Master Course Syllabus

Date Revised:	January 30, 2024
Revised by:	Kim Sheppard, M.S.
Course Title:	Introduction to Statistics (M)
Course Number:	MAT 127
Lecture Hours:	60
Laboratory Hours:	0
Course Contact Hours:	60
Credit Hours:	4
Pre-requisites:	EGL 093 and Grade of C or better in MAT 097
Co-requisites:	None

Course Description:

Introduction to Statistics introduces students to the study of measures of central tendency,
measures of variation, graphical representation of data, least squares regression, correlation,
probability, probability distributions, sampling techniques, parameter estimation, and hypothesis
testing. The emphasis is on applications from a variety of sources including newspapers,
periodicals, journals, and many of the disciplines that students may encounter in their college
education. Students shall be expected to gather and analyze data, and formally report the results
of their research. The use of technology and statistical software is integrated throughout the course.

Credit Hour Information

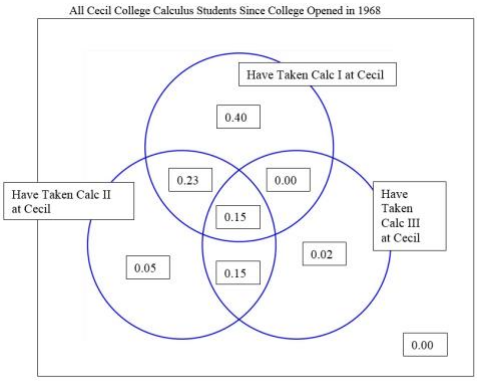
At Cecil College, for all credit courses, students are expected to spend a minimum of 45 hours of 50 minutes each of combined instructional time and related coursework time per credit hour. For this course, the following applies:

4-Credit Course	**Number of Hours**
Total hours of direct instruction and/or out-of-class student work required	180
Direct Faculty Instruction	60
Out-of-Class Student Work	120

Assessment

Course-Level Outcomes/Goals *Students will:*	Indicators *Students will:*	Sample Assessment Tasks
1. Collect, classify, organize, summarize, and describe data.	1.1 Collect sample data that represents the population. Use proper sampling techniques. 1.2 Classify a variable as categorical or quantitative. 1.3 Summarize a categorical variable with a table or pie chart and determine a sample proportion. 1.3 Summarize a quantitative variable with summary statistics such as the mean, median, mode, standard deviation, variance and range. 1.4 Display a quantitative variable graphically with a histogram, dot plot, or box plot. 1.5 Using the z-score formula, determine if an observation is unusual.	• Open the "Hip Surgery Outcomes" data set in Stat Crunch. What type of variable "Surgeon"? • Open the "Large Survey" data set in Stat Crunch. Determine how many students are "Vegetarian". • Open the "Skyscrapers in the U.S." data set in Stat Crunch. Make a dot plot for "Floors". Determine how many buildings have at least 75 floors. What is the name of the building with the most floors? • Open the "Hip Surgery Outcomes" data set in Stat Crunch. How many "Hispanic" patients had a "Complication"? • Open the "Hip Surgery Outcomes" data set in Stat Crunch. Create side-by-side pie chart of "Complications" grouped by "Surgeon". Use the 10% rule of thumb to determine if "Complications" and "Surgeon" are independent or dependent. • Open the "Roller Coasters" data set in Stat Crunch. Report the best measure of spread (IQR or standard

		deviation) for "Length" based on the shape of the distribution. • Open the "Bachelor's Degree Institutions" data set in Stat Crunch. Determine the median "Student-to-Faculty" ratio for the schools found in Large Cities. • We have the variable "Retirement Account Balance" for a sample of n = 300 Walmart employees. The mean balance of the sample is $18,506 and the standard deviation of the sample is $36,570. A particular employee has a Retirement Account Balance of $0. Find and interpret the z-score of this employee. Is his Retirement Account Balance unusual?
2. Analyze bivariate data and fit linear regression models to appropriate data.	2.1 Graph bivariate data and describe the relationship between two variables. 2.2 Use simple linear regression to fit a least squares regression model to bivariate data. 2.3 Interpret the slope and y-intercept of a regression model in context. 2.4 Evaluate the adequacy of a regression	• Open the "Audi A5" Stat Crunch data set. Completely describe the relationship between X = Mileage and Y = Price, include a measure of strength. • Use the "Audi A5" Stat Crunch data set. Use "Mileage" to predict "Price". Run the linear regression and report the linear regression equation. • Interpret, in context, the slope and y-intercept of the

