DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

MAT120 SI: Introduction to Probability and Statistics

Credit Hours: 3.0

Equated Hours: 6.0

Class Hours: 6.0

Prerequisites: Placement via the CUNY's Proficiency Index

Required Textbook: Introductory Statistics (free open-source textbook), Openstax.
Free download available: https://guides.hostos.cuny.edu/mat119-120

Course Description:
The student will identify, define, and compute the measures of central tendency and dispersion; develop frequency distributions and related histograms; determine the level of correlation; and draw inferences from regression lines. The student will also solve problems involving sample spaces, counting techniques, and mathematical expectation; determine the probability of normally distributed events through use of tables; conduct hypothesis testing; and determine confidence intervals. Additional supplementary basic algebra and critical thinking skills topics are: operations with real numbers, algebraic expressions, solving and graphing linear equations and inequalities, proportion and percent word problems, basic skills in manipulating exponential, and radical expressions. MAT120SI and MAT120 are equivalent courses.

Student Learning Outcomes:

1. Interpret and draw appropriate inferences from quantitative representations of data in numerical, chart or tabular form. This includes summarizing data by constructing frequency distributions, histograms, stem and leaf plots, box plots, pie charts or Pareto charts.
2. Use numerical and statistical methods as well as techniques from probabilities to reason statistically; i.e., to draw accurate conclusions and correctly interpret patterns of data sets. This

includes measures of center, spread or variation, combining probabilities, estimation procedures, hypothesis testing, correlation, regression and analysis of variance.

3. Represent quantitative problems expressed in natural language in a suitable statistical format and techniques.
4. Effectively communicate quantitative analysis or solutions to mathematical problems in written or oral form. This involves understanding and using the basic language and tools of statistics such as fundamental definitions with some very basic principles to attain statistical literacy.
5. Evaluate solutions to problems for reasonableness using a variety of means, including informed estimation. This includes estimation procedures, hypothesis tests and testing the goodness of fit of linear models to represent data sets.
6. Apply statistical methods to model and analyze problems in other fields of study including economics, social sciences, education, political science, health, etc.

Performance Objectives:

At the end of the course, the student should be able to do the following:

A. Categorize statistical studies as either descriptive or inferential
B. Difference between population and samples in an inferential study, compare and contrast different sampling methods.
C. Categorize variables as either qualitative or quantitative, and discrete or continuous.
D. Generate and interpret frequency distributions and graphs representing data sets.
E. Get and interpret descriptive measures of univariate data sets for both samples and populations. Also differentiate between a parameter and a statistic.
F. Be familiar with and use the basic definitions and rules of probability theory.
G. Study binomial, normal, and Student's t-random variables and their probability distributions.
H. Decide the sampling distribution of the mean for either a normally distributed variable or a variable that is not normally distributed, and state and apply the central limit theorem.
I. Apply the normal or the Student's t-distribution to estimate population parameters and conduct hypothesis tests.
J. Perform hypothesis and create confidence intervals for standard deviation of a normally distributed random variable

Instructional Objectives:

The expectations of the instructor are as follow:

A. Explain the nature of statistics
B. Show how data sets, tables, graphical displays and descriptive measures can be used.
C. Explain the binomial, normal and Student's t-distributions and explain how they can be applied to estimate population parameters and conduct hypothesis tests. Clarify the assumptions and limitations of the statistical techniques that are based on these distributions.

D. Establish the basic concepts of probability and the rules that apply to the probability of both simple and compound events
E. Establish the concepts of correlation and regression; explain the interpretation of the slope, correlation coefficient, and coefficient of determination, and the use of regression equation to make predictions.
F. Introduce to the student the basic understanding of the hypothesis testing procedure and theory estimation.
G. Offer a general examination of hypothesis testing, which will include the following:
   - Formulation of hypothesis
   - Purpose of decision rules for given significance levels
   - Testing Procedure (Ex: use of normal, t-distribution, chi-square distribution, F-distribution)
   - Analysis of Type I errors

Grade Point System

Hostos Community College awards letter grades to denote the level of achievement for each course. The grading system is as follows:

