Statistical Methods

Curriculum

Middle Township Public Schools
216 S. Main Street
Cape May Court House, NJ 08210

Born On Date: January 16, 2019

Table of Contents

Acknowledgements

Dr. David Salvo	Superintendent
Dr. Toni Lehman	Director of Curriculum and Instruction
George West	Principal, Middle Township High School

Statistical Methods Curriculum Work Committee
Kelsey Graham

Statistical Methods Course Overview

Statistical Methods is offered to any student who has successfully completed a second-year course in algebra and who possesses sufficient mathematical maturity and quantitative reasoning ability. Students with the appropriate mathematical background are encouraged to take both Statistical Methods and Honors Calculus in High School. There are six themes in the Statistical Methods course: exploring data, sampling and experimentation, anticipating patterns, and statistical inference. Upon completion of this course, students should possess the skills necessary to be successful in subsequent mathematics courses.

Student Learning Outcomes

1. STUDENT LEARNING OUTCOME: Student will build frequency distributions and present statistical results graphically.
2. STUDENT LEARNING OUTCOME: Student will describe data with descriptive statistics.
3. STUDENT LEARNING OUTCOME: Student will apply counting techniques to probability and discrete probability distributions.
4. STUDENT LEARNINGOUTCOME: Student will construct and employ confidence intervals.
5. STUDENT LEARNINGOUTCOME: Student will apply the normal distribution, confidence intervals, sample size, hypothesis testing, analysis of variance, correlation, and regression to obtain statistical results with which they will draw conclusions.
6. STUDENT LEARNING OUTCOME: Student will use technology to help solve problems, experiment, analyze results, interpret results, and verify conclusions.

Core Curriculum Content Standards

A note about Mathematics Standards and Cumulative Progress Indicators.

A complete copy of the Core Curriculum Content Standards for Mathematics may also be found at:

NJDOE Mathematics Model Curriculum Grades K-12
http://www.nj.gov/education/modelcurriculum/math/

NJDOE Mathematics Curriculum K-12 pdf
http://www.state.nj.us/education/cccs/2016/math/standards.pdf

Common Core State Standards Initiative -- Mathematics
http://www.corestandards.org/Math/

Statistical Methods

Scope and Sequence

<table>
<tr><th colspan="2">Quarter I</th></tr>
<tr><td>Unit 1 Introduction to Statistics
I. Data classification
II. Variable and Data Types
III. Data Collection and Experimental Design</td><td>Unit 2 Descriptive Statistics:
I. Frequency Distributions and their Graphs
II. Histograms, Ogive, Stem Plot, Dot Plot, Scatter Plot
III. Measures of Central Tendency
IV. Measures of Variation
V. Measures of Position</td></tr>
<tr><td>Unit 3 Probability Introduction:
I. Basic Concepts of Probability and Counting
II. The Multiplication Rule
III. The Addition Rule</td><td></td></tr>
<tr><th colspan="2">Quarter II</th></tr>
<tr><td>Unit 4 Discrete Probability Distributions:
I. Probability Distributions
II. Binomial Distributions
III. Mean, Variance, Standard Distribution, Expectation</td><td>Unit 5 Normal Probability Distributions:
I. Introduction to Normal Distributions
II. Normal Distributions: Probabilities
III. Normal Distributions: Finding Values
IV. Central Limit Theorem</td></tr>
</table>

<table>
<tr><th colspan="2">Quarter III</th></tr>
<tr><td>Unit 6 Confidence Intervals:
I. Confidence Intervals for the Mean (σ known)
II. Confidence Intervals for the Mean (σ unknown)
III. Confidence Intervals for Variance and Standard Deviation</td><td>Unit 7 Hypothesis testing with One Sample:
I. Introduction to Hypothesis Testing
II. Hypothesis Testing for a Mean (σ known)
III. Hypothesis Testing for a Mean (σ unknown)
IV. Hypothesis Testing for a Proportion
V. Hypothesis Testing for Variance and Standard Deviation</td></tr>
<tr><td>Unit 8 Hypothesis Testing with Two Samples:
I. Testing the Difference Between Two Means
II. Testing the Difference between Two Variances</td><td></td></tr>
<tr><th colspan="2">Quarter IV</th></tr>
<tr><td>Unit 9 Correlation and Regression:
I. Correlation
II. Regression</td><td>Unit 10 Chi-Square:
I. Chi-Square Test
II. Analysis of Variance</td></tr>
</table>

<table>
<tr><td rowspan="4">Suggested days of Instruction
15 days</td><td rowspan="3"><u>Subject/Grade Level</u>: 11/12

Statistical Methods</td><td>Unit 1: Introduction to Statistics</td></tr>
<tr><td>Topic: Data Collection and Classification</td></tr>
<tr><td><u>Overarching Goals:</u>
(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.
(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.
(3) Investigate, research, and synthesize various information from a variety of media sources.</td></tr>
<tr><td><u>Goal 1:</u> The student will be able to use basis of language of statistics while collecting data and classifying the various data types.

