TRUMBULL PUBLIC SCHOOLS

Trumbull, Connecticut

Advance College Prep Statistics
Grade 12

2024

Curriculum Writing Team

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ACP Statistics
Grade 11/12

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The Trumbull Board of Education promotes non-discrimination in all of its programs, including educational opportunities and services provided to students, student assignment to schools and classes, and educational offerings and materials.

CORE VALUES AND BELIEFS

The Trumbull High School community engages in an environment conducive to learning which believes that all students will **read and write effectively**, therefore communicating in an articulate and coherent manner. All students will participate in activities that present **problem-solving through critical thinking**. Students will **use technology as a tool applying it to decision making**. We believe that by fostering self-confidence, self-directed and student-centered activities, we will promote **independent thinkers and learners**. We believe **ethical conduct** to be paramount in sustaining the welcoming school climate that we presently enjoy.

Approved 8/26/2011

INTRODUCTION & PHILOSOPHY

Advanced College Preparatory Statistics is tailored for college-bound students aiming to build a strong foundation in statistical mathematics.

Throughout this curriculum, students will engage with a comprehensive range of statistical concepts, blending theory with practical problem-solving. Utilizing a variety of instructional methods, including hands-on activities, collaborative projects, and individual exploration, learners will develop proficiency in pattern recognition, data analysis, and decision-making.

Encouraging critical thinking and self-assessment, this course integrates modern technological tools such as Google Sheets and the TI-84 calculator alongside traditional methods. Projects and case studies will facilitate the application of theoretical concepts to real-world scenarios, fostering a deeper understanding of statistical principles and their practical significance.

Topics covered include data visualization, normal distribution, regression analysis, sampling methods, confidence intervals, and inference testing. By the course's conclusion, students will have acquired the skills to gather, interpret, and analyze data effectively to inform decision-making processes.

Throughout this educational journey, students will develop the statistical literacy necessary for success in higher education and beyond.

COURSE GOALS

The following course goals are from the 2010 Connecticut Common Core State Standards for Mathematics and apply to all units:

CCSS MATHEMATICS SID.1
Represent data with plots on the real number line (dot plots, histograms, and box plots)

CCSS MATHEMATICS SID.2
Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.

CCSS MATHEMATICS SID.3
Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

CCSS MATHEMATICS SID.4
Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.

CCSS MATHEMATICS SID.5
Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.

CCSS MATHEMATICS SID.6
Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. Informally assess the fit of a function by plotting and analyzing residuals. Fit a linear function for a scatter plot that suggests a linear association.

CCSS MATHEMATICS SID.7
Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

CCSS MATHEMATICS SID.8
Compute (using technology) and interpret the correlation coefficient of a linear fit.

CCSS MATHEMATICS SID.9
Distinguish between correlation and causation

CCSS MATHEMATICS S-IC.1
Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

CCSS MATHEMATICS S-IC.3
Recognize the purposes of and differences among sample surveys, experiments, and observational

studies; explain how randomization relates to each.

CCSS MATHEMATICS S-IC.4
Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.
CCSS MATHEMATICS S-CP.1
Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not").

CCSS MATHEMATICS S-CP.2
Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.

CCSS MATHEMATICS S-CP.3
Understand the conditional probability of A given B as P(A and B)/P(B), and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.

CCSS MATHEMATICS S-CP.4
Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities.

CCSS MATHEMATICS S-CP.5
Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.

CCSS MATHEMATICS S-CP.6
Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model.

CCSS MATHEMATICS S-CP.7
Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model.

CCSS MATHEMATICS S-CP.8
Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model.

CCSS MATHEMATICS S-CP.9
Use permutations and combinations to compute probabilities of compound events and solve problems.

CCSS MATHEMATICS S-MD.2
Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.

CCSS MATHEMATICS S-MD.3
Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value.

CCSS MATHEMATICS S-MD.4
Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value.

CCSS MATHEMATICS S-MD.5
Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. Find the expected payoff for a game of chance. Evaluate and compare strategies on the basis of expected values.

CCSS MATHEMATICS S-MD.7
Analyze decisions and strategies using probability concepts.

COURSE ENDURING UNDERSTANDINGS

Students will understand that…

- mathematical and statistical operations and procedures may be used to organize, calculate, analyze, and present data in different ways.
- the credibility of statistical graphs can be manipulated to make conclusions which are not supported by the data.
- statistical inference is acquired through inquiry, experimentation, data analysis, and interpretation.
- conclusions and explanations are based on research data using samples whose results are extrapolated to the population.
- statistical results can be adjusted using various levels of confidence.
- statistics and technology are used to make decisions which affect the quality of our lives.