A = 4.00 pts./credit (93-100)
A- = 3.70 pts./credit (90-92)
B+ = 3.30 pts./credit (87-89)
B = 3.00 pts./credit (83-86)
B- = 2.70 pts./credit (80-82)
C+ = 2.30 pts./credit (77-79)
C = 2.00 pts./credit (70-76)
D = 1.00 pts./credit (60-69)
F = 0.00 pts./credit (0-59)

For more detailed Grades Policy, please refer to:
http://www.hostos.cuny.edu/Administrative-Offices/Office-of-the-Registrar/Academic-Info/Grades-Policy

COURSE OUTLINE

Lesson	Topic
1	1.1 Definitions of Statistics, Probability, and Key Terms Introduction: sets of integers, rational, irrational, real numbers, and the real number line Absolute value, addition and subtraction of real numbers
2	1.2 Data, Sampling, and Variation in Data and Sampling The concept of variable and constant; defining like and unlike terms Definition of algebraic expressions and like terms
3	1.3 Frequency, Frequency Tables, and Levels of Measurement The substitution principle for evaluating formulas and algebraic expressions
4	2.1 Stem-and-Leaf Graphs, Line Graphs, and Bar Graphs
	2.2 Histograms, Frequency Polygons, and Time Series Graphs Basic exponent rules, including negative exponents for scientific notation Finding roots and simplifying radicals
5	2.3 Measures of the Location of the Data Definition and solution of a linear equation in one variable
6	2.4 Box Plots
	2.5 Measures of the Center of the Data Solving linear equations using: Addition/Subtraction and Multiplication/Division Principles of Equality
7	2.6 Skewness and the Mean, Median, and Mode Language translation problems (e.g., “three less than twice a number is what?”)
8	2.7 Measures of the Spread of the Data Solving word problems (application problems) using linear equations
9	3.1 Terminology The Cartesian coordinate system; Ordered pairs of real numbers and finding points in a plane, given a table
10	3.2 Independent and Mutually Exclusive Events Definition and solution of a linear equation in two variables ($ax + by = c$), graphing a linear equation
11	3.3 Two Basic Rules of Probability Concept of the slope of a straight line: Slope formula Finding the slope of a line on a graph given its equation Finding the slope of a line using $y = mx + b$ Given possible graphs of a line, use slope and y-intercept to select correct graph
12	3.4 Contingency Tables Finding equations of lines: Using the slope-intercept formula ($y = mx + b$) Using the point-slope formula Given two points on the line
13	**REVIEW TEST 1**
14	**Test # 1 (1hour and 15 min Exam)**
15	4.1 Probability Distribution Function (PDF) for a Discrete Random Variable Solving and graphing linear inequalities
16	4.2 Mean or Expected Value and Standard Deviation

	More algebra word problems, including area problems, and linear inequality problems
17	4.3 Binomial Distribution
18	**Departmental Midterm Test Review**
19	**Departmental Midterm Test**
20	5.1 Continuous Probability Functions
21	5.2 The Uniform Distribution
22	6.1 The Standard Normal Distribution
23	6.2 Using the Normal Distribution
24	7.1 The Central Limit Theorem for Sample Means (Averages)
25	7.3 Using the Central Limit Theorem
26	**REVIEW TEST 2**
27	**Test # 2 (1hour and 15 min Exam)**
28	8.1 A Single Population Mean using the Normal Distribution
29	8.2 A Single Population Mean using the Student t Distribution
30	8.3 A Population Proportion
31	9.1 Null and Alternative Hypotheses
32	9.2 Outcomes and the Type I and Type II Errors
33	9.3 Distribution Needed for Hypothesis Testing
33	9.4 Rare Events, the Sample, Decision and Conclusion
35	9.5 Additional Information and Full Hypothesis Test Examples
36	9.6 Hypothesis Testing of a Single Mean and Single Proportion
37	10.1 Two Population Means with Unknown Standard Deviations
	10.2 Two Population Means with Known Standard Deviations
	10.3 Comparing Two Independent Population Proportions
38	11.1 Facts About the Chi-Square Distribution
	11.2 Goodness-of-Fit Test
	11.3 Test of Independence
	11.4 Test for Homogeneity
39	12.1 Linear Equations
40	12.2 Scatter Plots
41	12.3 The Regression Equation
42	**DEPARTAMENTAL FINAL EXAM REVIEW**
43	**FINAL EXAM (2 HOURS AND 30 MINUTES)**