistics for One Quantitative Variable                                                         |
| 1: Exploring One-Variable Data and Collecting Data              | 1.4 Numerical summaries and boxplots                                | TOPIC 1.8 Graphical Representations of Summary Statistics for One Quantitative Variable                            |
| 1: Exploring One-Variable Data and Collecting Data              | 1.4 Numerical summaries and boxplots                                | TOPIC 1.9 Comparisons of the Distributions for One Quantitative Variable                                           |
| 1: Exploring One-Variable Data and Collecting Data              | 1.5 Overview of data collection principles                          | TOPIC 1.10 The Investigative Question Revisited and Data Collection                                                |
| 1: Exploring One-Variable Data and Collecting Data              | 1.6 Sampling methods and sources of bias                            | TOPIC 1.11 Random Sampling                                                                                         |
| 1: Exploring One-Variable Data and Collecting Data              | 1.6 Sampling methods and sources of bias                            | TOPIC 1.12 Potential Problems with Sampling                                                                        |
| 1: Exploring One-Variable Data and Collecting Data              | 1.7 Experimental design                                             | TOPIC 1.13 Experimental Design                                                                                     |
| 2: Probability, Random Variables, and Probability Distributions | 2.1 Relationships between two categorical variables                 | TOPIC 2.1 Tabular and Graphical Representations for the Distributions of Two Categorical Variables                 |
| 2: Probability, Random Variables, and Probability Distributions | 2.1 Relationships between two categorical variables                 | TOPIC 2.2 Summary Statistics for Two Categorical Variables                                                         |
| 2: Probability, Random Variables, and Probability Distributions | 2.2 Probability basics                                              | TOPIC 2.3 Estimating Probabilities Using Simulation                                                                |
| 2: Probability, Random Variables, and Probability Distributions | 2.2 Probability basics                                              | TOPIC 2.4 Introduction to Probability                                                                              |
| 2: Probability, Random Variables, and Probability Distributions | 2.2 Probability basics                                              | TOPIC 2.5 Mutually Exclusive Events                                                                                |
| 2: Probability, Random Variables, and Probability Distributions | 2.3 Conditional probability, intersections, and unions              | TOPIC 2.6 Conditional Probability                                                                                  |
| 2: Probability, Random Variables, and Probability Distributions | 2.3 Conditional probability, intersections, and unions              | TOPIC 2.7 Independent Events and Unions of Events                                                                  |
| 2: Probability, Random Variables, and Probability Distributions | 2.4 Discrete random variables                                       | TOPIC 2.8 Introduction to Random Variables and Probability Distributions                                           |
| 2: Probability, Random Variables, and Probability Distributions | 2.4 Discrete random variables                                       | TOPIC 2.9 Parameters of Random Variables                                                                           |
| 2: Probability, Random Variables, and Probability Distributions | 2.5 Binomial distributions                                          | TOPIC 2.10 The Binomial Distribution                                                                               |
| 2: Probability, Random Variables, and Probability Distributions | 2.6 Normal distributions                                            | TOPIC 2.11 The Normal Distribution                                                                                 |
| 2: Probability, Random Variables, and Probability Distributions | 2.7 Sampling distributions and the Central Limit Theorem            | TOPIC 2.12 Sampling Distributions and the Central Limit Theorem                                                    |
| 3: Inference for Categorical Data: Proportions                  | 3.1 Point estimators                                                | TOPIC 3.1 Estimators                                                                                               |
| 3: Inference for Categorical Data: Proportions                  | 3.2 Sampling distribution of a sample proportion                    | TOPIC 3.2 Sampling Distributions for Sample Proportions                                                            |
| 3: Inference for Categorical Data: Proportions                  | 3.3 Confidence intervals for a population proportion                | TOPIC 3.3 Constructing a Confidence Interval for a Population Proportion                                           |
| 3: Inference for Categorical Data: Proportions                  | 3.3 Confidence intervals for a population proportion                | TOPIC 3.4 Justifying a Claim Based on a Confidence Interval for a Population Proportion                            |
| 3: Inference for Categorical Data: Proportions                  | 3.4 Hypothesis testing for a population proportion                  | TOPIC 3.5 Setting Up a Test for a Population Proportion                                                            |
| 3: Inference for Categorical Data: Proportions                  | 3.4 Hypothesis testing for a population proportion                  | TOPIC 3.6 p-Values                                                                                                 |
