Advanced Placement Statistics

AP STATISTICS - 3580

Grades 11 or 12

Full year - 1 credit

Prerequisite: Completion of a course in Algebra II and Trigonometry or department approval. Honors Policy Applies

Course Overview

This course provides instruction in exploring data, designing samples and experiments, and an in-depth view of probability and statistical inference. It also provides the students with knowledge on how to use the graphing calculator to assist with computations, simulations, and assessment of data. This course and curriculum content has been approved by the College Board.

The Advanced Placement Statistics course is an option for any student who has successfully completed the Algebra II/Trigonometry course and corresponding Regents examination. The typical AP Stat student will have scored an 88 or higher on the Algebra II and Trigonometry Regents. At least one statistics course is typically required for college majors such as engineering, psychology, sociology, health science, and business. The AP Stat course is a good preparation for these areas of study. The use of a graphics calculator (TI-84+ is recommended) is a mandatory instructional tool for the course, and is required on the Advanced Placement examination. Topics studied include graphical displays, data collection methods, distributions of data, probability, and statistical inference. Students are expected to interpret case study scenarios and write a description of an appropriate conclusion. All students enrolled in this course will take the Advanced Placement Statistics examination in May.

General Departmental Philosophy

The Garden City Mathematics Department presents courses that align with either the New York State Regents (common core) curriculum or the College Board’s Advanced Placement curriculum. In either case, the course material prepared by the Department (Grades 6 – 12) is fully consistent with these standards. In particular, our Advanced Placement syllabi have been approved by the College Board. Our Regents courses address the NYS common core standards. Our instructional activities are created to promote written and verbal mathematical communication and critical thinking skills that employ accurate mathematical ideas. The Department develops student assessments that are also consistent with the New York State and/or College Board assessment in both style and content. The scoring rubrics employed by the Department are modeled after the particular associated scoring guides. Additional information about the NYS Mathematics program can be found at https://www.engageny.org/resource/grades-9-12-mathematics-curriculum-map and Advanced Placement program at http://www.apcentral.collegeboard.com.

Members of the Department encourage their students to explore, discover and question the many fundamental concepts developed within each courses. The primary objective is to engage our students in lessons that are meaningful, inspiring and enjoyable and promote a greater interest in mathematics – at the post secondary level and beyond. Technology applications, such as calculator usage, are incorporated as developmentally appropriate and as specified by the NYS and/or College Board curriculum. The Department wants each student to realize that they can make a contribution to their class and that others can benefit from their input. The Department wants all students to maximize their mathematical potential as we move through the challenging curriculum and prepare to master all course requirements.
An Introduction to Statistics

Exploring Data
- Histograms and Dot plots
- Stem and Leaf, time plots
- Histograms on a TI-83/84
- Mean and median
- [http://www.mste.uiuc.edu/hill/dstat/dstat.html](http://www.mste.uiuc.edu/hill/dstat/dstat.html)
- 5 number summary/Boxplots, IQR, Tukey’s rule
- Comparing side-by-side boxplots
- Describing and comparing the shape, center, and spread of a distribution
- Calculating variance and standard deviation
- Frequency and cumulative distributions tables

The Normal Distributions
- Density Curves
- Normal Distribution
- Standard Normal; Z-score
- Z-table
- Assessing normality- by using graphing methods and NPP
- **Activity**: Students will be given cards with word problems describing normal distributions. On the back of each card there is a bar code with the hidden correct answer. The students will use a scanning device to check the accuracy of their answers.

Examining Relationships
- Introduction to Examining Relationships
- Scatter plots, Correlation
- Facts about Correlation
- **Activity**: Is there a relationship? Students must research an area where they think there might be a relationship between the variables. Examples will be suggested. They will report in a well-written paper on each of the following items:
  1. An explanation of how the data was collected.
  2. A graphical display.
  3. Any explanations with respect to calculations or formulas used.
  4. A conclusion that describes how strongly or weakly the data supported the correlation.
  5. Students will give a brief oral summary of their paper.
- Least Squared Regression (Illuminations Line of Best Fit Applet)
- Facts about Least Squared Regression
- Correlation coefficient and Coefficient of determination (manually/calculator)
- Interpreting the slope of the LSRL in the context of the problem
- **Activity**: Understanding the LSRL with a visual model – adapted from Illuminations
- Interpret information from statistical software
- Residuals
- Influential Points

More on Two-Variable Data
- Modeling Non-linear Data (exponential)
- Power transformations
- Interpreting Correlation and Regression
• Relations in Categorical Data
• Two way Tables

