

**Atlantic Cape Community College  
Mathematics Department**

**MATH220 Statistical Methods      Credits: 4-0-4**

**COURSE DESCRIPTION**

**Prerequisite:**

Completion of Math 074 or Math 080 with a grade of C or better or Placement Test or SAT scores.

Topics of study include frequency distributions and graphs, data description, counting techniques, probability, discrete probability distributions, the normal distribution, confidence intervals and sample size, hypothesis testing, analysis of variance, correlation, and regression. Students will be required to work with a graphing calculator and a computer software program.

**TEXTBOOK AND MATERIALS**

- A Brief Version Elementary Statistics A Step by Step Approach - 7<sup>th</sup> edition by Bluman
- The TI-83 or TI-84plus Graphing Calculator will be used during classroom demonstrations; therefore the **TI-83 or TI-84plus is required**. If you choose a calculator other than the TI-83 or TI-84plus, it is your responsibility to learn the statistical applications by reading your user manual.
- Notebook: A loose-leaf notebook is highly recommended for taking notes and recording homework. Group work assignments can also be easily inserted into its proper location for reviewing for a test.

**COURSE GOALS**

**Students will:**

- Students will explore the nature of probability and statistics.
- Students will express statistical results graphically.
- Students will begin to appreciate and understand applications of counting techniques and probabilities.
- Students will apply the normal distribution to obtain statistical results.
- Students will construct and employ confidence intervals.
- Students will formulate conclusions through hypothesis testing.
- Students will formulate conclusions through regression analysis.
- Use technology to help solve problems, experiment, analyze results, interpret results, and verify conclusions.

**Student Learning Outcomes:**

**Students will be able to:**

- Build frequency distributions and present statistical results graphically
- Describe data with descriptive statistics
- Apply counting techniques to probability and discrete probability distributions
- Construct and employ confidence intervals.
- 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
- Use technology to help solve problems, experiment, analyze results, interpret results, and verify conclusions.

### ASSESSMENT STRATEGIES:

Student Learning Outcomes	Assessment Strategies
<ul style="list-style-type: none"> <li>• Students will be able to build frequency distributions and present statistical results graphically</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Minitab</b> Lab(s)</li> <li>• Comprehensive Exam</li> <li>• Classroom Observation</li> </ul>
<ul style="list-style-type: none"> <li>• Students will be able to describe data with descriptive statistics</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Minitab</b> Lab(s) or a Project</li> <li>• Comprehensive Exam</li> <li>• Classroom Observation</li> </ul>
<ul style="list-style-type: none"> <li>• Students will be able to apply counting techniques to probability and discrete probability distributions</li> </ul>	<ul style="list-style-type: none"> <li>• Comprehensive Exam</li> <li>• Classroom Observation</li> </ul>
<ul style="list-style-type: none"> <li>• Students will be able to 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</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Minitab</b> Lab(s)</li> <li>• Comprehensive Exam</li> <li>• Classroom Observation</li> </ul>
<ul style="list-style-type: none"> <li>• Students will be able to construct and employ confidence intervals.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Minitab</b> Lab(s)</li> <li>• Comprehensive Exam</li> <li>• Classroom Observation</li> </ul>

### College Grading Scale:

93–100 = A (as there is no A+)  
 90–92 = A-  
 87–89 = B+  
 83–86 = B  
 80–82 = B-  
 77–79 = C+  
 70–76 = C (as there is no C-)

60–69 = D  
59+below = F

### **ADA Accommodations**

As per the Americans with Disabilities Act (ADA), reasonable accommodations can be provided to students who present current documentation (within five years) of a disability to Atlantic Cape Community College's Center for Accessibility, located on the first floor of "J" Building in the Counseling and Support Services department (Mays Landing campus). Reasonable accommodations cannot be provided for a course until the student registers with the Center for Accessibility. For more information, please contact the Center for Accessibility via email at [cfa@atlantic.edu](mailto:cfa@atlantic.edu) or call [609-343-5680](tel:609-343-5680).

**The remaining portion of this syllabus gives the outline for the class lectures followed by a complete list of class exercises and homework exercises.**

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## Course Learning Objectives by Chapter

### CHAPTER ONE

#### The Nature of Probability and Statistics

##### 1-1: Descriptive and Inferential Statistics

- Students will be able to demonstrate knowledge of statistical terms.
- Students will be able to differentiate between the two branches of statistics.

##### 1-2: Variables and Types of Data

- Students will be able to identify types of data.
- Students will be able to identify measurement level for each variable.

##### 1-3: Data Collection and Sampling Techniques

- Students will be able to identify the four basic sampling techniques.

##### 1-4: Experimental Design

- Students will be able to differentiate between an observational and an experimental study.
- Students will be able to explain how statistics can be used and misused.

##### 1-5: Computers and Calculators

- Students will be able to explain the importance of computers and calculators in statistics.

### CHAPTER TWO

#### Frequency Distributions and Graphs

##### 2-1: Organizing Data

- Students will be able to organize data using frequency distributions.

##### 2-2: Histograms, Frequency Polygons, and Ogives

- Students will be able to represent data in frequency distributions graphically using histograms, frequency polygons, and ogives.
- Students will be able to recognize and differentiate between distribution shapes.

##### 2-3: Other Types of Graphs

- Students will be able to represent data using bar graphs, Pareto charts, time series graphs, pie graphs and dot plots.
- Students will be able to construct and interpret a stem and leaf plot.

