Greenwich Public Schools Curriculum Overview

ADVANCED PLACEMENT STATISTICS

Personalized learning is achieved through standards-based, rigorous and relevant curriculum that is aligned to digital tools and resources.

Note: Teachers retain professional discretion in how the learning is presented based on the needs and interests of their students.

Course Description

AP Statistics
Full Year
029300 6 Blocks 1 Credit
Prerequisite: Algebra 2A or Honors Algebra 2 with a B or better and teacher recommendation.
This full year Advanced Placement Statistics course will offer a more in-depth study of the field of statistics. It will introduce students to the major concepts and tools necessary to collect and analyze data; plan and execute statistical studies, employ probability and use statistical inference to make informed decisions. Students taking this course are expected to take the corresponding national Advanced Placement exam given in May.

Unit Guide

Chapter 1: Exploring Data
Chapter 2: Describing Data
Chapter 3: Regression
Chapter 4: Designing Studies
Chapter 5: Introduction to Probability
Chapter 6: Discrete and Continuous Random Variables
Chapter 7: Sampling Distributions
Midterm Review & Midterm Exam*
Chapter 8: Confidence Intervals
Chapter 9: Tests of Significance
Chapter 10: Two Sample Inference
Chapter 11: Chi-Squared Test
Chapter 12: Inference for Regression
Final Review & Final Exam*

***Note**: Semester exam review packets, answer keys and formula sheets can be found by joining our **Schoology** *Math Department Review Course*, using COURSE access code P9V9X-H6V37.

Common Core Mathematical Practices

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.

- Use appropriate tools strategically.
- Attend to precision.
- Look for and make use of structure.

AP Statistics Course Skills (page 16 of hyperlinked document):

1. *Selecting Statistical Methods:* Select methods for collecting and/or analyzing data for statistical inference.
2. *Data Analysis:* Describe patterns, trends, associations, and relationships in data.
3. *Using Probability and Simulation:* Explore random phenomena.
4. *Statistical Argumentation:* Develop an explanation or justify a conclusion using evidence from data, definitions, or statistical inference.

Enduring Understandings (see AP Statistics Unit Guides, page 34)

AP Unit 1:
- *Chapter 1*:
  - Given that variation may be random or not, conclusions are uncertain.
  - Graphical representations and statistics allow us to identify and represent key features of data.
- *Chapter 2*:
  - Graphical representations and statistics allow us to identify and represent key features of data.
  - The normal distribution can be used to represent some population distributions.

AP Unit 2:
- *Chapter 3*:
  - Given that variation may be random or not, conclusions are uncertain.
  - Graphical representations and statistics allow us to identify and represent key features of data.
  - Regression models may allow us to predict responses to changes in an explanatory variable.

AP Unit 3:
- *Chapter 4*:
  - Given that variation may be random or not, conclusions are uncertain.
  - The way we collect data influences what we can and cannot say about a population.
  - Well-designed experiments can establish evidence of causal relationships.

AP Unit 4:

Chapter 5:
  - Given that variation may be random or not, conclusions are uncertain.
  - Simulation allows us to anticipate patterns in data.
  - The likelihood of a random event can be quantified.
  - Probabilistic reasoning allows us to anticipate patterns in data.
- *Chapter 6*:
  - Probability distributions may be used to model variation in populations.

AP Unit 5:
- *Chapter 7*:
  - Given that variation may be random or not, conclusions are uncertain.
  - The normal distribution may be used to model variation.
  - Probabilistic reasoning allows us to anticipate patterns in data.

AP Units 6-7:

- *Chapter 8*:
    - Given that variation may be random or not, conclusions are uncertain.
    - An interval of values should be used to estimate parameters, in order to account for uncertainty.
    - The normal distribution may be used to model variation.
- *Chapter 9*:
    - A significance test assesses the evidence provided by data against a null hypothesis and in favor of an alternative hypothesis.
    - The normal distribution may be used to model variation.
    - The t-distribution may be used to model variation.
    - Significance testing allows us to make decisions about hypotheses within a particular context.
    - Probabilities of Type I and Type II errors influence inference.
- *Chapter 10*:
    - Given that variation may be random or not, conclusions are uncertain.
    - The t-distribution may be used to model variation.
    - Inference is a tool for validating a claim about a population parameter.
    - Inference is a tool for estimating an unknown population parameter.
    - An interval of values should be used to estimate parameters, in order to account for uncertainty.
    - The normal distribution may be used to model variation.

