**Math 103: Statistics**

**Guttman Community College**

**Insert Meeting times**

|  |  |
| --- | --- |
| Instructor: Email: Phone: Course eportfolio: | Office: Office Hours:   |

**Catalogue Description and Overview**

This course will provide students with an in‐depth understanding of the fundamental concepts and computational methods of statistics. These concepts will be developed through the question of how to estimate an unknown quantity using sample data. Students will learn to incorporate the foundational concepts of mathematics with statistical analysis to describe and solve real-life problems and questions. Students will be taught to use estimation as well as to be precise and accurate. The course will also focus on teaching math study skills so students may assess and enhance their learning, their processes and their results. Students will use statistical software, or Microsoft Excel to carry out a semester‐long project involving data description and analysis. Students will work collaboratively and write using appropriate mathematical and non-mathematical language in order to successfully complete their projects.

The topics addressed include: displaying categorical data using tables, bar graphs, and circle graphs; drawing conclusions about categorical data; displaying quantitative data using dot plots, stem-and-leaf plots, histograms and box-and-whisker plots; describing data distributions using measures of center (mode, mean, and median) and measures of spread (standard deviation, range and IQR); Displaying bivariate data using scatterplots; analyzing bivariate data using linear regression; elementary probability; normal probability distributions, sampling distributions; confidence intervals and hypothesis testing of the proportion and the mean.

**Co-requisites or Pre-requisites:** Demonstration of Elementary Algebra Proficiency

**Credits/Contact Hours:** 3 credits/4.5 contact hours

**CUNY Pathways Category:** Mathematics and Quantitative Reasoning

 **Course Learning Outcomes:**

Upon successful completion of the course, students will be able to:

1. Identify and apply the concepts of numeracy to solve statistical and mathematical problems both with and without technological assistance.
2. Represent and know how to read, collect and organize data in written and graphical forms as well as interpret the data and make appropriate inferences from their readings.
3. Demonstrate an understanding of proportional relationships and how statistical inference is based in probability.
4. Design a project involving sample data from a variety of fields and appropriate statistical data analysis including formulating a question, selecting data and recognizing which statistical model is most appropriate for different data types and to answer different questions.
5. Recognize and understand functions as a way of modeling correspondence between two variables and employ appropriate statistical language, correct written English, and illustrative graphical depictions to communicate the relationship.
6. Construct, compute and accurately interpret confidence intervals and hypothesis tests and determine if the data supports a hypothesis to a given level of significance.
7. Demonstrate the ability to work collaboratively and independently on assignments in and outside a classroom setting.
8. Estimate mathematical quantities and evaluate the accuracy of their answers and adjust their work when necessary.

**Guttman Learning Outcomes**

Upon successful completion of this course, you will be able to do the following:

**Broad, Integrative Knowledge:**

1. Exhibits an understanding of how different disciplines create knowledge and approach problem-solving

**Intellectual Skills for Life-Long Learning**

1. Presents accurate mathematical calculations and operations, and explains how they are used to solve problems and to interpret data.
2. Utilizes both quantitative and qualitative data to explore and understand important issues.
3. Locates, evaluates and cites multiple information resources in projects, papers and presentations.
4. Demonstrates ability to use appropriate technologies, acquire new ones and to resolve technology problems to meet academic, professional and personal goals
5. Displays ability to assess own work and its relative value

**Required Texts/Readings**

Illowsky, B., Dean, Susan. *Introductory Statistics.* Texas, Houston: OpenStax. Download for free at

<https://openstax.org/details/books/introductory-statistics>

**Required Materials**

A student account to MyOpenMath: <https://www.myopenmath.com/>

Access to the Internet

Digication ePortfolio

**Classroom Policies and Expectations for Classroom Participation & Engagement**

*Policy on attendance: Insert your attendance policy*

*Insert other policies specific to you and your classroom*

*Insert your expectations for classroom behavior and engagement here. You might consider food and drink policy, what to do in the event of an absence, cell phone use, participation, etc..*

**Assignments and Assessment**

*MyOpenMath Problem Sets:* *Explain how you will structure the MyOpenMath assignments*

*Short Quizzes:* *Will you have quizzes? If so insert information about them here*