	model using the linear correlation coefficient, a scatterplot, and residual analysis.	linear regression equation from the previous example. • Evaluate the adequacy of your linear regression model by reviewing the correlation coefficient, the scatterplot, and analyzing the residuals. Is the linear model appropriate?
3. Solve problems by applying appropriate probability rules and probability distributions.	3.1 Solve problems using the appropriate probability rules. 3.2 Recognize the difference between discrete and continuous probability distributions. 3.3 Calculate probabilities for a discrete probability distribution such as the Binomial distribution and solve application problems 3.4 Calculate probabilities for a continuous distribution such as the normal distribution, the Uniform distribution or the Exponential distribution and solve application problems involving these random variables.	• We know that 14.41% of Cecil students are married. We take a random sample of n = 4 students. Determine the probability that at least one student is married. • Use the Venn Diagram to answer the following question: Determine the probability a student has taken Calc II at Cecil if we know they took Calc I at Cecil. Use the conditional probability formula.  • At Cecil College, we believe that 84% of students use SnapChat. Take a class of n = 24 Cecil students and calculate the probability that the whole class uses SnapChat. Find the

		expected number of students in the class that use SnapChat. • Use the Normal model calculator on Stat Crunch to determine the z-score that separates the top 6% from the bottom 94%. • Suppose that of all students, who took a standardized math test, their average score was 980 with a standard deviation of 100. If test scores are normally distributed, find the probability that a randomly selected student has a test score between 955 and 1000 inclusive.
4. Model the sampling distribution of the sample proportion, and model the sampling distribution of the sample mean and utilize the Central Limit Theorem to solve problems.	4.1 Graph data from a population. Graph data from a sample. Graph data of sample proportions from samples of size n. Graph data of sample means from samples of size n. 4.2 Calculate the mean and standard deviation of the sampling distribution of the sample proportion, p-hat. 4.3 Calculate the mean and standard deviation of the sampling distribution of the sample mean, x-bar.	• Pew reports that 79% of Americans use Facebook in some manner. We take an unbiased sample of n=648 shoppers at malls across America. We will model the proportion of American who use Facebook. Determine the mean and standard deviation of the p-hat model. Determine the probability of getting a sample of n=648 shoppers where 520 or more use Facebook. • Convert the sample proportion in the previous problem to a z-score. • Suppose we know with certainty the "Sleep"

	4.4 Calculate z-scores and compute probabilities for means and proportions drawn from samples of size n.	patterns of Cecil students. We know on average, students get 6.707 hours of "Sleep" each night. We know the standard deviation is 1.448 hours of "Sleep". We know the shape of "Sleep" hours is unimodal and symmetric. Take an unbiased class of n=30 statistics students as the sample. We will model the sample mean for "Sleep" hours with a Normal model. Determine the mean and standard deviation for the y-bar model. Determine the probability that the mean "Sleep" in the class exceeds 7 hours. Compute the 95th percentile for "Sleep".
5. Analyze data and perform inference techniques including confidence intervals and hypothesis testing for proportions and means. Both one sample and two sample problems are analyzed.	5.1 Construct and interpret confidence intervals. 5.2 Calculate the sample size needed for a given precision for a mean or a proportion. 5.3 Perform hypothesis tests to analyze and interpret data. 5.4 Explain whether conclusions can be generalized to a larger population and interpret inference results.	• Janice wanted to estimate mean number of hours her dog spent sleeping each day. In sample of 29 days, she found that her dog slept for an average of 18.7 hours with a standard deviation of 4.7 hours. Find and interpret the 99% confidence interval for the true mean number of hours her dog sleeps each day. Assume that her dog's sleep time is normally distributed. • The Associated Press reported that in a recent survey of 8000 women, 648 said that they were

		stalked at least once. Stalking was defined by researchers as "a course of conduct directed at a specific person that involves repeated physical or visual proximity, nonconsensual communication, or verbal, written or implied threats." Find and interpret the 99% confidence interval for the true proportion women who feel they were stalked. • In the American justice system, a jury has to decide whether a defendant is guilty or innocent. State the proper null and alternative hypotheses the jury should use and define the Type I and Type II errors associated with them. Explain why the Type I error should be the most serious error. • In a recent survey, it was discovered that 14 out of 50 people owned subcompact cars. In a related survey, it was found that 18 out of 100 people owned luxury cars. Can we conclude at a level of significance of 0.05 that subcompact cars are more popular than luxury cars? Perform a hypothesis test – write the hypotheses, compute the test statistic and p-value, make a

