

NASSAU COMMUNITY COLLEGE

DEPARTMENT OF MATHEMATICS/COMPUTER SCIENCE/INFORMATION TECHNOLOGY

Course Outline for

MAT 102
Introduction to Statistics

Curriculum	Interdisciplinary
Lab hours	1 (for large lecture classes only)
Semesters offered	Indicated in Catalog
Length of semester	15 Weeks
Class hours	3
Credits	3
Text	Introduction to Statistics 9 th Ed. by DeSanto, Moscatelli & Totoro. Published by Pearson In addition to the "Introduction to Statistics" text book by DeSanto and Totoro, instructors may optionally recommend supplementary manuals or other aids (such as the Frimerman TI-83/84 calculator handbook, as an example) to assist students in using the built-in statistical functions of the TI-83/84 calculator. As the supplementary manuals and other aids are optional, course work may not be assigned directly from them.
Website	http://www.pearsoncustom.com/introstatistics

PREREQUISITE

Students must have satisfied all MAT, ENG 001 and RDG 001 remediation requirements prior to starting the course.

CATALOG DESCRIPTION

Appropriate and inappropriate uses of Statistics, measures of central tendency and variability, basic concepts of probability, the binomial, normal and "t" distributions, testing hypotheses, estimation, chi-square, linear regression, and correlation.

MATH CENTER REQUIREMENT

If needed, students are encouraged to avail themselves of further study and/or educational assistance available in the Mathematics Center: B-130 and B-126. These activities and use of the resources provided are designed to help the student master necessary knowledge and skills.

CALCULATOR REQUIREMENT

The TI-83 or TI-84 graphing calculator is required and will be used extensively throughout the course. (The TI-83 Plus and the TI-84 Silver Edition are also acceptable.) However, if the student does not already own one of the listed calculators (s)he is encouraged to buy the TI-84 Plus Silver Edition.

OBJECTIVES

General

To enable the student to learn to critically analyze statistical information presented by the media, describe statistical data and develop an understanding of statistical methods frequently encountered in the fields of science, business, politics, health, and the behavioral sciences.

Specific

To enable the student to

- compute basic descriptive measures.
- draw appropriate graphs for a data set.
- understand the concept of sampling distributions.
- apply statistical theory for the purpose of estimating population parameters.
- conduct hypotheses tests using the normal, t, and chi square sampling distributions.
- extrapolate using correlation and regression.

SCHEDULE OF TOPICS

The following suggested schedule is based on 30 classes when 3-full-period exams and a full-period final are included. The 15-week (30-period) semester, makes this a very tight schedule.

Topics	Lectures*
1. Introduction to the course, grading and attendance procedures, general class rules, why the course is important, how it relates to students' lives, etc. Introduction to statistics, uses and misuses of statistics.	1-2
2. Introduction to the calculator, exploration of data analysis including stem-and-leaf frequency distributions, bar graphs, pie charts.	1
3. Using the calculator to construct frequency distribution tables, histograms, frequency polygons, Box-and-Whisker plots and other graphs.	2
4. Common statistical measures including measures of central tendency, measures of variability & measures of relative standing (z-scores and percentiles). Applications of Empirical Rule & (time permitting) Chebyshev's Theorem.	4
5. Linear Correlation and Regression Analysis	2
6. Basic probability definitions. This topic is limited to 1 lecture unless all other topics are covered.	1
7. The normal and binomial distributions with applications.	3
8. Confidence intervals.	2
9. Hypothesis testing, which may include sample means, proportions and differences of sample means.	5-6
10. Chi-square.	2
11. Inferences for Correlation and Regression.	1

* Based on 75 minute periods and does not include three full period tests.

DETAILED TOPICS OUTLINE

1. Introduction to Statistics

- Define sampling.
- Recognize basic misuses of statistics – misleading graphs, non-representative samples, inappropriate comparisons, etc.

2. Organizing and Presenting Data

- Classify data as discrete-continuous, numerical-categorical.
- Recognize and interpret data presented in graphical form such as line graphs, bar graphs, histograms and pie charts.
- Construct a stem-and-leaf display.
- Construct frequency distribution tables for categorical and numerical data that includes class ranges, class boundaries, class marks, frequencies and relative percentages.
- Create histograms from numerical data with appropriate labels including class boundaries and frequencies.
- Identify the characteristics of distributions (shape (bell, skewed), center, spread, outliers).
- Know and apply the empirical rule for normal distributions.