<u>Student Learning Outcome</u>: Student will describe data with descriptive statistics.</td></tr>
<tr><td>Objectives / Cluster Concepts / Cumulative Progress Indicators (CPI's) The student will be able to:</td><td colspan="2">Essential Question(s): What provocative questions will foster inquiry, understanding, and transfer of learning?</td></tr>
</table>

	1.1. Define statistics and its branches (i.e. descriptive and inferential) S-IC A-1 1.2. Distinguish data sets S-IC A-2 1.3. Types of data, quantitative and qualitative S-ID B-5 1.4. Levels of measurement, nominal, ordinal, interval, ratio S-ID B-5 1.5. Design of a statistical study S-IC B-3 1.6. Data Collection S-IC A-1 1.7. Observational Study S-IC B-3 1.8. Experimental Design S-IC B-3 1.9. Sampling Techniques S-IC B-4	**Essential Questions:** • **How do you collect and classify data?** • **How do you distinguish between descriptive and inferential statistics?** • **How do you distinguish between quantitative and qualitative data?** • **What are considerations when collecting data, including technique and ethical concerns?** • **How do you design a statistical study?** • **How do you design a sample with and without bias using various sampling techniques?**

In this unit plan, the following 21st Century themes and skills are addressed:

Check all that apply.	**21st Century Themes**	*Indicate whether these skills are **E**-Encouraged, **T**-Taught, or **A**-Assessed in this unit by marking **E, T, A** on the line before the appropriate skill.*	**21st Century Skills**
X	**Global Awareness**	**E,T,A**	**Critical Thinking & Problem Solving**
	Environmental Literacy	**E,T,A**	**Creativity and Innovation**
	Health Literacy	**E,T,A**	**Collaboration, Teamwork and Leadership**
	Civic Literacy	**E,T,A**	**Cross-Cultural and Interpersonal Communication**
X	**Financial, Economic, Business and**		**Communication and Media Fluency**

		Entrepreneurial Literacy		**Accountability, Productivity and Ethics**

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	CRP1. Act as a responsible and contributing citizen and employee
E,T,A	**CRP2. Apply appropriate academic and technical skills**
	CRP3. Attend to personal health and financial well-being
E,T,A	**CRP4. Communicate clearly and effectively with reason**
E,T	**CRP5. Consider the environmental, social and economic impacts of decisions**
E,T,A	**CRP6. Demonstrate creativity and innovation**
E,T,A	**CRP7. Employ valid and reliable research strategies**
E,T,A	**CRP8. Utilize critical thinking to make sense of problems and persevere in solving them**

		CRP9. Model integrity, ethical leadership and effective management
	E	**CRP10. Plan education and career paths aligned to personal goals**
	E, T, A	**CRP11. Use technology to enhance productivity**
	E,T	**CRP12. Work productively in teams while using cultural global competence**

Assessment Evidence:

Formative: *(Through what authentic performance tasks will students demonstrate the desired understandings? By what criteria will performances of understanding be judged?)* **NOTE: The assessment models provided in this document are suggestions for the teacher. If the teacher chooses to develop his/her own model, *it must be of equal or better quality and at the same or higher cognitive levels (as noted in parentheses*).** **Depending upon the needs of the class, the assessment questions may be answered in the form of essays, quizzes, mobiles, PowerPoint, oral reports, booklets, or other formats of measurement used by the teacher.** ACCC Math 220 – Lab #2 Case Study Rating Television Shows Real Statistics – Real Decisions project	**Summative Assessment Measures*:*** *(Through what other evidence (E.g. quizzes, tests, academic prompts, observations, homework, journals, etc.) will students demonstrate achievement of the desired results? How will students reflect upon and self- assess their learning?)* ******Attach all Benchmarks*** Lesson Quizzes Unit Test Homework – per lesson

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15 days</td><td rowspan="3"><u>Subject/Grade Level</u>: 11/12

Statistical Methods</td><td>Unit 2 Descriptive Statistics</td></tr>
<tr><td>Topic: The use of descriptive statistics as a tool</td></tr>
<tr><td><u>Overarching Goals:</u>
(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.
(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.
(3) Investigate, research, and synthesize various information from a variety of media sources.</td></tr>
<tr><td><u>Goal 2:</u> The student will be able to organization and description of data sets to make data easier to understand by describing trends, averages, and variations

<u>Student Learning Outcome</u>: Student will build frequency distributions and present statistical results graphically; Student will describe data with descriptive statistics</td></tr>
<tr><td>Objectives / Cluster Concepts /
Cumulative Progress Indicators (CPI's)
The student will be able to:</td><td colspan="2">Essential Questions, Enduring Understandings, Sample Conceptual Understandings</td></tr>
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	2.1. Frequency Distribution S-ID A-2 2.2. Graphs of Frequency Distributions (i.e. histogram, frequency polygon, ogive) S-ID A-1 2.3a Electronic construction of graphs using frequency distributions S-ID A-1 2.3. Graphing Quantitative Data Sets (i.e. stemplot, dot plot) S-ID A-1 2.4. Graphing Qualitative Data Sets (i.e. pie chart, Pareto) S-ID B-5 2.4a Graphing Paired Data Sets (i.e. scatter plot, time series chart) S-ID B-6 2.4b Mean, Median, Mode, Range S-ID A-2 2.5. Weighted Mean S-ID A-2 2.6. Distribution Shapes S-ID A-2 2.7. Variance and Standard Deviation including the Interpretation S-ID A-4 2.8. Coefficient of Variation S-ID A-4 2.9. Creating and Applying Five Number Summary S-ID A-1-3 2.10. Standard Score S-ID A-4	**Essential Questions:** ● **How do you organize and describe data sets?** ● **How do you graph and interpret quantitative data sets using histograms and ogives?** ● **How do you graph and interpret quantitative data sets using stem and dot plots?** ● **How do you graph and interpret qualitative data sets using pie charts and Pareto charts?** ● **How do you graph and interpret paired data sets using scatter plots and time series charts?** ● **How do you describe data with measures of central tendency, variation, and/or position?** ● **How do you interpret numerical descriptions of data sets?** ● **How do you find variance and standard deviation od a population and sample?** ● **How do you use coefficient of variation to compare variation in different data sets?** ● **How do you use quartiles to describe data sets?** ● **How do you interpret other fractals such as percentiles and how to find percentiles?** ● **How to find and interpret the standard score?**