COURSE ESSENTIAL QUESTIONS

- How is data identified and used in an unbiased way to make statistical inferences?
- How should statistical studies and experiments be designed in order to produce legitimate and meaningful results?
- What type of graph best represents the data and steers the reader toward accurate inference?
- How can measures of central tendency be used to interpret data?
- What does variation and standard deviation indicate about a sample or population?
- How do we analyze the data and probabilities in order to use the proper rules to calculate probability?
- What are the determining factors that indicate the proper use of permutations, combinations, and the Fundamental Counting Theorem?
- Is there a relationship between independence and mutual exclusivity? If so, what is it?
- How can we use information such as expected values to make decisions in real-world situations?
- How do we apply the binomial and geometric distributions to real-world situations and how does this knowledge help us analyze data and make decisions?
- How does one recognize the normal distribution and why is it important to the study of statistics?
- How do we use probability to find data points and make inferences?
- Why is it advantageous to use sample means as data and how does that change the standard deviation?
- Why are there three different distributions when calculating confidence intervals?
- How does one interpret the information provided by confidence intervals?
- How are confidence intervals applied to real-world situations?
- What are the determining factors when deciding what test to use?
- How does one interpret the decisions based on the results of a statistical test?
- How does technology enhance our understanding of statistical testing?
- How does one determine if two samples are independent or dependent and why does that matter?
- How does one interpret the results of a two-sample test and how can this be applied to real-world situations?
- What is the relationship between scatter plots, correlation coefficients, and predictions?
- What is the difference between correlation and causation and how does that affect decisions and predictions?

COURSE KNOWLEDGE & SKILLS

Students will know how to interpret data through various statistical measures of central tendency such as mean, median, mode, and standard deviation. They will understand the significance of probability in real-world scenarios. Students will be adept at constructing and analyzing different types of graphs and charts to visually represent data, facilitating clear communication of findings. Through hands-on activities and real-life applications, they will develop critical thinking skills necessary to evaluate the validity of statistical claims and draw meaningful conclusions from data sets. Moreover, students will delve into more advanced concepts such as confidence intervals, where they will learn to estimate population parameters with a specified level of confidence. They will explore the properties of the normal distribution and its applications in describing and analyzing data. Hypothesis testing will be another crucial aspect, allowing students to assess the validity of claims and draw conclusions based on sample data. Additionally, students will explore counting techniques as an integral part of understanding probabilities. They will delve into permutations and combinations, essential tools for analyzing situations involving arrangements and selections. By mastering these counting methods, students will gain a deeper understanding of probability and its applications in the real-world. They will be equipped to calculate the likelihood of various outcomes and make informed decisions.

Students will be able to identify and use data in an unbiased manner to make statistical inferences by understanding the principles of sampling techniques, randomization, and avoiding bias in data collection. They will be able to design statistical studies and experiments effectively to produce legitimate and meaningful results, considering factors such as sample size, experimental design, and the control of variables. Students will be able to use various types of graphs to represent data accurately, understanding how each graph type conveys different aspects of the data and guides readers towards accurate inference. They will be able to discuss measures of central tendency and variation, using tools like mean, median, mode, and standard deviation to interpret data and understand the spread of values. Students will be able to analyze data and probabilities using appropriate rules, determining the proper use of permutations, combinations, and the Fundamental Counting Theorem based on given situations. They will grasp the relationship between independence and mutual exclusivity, applying this understanding to make informed decisions in real-world scenarios. Furthermore, students will utilize concepts like expected values, binomial, geometric, and the normal distribution to analyze data, make predictions, and understand the underlying patterns in datasets. Students will interpret confidence intervals, understand their significance in statistical inference, and apply them to real-world situations to make informed decisions. Additionally, students will be able to select appropriate statistical tests based on determining factors and interpret the results of these tests, considering technology's role in enhancing their understanding of statistical testing. They will discern between independent and dependent samples, interpret the results of two-sample tests, and apply this knowledge to real-world situations. Furthermore, students will explore the relationship between scatter plots, correlation coefficients, and predictions, distinguishing between correlation and causation and understanding their implications for decision-making and predictions. Through a comprehensive understanding of these essential questions, students will develop the skills necessary to navigate the complexities of statistical analysis with confidence and proficiency.

COURSE SYLLABUS

Course Name

Advanced College Prep Statistics

Level

Advanced College Prep

Prerequisites

This course requires an A- or higher in CP Algebra II and teacher recommendation or successful completion of ACP or Honors Algebra II.

General Description of the Course

This course includes a variety of activities, projects, and vocational connections. The curriculum concentrates on learning how to appropriately gather, display, interpret, analyze, and user data to make and support decisions. Numerous projects will be included throughout the course connecting the class to current, "real-world" applications of statistics using many of the same topics as AP Statistics. A graphing calculator is required for this course..