##### 2-4: Paired Data and Scatter Plots

- Students will be able to draw and interpret a scatter plot for a set of paired data.

#### QUIZ #1

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### CHAPTER THREE

#### Data Description

**3-1: Measures of Central Tendency**

- Students will be able to summarize data using measures of central tendency, such as the mean, median, mode and midrange.

**3-2: Measures of Variation**

- Students will be able to describe data using measures of variation, such as the range, variance, standard deviation, coefficient of variation, empirical rule and Chebyshev's Theorem.

**3-3: Measures of Position**

- Students will be able to identify the position of a data value in a data set using various measures of position such as percentiles, deciles and quartiles.

**3-4: Exploratory Data Analysis**

- Students will be able to use the techniques of exploratory data analysis, including box plots and five number summaries to discover various aspects of data.

**LAB #2:**

- Students will be able to calculate the measure of central tendency and dispersion using computer software.

**QUIZ #2****CHAPTER SIX****The Normal Distribution****6-1: Normal Distribution**

- Students will be able to identify distributions as symmetrical or skewed.
- Students will be able to identify the properties of the normal distribution.
- Students will be able to determine the area under the standard normal distribution, given various  $z$  values.

**6-2: Applications of the Normal Distribution**

- Students will be able to find probabilities for a normally distributed variable by transforming it into a standard normal variable.
- Students will be able to determine specific data values for given percentages using the standard normal variable.

**6-3: The Central Limit Theorem**

- Students will be able to apply the central limit theorem to solve problems involving sample means for large samples.

**CHAPTER SEVEN****Confidence Intervals and Sample Size****7-1: Confidence Intervals for the Mean when the  $\sigma$  is Known**

- Students will be able to find the confidence interval for the mean, when  $\sigma$  is known (Either  $n \geq 30$  or  $\sigma$  is known when  $n < 30$ ).

- Students will be able to calculate the minimum sample size for finding a confidence interval for the mean.

#### 7-2: Confidence Intervals for the Mean when $\sigma$ is Unknown

- Students will be able to find the confidence interval for the mean when  $\sigma$  is unknown and  $n < 30$ ).

#### 7-4: Confidence Intervals for Variances and Standard Deviations

- Students will be able to find a confidence interval for a variance and a standard deviation.

#### LAB #3:

Students will be able to calculate confidence intervals using computer software.

#### QUIZ #3

### CHAPTER EIGHT

#### Hypothesis Testing

#### 8-1: Steps in Hypothesis Testing – Traditional Method

- Students will be able to define the terminology used in hypothesis testing.
- Students will be able to state the null and alternative hypothesis and identify the claim.
- Students will be able to determine the critical values for the  $z$  test.
- Students will be able to state the five steps used in hypothesis testing.

#### 8-2: $z$ Test for a Mean

- Students will be able to test means when  $\sigma$  is known, using the  $z$  test.

#### 8-3: $t$ Test for a Mean

- Students will be able to test means when  $\sigma$  is unknown, using the  $t$  test.

### CHAPTER NINE

#### Testing the Differences Between Two Means, Two Proportions and Two Variances.

#### 9-1: Testing the Differences Between Two Means: Using the $Z$ Test

- Students will be able to test the difference between two means, using the  $z$ -test.

#### 9-5: Testing the Differences Between Two Variances

- Students will be able to test the differences between two variances or two standard deviations.

#### LAB #4:

Students will be able to conduct hypothesis tests using computer software.

### CHAPTER TEN

#### Correlation and Regression

**10-1: Correlation**

- Students will be able to draw a scatter plot for a set of ordered pairs, and predict from the pattern whether there is a positive correlation, negative correlation or no correlation.
- Students will be able to compute the correlation coefficient.
- Students will be able to conduct a hypothesis test to determine significant correlation.

**10-2: Regression**

- Students will be able to compute the equation of the regression line.
- Students will be able to make predictions with the equation of the regression line.

**LAB #5:**

Students will be able to construct scatter plots and run correlation and regression analysis using computer software.

**CHAPTER Eleven****Chi-Square and Analysis of Variance (ANOVA)****11-3: Analysis of Variance (ANOVA)**

- Students will be able to use the ANOVA technique to determine if there is a significant difference among three or more means.

**LAB #6:**

Students will be able to conduct an ANOVA using computer software.

**QUIZ #4****CHAPTER FOUR****Probability and Counting Rules****4-1: Sample Spaces and Probability**

- Students will be able to determine sample spaces and find the probability of an event using classical probability or empirical probability.

**4-2: The Addition Rules for Probability**

- Students will be able to calculate the probability of compound events using the addition rules.

**4-3: The Multiplication Rules and Conditional Probability**

- Students will be able to determine the probability of compound events using the multiplication rules.
- Students will be able to calculate the conditional probability of an event.

**CHAPTER FIVE****Discrete Probability Distributions****5-1: Probability Distributions**

- Students will be able to construct a probability distribution of a random variable.

**5-2: Mean, Variance, Standard Deviation and Expectation**

- Students will be able to calculate the mean, variance, standard deviation and expected value for a discrete random variable.

**5-3: The Binomial Distribution**

- Students will be able to determine the exact probability for  $X$  successes in  $n$  trials of a binomial experiment.

- Students will be able to calculate the mean, variance, and standard deviation for the variable of a binomial distribution.

## **FINAL EXAM**

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