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	X	**Global Awareness**	**E,T,A**	**Critical Thinking & Problem Solving**
		Environmental Literacy	**E,T,A**	**Creativity and Innovation**
		Health Literacy	**E,T,A**	**Collaboration, Teamwork and Leadership**
		Civic Literacy	**E,T,A**	**Cross-Cultural and Interpersonal Communication**
	X	**Financial, Economic, Business and Entrepreneurial Literacy**		**Communication and Media Fluency**
				Accountability, Productivity and Ethics

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		CRP1. Act as a responsible and contributing citizen and employee
	E,T,A	**CRP2. Apply appropriate academic and technical skills**
		CRP3. Attend to personal health and financial well-being
	E,T,A	**CRP4. Communicate clearly and effectively with reason**
	E,T	**CRP5. Consider the environmental, social and economic impacts of decisions**
	E,T,A	**CRP6. Demonstrate creativity and innovation**
	E,T,A	**CRP7. Employ valid and reliable research strategies**
	E,T,A	**CRP8. Utilize critical thinking to make sense of problems and persevere in solving them**

		CRP9. Model integrity, ethical leadership and effective management
	E	**CRP10. Plan education and career paths aligned to personal goals**
	E, T, A	**CRP11. Use technology to enhance productivity**
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Assessment Evidence:

Formative: *(Through what authentic performance tasks will students demonstrate the desired understandings? By what criteria will performances of understanding be judged?)* **NOTE: The assessment models provided in this document are suggestions for the teacher. If the teacher chooses to develop his/her own model, *it must be of equal or better quality and at the same or higher cognitive levels (as noted in parentheses*).** **Depending upon the needs of the class, the assessment questions may be answered in the form of essays, quizzes, mobiles, PowerPoint, oral reports, booklets, or other formats of measurement used by the teacher.** ACCC Math 220 – Lab #1 Case Study Business Size Real Statistics – Real Decisions project	**Summative Assessment Measures:** *(Through what other evidence (E.g. quizzes, tests, academic prompts, observations, homework, journals, etc.) will students demonstrate achievement of the desired results? How will students reflect upon and self- assess their learning?)* ******Attach all Benchmarks*** Lesson Quizzes Unit Test Homework – per lesson

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15 days</td><td rowspan="3"><u>Subject/Grade Level</u>: 11/12

Statistical Methods</td><td>Unit 3 Probability Introduction</td></tr>
<tr><td>Topic: Applying basic probability to various events</td></tr>
<tr><td><u>Overarching Goals:</u>
(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.
(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.
(3) Investigate, research, and synthesize various information from a variety of media sources.</td></tr>
<tr><td><u>Goal 3:</u> The student will be able to determine the probability of an event.

<u>Student Learning Outcome:</u> Student will apply counting techniques to probability and discrete probability distributions</td></tr>
<tr><td>Objectives / Cluster Concepts /
Cumulative Progress Indicators (CPI's)
The student will be able to:</td><td colspan="2">Essential Questions, Enduring Understandings, Sample Conceptual Understandings</td></tr>
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	3.1. Probability Experiments S-CP A-1 3.2. The Fundamental Counting Experiment S-CP B-1 3.3. Classical, Subjective, Experimental Probability S-CP A-1 3.4. Complementary Events 3.5. Conditional Probability S-CP A-3 3.6. Independent and Dependent Events S-CP A-2 3.7. The Multiplication Rule S-CP B-8 3.8. The Addition Rule S-CP B-7 3.9. Permutations S-CP B-9 3.10. Combinations S-CP B-9 3.11. Applications of Probability S-MD B-5-7	**Essential Questions:** **How do you determine sample space?** **How do you use the Fundamental Counting Principle?** **How do you find and apply classical, subjective, and experimental probability?** **How do you find conditional probability?** **How do you find and apply Addition and Multiplication Rule for probability?** **When and how do you use permutations and combinations?**

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<table>
<tr><td rowspan="4">Suggested days of Instruction
22 days</td><td rowspan="3"><u>Subject/Grade Level</u>: 11/12