Assured Assessments

Formative assessments can include, but are not limited to:

- Warm-up problems
- Individual and group activities
- Homework

Summative assessments:

- Individual and group assessments
- Individual and group projects
- End-of-semester examination

Core Texts & Resources

- Larson, Ron, Elementary Statistics, Picturing the World 8e. Pearson. Print.
- TI 83, 84, or 84+ Graphing Calculator

UNIT 1
Introduction to Statistics

Unit Goals
At the completion of this unit, students will be able to:
- describe and define statistics using accurate terminology
- distinguish between samples and parameters, descriptive and inferential statistics, qualitative and quantitative data, and observational studies and experiments
- design a observational study and an experiment
- create a sample using unbiased methods of sampling

2010 Connecticut Common Core State Standards for Mathematics

CCSS MATHEMATICS S-IC.1
Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

CCSS MATHEMATICS S-IC.3
Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.

CCSS MATHEMATICS S-IC.4
Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.

Unit Essential Questions
- How is data identified and used in an unbiased way to make statistical inferences?
- How should statistical studies and experiments be designed in order to produce legitimate and meaningful results?

Unit Essential Vocabulary
- Statistics
- Parameter/Sample
- Data
- Population/Sample
- Descriptive/Inferential
- Qualitative/Quantitative
- Confounding variable
- Double blind-experiment
- Randomization
- Replication

Scope and Sequence

1. Population versus sample
2. Parameter versus statistic
3. Descriptive versus inferential statistics
4. Qualitative versus quantitative data
5. Statistical studies, observational study versus an experiment
6. Different methods of random sampling
7. Studies using one of the methods of random sampling
8. Bias in sampling

Assured Assessments

Formative Assessment:

- Homework review
- Individual and group activities

Summative Assessment:

- Students will complete an assessment consisting of multiple-choice questions and free-response questions.

Resources

Core:

- Larson, Ron, Elementary Statistics, Picturing the World 8e. Pearson. Print.
- TI 83, 84, or 84+ Graphing Calculator

Time Allotment

- 6 days

UNIT 2
Descriptive Statistics

Unit Goals
At the completion of this unit, students will be able to:

- construct a frequency distribution, frequency histogram, frequency polygon, and ogive
- graph and interpret quantitative data sets using stem-and-leaf plots and dot plots
- graph and interpret qualitative data sets using pie charts and Pareto charts
- graph and interpret paired data sets using scatter charts and time series charts
- find the mean, median, and mode, range, and weighted mean of data
- describe the shape of a distribution as symmetric, uniform, or skewed
- find the variance and standard deviation of a population or sample
- use the Empirical Rule or Chebychev's Theorem to interpret standard deviation
- find the standard deviation of grouped data
- use the coefficient of variation as a comparison tool
- find quartiles of a data set and use them to create a box-and whisker plot
- find and interpret fractiles and percentiles
- find and interpret z-scores

2010 Connecticut Common Core State Standards for Mathematics

CCSS MATHEMATICS SID.1
Represent data with plots on the real number line (dot plots, histograms, and box plots)

CCSS MATHEMATICS SID.2
Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.

CCSS MATHEMATICS SID.3
Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

Unit Essential Questions

- What type of graph best represents the data and steers the reader toward accurate inference?
- How can measures of central tendency be used to interpret data?
- What does variation and standard deviation indicate about a sample or population?

Unit Essential Vocabulary

- Frequency distribution, relative and cumulative
- Histogram
- Ogive
- Mean, median, mode
- Weighted mean
- Outlier
- Symmetric, uniform, skewed right or left
- Range

- Standard deviation
- Variance
- Empirical Rule
- Coefficient of variation

Scope and Sequence

1. Frequency distributions and their graphs
2. Stem-and-leaf and dot plots
3. Pie charts and Pareto charts
4. Scatter plots and time series charts
5. Mean, median, and mode
6. Weighted mean
7. Distribution shape - symmetric, uniform, skewed
8. Variation and standard deviation
9. Empirical Rule and Chebychev's Theorem
10. Coefficient of variation
11. Quartiles, percentiles, and box-and-whisker plots
12. Z-scores

Assured Assessments

Formative Assessment:

- Homework review
- Individual and group activities

Summative Assessment:

- Students will complete assessments consisting of multiple-choice questions and free-response questions.
- Case Study: A Mourner (supplemental)

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Resources

Core:

- Larson, Ron, Elementary Statistics, Picturing the World 8e. Pearson. Print.
- TI 83, 84, or 84+ Graphing Calculator

Time Allotment

- 16 days

UNIT 3
Probability

Unit Goals
At the completion of this unit, students will be able to:

- identify the sample space of a probability and identify simple events
- use the Fundamental Counting Theorem
- distinguish between empirical, classical, and subjective probability
- calculate probability using the complement of an event
- distinguish between independent and dependent events
- use the Multiplication Rule
- determine whether two events are mutually exclusive
- use the Addition Rule
- use permutations and combinations to determine the number of ways a group can be arranged
- use counting principles to calculate probabilities

2010 Connecticut Common Core State Standards for Mathematics

CCSS MATHEMATICS S-CP.1
Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not").