AP Unit 8:

- *Chapter 11*:
    - Given that variation may be random or not, conclusions are uncertain.
    - The chi-square distribution may be used to model variation.
    - Significance testing allows us to make decisions about hypotheses within a particular context.

AP Unit 9:

- *Chapter 12*:
    - Given that variation may be random or not, conclusions are uncertain.
    - Regression is an instrument used to generalize relationships for bivariate data.
    - Inference is a tool for validating a claim about a population parameter.
    - An interval of values should be used to estimate parameters, in order to account for uncertainty.
    - The t-distribution may be used to model variation.

Essential Questions

AP Unit 1:

- *Chapter 1*:
    - What is data?
    - How do we understand and communicate data?
    - What assumptions can be made from data?
    - How can graphical displays be manipulated to present misleading information?
    - What is the difference between categorical and quantitative variables?
    - How can categorical and quantitative variables be represented graphically?
    - How can data be represented numerically?
    - How certain are we that what seems to be a pattern is not just a coincidence?
- *Chapter 2*:
    - Why is the normal distribution essential to the study of statistics?
    - How does the normal distribution apply to the real world?
    - Is my cat old, compared to other cats?

AP Unit 2:

- *Chapter 3*:
    - What is regression?
    - How well does data fit a regression model?
    - What are the properties of a linear regression model?
    - How can non-linear data be linearized for regression?
    - Does the fact that the number of shark attacks increases with ice cream sales necessarily mean that ice cream sales cause shark attacks?
    - How might you represent incomes of individuals with and without a college degree to help describe similarities and/or differences between the two groups?

AP Unit 3:

- *Chapter 4*:
    - What does our data tell us?
    - How do you design and carry out an experiment to produce valid information?
    - How do you use chance in random sampling and randomized comparative experiments to simulate random behavior?
    - How can technology be applied to carry out simulations?
    - How can technology be used in randomized experiments and surveys?
    - How can you determine the effectiveness of a linear model that uses the number of cricket chirps per minute to predict temperature?
    - Why might the data we collected not be valid for drawing conclusions about an entire population?

AP Unit 4:

- *Chapter 5*:
    - What is probability?
    - What is a probability model?
    - What is a probability distribution?
    - How does one determine probability for a given event?
    - What are the general probability rules?
    - How do you use probability rules to evaluate chance behavior in real world contexts?
    - About how many rolls of a fair six-sided die would we anticipate it taking to get three 1s?
- *Chapter 6*:
    - What is a probability distribution?
    - How can probability be simulated?
    - What is a random variable?
    - What is a probability distribution for a random variable?
    - How does one determine probability for a given event?
    - What is demonstrated by the law of large numbers?
    - What is a binomial distribution?
    - How does one use known means and standard deviations to compute the mean and standard deviation for a combination of variables?
    - How can an event be both random and predictable?

AP Unit 5:

- *Chapter 7*:
    - Why is the normal distribution important to the study of statistics?
    - How does one assess normality?
    - What does the normal distribution imply about the spread of data?
    - What is a sampling distribution?
    - How does one compute the mean and standard deviation for a sample proportion?
    - When does one use a normal approximation to the sampling proportion?
    - How does one compute the mean and standard deviation for a sampling distribution of

means?
    - What is the Central Limit Theorem?
    - How is the Central Limit Theorem applied to sampling distributions?
    - How can we anticipate patterns in the values of a statistic from one sample to another?
    - How likely is it to get a value this large just by chance?

AP Units 6-7:

- *Chapter 8*:
    - What does it mean to make an inference?
    - What is a confidence interval?
    - How does one distinguish among the various confidence intervals?
    - How does one construct a confidence interval?
    - How can we narrow the width of a confidence interval?
    - What is a margin of error?
    - When can we use a normal distribution to perform inference calculations involving population proportions?
- *Chapter 9*:
    - What is a test of significance?
    - How does one determine significance?
    - What are the steps to execute a test of significance for a population mean?
    - If the proportion of subjects who experience serious side effects when taking a new drug is smaller than the proportion of subjects who experience serious side effects when taking a placebo, how can we determine if the difference is statistically significant?
- *Chapter 10*:
    - What is the inference for comparing two populations?
    - How does one compute a confidence interval for two population means?
    - How does one execute a test of significance for two population means?
    - How does one compute a confidence interval for two population proportions?
    - How does one execute a test of significance for two population proportions?
    - How does one distinguish among the various confidence intervals?
    - How do we know whether to use a t-test or a z-test for inference with means?
    - How does one distinguish among the various tests of significance?
    - How can we make sure that samples are independent?
    - Why is it inappropriate to accept a hypothesis as true based on the results of statistical inference testing?