Statistical Methods</td><td>Unit 4 Discrete Probability Distributions</td></tr>
<tr><td>Topic: Creating and using probability distributions</td></tr>
<tr><td><u>Overarching Goals:</u>
(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.
(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.
(3) Investigate, research, and synthesize various information from a variety of media sources.</td></tr>
<tr><td><u>Goal 4:</u> The student will be able to create and use probability distributions.
Student Learning Outcome: Student will construct and employ confidence intervals</td></tr>
<tr><td>Objectives / Cluster Concepts /
Cumulative Progress Indicators (CPI's)
The student will be able to:</td><td colspan="2">Essential Questions, Enduring Understandings,
Sample Conceptual Understandings</td></tr>
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	4.1. Random Variables S-MD A-1 4.2. Discrete Probability Distributions S-MD A-1 4.3. Mean, Variance, and Standard Deviation S-MD A-2 4.4. Expected Value S-MD A-2, 3, 4 4.5. Binomial Experiments 4.6. Binomial Probability Formula 4.7. Using technology to find Binomial Probabilities 4.8. Graphing Binomial Distributions 4.9. Population Parameters of Binomial Distribution	**Essential Questions:** **How do you construct and graph discrete probability distributions?** **How do you find the mean, variance, and standard deviation of a discrete probability distribution?** **How do find expected value of a discrete probability distribution?** **How do you find binomial probabilities using, formulas, table, and technology?** **How do you construct and graph a binomial distribution?** **How do you find the mean, variance, and standard deviation of a binomial probability distribution?**

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<tr><td rowspan="4">Suggested days of Instruction
23 days</td><td rowspan="3"><u>Subject/Grade Level</u>: 11/12

Statistical Methods</td><td>Unit 5 Normal Probability Distributions</td></tr>
<tr><td>Topic: Normal Distribution Curves and use of their properties</td></tr>
<tr><td><u>Overarching Goals:</u>
(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.
(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.
(3) Investigate, research, and synthesize various information from a variety of media sources.</td></tr>
<tr><td><u>Goal 5:</u> The student will be able to recognize normal distributions and apply their properties to real-life situations.
Student Learning Outcome: Student will apply the Normal distribution, confidence intervals, sample size, hypothesis testing, analysis of variance, correlation, and regressio nto obtain statistical results with which they will draw conclusions.</td></tr>
<tr><td>Objectives / Cluster Concepts /
Cumulative Progress Indicators (CPI's)
The student will be able to:</td><td colspan="2">Essential Questions, Enduring Understandings, Sample Conceptual Understandings</td></tr>
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	5.1. Properties of a Normal Distribution S-ID A-4 5.2. Standard Normal Distribution Area S-ID A-4 5.3. Application of Normal Distribution S-ID A-4 5.4. Probability for Normal Distributions S-ID A-4 5.5. Finding and applying Z-score S-ID A-4 5.6. Sampling distributions S-MD A-3 5.7. The Central Limit Theorem	**Essential Questions:** **How do you interpret graphs of normal probability distributions?** **How do find area under the standard normal curve?** **How do find probabilities for normal distributions using a table and technology?** **How do you find *z*-score and transform it to an x-value?** **How do you apply normal distribution to find data?** **How do you find and verify sampling distribution?** **How do you interpret the Central Limit Theorem?** **How do you apply the Central Limit Theorem to find the probability of a sample mean?**

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<table>
<tr><td rowspan="4">Suggested days of Instruction
15 days</td><td rowspan="3"><u>Subject/Grade Level</u>: 11/12

Statistical Methods</td><td>Unit 6 Confidence Intervals</td></tr>
<tr><td>Topic: Confidence Intervals when σ is known, unknown, and population proportions</td></tr>
<tr><td><u>Overarching Goals:</u>
(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.
(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.
(3) Investigate, research, and synthesize various information from a variety of media sources.</td></tr>
<tr><td><u>Goal 6:</u> The student will be able to make a meaningful estimate by specifying an interval of values on a number line, together with a statement of how confident you are that your interval contains the population parameter.
Student Learning Outcome: Student will construct and employ confidence intervals.</td></tr>
<tr><td>Objectives / Cluster Concepts /
Cumulative Progress Indicators (CPI's)
The student will be able to:</td><td colspan="2">Essential Questions, Enduring Understandings, Sample Conceptual Understandings</td></tr>
</table>

	6.1. Estimation Population Parameter S-IC A, B 6.2. Confidence Intervals for a Population Mean S-IC B-3-4 6.3. Finding Minimum Sample Size to Estimate the Population S-IC B-3-4 6.4. Confidence Intervals and t-distribution S-IC B 3-6 6.5. Confidence Intervals for Population Proportions S-IC B-4, 6	**Essential Questions:** **What is inferential statistics?** **How do you find point estimate and margin of error?** **How do you construct and interpret confidence intervals for a population mean when σ is known?** **How do you determine the minimum sample size required when estimating a population sample size?** **How do you construct and interpret confidence intervals for a population mean when σ is unknown?** **How do you construct and interpret confidence intervals for a population proportion?** **How to determine the minimum sample size required when estimation a population proportion?**

In this unit plan, the following 21st Century themes and skills are addressed:

Check all that apply. **21st Century Themes**		*Indicate whether these skills are **E**-Encouraged, **T**-Taught, or **A**-Assessed in this unit by marking **E, T, A** on the line before the appropriate skill.* **21st Century Skills**	
X	**Global Awareness**	**E,T,A**	**Critical Thinking & Problem Solving**
	Environmental Literacy	**E,T,A**	**Creativity and Innovation**
	Health Literacy	**E,T,A**	**Collaboration, Teamwork and Leadership**
	Civic Literacy	**E,T,A**	**Cross-Cultural and Interpersonal Communication**
X	**Financial, Economic, Business and**		**Communication and Media Fluency**