CCSS MATHEMATICS S-CP.2
Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.

CCSS MATHEMATICS S-CP.3
Understand the conditional probability of A given B as P(A and B)/P(B), and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.

CCSS MATHEMATICS S-CP.4
Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities.

CCSS MATHEMATICS S-CP.5
Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.

CCSS MATHEMATICS S-CP.6
Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model.

CCSS MATHEMATICS S-CP.7

Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model.

CCSS MATHEMATICS S-CP.8

Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model.

CCSS MATHEMATICS S-CP.9

Use permutations and combinations to compute probabilities of compound events and solve problems.

Unit Essential Questions

- How do we analyze the data and probabilities in order to use the proper rules to calculate probability?
- What are the determining factors that indicate the proper use of permutations, combinations, and the Fundamental Counting Theorem?
- Is there a relationship between independence and mutual exclusivity? If so, what is it?

Unit Essential Vocabulary

- Probability experiment
- Outcome
- Sample Space
- Event
- Classical/Empirical Probability
- Complement
- Conditional Probability
- Independent/Dependent
- Mutually exclusive
- Factorial
- Permutation/Combination

Scope and Sequence

1. Sample space and simple events
2. Classical and Empirical Probability
3. Complement of an event
4. Independent and dependent events
5. Multiplication Rule
6. Mutual exclusivity
7. Addition Rule
8. Permutations and Combinations

Assured Assessments

Formative Assessment:

- Homework review
- Individual and group activities

Summative Assessment:

- Students will complete assessments consisting of multiple-choice questions and free-response questions.
- Case Study: United States Congress, p. 167

  Apply Independent Learning and Critical Thinking Rubrics as per the Vision of the Graduate

Resources

Core:

- Larson, Ron, Elementary Statistics, Picturing the World 8e. Pearson. Print.
- TI 83, 84, or 84+ Graphing Calculator

Time Allotment

- 19 days

UNIT 4
Discrete Probability Distributions

Unit Goals
At the completion of this unit, students will be able to:

- explain the difference between discrete random variables and continuous random variables
- construct and graph a discrete probability distribution
- calculate the mean, variance, and standard deviation of a discrete probability distribution
- calculate the expected value of a discrete probability distribution
- identify a binomial distribution
- calculate binomial probabilities using the formula
- determine binomial probabilities using technology
- calculate the mean, variance, and standard deviation of a binomial probability distribution
- calculate probabilities using the geometric distribution

2010 Connecticut Common Core State Standards for Mathematics

CCSS MATHEMATICS S-MD.2
Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.

CCSS MATHEMATICS S-MD.3
Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value.

CCSS MATHEMATICS S-MD.4
Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value.

CCSS MATHEMATICS S-MD.5
Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. Find the expected payoff for a game of chance. Evaluate and compare strategies on the basis of expected values.

CCSS MATHEMATICS S-MD.7
Analyze decisions and strategies using probability concepts.

Unit Essential Question(s)

- How can we use information such as expected values to make decisions in real-world situations?
- How do we apply the binomial and geometric distributions to real-world situations and how does this knowledge help us analyze data and make decisions?

Unit Essential Vocabulary

- Random variable
- Discrete/continuous

- Discrete probability distribution
- Expected Value
- Binomial Experiment
- Geometric Distribution

Scope and Sequence

1. Random variables versus continuous variables
2. Graphs of discrete probability distributions
3. Mean, variance, and standard deviation of a discrete probability distribution
4. Expected value of a discrete probability distribution
5. Binomial Experiments
6. Binomial Probabilities, by formula and technology
7. Mean, variance, and standard deviation of a binomial probability distribution
8. Geometric Distribution

Assured Assessments

Formative Assessment:

- Homework review
- Individual and group activities

Summative Assessment:

- Students will complete assessments consisting of multiple-choice questions and free-response questions.

Resources

Core:

- Larson, Ron, Elementary Statistics, Picturing the World 8e. Pearson. Print.
- TI 83, 84, or 84+ Graphing Calculator

Time Allotment

- 10 days

UNIT 5
Normal Probability Distributions

Unit Goals
At the completion of this unit, students will be able to:

- interpret graphs of normal probability distributions
- calculate areas under the standard normal curve
- find probabilities for normally distributed variables using a table and technology
- determine a z-score given the area under the normal curve
- transform a z-score to an x-value
- determine a data value given the probability
- identify sampling distributions
- interpret and apply the Central Limit Theorem
- determine when a normal distribution can approximate a binomial distribution
- accurately use the continuity correction
- use the normal distribution to approximate binomial probabilities

2010 Connecticut Common Core State Standards for Mathematics

CCSS MATHEMATICS SID.3
Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

CCSS MATHEMATICS SID.4
Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.

