FAIRFIELD PUBLIC SCHOOLS
FAIRFIELD, CONNECTICUT

ADVANCED PLACEMENT STATISTICS

Board of Education Approved 03/27/2007

ADVANCED PLACEMENT STATISTICS

Statement of Purpose
Advanced Placement (AP) Statistics offers a course to students who wish to complete studies equivalent to a semester of a non-calculus based, college course in Statistics. The purpose of this course is to develop students' understanding of the major concepts and tools for collecting, analyzing, and drawing conclusions from data. Additionally, students will be able to make judgments and discuss findings rather than just solving problems. Technology is used regularly by students and teachers to display and examine data, communicate conclusions in words, and judge whether their conclusions are sensible. Through the AP Exam and beginning in the 2007-2008 school year, by virtue of our affiliation with the University of Connecticut's Early College Experience (ECE) program, students may receive up to four college credits of undergraduate statistics.

Audience
This course is intended for students who have successfully completed Algebra 31. It is expected that students taking this course will take the Advanced Placement Exam.

Prerequisites
A grade of B+ or better in Algebra 31 or Precalculus 41 along with teacher recommendation. This course is an elective and is taken with or after taking Precalculus 41.

Course Description
AP Statistics is a rigorous course that offers advanced students an opportunity to do college level work in high school. Students will explore four broad conceptual themes: exploring data, planning a study, probability, and statistical inference. The content of the course requires students to use high level problem solving skills to analyze, describe and make conclusions about sets of data. AP Statistics is an excellent option for all students meeting the prerequisites, regardless of their intended college major. It is expected that students in this course will take the AP exam. Beginning in the 2007-2008 school year, by virtue of our affiliation with the University of Connecticut's ECE program, students can apply for 4 college credits of Math 110 at the University of Connecticut.

Course Objectives
Students will be able to:
- observe and describe patterns and departures from patterns.
- plan and conduct a study using samples, experiments, and simulations.
- explore random phenomenon using probability and simulation.
- use statistical inference to make conclusions with confidence.
- estimate population parameter and test hypotheses.

Skill Objectives
Students will:
- collect real data and create meaningful graphical representations of the data.

- develop, use and explain applications and limitations of linear and nonlinear models and regression in a variety of contexts.
- investigate and solve relevant problems by designing statistical experiments and collecting, organizing, displaying and analyzing data in tabular, graphical and symbolic forms.
- apply and defend regression models for bivariate data and use them to formulate predictions.
- recognize the limitations of mathematical models based on sample data as representations of real-world situations.
- estimate an unknown value between data points on a graph (interpolation) and make predictions by extending the graph (extrapolation).
- use the data from samples to make inferences about a population and determine whether claims are reasonable or false.
- determine and use measures of spread and central tendency to describe and compare sets of data.
- determine statistical measures to describe univariate data.
- use relative frequency and expected values to represent and solve problems involving uncertainty.
- differentiate between association and causation when studying the relationship between one variable and another.
- describe characteristics of sampling methods and analyze the effects of random versus biased sampling.
- solve problems involving the probabilities of mutually exclusive events or complementary events.
- explore the concepts of conditional probability and independent events in real-world contexts.
- use theoretical probabilities to solve problems and predict experimental outcomes.
- understand and use permutations, combinations, recursion and mathematical induction to solve problems.
- solve problems using finite graphs.
- explore the characteristics and applications of the normal distribution and standardized scores.
- construct and interpret confidence intervals.
- explore a variety of statistical tests such as chi-squares and t-tests and understand the meaning of hypothesis testing.

Math Standards
Working with Data: Probability and Statistics – Data can be analyzed to make informed decisions using a variety of strategies, tools and technologies.
Core
4.1 Students should collect, organize and display data using appropriate statistical and graphical methods.
4.1a Students will create the appropriate visual or graphical representation of real data.
4.2 Students should analyze data sets to form hypotheses and make predictions.
4.2a Students will analyze real world problems using statistical techniques.