		Entrepreneurial Literacy		**Accountability, Productivity and Ethics**

In this unit plan, the following Career Ready Practices are addressed:	
*Indicate whether these skills are **E**-Encouraged, **T**-Taught, or **A**-Assessed in this unit by marking **E, T, A** on the line before the appropriate skill.*	
	CRP1. Act as a responsible and contributing citizen and employee
E,T,A	**CRP2. Apply appropriate academic and technical skills**
	CRP3. Attend to personal health and financial well-being
E,T,A	**CRP4. Communicate clearly and effectively with reason**
E,T	**CRP5. Consider the environmental, social and economic impacts of decisions**
E,T,A	**CRP6. Demonstrate creativity and innovation**
E,T,A	**CRP7. Employ valid and reliable research strategies**
E,T,A	**CRP8. Utilize critical thinking to make sense of problems and persevere in solving them**

		CRP9. Model integrity, ethical leadership and effective management
	E	**CRP10. Plan education and career paths aligned to personal goals**
	E, T, A	**CRP11. Use technology to enhance productivity**
	E,T	**CRP12. Work productively in teams while using cultural global competence**

Assessment Evidence:

Formative: *(Through what authentic performance tasks will students demonstrate the desired understandings? By what criteria will performances of understanding be judged?)* **NOTE: The assessment models provided in this document are suggestions for the teacher. If the teacher chooses to develop his/her own model, *it must be of equal or better quality and at the same or higher cognitive levels (as noted in parentheses*).** **Depending upon the needs of the class, the assessment questions may be answered in the form of essays, quizzes, mobiles, PowerPoint, oral reports, booklets, or other formats of measurement used by the teacher.** ACCC Math 220 – Lab #3 Case Study: Marathon Training Real Statistics – Real Decisions project	**Summative Assessment Measures*:*** *(Through what other evidence (E.g. quizzes, tests, academic prompts, observations, homework, journals, etc.) will students demonstrate achievement of the desired results? How will students reflect upon and self- assess their learning?)* ******Attach all Benchmarks*** Lesson Quizzes Unit Test Homework – per lesson

<table>
<tr><td rowspan="4">Suggested days of Instruction
15 days</td><td><u>Subject/Grade Level</u>: 11/12

Statistical Methods</td><td>Unit 7 Hypothesis Testing with One Sample</td></tr>
<tr><td></td><td>Topic: Hypothesis Testing for Mean (σ known and unknown), Proportions, Variance and Standard Deviations</td></tr>
<tr><td></td><td><u>Overarching Goals:</u>
(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.
(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.
(3) Investigate, research, and synthesize various information from a variety of media sources.</td></tr>
<tr><td></td><td><u>Goal 7:</u> The student will be able to test a claim about a parameter.

<u>Student Learning Outcome</u>: Student will construct and employ confidence intervals
<u>Student Learning Outcome</u>: Student will apply the Normal distribution, confidence intervals, sample size, hypothesis testing, analysis of variance, correlation, and regressio nto obtain statistical results with which they will draw conclusions.</td></tr>
<tr><td></td><td>Objectives / Cluster Concepts /
Cumulative Progress Indicators (CPI's)
The student will be able to:</td><td>Essential Questions, Enduring Understandings, Sample Conceptual Understandings</td></tr>
</table>

	7.1. Hypothesis Test Terminology S-IC B 7.2. Stating a a Hypothesis S-IC B 7.3. Types of Errors and Level of Significance S-IC B 7.4. Statistical Test and *P*-Values 7.5. Decision Rule Based on *P*-Value 7.6. Hypothesis Testing for the Mean with Known Population Standard Deviation 7.7. Hypothesis Testing for the Mean with Unknown Population Standard Deviation 7.8. Hypothesis Test for Proportions 7.9. Hypothesis Test for Variance and Standard Deviation	**Essential Questions:** **What is a hypothesis test?** **How do you state a hypothesis?** **What are error types and interpret the level of significance?** **When do you use one-tail or tow-tailed statistical test and find *p*-value?** **How do you make and interpret a decision based on the results of a statistical test?** **How do you find and interpret *P*-values?** **How do you use *P*-values for a *z*-test for a mean when μ and σ is known?** **How to find critical values and rejection regions of a standard normal distribution?** **How to use rejection regions for a *z*-test for a mean μ when σ is known?** **How do you use *z*-test to test a population proportion?**

In this unit plan, the following 21st Century themes and skills are addressed:

Check all that apply. **21st Century Themes**		*Indicate whether these skills are **E**-Encouraged, **T**-Taught, or **A**-Assessed in this unit by marking **E, T, A** on the line before the appropriate skill.* **21st Century Skills**	
X	**Global Awareness**	**E,T,A**	**Critical Thinking & Problem Solving**
	Environmental Literacy	**E,T,A**	**Creativity and Innovation**
	Health Literacy	**E,T,A**	**Collaboration, Teamwork and Leadership**
	Civic Literacy	**E,T,A**	**Cross-Cultural and Interpersonal Communication**
X	**Financial, Economic, Business and**		**Communication and Media Fluency**