*Chapter Tests: This can vary some if you wish but you must have at least four tests. You should decide what you want your policy on make ups to be.*

*There will be four tests during the semester. These will be given during class and will be completed individually. No make-up tests will be given unless prior arrangements are made and the reason for the absence was unavoidable.*

*Project/Signature Assignment:* The signature assignment for this course requires you to organize and analyze data using the statistical techniques that you have learned during the course. You will pose a research question, gather or identify data that can be used to help answer your question, analyze the data, and write a paper or give a presentation (depending on the choice of the instructor) that describes your data analysis and conclusions. Specific details about this assignment will be distributed by your instructor.

*Technology Use:* *(You may adjust as desired for your course but you should use some type of technology for the statistical calculations.)*

You are encouraged to make appropriate use of technology throughout this course. We will use both Excel and Statistics software that will help streamline needed computations. Note that during tests and quizzes any technology that is used should be used for computational purposes only. Access to other people and/or the internet is not allowed during tests and quizzes.

**College-wide Policies**

*Policy on Academic Honesty*

Guttman Community College considers intellectual honesty to be the cornerstone of all academic and scholarly work. GCC views any form of academic dishonesty as a serious matter and requires all instructors to report every case of academic dishonesty to its Academic Integrity Officer, who keeps records of all cases. All work submitted or posted by students in this course must be their own. Submission of writing or ideas which are not the original work of the student, or which is not adequately referenced, is considered plagiarism. Unintentional plagiarism is still plagiarism, so if you have any question about whether or not to acknowledge a source, acknowledge it. And if you are still uncertain, be sure to ask. Refer to Article II of your Student Grievance Procedures for further details on academic honesty and Guttman’s academic integrity procedures, at [Academic Policies url link] Penalties for academic dishonesty include academic sanctions, such as failing or otherwise reduced grades, and/or disciplinary sanctions, including suspension or expulsion.

*Disability Support Services*

In compliance with the American Disability Act of 1990 (ADA) and with Section 504 of the Rehabilitation Act of 1973, Guttman Community College is committed to ensuring educational parity and accommodations for all students with documented disabilities and/or medical conditions. It is recommended that all students with documented disabilities (Emotional, Medical, Physical and/ or Learning) consult the Office of AccessABILITY located in Room 506 to secure necessary academic accommodations.  For further information and assistance please call 646-313-8061 or speak to your Student Success Advocate or Career Strategist.

*Critical Incident Management*

Guttman expects students to respect the rights, privileges and property of other people. Faculty are required to report disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment or inhibits students' ability to learn.

*Viewpoint Tolerance*

Some of the issues covered during the seminar may evoke strong emotions. Students, faculty and staff must be able to disagree respectfully with others on topics that are personally very important to them. **Civility is essential to all scholarly discourse**.

*Expectations for Out-of-Class Time*

For every one instructional credit hour in class, a Guttman student is expected to spend at least two hours out-of-class studying, reading, writing, researching and working on projects, and preparing for tests. E.g. for a 3 credit course that meets for 3 hours each week, a student is expected to spend at least 6 hours outside of class time doing related course work. If a course provides more time in class than one hour for one credit, the additional time may offset out- of- class time expectations.

**Assessment**

Means of Formative and Summative Assessment

1. Frequent quizzes *(these are optional)*
2. Four in-class tests, some of which may include a take-home portion. Tentative test dates are *Insert your dates here*.
3. A final examination, comprising take‐home and in‐class components *(This is optional – you decide. BUT you must have some type of meeting during the culminating course experience/final exam time. If you do not have a final, you could have project presentations.)*
4. A semester‐long project to be written in phases, including:
	1. The formulation of a research question
	2. the design of data collection and sampling methods
	3. collecting data
	4. descriptive analysis of the database population represented graphically, mathematically and in text
	5. calculating confidence interval and performing an hypothesis test
	6. final paper and presentation to be included in students’ ePortfolio
5. Weekly online problem sets

**Grading:** ***These percentages can vary some from one professor to another. Every section of the course must include a semester project, MyOpenMath homework, and at least 4 chapter tests. In most sections the tests and final exam combined are worth approximately 50% of the grade for the class. This is one possibility for the breakdown of grades.***