4.3 Students should understand and apply basic concepts of probability.
4.3a Students will understand and apply the principles of probability in a variety of situations.
Extended
4.1 Students should collect, organize and display data using appropriate statistical and graphical methods.
4.1a Students will model real data graphically using appropriate tools, technology and strategies.
4.2 Students should analyze data sets to form hypotheses and make predictions.
4.2a Students will describe and analyze sets of data using statistical models.
4.3 Students should understand and apply basic concepts of probability.
4.3a Students will solve problems using the methods of discrete mathematics
4.3b Students will make statistical inferences through the use of probability.

<u>Information and Technology Standards (to be added)</u>

<u>Essential Question</u>
- How can collecting, organizing and displaying data help us analyze information and make reasonable predictions and informed decisions?

<u>Focus Questions</u>
- What is Statistics and what role does it play as a tool in science, business, and other areas of study?
- How does Statistics model the real world?
- How are appropriate techniques, tools, and formulas used in Statistics to draw conclusions?
- How can the language of Statistics be used to communicate mathematical ideas coherently and precisely?
- How can technology be applied to create and interpret models?
- What is the structure of the Advanced Placement exam?
- How can students maximize their efforts to be successful on the exam, in addition to having knowledge of the course content?
- How do you describe a distribution of data numerically and graphically?
- How do you create a model for bivariate data and how do you describe, interpret and analyze the model?
- How do you develop sample and experiment to produce valid information?
- How do you use chance in random sampling and randomized comparative experiments to simulate random behavior?
- How do you anticipate what a distribution of data should look like under a given model?
- How do you use probability rules to evaluate chance behavior in real world contexts?

- How do you use inferential models to analyze experimental designs, draw statistically significant conclusions form data, and make inferences about populations?

UNITS of STUDY

Unit 1: Exploring Data

Math Standards

Working with Data: Probability and Statistics – Data can be analyzed to make informed decisions using a variety of strategies, tools and technologies.

Core

4.1 Students should collect, organize and display data using appropriate statistical and graphical methods.

4.1a Students will create the appropriate visual or graphical representation of real data.

4.2 Students should analyze data sets to form hypotheses and make predictions.

4.2a Students will analyze real world problems using statistical techniques.

Extended

4.1 Students should collect, organize and display data using appropriate statistical and graphical methods.

4.1a Students will model real data graphically using appropriate tools, technology and strategies.

4.2 Students should analyze data sets to form hypotheses and make predictions.

4.2a Students will describe and analyze sets of data using statistical models.

4.3 Students should understand and apply basic concepts of probability.

4.3a Students will solve problems using the methods of discrete mathematics

4.3b Students will make statistical inferences through the use of probability.

Essential Question

- How can collecting, organizing and displaying data help us analyze information and make reasonable predictions and informed decisions?

Focus Questions

- What is Statistics and what role does it play as a tool in science, business, and other areas of study?
- How does Statistics model the real world?
- How are appropriate techniques, tools, and formulas used in Statistics to draw conclusions?
- How can the language of Statistics be used to communicate mathematical ideas coherently and precisely?
- How can technology be applied to create and interpret models?
- What is the structure of the Advanced Placement exam?
- How can students maximize their efforts to be successful on the exam, in addition to having knowledge of the course content?
- How do you describe a distribution of data numerically and graphically?
- How do you create a model for bivariate data and how do you describe, interpret and analyze the model?

Core Topics
- Constructing and interpreting graphical displays of distributions of univariate data.
- Summarizing and comparing distributions of univariate data.
- Exploring categorical data

Unit Objective
Students will be able to:
- observe and describe patterns and departures from patterns.

Skill Objectives
Students will:
- collect real data and create meaningful graphical representations of the data.
- develop, use and explain applications and limitations of linear and nonlinear models and regression in a variety of contexts.
- investigate and solve relevant problems by designing statistical experiments and collecting, organizing, displaying and analyzing data in tabular, graphical and symbolic forms.
- apply and defend regression models for bivariate data and use them to formulate predictions.
- recognize the limitations of mathematical models based on sample data as representations of real-world situations.
- estimate an unknown value between data points on a graph (interpolation) and make predictions by extending the graph (extrapolation).
- use the data from samples to make inferences about a population and determine whether claims are reasonable or false.
- determine and use measures of spread and central tendency to describe and compare sets of data.
- determine statistical measures to describe univariate data.
- use relative frequency and expected values to represent and solve problems involving uncertainty.
- differentiate between association and causation when studying the relationship between one variable and another.