		decision and report your conclusion. • A certain kind of screw produced by an automatic machine should average three inches in length. It is suspected, however, that the machine is no longer functioning properly and that the screws it produces are, on the average, either longer or shorter than three inches. Suppose that a sample of 25 screws yields an average length of 2.9 inches and a standard deviation of 0.25 inches. At a level of significance of 0.10 is there sufficient evidence to conclude that the machine is functioning improperly? Assume that the length of the screws has a distribution that is nearly normal. • Suppose that we wish to estimate the proportion of eligible voters who refuse to register to vote because they fear that registering will cause them to be called for jury duty. What size sample is need, if we wish to be 99% confident that the sample proportion is within 2% of the true proportion of eligible voters who fail to register to vote out of fear that it will cause them to be called for jury duty?

Indicate which of the following General Education Student Learning Outcomes this course contributes to

Goal Number	**Competency**	**Contributes to**
I	Critical Thinking	✓
II	Arts and Human Cultures	
III	Written and Oral Communication	
IV	Information Literacy	✓
V	Technological Skills	✓
VI	Quantitative and Scientific Reasoning	✓

Indicate the Program Learning Outcomes this course contributes to

Goal Number	**Competency**	**Contributes to**
1	Apply basic statistical concepts in real-life situations.	✓
2	Communicate mathematics in written and oral form.	✓
3	Use appropriate technology to investigate and solve mathematical problems.	✓
4	Correctly apply techniques of algebra and calculus to solve problems.	
5	Apply mathematical techniques to solve application problems	✓
6	Work with abstract mathematics to verify identities and prove results	

Topical Outline

I. Populations, Samples, Parameters, Statistics and Data Classification
II. Displaying Data in Tables and Graphs
III. Describing Data in One Variable
IV. Discovering Relationships (Correlation and Simple Linear Regression)
V. Probability
VI. Discrete Probability Distributions
VII. Continuous Probability Distributions
VIII. Sampling Distribution of the Mean and the Central Limit Theorem
IX. Parameter Estimation and Confidence Intervals
X. Hypothesis Testing

Draft Statewide Objectives for Transfer

Cecil College's MAT 127 meets all of the objectives listed below.

Course: Statistics

This is intended for an "equate" transfer of a single Statistics course from a community college in Maryland, which meets all of the objectives below, to a single Statistics course at a four-year institution in the University System of Maryland (USM). This same "equate" transfer will also apply in reverse transfer situations.

Community College USM

These objectives are based on the UMCP objectives for a single Statistics course:

1 Select and apply appropriate technologies to manage and explore data numerically

2 Select and apply appropriate technologies to manage and explore data graphically

3 Select and apply appropriate technologies to manage and explore data to perform inference

4 Select and apply appropriate technologies to manage and explore data to answer questions of a statistical nature.

5 Identify characteristics of good study designs

6 Explain what conclusions are appropriate for a given design

7 Explain whether conclusions can be generalized to a larger population

8 Know statistical terminology and formulas

9 Solve for various variables in the formulas, using technology and algebraic manipulations

10 Perform elementary probability calculations

11 Solve problems by applying appropriate standard probability distributions (discrete)

12 Solve problems by applying appropriate standard probability distributions (binomial)

13 Solve problems by applying appropriate standard probability distributions (uniform)

14 Solve problems by applying appropriate standard probability distributions (normal)

15 Construct and interpret confidence intervals to estimate population with 1 or 2 means

16 Construct and interpret confidence intervals to estimate population with differences

17 Construct and interpret confidence intervals to estimate population 1 or 2 proportions

18 Model the sampling distribution with proportions and means

19 Model the sampling distribution with samples including verifying the conditions for the Central Limit Theorem

20 Perform hypothesis tests to analyze and interpret data: Perform hypothesis tests with 1 or 2 means

21 Perform hypothesis tests to analyze and interpret data: Perform hypothesis tests with 1 or 2 proportions

22 Perform hypothesis tests to analyze and interpret data: Perform hypothesis tests

23 Find the equation of best fit

24 Generate the various measures for the strength of the relationship, in regression.