Attendance and participation 10%

MyOpenMath Homework 15%

Quizzes 10%

Chapter Tests 40%

Final Exam 10%

Semester-long project: 15%

Overall grades will be based on the following scale

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| A+  | 97% and up | A | Between 93% and 97% | A- | Between 90% and 93% |
| B+ | Between 87% and 90% | B | Between 83% and 87% | B- | Between 80% and 83% |
| C+ | Between 77% and 80% | C | Between 73% and 77% | C- | Between 73% and 70% |
| D+ | Between 67% and 70% | D | Between 60% and 67% | NC or F | Below 60% |

Incompletes are rarely given and will only be considered under the following circumstances: The student has completed the majority of the work for the course, the student is passing the course based on the work completed at the time the incomplete is requested, and there are extenuating circumstances that prohibit the completion of a small portion of the course.

***Conferences****:* Students will have one conference with the professor to discuss their progress. Students and the professor will work together in order to insure a comfortable and successful class.

**Calendar: You may change the timing here if you would like, but the coverage must remain as described here.**

**Classes 1-5**

**Unit 1. Sampling and Data**

|  |
| --- |
| **Objectives** |
| * Recognize and differentiate between key terms; [*data, frequency, quantitative variables*](https://www.myopenmath.com/assessment/showtest.php?id=3855607&cid=53160)*, qualitative variables, discrete variable, continuous variable, population, sample, statistic, parameter, mean, and proportion.*
* Find and use rates, including percentages.
* Know how to draw a random sample and understand that random sampling reduces bias.
* Create and interpret frequency, relative frequency, and cumulative frequency tables.
* Distinguish between observational studies and controlled experiments.
* Identify explanatory and response variables, treatments, control and treatment groups, and possible lurking variables.
* Understand what it means for an experiment to be blind or double blind.
 |

Reference: Chapter 1 of Introductory Statistics- OpenStax

Section 1.1. Definitions of Statistics, Probability, and Key Terms

Section 1.2. Data, Sampling, and Variation in Data and Sampling

Section 1.3. Frequency, Frequency Tables, and Levels of Measurement

Section 1.4. Experimental Design and Ethics

**Classes 6-11**

**Unit 2. Descriptive Statistics**

|  |
| --- |
| **Objectives** |
| * Know how to make [histograms, dotplots](https://www.myopenmath.com/assessment/showtest.php?id=3855612&cid=53160), [stemplots, bar graphs](https://www.myopenmath.com/assessment/showtest.php?id=3855613&cid=53160), and box plots and interpret the graphs in context.
* Calculate and interpret the measures of center of data: mean, median, and mode.
* Calculate and interpret the measures of location of data: median, quartiles, and percentiles.
* Calculate and interpret the measures of spread of data: variance, standard deviation, interquartile range, and range.
* Identify the shape of data distribution.
* Use the 1.5-rule to identify outliers.
* Know how measures of center and spread are related to the shape of a data distribution.
* Compare centers and spreads of distributions of samples informally.
* Write comparison statements between samples of data in context.
* Determine and interpret *z*-scores and compare values from different data sets using *z*-scores.
 |

Reference: Chapter 2 of Introductory Statistics- OpenStax

Section 2.1. Stem-and-Leaf Graphs (Stemplots), Line Graphs, and Bar Graphs

Section 2.2. Histograms, Frequency Polygons, and Time Series Graphs

Section 2.3. Measures of the Location of the Data

Section 2.4. Box Plots

Section 2.5. Measures of the Center of the Data

Section 2.6. Skewness and the Mean, Median, and Mode

Section 2.7. Measures of the Spread of the Data

**Classes 12-14**

**Unit 3. Linear Regression and Correlation**

|  |
| --- |
| **Objectives** |
| * Discuss basic ideas of linear regression and correlation.
* Describe and interpret strength, trend, and shape of scatterplots.
* Calculate and interpret the correlation coefficient.
* Explain the difference between correlation and causation.
* Create and interpret a line of best fit and know how to use the regression line to predict values of the response variable.
* Identify outliers and describe how outliers might affect correlation and the regression line.
 |