		Entrepreneurial Literacy		**Accountability, Productivity and Ethics**

In this unit plan, the following Career Ready Practices are addressed:	
*Indicate whether these skills are **E**-Encouraged, **T**-Taught, or **A**-Assessed in this unit by marking **E, T, A** on the line before the appropriate skill.*	
	CRP1. Act as a responsible and contributing citizen and employee
E,T,A	**CRP2. Apply appropriate academic and technical skills**
	CRP3. Attend to personal health and financial well-being
E,T,A	**CRP4. Communicate clearly and effectively with reason**
E,T	**CRP5. Consider the environmental, social and economic impacts of decisions**
E,T,A	**CRP6. Demonstrate creativity and innovation**
E,T,A	**CRP7. Employ valid and reliable research strategies**
E,T,A	**CRP8. Utilize critical thinking to make sense of problems and persevere in solving them**

		CRP9. Model integrity, ethical leadership and effective management
	E	**CRP10. Plan education and career paths aligned to personal goals**
	E, T, A	**CRP11. Use technology to enhance productivity**
	E,T	**CRP12. Work productively in teams while using cultural global competence**

Assessment Evidence:

Formative: *(Through what authentic performance tasks will students demonstrate the desired understandings? By what criteria will performances of understanding be judged?)* **NOTE: The assessment models provided in this document are suggestions for the teacher. If the teacher chooses to develop his/her own model, *it must be of equal or better quality and at the same or higher cognitive levels (as noted in parentheses*).** **Depending upon the needs of the class, the assessment questions may be answered in the form of essays, quizzes, mobiles, PowerPoint, oral reports, booklets, or other formats of measurement used by the teacher.** ACCC Math 220 – Lab #4 Case Study: Human Body Temperature What's Normal Real Statistics – Real Decisions project	**Summative Assessment Measures*:*** *(Through what other evidence (E.g. quizzes, tests, academic prompts, observations, homework, journals, etc.) will students demonstrate achievement of the desired results? How will students reflect upon and self- assess their learning?)* ******Attach all Benchmarks*** Lesson Quizzes Unit Test Homework – per lesson

<table>
<tr><td rowspan="4">Suggested days of Instruction
15 days</td><td rowspan="3"><u>Subject/Grade Level</u>: 11/12

Statistical Methods</td><td>Unit 8 Hypothesis Testing with Two Samples</td></tr>
<tr><td>Topic:</td></tr>
<tr><td><u>Overarching Goals:</u>
(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.
(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.
(3) Investigate, research, and synthesize various information from a variety of media sources.</td></tr>
<tr><td><u>Goal 8:</u> The student will be able to test a hypothesis that compares two populations.
<u>Student Learning Outcome</u>: Student will apply the Normal distribution, confidence intervals, sample size, hypothesis testing, analysis of variance, correlation, and regressio nto obtain statistical results with which they will draw conclusions.</td></tr>
<tr><td>Objectives / Cluster Concepts /
Cumulative Progress Indicators (CPI's)
The student will be able to:</td><td colspan="2">Essential Questions, Enduring Understandings, Sample Conceptual Understandings</td></tr>
</table>

	8.1. Independent and Dependent Samples 8.2. Two-Sample z-Test for the Difference Between Means 8.3. Testing the Difference Between Two Variances	**Essential Questions:** **How do you determine whether two samples are independent or dependent?** **How do you perform a two-sample *z*-test for the difference between two means using independent samples σ_1 and σ_2 known?** **How to hypothesis test for a difference between two variances?**

In this unit plan, the following 21st Century themes and skills are addressed:

Check all that apply. **21st Century Themes**		*Indicate whether these skills are **E**-Encouraged, **T**-Taught, or **A**-Assessed in this unit by marking **E, T, A** on the line before the appropriate skill.* **21st Century Skills**	
X	**Global Awareness**	**E,T,A**	**Critical Thinking & Problem Solving**
	Environmental Literacy	**E,T,A**	**Creativity and Innovation**
	Health Literacy	**E,T,A**	**Collaboration, Teamwork and Leadership**
	Civic Literacy	**E,T,A**	**Cross-Cultural and Interpersonal Communication**
X	**Financial, Economic, Business and**		**Communication and Media Fluency**

		Entrepreneurial Literacy		**Accountability, Productivity and Ethics**

In this unit plan, the following Career Ready Practices are addressed:	
*Indicate whether these skills are **E**-Encouraged, **T**-Taught, or **A**-Assessed in this unit by marking **E, T, A** on the line before the appropriate skill.*	
	CRP1. Act as a responsible and contributing citizen and employee
E,T,A	**CRP2. Apply appropriate academic and technical skills**
	CRP3. Attend to personal health and financial well-being
E,T,A	**CRP4. Communicate clearly and effectively with reason**
E,T	**CRP5. Consider the environmental, social and economic impacts of decisions**
E,T,A	**CRP6. Demonstrate creativity and innovation**
E,T,A	**CRP7. Employ valid and reliable research strategies**
E,T,A	**CRP8. Utilize critical thinking to make sense of problems and persevere in solving them**