Sample Assessment
Linear Regression – "What's Your Best Offer" (Special Problem 3B)

Pacing
Approximately 9 weeks

<h1 style="text-align:center">Unit 2: Planning a Study</h1>

Math Standards
Working with Data: Probability and Statistics – Data can be analyzed to make informed decisions using a variety of strategies, tools and technologies.
Core
4.1 Students should collect, organize and display data using appropriate statistical and graphical methods.
4.1a Students will create the appropriate visual or graphical representation of real data.
4.2 Students should analyze data sets to form hypotheses and make predictions.
4.2a Students will analyze real world problems using statistical techniques.
Extended
4.1 Students should collect, organize and display data using appropriate statistical and graphical methods.
4.1a Students will model real data graphically using appropriate tools, technology and strategies.
4.2 Students should analyze data sets to form hypotheses and make predictions.
4.2a Students will describe and analyze sets of data using statistical models.

Essential Question
- How can collecting, organizing and displaying data help us analyze information and make reasonable predictions and informed decisions?

Focus Questions
- What is Statistics and what role does it play as a tool in science, business, and other areas of study?
- How does Statistics model the real world?
- How are appropriate techniques, tools, and formulas used in Statistics to draw conclusions?
- How can the language of Statistics be used to communicate mathematical ideas coherently and precisely?
- How can technology be applied to create and interpret models?
- What is the structure of the Advanced Placement exam?
- How can students maximize their efforts to be successful on the exam, in addition to having knowledge of the course content?
- How do you develop sample and experiment to produce valid information?
- How do you use chance in random sampling and randomized comparative experiments to simulate random behavior?

Core Topics
- Overview of methods of data collection
- Planning and conducting surveys and experiments
- Generalizing results and types of conclusions that can be drawn from observational studies, experiments, and surveys

Unit Objective

Students will be able to:

- plan and conduct a study using samples, experiments, and simulations.

Skill Objectives

Students will:

- collect real data and create meaningful graphical representations of the data.
- investigate and solve relevant problems by designing statistical experiments and collecting, organizing, displaying and analyzing data in tabular, graphical and symbolic forms.
- recognize the limitations of mathematical models based on sample data as representations of real-world situations.
- use data from samples to make inferences about a population and determine whether claims are reasonable or false.
- describe characteristics of sampling methods and analyze the effects of random versus biased sampling.

Sample Assessment

CSA - Analyzing Surveys (Chapter 5 – Golden Book)

Pacing

Approximately 4 weeks

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Unit 3: Probability

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Math Standards
Working with Data: Probability and Statistics – Data can be analyzed to make informed decisions using a variety of strategies, tools and technologies.
Core
4.1 Students should collect, organize and display data using appropriate statistical and graphical methods.
4.1a Students will create the appropriate visual or graphical representation of real data.
4.2 Students should analyze data sets to form hypotheses and make predictions.
4.2a Students will analyze real world problems using statistical techniques.
4.3 Students should understand and apply basic concepts of probability.
4.3a Students will understand and apply the principles of probability in a variety of situations.
Extended
4.1 Students should collect, organize and display data using appropriate statistical and graphical methods.
4.1a Students will model real data graphically using appropriate tools, technology and strategies.
4.2 Students should analyze data sets to form hypotheses and make predictions.
4.2a Students will describe and analyze sets of data using statistical models.
4.3 Students should understand and apply basic concepts of probability.
4.3a Students will solve problems using the methods of discrete mathematics
4.3b Students will make statistical inferences through the use of probability.

Essential Question
- How can collecting, organizing and displaying data help us analyze information and make reasonable predictions and informed decisions?

Focus Questions
- What is Statistics and what role does it play as a tool in science, business, and other areas of study?
- How does Statistics model the real world?
- How are appropriate techniques, tools, and formulas used in Statistics to draw conclusions?
- How can the language of Statistics be used to communicate mathematical ideas coherently and precisely?
- How can technology be applied to create and interpret models?
- What is the structure of the Advanced Placement exam?
- How can students maximize their efforts to be successful on the exam, in addition to having knowledge of the course content?
- How do you anticipate what a distribution of data should look like under a given model?
- How do you use probability rules to evaluate chance behavior in real world contexts?

