HOSTOS COMMUNITY COLLEGE
DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

MAT 301: PROBABILITY AND MATHEMATICAL STATISTICS I

CREDIT HOURS: 3.0

EQUATED HOURS: 3.0

CLASS HOURS: 3.0

PREREQUISITES: MAT 210 Calculus
PRE/Co-requisites ESL 86-88 or ESL 91 or higher, or ENG 100 or higher

RECOMMENDED TEXTS BOOKS:
"Probability and Statistics for Engineering and the Sciences", 9th edition by Jay L. Devore published by Cengage Publishing Company.

DESCRIPTION:
This course emphasizes the calculus-based probability theory necessary for the study of statistical inference. Topics include pictorial and tabular results of descriptive statistics, an introduction to probability theory, independence, and conditional probabilities including Bayes' Theorem. Several discrete (binomial, hypergeometric, negative binomial, Poisson) and continuous (Normal, exponential, gamma, uniform) probability distributions will be studied including the concepts of a distribution function, probability mass, and density functions, expected value, variance, and standard deviation. Joint probability distributions and sampling distributions follow. We shall see how the law of large numbers and the Central Limit Theorem are used in statistics. The course will then apply the concepts of probability learned to the point estimates, confidence intervals, tests of hypothesis, and regression. Probability can be taught as a branch of mathematics but is much better appreciated if taught Students will use computer software such as Maple or R. In fact, learning how to use Maple/R is among major course objectives.

CALCULATOR: Any Scientific calculator will do it. TI83/TI 84 is highly recommended

GRADES: A, A^-, B^+, B, B^-, C^+, C, D, I, F

COURSE OBJECTIVES:

- Choose an appropriate probability or statistical model for a particular problem.
- Know what conditions are typically required for the use of particular probability and statistical models and be able to assess whether those conditions are reasonably met.
- Interpret calculated solutions of particular probability models.
- Make appropriate inferences using the chosen statistical models.
- Use the R/Maple software system to handle datasets, display a data set graphically, and to do probability computations, statistical analyses, and computer simulations.

STUDENT LEARNING OUTCOMES:

Students will be able to:

1. Make appropriate inferences from quantitative representations of data, and other problem information concerning the appropriate probability or statistical model to resolve a given problem.
2. Apply appropriate probability or statistical models based upon their understanding of the problem information.
3. Explain how the results of a probability or statistical model applied to a problem assist towards resolving or interpreting the problem situation.
4. Use Maple/R software system to handle datasets, display a dataset graphically, and to do probability computations, statistical analyses, and computer simulations.
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.

Attendance:

A. Students are required to attend all class meetings
B. Students are responsible for all class information, materials, and assignments
C. Students should check with the college catalog to find the terms and conditions under which a WU, incomplete, or an F grade may be given by the instructor

EVALUATION in MAT 301

Homework (Online HW + R Projects)	**30%**
Exam I	**20%**
Exam II	**20%**
Final Exam	**30%**

Course Outline

Session	Topics	Chapter
1	What is probability? Statistics? How do they differ? Descriptive Statistics? Inferential Statistics? How are they used? Why are they important? Populations and Samples, Collecting data	1
2	Visual displays of data – Stem and Leaf, Histogram, Dot plot, Boxplot. Numerical measures of location and variability. Mean, median, percentiles, trimmed means, sample proportions, variance, and standard deviation.	1
3	Probability – experiment, sample space, events, union, intersection, complement, null. Axioms of probability. Proving results from axioms. Properties of probability. The equally likely case and counting. Multiplication principle, permutations, combinations	2
4	Conditional probability and Bayes' Theorem. Independence	2
5	Examples related to independence and conditional probability.	2
6	Discrete random variables and their probability distributions. Probability mass function, cumulative distribution function. Expected value, variance, standard deviation. Chebychev's inequality and statistics.	3
7	Binomial probability distribution. Hypergeometric distribution	3
8	Negative binomial and Poisson distributions.	3
9	Continuous probability distributions. Probability density function, cumulative distribution function. Expected value, variance, and standard deviation.	4
10	The Normal Distribution. Standard vs nonstandard normal distributions. Approximation to binomial.	4
11	Exponential and Gamma Distributions. Other distributions used for approximations. Probability plots.	4
12	**Exam One.**	
13	Joint distributions. Independent random variables. Conditional distributions	5
14	Expected value of a function of a random variable. Covariance. Correlation.	5
15	Statistics and sampling distributions. Simulation.	5
16	Distribution of the sample mean and the Central limit theorem.	5
17	Point estimators. Unbiased. Minimum variance. Standard error	6
18	Point estimation: Method of moments. Maximum likelihood method.	6
19	Point estimation: Maximum likelihood method.	
20	Confidence intervals – single sample. Confidence level, precision, sample size.	7
21	Large sample confidence intervals and the normal distribution.	7
22	Small sample confidence intervals and the t distribution. Chi-Square confidence intervals for variance.	7
23	**Exam Two**	
24	Tests of hypotheses – single sample. Null vs alternative hypothesis. Type I, type II error, Power.	8
25	Tests concerning means, proportions.	8

26	Inferences based on two samples	9
27-28	Review	12
29	**Final Examination**	