CCSS MATHEMATICS S-MD.7
Analyze decisions and strategies using probability concepts.

Unit Essential Questions

- How does one recognize the normal distribution and why is it important to the study of statistics?
- How do we use probability to find data points and make inferences?
- Why is it advantageous to use sample means as data and how does that change the standard deviation?

Unit Essential Vocabulary

- Normal Distribution
- Standard Normal Distribution
- Sampling Distribution
- Continuity Correction

Scope and Sequence

1. Normal probability distribution graphs
2. Area under the standard normal curve
3. Z-scores
4. Data points using probability
5. Sampling distribution
6. Central limit theorem
7. Normal distribution approximation of binomial distribution

Assured Assessments

Formative Assessment:

- Homework review
- Individual and group activities

Summative Assessment:

- Students will complete assessments consisting of multiple-choice questions and free-response questions.
- Case Study: Abby's Bloodwork (Supplemental)

  Apply Independent Learning, Critical Thinking, and Writing Rubrics as per the Vision of the Graduate

Resources

Core:

- Larson, Ron, Elementary Statistics, Picturing the World 8e. Pearson. Print.
- TI 83, 84, or 84+ Graphing Calculator

Time Allotment

- 19 days

UNIT 6
Confidence Intervals

Unit Goals
At the completion of this unit, students will be able to:

- find a point estimate and margin of error
- construct and interpret confidence intervals for a population mean with the standard deviation known
- determine the minimum sample size required to estimate a population mean
- interpret the t-distribution
- construct and interpret a confidence interval for a population mean with the standard deviation unknown
- find a point estimate for a population proportion
- construct and interpret a confidence interval for the population proportion
- determine the minimum sample size required to estimate a population proportion
- interpret the chi-square distribution and use a chi-square table
- construct and interpret a confidence interval for the population variance and standard deviation

2010 Connecticut Common Core State Standards for Mathematics

CCSS MATHEMATICS S-IC.4
Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.

CCSS MATHEMATICS S-MD.7
Analyze decisions and strategies using probability concepts.

Unit Essential Questions

- Why are there three different distributions when calculating confidence intervals?
- How does one interpret the information provided by confidence intervals?
- How are confidence intervals applied to real-world situations?

Unit Essential Vocabulary

- Point estimate
- Interval estimate
- Level of confidence
- Critical value
- Confidence interval
- Margin of error
- t-distribution
- Chi-square distribution

Scope and Sequence

1. Point estimates and margin of error
2. Confidence interval for a population mean
3. Minimum sample size for population mean
4. t-distribution
5. Confidence interval using the t-distribution
6. Confidence interval for a population proportion
7. Minimum sample size for a population proportion
8. Chi-square distribution
9. Confidence interval for population variance and standard deviation

Assured Assessments

Formative Assessment:

- Homework review
- Individual and group activities

Summative Assessment:

- Students will complete assessments consisting of multiple-choice questions and free-response questions.
- Confidence interval poster project

  Apply Independent Learning, Critical Thinking, and Writing Rubrics as per the Vision of the Graduate

Resources

Core:

- Larson, Ron, Elementary Statistics, Picturing the World 8e. Pearson. Print.
- TI 83, 84, or 84+ Graphing Calculator

Time Allotment

- 14 days

UNIT 7
Hypothesis Testing with One Sample

Unit Goals
At the completion of this unit, students will be able to:

- state a null and alternative hypothesis
- identify Type I and Type II errors
- use the p-value approach for statistical testing
- make and interpret a decision based on the results of a statistical test
- write a claim for a hypothesis test
- use p-values for a z-test when the standard deviation is known
- use technology to find p-values and use them with a t-test when the standard deviation is unknown
- use the z-test to test a population proportion
- use the chi-square test to test a variance or standard deviation

2010 Connecticut Common Core State Standards for Mathematics

CCSS MATHEMATICS S-IC.4
Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.

CCSS MATHEMATICS SID.4
Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.

CCSS MATHEMATICS S-MD.7
Analyze decisions and strategies using probability concepts.

Unit Essential Questions

- What are the determining factors when deciding what test to use?
- How does one interpret the decisions based on the results of a statistical test?
- How does technology enhance our understanding of statistical testing?