Core Topics
- Probability
- Combining independent random variables.
- The normal distribution.
- Central Limit Theorem
- Probability Distributions

Unit Objective
Students will be able to:
- explore random phenomenon using probability and simulation.

Skill Objectives
Students will:
- collect real data and create meaningful graphical representations of the data.
- investigate and solve relevant problems by designing statistical experiments and collecting, organizing, displaying and analyzing data in tabular, graphical and symbolic forms.
- recognize the limitations of mathematical models based on sample data as representations of real-world situations.
- use data from samples to make inferences about a population and determine whether claims are reasonable or false.
- determine and use measures of spread and central tendency to describe and compare sets of data.
- determine statistical measures to describe univariate data.
- solve problems involving the probabilities of mutually exclusive events or complementary events.
- explore the concepts of conditional probability and independent events in real-world contexts.
- use theoretical probabilities to solve problems and predict experimental outcomes.
- understand and use permutations, combinations, recursion and mathematical induction to solve problems.
- solve problems using finite graphs.
- explore the characteristics and applications of the normal distribution and standardized scores.
- use relative frequency and expected values to represent and solve problems involving uncertainty.

Sample Assessment
Probability "Airline Overbooking" (Special Problem 8A)

Pacing
Approximately 9 weeks

<center>**Unit 4: Inference**</center>

Math Standards
Working with Data: Probability and Statistics – Data can be analyzed to make informed decisions using a variety of strategies, tools and technologies.
Core
4.1 Students should collect, organize and display data using appropriate statistical and graphical methods.
4.1a Students will create the appropriate visual or graphical representation of real data.
4.2 Students should analyze data sets to form hypotheses and make predictions.
4.2a Students will analyze real world problems using statistical techniques.
Extended
4.1 Students should collect, organize and display data using appropriate statistical and graphical methods.
4.1a Students will model real data graphically using appropriate tools, technology and strategies.
4.2 Students should analyze data sets to form hypotheses and make predictions.
4.2a Students will describe and analyze sets of data using statistical models.
4.3 Students should understand and apply basic concepts of probability.
4.3a Students will solve problems using the methods of discrete mathematics
4.3b Students will make statistical inferences through the use of probability.

Essential Question
- How can collecting, organizing and displaying data help us analyze information and make reasonable predictions and informed decisions?

Focus Questions
- What is Statistics and what role does it play as a tool in science, business, and other areas of study?
- How does Statistics model the real world?
- How are appropriate techniques, tools, and formulas used in Statistics to draw conclusions?
- How can the language of Statistics be used to communicate mathematical ideas coherently and precisely?
- How can technology be applied to create and interpret models?
- What is the structure of the Advanced Placement exam?
- How can students maximize their efforts to be successful on the exam, in addition to having knowledge of the course content?
- How do you use inferential models to analyze experimental designs, draw statistically significant conclusions form data, and make inferences about populations?

Core Topics
- Estimation (point estimators and confidence intervals)
- Tests of significance

Unit Objectives

Students will be able to:
- use statistical inference to make conclusions with confidence.
- estimate population parameter and test hypotheses.

Skill Objectives

Students will:
- collect real data and create meaningful graphical representations of the data.
- develop, use and explain applications and limitations of linear and nonlinear models and regression in a variety of contexts.
- investigate and solve relevant problems by designing statistical experiments and collecting, organizing, displaying and analyzing data in tabular, graphical and symbolic forms.
- apply and defend regression models for bivariate data and use them to formulate predictions.
- recognize the limitations of mathematical models based on sample data as representations of real-world situations.
- use data from samples to make inferences about a population and determine whether claims are reasonable or false.
- determine and use measures of spread and central tendency to describe and compare sets of data.
- determine statistical measures to describe univariate data.
- explore the characteristics and applications of the normal distribution and standardized scores.
- construct and interpret confidence intervals.
- explore a variety of statistical tests such as chi-squares and t-tests and understand the meaning of hypothesis testing.
- use relative frequency and expected values to represent and solve problems involving uncertainty.

Sample Assessment

Poster Project

Pacing

Approximately 12 weeks