3. Numerical Techniques for Describing Data

- Calculate and/or determine the mode, range, sample and population means, medians and standard deviations from numerical data.
- Understand the meaning and relevance of the population standard deviation, σ , and sample standard deviation, s (as an estimate of σ).
- Understand how means, medians and modes are affected by changes in the data (for example; addition of constants, multiplication by constants, and exclusion of outliers).
- Understand the operations dictated by basic mathematical formulas such as

$$Z = \frac{X - \mu}{\sigma}$$

- Characterize distributions as bell shaped (normal), skewed or other.
- Compute z-scores from raw scores and vice versa.
- Determine percentile rank, percentiles and quartiles.
- Create, label and interpret Box-and-Whisker plots using 1-variable stats on the TI-83/84 calculator. Calculate and interpret the 5-number summary for the Box-and-Whisker plot and discuss outliers.

4. Linear Correlation and Regression Analysis

- Create a scatter diagram from sets of raw data.
- Distinguish scatter diagrams which show obvious linear correlation from those which do not.
- Calculate the linear regression equation and use it to make predictions (estimates).
- Interpret the meaning of the Correlation Coefficient, r , and the Coefficient of Determination, r^2 .

5. Probability

Faculty are strongly advised not to spend more than one lecture on probability unless there is time to cover all outline topics.

- Basic concept of the meaning of probability.
- Basic combinations and sample spaces.
- Cover the law of large numbers and methods of assigning probabilities, i.e.

Classical definition for equally likely events

$$P(\text{Event } E) = \frac{\text{number of outcomes satisfying event } E}{\text{total number of outcomes in the sample space}}$$

Relative Frequency Approach

$$P(\text{Event } E) = \frac{\text{number of event } E \text{ occurred}}{\text{total number of times the experiment was performed}}$$

- Determine probabilities of combinations of mutually exclusive events (addition rule) and independent events (multiplication rule).

6. Random Variables and Discrete Probability Distributions

- Discuss the difference between discrete and continuous random variables.
- Interpret the probability Distribution of a Discrete Random Variable.
- Calculate binomial probabilities using the Binomial Probability Formula.
- Evaluate nCs using the TI-83/84 calculator.

7. Continuous Probability Distributions and the Normal Distribution

- Use of the tables to introduce and enhance instruction is encouraged but the use of the calculator is required.
- Interpret areas of continuous probability distributions. (Apply the continuity correction.)
- Determine areas, z-scores and raw scores using the normal curve with the TI-83/84 calculator.
- Interpret areas under the normal curve as proportions of populations, probabilities of events, percentiles and approximations to binomial experiments.

8. Sampling and Sampling Distributions

- Determine the Mean and Standard Deviation of the Sampling Distribution of the Mean.
- Interpret the Standard Error of the Mean.
- Apply the Central Limit Theorem ($n > 30$).
- Calculate probabilities using the sampling distribution of the mean.
- If time permits
 - Include calculations and interpretation of the standard error of the proportion ($np > 5$, $n(1-p) > 5$).
 - Calculate probabilities using the sampling distribution of the proportion.

9. Estimation

- Construct point estimates, confidence intervals and margin of error of the mean using the t-distribution.
- When time permits these topics may be extended to population proportion and determination of sample size.

10-13. Hypothesis Testing

- Instructors should cover the basic concepts of hypothesis testing in chapter 10 and may, at their discretion, use one or more of the hypothesis testing chapters to deal with particular applications.
 11. Hypothesis Test Involving a Population Proportion.
 11. Hypothesis Test Involving a Population Mean.
 12. Hypothesis Test Involving Two Population Proportions Using Independent Samples.
 13. Hypothesis Test Involving Two Population Means Using Independent Samples.

Key topics to be included in covering hypothesis testing are the application and use of z-scores, t-scores, alphas and p-values.

For all hypothesis tests, (Chapters 11-13)

utilize the TI-83/84 calculator.

formulate null and alternative hypotheses from verbal problem descriptions.

identify 1TT or 2TT.

identify alpha for the test.

identify and determine the test statistic.

state the decision rule.

reach a conclusion by either (or both)

- obtaining and relating the p-value to α and/or

- using α to determine the decision rule and relating the test statistic to the critical value(s).

14. Chi-Square

- Create a table for calculation of chi-square.
- Formulate and carry out hypothesis test for chi-square using the TI-83 calculator.
- Interpret the p-value.

15. Inference for Correlation and Regression

- Testing the significance of the correlation coefficient.
- Assumptions for linear regression analysis.

Date Last Revised: Summer 2010

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