| 3: Inference for Categorical Data: Proportions                  | 3.4 Hypothesis testing for a population proportion                  | TOPIC 3.7 Carrying Out a Test for a Population Proportion                                                          |
| 3: Inference for Categorical Data: Proportions                  | 3.4 Hypothesis testing for a population proportion                  | TOPIC 3.8 Potential Errors When Performing Tests                                                                   |
| 3: Inference for Categorical Data: Proportions                  | 3.5 Sampling distribution for a difference of sample proportions    | TOPIC 3.9 Sampling Distributions for the Difference Between Sample Proportions                                     |
| 3: Inference for Categorical Data: Proportions                  | 3.6 Confidence intervals for a difference in population proportions | TOPIC 3.10 Constructing a Confidence Interval for the Difference Between Two Population Proportions                |
| 3: Inference for Categorical Data: Proportions                  | 3.6 Confidence intervals for a difference in population proportions | TOPIC 3.11 Justifying a Claim Based on a Confidence Interval for the Difference Between Two Population Proportions |
| 3: Inference for Categorical Data: Proportions                  | 3.7 Hypothesis testing for a difference in population proportions   | TOPIC 3.12 Setting Up a Test for the Difference Between Two Population Proportions                                 |
| 3: Inference for Categorical Data: Proportions                  | 3.7 Hypothesis testing for a difference in population proportions   | TOPIC 3.13 Carrying Out a Test for the Difference Between Two Population Proportions                               |
| 3: Inference for Categorical Data: Proportions                  | 3.8 Goodness of fit using chi-square (special topic)                |                                                                                                                    |
| 3: Inference for Categorical Data: Proportions                  | 3.9 Chi-square tests for two-way tables                             | TOPIC 3.14 Setting Up a Chi-Square Test for Homogeneity or Independence                                            |
| 3: Inference for Categorical Data: Proportions                  | 3.9 Chi-square tests for two-way tables                             | TOPIC 3.15 Carrying Out a Chi-Square Test for Homogeneity or Independence                                          |
| 4: Inference for Quantitative Data: Means                       | 4.1 Sampling distribution of a sample mean                          | TOPIC 4.1 Sampling Distributions for Sample Means                                                                  |
| 4: Inference for Quantitative Data: Means                       | 4.2 Confidence intervals for a population mean                      | TOPIC 4.2 Constructing a Confidence Interval for a Population Mean or Population Mean Difference                   |
| 4: Inference for Quantitative Data: Means                       | 4.2 Confidence intervals for a population mean                      | TOPIC 4.3 Justifying a Claim Based on a Confidence Interval for a Population Mean or Population Mean Difference    |
| 4: Inference for Quantitative Data: Means                       | 4.3 Hypothesis testing for a population mean                        | TOPIC 4.4 Setting Up a Test for a Population Mean or Population Mean Difference                                    |
| 4: Inference for Quantitative Data: Means                       | 4.3 Hypothesis testing for a population mean                        | TOPIC 4.5 Carrying Out a Test for a Population Mean or Population Mean Difference                                  |
| 4: Inference for Quantitative Data: Means                       | 4.4 Sampling difference for a difference in sample means            | TOPIC 4.6 Sampling Distributions for the Difference Between Two Sample Means                                       |
| 4: Inference for Quantitative Data: Means                       | 4.5 Confidence intervals for a difference in population means       | TOPIC 4.7 Constructing a Confidence Interval for the Difference Between Two Population Means                       |
| 4: Inference for Quantitative Data: Means                       | 4.5 Confidence intervals for a difference in population means       | TOPIC 4.8 Justifying a Claim Based on a Confidence Interval for the Difference Between Two Population Means        |
| 4: Inference for Quantitative Data: Means                       | 4.6 Hypothesis testing for a difference in population means         | TOPIC 4.9 Setting Up a Test for the Difference Between Two Population Means                                        |
| 4: Inference for Quantitative Data: Means                       | 4.6 Hypothesis testing for a difference in population means         | TOPIC 4.10 Carrying Out a Test for the Difference Between Two Population Means                                     |
| 5: Regression Analysis                                          | 5.1 Summarizing bivariate numerical data                            | TOPIC 5.1 Graphical Representations Between Two Quantitative Variables                                             |
| 5: Regression Analysis                                          | 5.1 Summarizing bivariate numerical data                            | TOPIC 5.2 Correlation                                                                                              |
| 5: Regression Analysis                                          | 5.2 Line fitting and residuals                                      | TOPIC 5.3 Linear Regression Models                                                                                 |
| 5: Regression Analysis                                          | 5.2 Line fitting and residuals                                      | TOPIC 5.4 Residuals                                                                                                |
| 5: Regression Analysis                                          | 5.3 Least squares regression                                        | TOPIC 5.5 Least-Squares Regression                                                                                 |