		CRP9. Model integrity, ethical leadership and effective management
	E	**CRP10. Plan education and career paths aligned to personal goals**
	E, T, A	**CRP11. Use technology to enhance productivity**
	E,T	**CRP12. Work productively in teams while using cultural global competence**

Assessment Evidence:

Formative: *(Through what authentic performance tasks will students demonstrate the desired understandings? By what criteria will performances of understanding be judged?)* **NOTE: The assessment models provided in this document are suggestions for the teacher. If the teacher chooses to develop his/her own model, *it must be of equal or better quality and at the same or higher cognitive levels (as noted in parentheses*).** **Depending upon the needs of the class, the assessment questions may be answered in the form of essays, quizzes, mobiles, PowerPoint, oral reports, booklets, or other formats of measurement used by the teacher.** ACCC Math 220 – Lab #4 Real Statistics – Real Decisions project Case Study: How Protein Affects Weight Gain in Overeaters	**Summative Assessment Measures*:*** *(Through what other evidence (E.g. quizzes, tests, academic prompts, observations, homework, journals, etc.) will students demonstrate achievement of the desired results? How will students reflect upon and self- assess their learning?)* ******Attach all Benchmarks*** Lesson Quizzes Unit Test Homework – per lesson

<table>
<tr><td rowspan="4">Suggested days of Instruction
22 days</td><td rowspan="3"><u>Subject/Grade Level</u>: 11/12

Statistical Methods</td><td>Unit 9 Correlation and Regression</td></tr>
<tr><td>Topic: Correlation, Regression, and Prediction Intervals</td></tr>
<tr><td><u>Overarching Goals:</u>
(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.
(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.
(3) Investigate, research, and synthesize various information from a variety of media sources.

<u>Goal 9:</u> The student will be able to calculate and apply properties of correlation and regression to real-life problems.

<u>Student Learning Outcome</u>: Student will apply the normal distribution, confidence intervals, sample size, hypothesis testing, analysis of variance, correlation, and regression to obtain statistical results with which they will draw conclusions</td></tr>
<tr><td>Objectives / Cluster Concepts /
Cumulative Progress Indicators (CPI's)
The student will be able to:</td><td>Essential Questions, Enduring Understandings, Sample Conceptual Understandings</td></tr>
</table>

	9.1. Correlation Introduction S-ID B-5 9.2. Correlation Coefficient S-ID B-5-6, C-8 9.3. Test a Population Correlation Coefficient S-ID B-5, C-8 9.4. Hypothesis Testing for a Population Correlation Coefficient S-ID B-5, 6, C-8 9.5. Correlation and Causation S-ID C-9 9.6. Regression Lines and their Application S-ID B-6a-c, S-ID C-7-8 9.7. Variation of a Regression Line S-ID B-6b 9.8. Coefficient of Determination S-ID C-8 9.9. Standard Error of Estimate S-ID C-8 9.10. Prediction Intervals S-ID C-9 9.11. Multiple Regression Equations 9.12. Prediction *y*-Values S-ID C-9	**Essential Questions:** **What is correlation and types of correlation?** **How do you find correlation coefficient?** **How do you test a population correlation coefficient ρ using a table?** **How to perform a hypothesis test for a population correlation coefficient?** **How do you determine between correlation and causation?** **How do you find the equation of a regression line?** **How do you predict *y*-values using a regression equation?** **How to interpret the three types of variation about a regression line?** **How to find and interpret the coefficient of determination?** **How to find and interpret the standard error of estimate for a regression line?** **How to construct and interpret a prediction interval for *y*?** **How to use technology to find and interpret correlation and multiple regression?** **How to use multiple regression to predict *y*-values?**

In this unit plan, the following 21st Century themes and skills are addressed:

Check all that apply. **21st Century Themes**		*Indicate whether these skills are **E**-Encouraged, **T**-Taught, or **A**-Assessed in this unit by marking **E, T, A** on the line before the appropriate skill.* **21st Century Skills**	
X	**Global Awareness**	**E,T,A**	**Critical Thinking & Problem Solving**
	Environmental Literacy	**E,T,A**	**Creativity and Innovation**

	Health Literacy	E,T,A	Collaboration, Teamwork and Leadership
	Civic Literacy	E,T,A	Cross-Cultural and Interpersonal Communication
X	Financial, Economic, Business and Entrepreneurial Literacy		Communication and Media Fluency
			Accountability, Productivity and Ethics

In this unit plan, the following Career Ready Practices are addressed:

*Indicate whether these skills are **E**-Encouraged, **T**-Taught, or **A**-Assessed in this unit by marking **E, T, A** on the line before the appropriate skill.*

	CRP1. Act as a responsible and contributing citizen and employee
E,T,A	CRP2. Apply appropriate academic and technical skills
	CRP3. Attend to personal health and financial well-being
E,T,A	CRP4. Communicate clearly and effectively with reason
E,T	CRP5. Consider the environmental, social and economic impacts of decisions
E,T,A	CRP6. Demonstrate creativity and innovation
E,T,A	CRP7. Employ valid and reliable research strategies
E,T,A	CRP8. Utilize critical thinking to make sense of problems and persevere in solving them