Unit Essential Vocabulary

- Null and alternative hypotheses
- Type I and Type II errors
- Level of significance
- P-value
- Critical (rejection) region
- Critical value
- Hypothesis test
- Right-tailed, left-tailed, and two-tailed

Scope and Sequence

1. Null and alternative hypotheses
2. Type I and Type II errors
3. One-tailed and two-tailed tests
4. Claims based on hypothesis test
5. P-values
6. Z-test for a mean when standard deviation is known
7. Critical values and rejection region
8. Critical values in a t-distribution
9. T-test for a mean when standard deviation is unknown
10. Technology to find p-values
11. Z-test for population proportion
12. Critical values for a chi-square test
13. Chi-square test for variance and standard deviation

Assured Assessments

Formative Assessment:

- Homework review
- Individual and group activities

Summative Assessment:

- Students will complete assessments consisting of multiple-choice questions and free-response questions.
- Case Study: StoneHenge (Supplemental)
  Apply Independent Learning, Critical Thinking, and Writing Rubrics as per the Vision of the Graduate

Resources

Core:

- Larson, Ron, Elementary Statistics, Picturing the World 8e. Pearson. Print.
- TI 83, 84, or 84+ Graphing Calculator

Time Allotment

- 17 days

UNIT 8
Hypothesis Testing with Two Samples

Unit Goals
At the completion of this unit, students will be able to:

- determine whether two samples are independent or dependent
- perform a two-sample z-test for the difference between two means with the standard deviation known
- perform a two-sample z-test for the difference between two means with the standard deviation unknown
- perform a t-test to test the mean of the differences for a population of paired data
- Perform a two-sample z-test for the difference between two population proportions

2010 Connecticut Common Core State Standards for Mathematics

CCSS MATHEMATICS S-IC.4
Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.

CCSS MATHEMATICS S-MD.7
Analyze decisions and strategies using probability concepts.

Unit Essential Questions

- How does one determine if two samples are independent or dependent and why does that matter?
- How does one interpret the results of a two-sample test and how can this be applied to real-world situations?

Unit Essential Vocabulary

- Independent/Dependent samples
- Paired/matched samples
- Difference of the sample means
- Two-sample z-test
- Two sample t-test
- Difference between the sample proportions

Scope and Sequence

1. Independent or dependent samples
2. Hypothesis testing for the difference between population parameters
3. Two-sample z-test for the difference between two means with standard deviations known
4. Two-sample z-test for the difference between two means with standard deviations unknown
5. T-test for the mean of the differences for a population of paired data
6. Two-sample z-test for the difference between two population proportions

Assured Assessments

Formative Assessment:

- Homework review
- Individual and group activities

Summative Assessment:

- Students will complete assessments consisting of multiple-choice questions and free-response questions.

Resources

Core:

- Larson, Ron, Elementary Statistics, Picturing the World 8e. Pearson. Print.
- TI 83, 84, or 84+ Graphing Calculator

Time Allotment

- 12 days

UNIT 9
Correlation and Regression

Unit Goals
At the completion of this unit, students will be able to:

- find a correlation coefficient
- test a population correlation coefficient using a table
- perform a hypothesis test for a population correlation coefficient
- distinguish between correlation and causation
- find the equation of a regression line
- predict y-values using a regression equation

2010 Connecticut Common Core State Standards for Mathematics

CCSS MATHEMATICS SID.1
Represent data with plots on the real number line (dot plots, histograms, and box plots)

CCSS MATHEMATICS SID.6
Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. Informally assess the fit of a function by plotting and analyzing residuals. Fit a linear function for a scatter plot that suggests a linear association.

CCSS MATHEMATICS SID.7
Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

CCSS MATHEMATICS SID.8
Compute (using technology) and interpret the correlation coefficient of a linear fit.

CCSS MATHEMATICS SID.9
Distinguish between correlation and causation

CCSS MATHEMATICS S-MD.7
Analyze decisions and strategies using probability concepts.

Unit Essential Questions

- What is the relationship between scatter plots, correlation coefficients, and predictions?
- What is the difference between correlation and causation and how does that affect decisions and predictions?