Producing Data
• Designing Samples
• Activity: The students will make a foldable. The task will be for the students to match a given picture illustrating a particular sample design and write the definition.
• Random Samples
• Designing Experiments
• Blocking
• Matched Pairs
• Activity: The students will be randomly assigned to groups. Each group will receive a pack of cards describing 12 different types of experiments. The task is for the student to correctly identify the type of experiment be described and then each group will present one experiment to the class
• Simulations

Probability: The Study of Randomness
• Introduction to Probability
• Sample Space
• Basic rules of probability
• Complement
• Union
• Intersection
• Venn Diagram
• All Probability Models
• Conditional Probability

Random Variables
• Activity: The Game of Craps
• Introduction to Random Variables
• Discrete Random Variables
• Continuous Random Variables
• Mean and Variance of Random Variables

The Binomial and Geometric Distributions
• Binomial Settings
• Calculating binomial probabilities by formula/calculator
• Binomial Mean and Standard Deviation
• Geometric Settings
• Calculating geometric probabilities by formula/calculator
• Mean of a geometric random variable
• Identifying experiments as binomial, geometric, negative binomial or none of these

Sampling Distributions
• Introduction to Sampling Distributions
• Activity: M&M’s activity- determine the proportion of yellow in a cup of 60
• Sampling Distribution of the sample proportion
- **Activity:** The students are asked to sample 50 females they meet at random. When all their data is collected, they will take an average. This information is then graphed at the blackboard using post-it notes with their average placed on a number line. The students see that the distribution is normal.
- Sampling Distribution of the sample mean
- Central limit theorem

**Introduction to Inference**
- Introduction to Confidence Intervals
- Confidence Intervals
- Tests of significance
- The reasoning of a significance test
- Hypothesis Tests
- Statistical Significance
- Calculator Usage for Confidence Intervals
- Margin of error
- Tests for a population mean
- Drawing conclusions based on the p-value and a level of significance
- Tests from confidence intervals and drawing conclusions on the null hypothesis based on the interval
- Using the tests menu on the TI83/84
- Using Significance Tests
- Inference as a decision (Type I and II errors)
- Calculating beta (one day)

**Inference for Distributions**
- Inference for the mean of a population
- T-procedures
- Matched t-tests
- Robustness and the power of the t test
- T confidence intervals
- Comparing two means
- Assumptions for comparing two means
- Two-sample t procedures (hypothesis test and confidence interval)
- Activity: The students are asked to build two types of paper airplanes state their hypothesis about the flight distances before they begin. The must fly each plane a minimum of 30 times each and record their distances. The must then calculate a 2-sample t-test statistic and p-value. Lastly, they will write up a conclusion based upon the original hypothesis and share the results with the class.
- Drawing conclusions based on the p-value and a level of significance
- Two-sample inference with the TI-83/84
- Degrees of freedom (calculator/formula)
- Robustness and the pooled two-sample t procedures

**Inference for Proportions**
- Inference for a Population Proportion
- Assumptions for inference about a proportion
- Large Sample Inference for a population proportion
- Choosing the sample size
- TI-83/84 techniques to perform inference for a population proportion
• **Activity:** From Here to There – Students will receive a plain bag of m&m’s. They will create a frequency table and a relative frequency histogram for the colors in their populations. Next, they will be asked to select a particular color. They will compute the proportion of this color in the population of colored objects they have in total. Students will then place all the objects in a bag. I will choose an appropriate sample size and decide on the number of trials to perform. They will be asked to construct confidence levels of 95%. Students must then compare the widths of their confidence interval with those whose sample sizes are larger and smaller. They will be asked to draw conclusions with respect to sample size. Students will also be asked to comment on the inclusion or non-inclusion of the population proportion in the various intervals. All students will report and discuss their findings.

• Comparing Two proportions
• Confidence Intervals for comparing two proportions
• Significance Tests for comparing two proportions
• TI-83/84 techniques to compare two population proportions

**Inference for Tables: Chi-Square Procedures**

• **Activity:** M&M Activity
• Test for Goodness of Fit
• Properties of the chi-square distributions
• Conducting inference by simulation
• Inference for two-way tables
• Expected counts
• The chi-square test
• Chi-square statistic
• Using technology to calculate chi-square
• Using the chi-square table
• Uses of the chi-square test

**Inference for Regression**

• Confidence Intervals for the slope of the LSRL
• Hypothesis test for the slope of the LSRL

**Review for AP Exam**

• Selected multiple-choice and free response questions from previous published exams and from various published review books.
• Review questions from Yates’ Golden/Platinum binder supplement
• AP Exam

**Primary Textbook:**

**Supplemental Text:**


**Technology:**
- All students have a TI-83/TI-83+/TI-84 graphing calculator for use in class, at home, and on the AP exam.
- Various applets on the Internet adapted from lessons available on Illuminations and WH Freeman Publications.