		CRP9. Model integrity, ethical leadership and effective management
	E	**CRP10. Plan education and career paths aligned to personal goals**
	E, T, A	**CRP11. Use technology to enhance productivity**
	E,T	**CRP12. Work productively in teams while using cultural global competence**

Assessment Evidence:

Formative: *(Through what authentic performance tasks will students demonstrate the desired understandings? By what criteria will performances of understanding be judged?)* **NOTE: The assessment models provided in this document are suggestions for the teacher. If the teacher chooses to develop his/her own model, *it must be of equal or better quality and at the same or higher cognitive levels (as noted in parentheses*).** **Depending upon the needs of the class, the assessment questions may be answered in the form of essays, quizzes, mobiles, PowerPoint, oral reports, booklets, or other formats of measurement used by the teacher.** ACCC Math 220 – Lab #5 Real Statistics – Real Decisions project	**Summative Assessment Measures*:*** *(Through what other evidence (E.g. quizzes, tests, academic prompts, observations, homework, journals, etc.) will students demonstrate achievement of the desired results? How will students reflect upon and self- assess their learning?)* ******Attach all Benchmarks*** Lesson Quizzes Unit Test Homework – per lesson

<table>
<tr><td rowspan="4">Suggested days of Instruction
23 days</td><td rowspan="3"><u>Subject/Grade Level</u>: 11/12

Statistical Methods</td><td>Unit 10 Chi-Square</td></tr>
<tr><td>Unit 10 Topic: Chi-square and Analysis of Variance (ANOVA)</td></tr>
<tr><td><u>Overarching Goals:</u>
(1) Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.
(2) Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.
(3) Investigate, research, and synthesize various information from a variety of media sources.</td></tr>
<tr><td><u>Goal 10:</u> The student will be able to use ANOVA to determine if there is a significant difference among three or more means.
Student learning outcomes: Student will apply the normal distribution, confidence intervals, sample size, hypothesis testing, analysis of variance, correlation, and regression to obtain statistical results with which they will draw conclusions; Student will use technology to help solve problems, experiment, analysis results, interpret results, and verify conclusions</td></tr>
<tr><td>Objectives / Cluster Concepts /
Cumulative Progress Indicators (CPI's)
The student will be able to:</td><td colspan="2">Essential Questions, Enduring Understandings,
Sample Conceptual Understandings</td></tr>
</table>

	10.1. Chi-Square Distribution 10.2. Contingency Tables 10.3. Chi-Square Independence Test 10.4. *F*-Distribution 10.5. Two -Sample *F*-Test for Variance 10.6. Analysis of Variance (ANOVA)	**Essential Questions:** **What is Chi-Square distribution?** **How to find critical values for a chi-square test?** **How to use the chi-square distribution to test whether a frequency distribution fits an expected distribution?** **How to use a contingency table?** **How to use a chi-square distribution to test whether two variables are independent?** **How do you interpret *F*-distribution and use *F*-table to find critical values?** **How to perform a two-sample *F*-test to compare two variances?** **How to use analysis of variance to test claims involving three or more means?**

In this unit plan, the following 21st Century themes and skills are addressed:

Check all that apply. **21st Century Themes**		*Indicate whether these skills are **E**-Encouraged, **T**-Taught, or **A**-Assessed in this unit by marking **E, T, A** on the line before the appropriate skill.* **21st Century Skills**	
X	**Global Awareness**	**E,T,A**	**Critical Thinking & Problem Solving**
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X	**Financial, Economic, Business and**		**Communication and Media Fluency**

		Entrepreneurial Literacy		**Accountability, Productivity and Ethics**

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E,T,A	**CRP2. Apply appropriate academic and technical skills**
	CRP3. Attend to personal health and financial well-being
E,T,A	**CRP4. Communicate clearly and effectively with reason**
E,T	**CRP5. Consider the environmental, social and economic impacts of decisions**
E,T,A	**CRP6. Demonstrate creativity and innovation**
E,T,A	**CRP7. Employ valid and reliable research strategies**
E,T,A	**CRP8. Utilize critical thinking to make sense of problems and persevere in solving them**

		CRP9. Model integrity, ethical leadership and effective management
	E	**CRP10. Plan education and career paths aligned to personal goals**
	E, T, A	**CRP11. Use technology to enhance productivity**
	E,T	**CRP12. Work productively in teams while using cultural global competence**

Assessment Evidence:

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Modifications

Additional considerations for English Language Learners (ELLs), Special Needs, Below Level (BSI)

Individualized Education Plans (IEPs):

- ⇒ Exemplars of varied performance levels
- ⇒ Multi-media presentations Consultation with ESL teachers
- ⇒ Manipulatives
- ⇒ Tiered/Scaffolded Lessons
- ⇒ Mnemonic devices
- ⇒ Visual aids
- ⇒ Modeling
- ⇒ Guided note-taking
- ⇒ Study Guides
- ⇒ Modified homework
- ⇒ Differentiated pre-typed class notes and example problems

Advanced/Gifted Students:

- ⇒ Open-ended responses
- ⇒ Curriculum Compacting
- ⇒ Advanced problems to extend the critical thinking skills of advanced learner
- ⇒ Supplemental reading material for independent study
- ⇒ Flexible grouping
- ⇒ Tiered assignments

Resources

Elementary Statistics: Picturing the world

Supplemental Material from The Practice of Statistics