Unit Essential Vocabulary

- Linear correlation
- Independent/dependent variables
- Correlation coefficient
- Causation
- Regression
- Regression line
- Regression equation

Scope and Sequence

1. Independent/dependent variables
2. Correlation coefficient
3. Hypothesis test for a population correlation coefficient
4. Correlation versus causation
5. Equation of a regression line
6. Predictions of y-values using regression equations

Assured Assessments

Formative Assessment:

- Homework review
- Individual and group activities

Summative Assessment:

- Students will complete assessments consisting of multiple-choice questions and free-response questions.
- Case Study: Correlation of Body Measurements, p. 497

  Apply Independent Learning, Critical Thinking, and Writing Rubrics as per the Vision of the Graduate

Resources

Core:

- Larson, Ron, Elementary Statistics, Picturing the World 8e. Pearson. Print.
- TI 83, 84, or 84+ Graphing Calculator

Time Allotment

- 8 days

COURSE CREDIT

1.0 credits in mathematics
One class period for one year
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TPS VISION OF THE GRADUATE SKILLS AND DISPOSITIONS

ASSURED STUDENT PERFORMANCE RUBRICS

- Trumbull High School School-Wide Writing Rubric
- Trumbull High School School-Wide Problem-Solving Rubric
- Trumbull High School School-Wide Independent Learning and Thinking Rubric

Trumbull High School School-Wide Problem Solving Through Critical Thinking Rubric

Category/ Weight	Exemplary 4	Goal 3	Working Toward Goal 2	Needs Support 1-0
Understanding X_____	• Student demonstrates clear understanding of the problem and the complexities of the task	• Student demonstrates sufficient understanding of the problem and most of the complexities of the task	• Student demonstrates some understanding of the problem but requires assistance to complete the task	• Student demonstrates limited or no understanding of the fundamental problem after assistance with the task
Research X_____	• Student gathers compelling information from multiple sources including digital, print, and interpersonal	• Student gathers sufficient information from multiple sources including digital, print, and interpersonal	• Student gathers some information from few sources including digital, print, and interpersonal	• Student gathers limited or no information
Reasoning and Strategies X_____	• Student demonstrates strong critical thinking skills to develop a comprehensive plan integrating multiple strategies	• Student demonstrates sufficient critical thinking skills to develop a cohesive plan integrating strategies	• Student demonstrates some critical thinking skills to develop a plan integrating some strategies	• Student demonstrates limited or no critical thinking skills and no plan
Final Product and/or Presentation X_____	• Solution shows deep understanding of the problem and its components • Solution shows extensive use of 21st-century technology skills	• Solution shows sufficient understanding of the problem and its components • Solution shows sufficient use of 21st-century technology skills	• Solution shows some understanding of the problem and its components • Solution shows some use of 21st-century technology skills	• Solution shows limited or no understanding of the problem and its components • Solution shows limited or no use of 21st-century technology skills

Trumbull High School School-Wide Writing Rubric

Category/ Weight	Exemplary 4 Student work:	Goal 3 Student work:	Working Toward Goal 2 Student work:	Needs Support 1-0 Student work:
Purpose X_____	• Establishes and maintains a clear purpose • Demonstrates an insightful understanding of audience and task	• Establishes and maintains a purpose • Demonstrates an accurate awareness of audience and task	• Establishes a purpose • Demonstrates an awareness of audience and task	• Does not establish a clear purpose • Demonstrates limited/no awareness of audience and task
Organization X_____	• Reflects sophisticated organization throughout • Demonstrates logical progression of ideas • Maintains a clear focus • Utilizes effective transitions	• Reflects organization throughout • Demonstrates logical progression of ideas • Maintains a focus • Utilizes transitions	• Reflects some organization throughout • Demonstrates logical progression of ideas at times • Maintains a vague focus • May utilize some ineffective transitions	• Reflects little/no organization • Lacks logical progression of ideas • Maintains little/no focus • Utilizes ineffective or no transitions
Content X_____	• Is accurate, explicit, and vivid • Exhibits ideas that are highly developed and enhanced by specific details and examples	• Is accurate and relevant • Exhibits ideas that are developed and supported by details and examples	• May contain some inaccuracies • Exhibits ideas that are partially supported by details and examples	• Is inaccurate and unclear • Exhibits limited/no ideas supported by specific details and examples
Use of Language X_____	• Demonstrates excellent use of language • Demonstrates a highly effective use of standard writing that enhances communication • Contains few or no errors. Errors do not detract from meaning	• Demonstrates competent use of language • Demonstrates effective use of standard writing conventions • Contains few errors Most errors do not detract from meaning	• Demonstrates use of language • Demonstrates use of standard writing conventions • Contains errors that detract from meaning	• Demonstrates limited competency in use of language • Demonstrates limited use of standard writing conventions • Contains errors that make it difficult to determine meaning