AP Unit 8:

- *Chapter 11*:
    - How is a test of significance done?
    - How does one distinguish among the various tests of significance?
    - What is a chi-square test?
    - How does one conduct a chi-square goodness of fit test?
    - What is a two-way table?
    - What is a chi-square test for homogeneity?
    - What is a chi-square test for association/independence?
    - How does increasing the degrees of freedom influence the shape of the chi-square distribution?
    - Why is it inappropriate to use statistical inference to justify a claim that there is *no association* between variables?

AP Unit 9:

- *Chapter 12*:
    - How well does data fit a regression model?
    - What are the properties of a linear regression model?

- How is a test of significance done?
- What conditions are necessary to do inference for regression?
- What is meant by the standard error about the least-squares line?
- How does one compute a confidence interval for the slope of the least squares line?
- How does one conduct a test of significance for the slope of the least-squares line?
- How can there be variability in slope if the slope statistic is uniquely determined for a line of best fit?
- When is it appropriate to perform inference about the slope of a population regression line based on sample data?
- Why do we not conclude that there is no correlation between two variables based on the results of a statistical inference for slopes?

Resources and Assured Experiences

Textbook Information:
The Practice of Statistics
W. H. Freeman (2015~ 5th Edition)
ISBN 978-1-4641-0873-0

AP Classroom
Khan Academy - https://www.khanacademy.org/math/ap-statistics
YouTube/Text: Skew the Script Channel - https://skewthescript.org/ap-stats-curriculum

Quarterly Grading

Quarter Grades will be determined using the following components:

- Participation (includes Classwork) = 5%
- Preparation (includes Homework) = 5%
- Assessments (both Summative & Formative) = 90%

Connecticut Common Core State Standards

- *Chapter 1*: CCSS.MATH.CONTENT.HSS.ID.A.1, A.2, A.3, A.4, B.5.
- *Chapter 2*: CCSS.MATH.CONTENT.HSS.ID.A.4, B.5.
- *Chapter 3*: CCSS.MATH.CONTENT.HSS.ID.B.6, B.6a, B.6b, B.6c, C.7, C.8, C.9.
- *Chapter 4*: CCSS.MATH.CONTENT.HSS.IC.B.3.
- *Chapter 5*: CCSS.MATH.CONTENT.HSS.CP.A.1, A.2, A.3, A.4, A.5, B.6, B.7, B.8, B.9.
- *Chapter 6*: CCSS.MATH.CONTENT.HSS.MD.A.1, A.2, A.3, A.4, B.5, B.5a, B.5b, B.6, B.7.
- *Chapter 7*: CCSS.MATH.CONTENT.HSS.IC.A.1, B.3; HSS.ID.A.4, B.5.
- *Chapter 8*: CCSS.MATH.CONTENT.HSS.IC.B.4.
- *Chapter 10*: CCSS.MATH.CONTENT.HSS.IC.B.5, B.6.
- *Chapter 11*: CCSS.MATH.CONTENT.HSS.IC.A.1, A.2.
- *Chapter 12*: CCSS.MATH.CONTENT.HSS.IC.A.1

AP Statistics Course Skills (page 16 of hyperlinked document):

- *Chapter 1*: 1.A, 2.A, 3.A, 4.B.
- *Chapter 2*: 2.A, 2.B, 2.C, 2.D, 3.A, 4.B.
- *Chapter 3*: 1.A, 2.A, 2.B, 2.C, 2.D, 4.B.

- *Chapter 4*: 1.A, 1.B, 1.C, 4.A, 4.B.
- *Chapter 5*: 1.A, 3.A, 3.B, 4.B.
- *Chapter 6*: 2.B, 3.B, 3.C, 4.B.
- *Chapter 7*: 1.A, 3.A, 3.B, 3.C, 4.B.
- *Chapter 8*: 1.A, 1.D, 3.D, 4.A, 4.B, 4.C, 4.D.
- *Chapter 9*: 1.B, 1.E, 1.F, 3.A, 3.E, 4.A, 4.B, 4.C, 4.E.
- *Chapter 10*: 1.A, 1.D, 1.E, 1.F, 3.C, 3.D, 3.E, 4.A, 4.B, 4.C, 4.D, 4.E.
- *Chapter 11*: 1.A, 1.E, 1.F, 3.A, 3.C, 3.E, 4.B, 4.C, 4.E.
- *Chapter 12*: 1.A, 1.D, 1.E, 1.F, 3.D, 3.E, 4.A, 4.B, 4.C, 4.D, 4.E.