Reference: Chapter 12 of Introductory Statistics- OpenStax

Section 12.1. Linear Equations

Section 12.2. Scatter Plots

Section 12.3. The Regression Equation

Section 12.5. Prediction

**Classes 15-16**

**Unit 4. Probability Topics**

|  |
| --- |
| **Objectives** |
| * Understand that probability is a long-term relative frequency.
* Know the difference between empirical and theoretical probabilities and how to calculate them.
* Understand that The Law of Large Numbers enables us to use empirical probabilities to estimate theoretical probabilities.
* Calculate probability from contingency tables.
 |

Reference: Chapter 3 of Introductory Statistics- OpenStax

Section 3.1. Terminology

Section 3.4. Contingency Tables

**Classes 17-19**

**Unit 5.** [**Probability Distribution Functions**](https://www.myopenmath.com/assessment/showtest.php?id=3855710&cid=53160) **and the Normal Distribution**

|  |
| --- |
| **Objectives** |
| * Recognize and understand discrete probability distribution functions, in general.
* State the properties of a normal probability distribution.
* Use the Empirical Rule to find probabilities related to normal distributions.
* Use technology to determine probabilities associated with normal distributions and interpret the probabilities.
* Find and interpret *z*-scores related to normal distributions.
 |

Reference: Chapters 4 and 6 of Introductory Statistics- OpenStax

Section 4.1. Probability Distribution Function (PDF) for a Discrete Random Variable

Section 6.1. The Standard Normal Distribution

Section 6.2. Using the Normal Distribution

**Classes 20-22**

**Unit 6. The Central Limit Theorem**

|  |
| --- |
| **Objectives** |
| * Apply and interpret the central limit theorem for sample proportions.
* Apply and interpret the central limit theorem for sample means.
 |

Reference: Chapter 7 of Introductory Statistics- OpenStax

Section 7.1. The Central Limit Theorem for Sample Means

Section 7.3. Using the Central Limit Theorem

Reference: See Attachment

Section 7.4 - Population and Sample Proportion

**Classes 23-28**

**Unit 7. Confidence Intervals**

|  |
| --- |
| **Objectives** |
| * Find, interpret and use confidence intervals for a single population mean.
* Find, interpret and use confidence intervals for a single population proportion.
* Discriminate between problems applying the normal and the Student's t distributions.
* Calculate the sample size required to estimate a population mean and a population proportion given a desired confidence level and margin of error.
* Use confidence intervals to compare two population means.
* Use confidence intervals to compare two population proportions.
 |

Reference: Chapter 8 of Introductory Statistics- OpenStax

Section 8.1. A Single Population Mean using the Normal Distribution

Section 8.2. A Single Population Mean using the Student t Distribution

Section 8.3. A Population Proportion

Reference: OpenIntro Statistics

5.3.1 Confidence interval for a difference of means

6.2.2 Confidence intervals for p1-p2

**Classes 29-33**

**Unit 8. Hypothesis Testing With One Sample**

|  |
| --- |
| **Objectives** |
| * Conduct and interpret hypothesis tests for a single population mean, $σ$ unknown.
* Conduct and interpret hypothesis tests for a single population proportion.
* Understand the meaning of a p-value and how it is used.
* Understand the meaning of significance level and how it is used.
* Differentiate between Type I and Type II Errors.
 |

Reference: Chapter 8 of Introductory Statistics- OpenStax

Section 9.1. Null and Alternative Hypotheses

Section 9.2. Outcomes and the Type I and Type II Errors

Section 9.3. Distribution Needed for Hypothesis Testing

Section 9.4. Rare Events, the Sample, Decision and Conclusion

Section 9.5. Additional Information and Full Hypothesis Test

**Classes 33-36**

**Unit 9. Hypothesis Testing With Two Samples**

|  |
| --- |
| **Objectives** |
| * Classify hypothesis tests by type.
* Conduct and interpret hypothesis tests for two population means, $σ$ unknown.
* Conduct and interpret hypothesis tests for two population proportions.
 |

Reference: Chapter 9 of Introductory Statistics- OpenStax

Section 10.1. Two Population Means with Unknown Standard Deviations

Section 10.3. Comparing Two Independent Population Proportions