Trumbull High School School-Wide Independent Learning and Thinking Rubric

Category/ Weight	Exemplary 4	Goal 3	Working Toward Goal 2	Needs Support 1-0
Proposal X_____	• Student demonstrates a strong sense of initiative by generating compelling questions, creating uniquely original projects/work	• Student demonstrates initiative by generating appropriate questions, creating original projects/work	• Student demonstrates some initiative by generating questions, creating appropriate projects/work	• Student demonstrates limited or no initiative by generating few questions and creating projects/work
Independent Research & Development X_____	• Student is analytical, insightful, and works independently to reach a solution	• Student is analytical, and works productively to reach a solution	• Student reaches a solution with direction	• Student is unable to reach a solution without consistent assistance
Presentation of Final Product X_____	• Presentation shows compelling evidence of an independent learner and thinker • Solution shows deep understanding of the problem and its components • Solution shows extensive and appropriate application of 21st-century skills	• Presentation shows clear evidence of an independent learner and thinker • Solution shows adequate understanding of the problem and its components • Solution shows adequate application of 21st-century skills	• Presentation shows some evidence of an independent learner and thinker • Solution shows some understanding of the problem and its components • Solution shows some application of 21st-century skills	• Presentation shows limited or no evidence of an independent learner and thinker • Solution shows limited or no understanding of the problem and its components • Solution shows limited or no application of 21st-century skills

ACP Statistics Pacing Guide

Semester 1: 65 Class Periods

Semester 2: 63 Class Periods

1. Introduction to Statistics: 6 Days

Days	Topics
1	1-1 An Overview of Statistics
1	1-2 Data Classification
2	1-3 Data Collection and Experimental Design
1	Review
1	Assessment

2. Descriptive Statistics: 16 Days

Days	Topics
3	2-1 Frequency Distributions and Their Graphs
2	2-2 More Graphs and Displays (No Stem-Leaf or DotPlot)
1	Review/Quiz
1	2-3 Measures of Central Tendency
3	2-4 Measures of Variation
2	2-5 Measures of Position
2	Review
1	Assessment
1	Case Study: A Mourner (supplemental)

3. Probability: 19 Days

Days	Topics
3	3-1 Basic Concepts of Probability and Counting
2	3-2 Conditional Probability and the Multiplication Rule
2	Review/Quiz
3	3-3 The Addition Rule
1	Case Study: United States Congress pg 167
Begin MP 2	
5	3-4 Additional Topics of Probability and Counting
2	Review
1	Assessment

4. Discrete Probability Distributions: 10 Days

Days	Topics
3	4-1 Probability Distributions (Expected Value)
1	Review/Quiz
2	4-2 Binomial Distributions (binomPDF, binomCDF)
1	4-3 More Discrete Probability Distributions (No Poisson)
2	Review
1	Assessment

5. Normal Probability Distributions: 19 days

9 days Semester 1+ 3 MT Review + 7 days Semester 2

Days	Topics
3	5-1 Introduction to Normal Distributions and the Standard Normal Distribution (using Norm CDF) Uniform (pg 245 and Supplement)
1	5-2 Normal Distribution: Finding Probabilities
2	5-3 Normal Distributions: Finding Values (invNorm)
2	Review/Quiz
1	Case Study: Abby's Bloodwork (Supplemental)
MIDTERM	
2	5-4 Sampling distributions and the Central Limit Theorem
2	5-5 Normal Approximation of the Binomial Distribution
2	Review
1	Assessment

6. Confidence Intervals: 14 days

Days	Topics
2	6-1 Confidence Intervals for the Mean (SD Known) (invNorm)
2	6-2 Confidence Intervals for the Mean (SD Unknown) (invT)
2	Review/Quiz
2	6-3 Confidence Intervals for Population Proportion (invNorm)
2	6-4 Confidence Intervals for Variance and Standard Deviation (chi-squared table)
1	Review
1	Assessment

2	Confidence Interval Poster

7. Hypothesis Testing with One Sample: 17 days

Days	Topics
2	7-1 Introduction to Hypothesis Testing (p-value approach)
2	7-2 Hypothesis Testing for the Mean (SD Known) (Examples 1-5)
2	7-3 Hypothesis Testing for the Mean (SD Unknown)
2	Quiz/Review
Begin MP 4	
2	7-4 Hypothesis Testing for Proportions
2	7-5 Hypothesis Testing for Variance and Standard Deviation
2	Review
1	Assessment
2	Case Study: StoneHenge (supplemental)

8. Hypothesis Testing with Two Samples: 12 days

Days	Topics
2	8-1 Testing the Difference Between Means (Independent Sample, SD Known)
2	8-2 Testing the Difference Between Means (Independent Sample, SD Unknown)

1	Quiz/Review
2	8-3 Testing the Difference Between Means (Dependent Samples)
2	8-4 Testing the Difference Between Proportions
2	Review
1	Assessment

9. Correlation and Regression: 8 days

Days	Topics
2	9-1 Correlation (using technology only for r)
2	9-2 Linear Regression (Residuals)
2	Quiz/Review
2	Case Study: Correlation of Body Measurements pg 497
skip	9-3 Measures of Regression
skip	9-4 Multiple Regression