## ACTIVITIES/PROJECTS

In addition to classwork and homework, you will apply the skills of the course and practice your written and verbal communication of statistical concepts through a variety of hands-on projects.

Mini-project 1. Data Comparison Report. You will use real data (e.g., ESPN, EPA, Spotify, American Community Survey) and choose two groups to compare. You will calculate summary statistics, make comparative graphs, and verbally compare and contrast the distributions with respect to center, spread, shape, outliers, and notable features. (*Skills 3.A, 3.B*)

Mini-project 2. You will be assigned a hypothesis test or confidence interval procedure. You will write your own problem that can be answered using your inference procedure, write out the full inference procedure (Identify, Check, Calculate, Conclude), and record a video of *you* verbally *explaining* each step, what it means, and why it is done that way. Each of you will then get to watch a few of your classmates to help review inference procedures before the AP Exam. (*Skills 4.F, 4.G*)

### Final Project. ASA Project Competition.

For your final assessment, will do a project that requires you to Formulate a Question, Collect Data, Analyze Data, and Interpret Results. By applying these four Statistical Practice to a project of your own design, you will gain a better understanding of how these practices connect and can be used to answer questions of interest.

For this project, you take part in and submit to the annual [ASA Statistics Project Competition](#). Winners of the ASA Statistics Project Competition will receive recognition and a cash award.

You will submit a project proposal that asks a valid research question that can be answered by collecting your own data. You will then collect your data and write up a formal report including the following:

**Statistical Question:** Valid statistical question that is clearly stated, focused, and interesting. You should also formulate a null and alternative hypothesis. (*Skills 1.A, 2.E*)

**Data Collection:** Evidence of direct data collection by students. Data were collected in an appropriate manner to answer the statistical question. You should also describe how and why you collected the data in the way that you did. Raw data are included. (*Skills 2A, 2.B*)

**Data Display:** Includes appropriate, well-labeled, accurate displays (graphs and tables) of the data. (*Skills 3A, 3.B*)

**Data Analysis:** Analysis of the data is accurate, thorough, and appropriate. Conditions are checked correctly for any inference procedures. You should set up, check conditions, and do the calculations for an appropriate hypothesis test. (*Skills 3.E, 4.E, 4.F*)

**Conclusion:** Conclusion includes a clear answer to the statistical question that is consistent with the data analysis and method of data collection. You should also discuss any possible errors (Type I or Type II) and the scope of your conclusion. (*Skills 4.G, 2.D*)

**Reflection on Process:** Gives a good overall picture of the project—what went well and what didn't—and includes ideas for further study.

**Overall Presentation:** Attractive, well-organized, well-written project report.