

M&IS 24056 001: Fundamentals of Business Statistics

Spring 2014

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Websites

<http://oli.cmu.edu>. This contains all the course materials, interactive tutors, and graded assessments called *checkpoints*.

<http://learn.kent.edu>. Contains audio lectures, and examinations.

Course Description

This course is an introduction to concepts in statistical methods and their applications to real-world problems. This course will examine both the theoretical and practical side of the different methods. Students will be given ample opportunities to apply the techniques to different problems. The goal of the course is for students to understand fundamental statistical concepts and methods, and their applications.

Course Requirements

Last day to withdraw from a course: Sunday, March 23, 2014

Prerequisites: Math 11011 (Algebra). Students attending the course who do not have the proper prerequisite risk being deregistered from the class.

Enrollment: Students have responsibility to ensure they are properly enrolled in classes. You are advised to review your official class schedule (using Student Tools on FlashLine) during the first two weeks of the semester to ensure you are properly enrolled in this class and section. Should you find an error in your class schedule, you have until Sunday, January 26, 2014 to correct the error. If registration errors are not corrected by this date and you continue to attend and participate in classes for which you are not officially enrolled, you are advised now that you

will not receive a grade at the conclusion of the semester for any class in which you are not properly registered.

Students With Disabilities: University policy 3342-3-01.3 requires that students with disabilities be provided reasonable accommodations to ensure their equal access to course content. If you have a documented disability and require accommodations, please contact the instructor at the beginning of the semester to make arrangements for necessary classroom adjustments. Please note, you must first verify your eligibility for these through Student Accessibility Services (contact 330-672-3391 or visit <http://www.kent.edu/sas> for more information on registration procedures).

If you are eligible to graduate, it is your responsibility to apply for graduation before the set deadline (May Graduation: Apply before September 15th August Graduation: Apply before December 13th December Graduation: Apply before March 15th) If you apply after the deadline you will be assessed a \$200 late fee. Please see your academic advisor as soon as possible if you are uncertain as to your progress toward graduation. To apply for graduation complete the following steps: Log onto your Flashline account 1. Click on the Student Tools tab, 2. Look in the Graduation Planning Tool Box, 3. Click on Application for Graduation

If an error message appears, you must contact your advisor.

Learning Outcomes

1. Examine distributions.
 - a. Summarize and describe the distribution of a categorical variable in context.
 - b. Generate and interpret several different graphical displays of the distribution of a quantitative variable (histogram, stemplot, boxplot).
 - c. Summarize and describe the distribution of a quantitative variable in context: a) describe the overall pattern, b) describe striking deviations from the pattern.
 - d. Relate measures of center and spread to the shape of the distribution, and choose the appropriate measures in different contexts.
 - e. Compare and contrast distributions (of quantitative data) from two or more groups, and produce a brief summary, interpreting your findings in context.
 - f. Apply the standard deviation rule to the special case of distributions having the "normal" shape.
2. Explore relationships between variables using graphical and numerical measures.
 - a. Classify a data analysis situation (involving two variables) according to the "role-type classification," and state the appropriate display and/or numerical measures that should be used in order to summarize the data.
 - b. Compare and contrast distributions (of quantitative data) from two or more groups, and produce a brief summary, interpreting your findings in context.
 - c. Produce a two-way table, and interpret the information stored in it about the association between two categorical variables by comparing conditional percentages.
 - d. Graphically display the relationship between two quantitative variables and describe: a) the overall pattern, and b) striking deviations from the pattern.

- e. Interpret the value of the correlation coefficient, and be aware of its limitations as a numerical measure of the association between two quantitative variables.
 - f. In the special case of linear relationship, use the least squares regression line as a summary of the overall pattern, and use it to make predictions.
 - g. Recognize the distinction between association and causation, and identify potential lurking variables for explaining an observed relationship.
 - h. Recognize and explain the phenomenon of Simpson's Paradox as it relates to interpreting the relationship between two variables.
3. Sampling. Examine methods of drawing samples from populations
 - a. Identify the sampling method used in a study and discuss its implications and potential limitations.
 - b. Critically evaluate the reliability and validity of results published in mainstream media.
 4. Designing Studies. Distinguish between multiple studies, and learn details about each study design.
 - a. Identify the design of a study (controlled experiment vs. observational study) and other features of the study design (randomized, blind etc.).
 - b. Explain how the study design impacts the types of conclusions that can be drawn.
 - c. Determine how the features of a survey impact the collected data and the accuracy of the data.
 5. Probability: Concepts and properties
 6. Random Variables: Discrete and continuous. Using distributions of random variables to compute probabilities.
 7. Sampling distributions of the sample mean and proportion.
 - a. Identify and distinguish between a parameter and a statistic.
 - b. Explain the concepts of sampling variability and sampling distribution.
 - c. Apply the sampling distribution of the sample proportion (when appropriate). In particular, be able to identify unusual samples from a given population.
 - d. Apply the sampling distribution of the sample mean as summarized by the Central Limit Theorem (when appropriate). In particular, be able to identify unusual samples from a given population.
 8. Estimation: Determine point and interval estimates for the population mean and proportion
 - a. Determine point estimates in simple cases, and make the connection between the sampling distribution of a statistic, and its properties as a point estimator.
 - b. Explain what a confidence interval represents and determine how changes in sample size and confidence level affect the precision of the confidence interval.
 - c. Find confidence intervals for the population mean and the population proportion (when certain conditions are met), and perform sample size calculations.
 9. Hypothesis Testing: Logic and process. Conduct tests for the population mean and proportion. Understand relationship between hypothesis testing and estimation.
 - a. Explain the logic behind and the process of hypotheses testing. In particular, explain what the p-value is and how it is used to draw conclusions.
 - b. In a given context, specify the null and alternative hypotheses for the population proportion and mean.

- c. Carry out hypothesis testing for the population proportion and mean (when appropriate), and draw conclusions in context.
- d. Apply the concepts of: sample size, statistical significance vs. practical importance, and the relationship between hypothesis testing and confidence intervals.
- e. Determine the likelihood of making type I and type II errors, and explain how to reduce them, in context.

Course Content

We will be using a course on Statistical Reasoning developed by the *Open Learning Initiative* at Carnegie Mellon University (<http://oli.cmu.edu/>). This course is completely self-contained, and was developed to provide a supportive learning environment for independent learners. The course is built around a series of carefully devised learning objectives, and contains several elements, like interactive tutors and videos, that make learning of statistics interesting and relevant. The following sections provide more information about accessing and utilizing the course.

Accessing the OLI course

To access our course, do the following:

1. Go to <http://oli.cmu.edu/>
2. Click on Register (top right corner of the page), and create an account. It is important that when registering, you enter your name, and choose an **username** identical to your Kent State University Flashline username. For security reasons, please choose a password different from your Flashline password.
3. Once you have created an account, log into the system. Under **Register for a course**, enter **15051-201410** as the course key. There is a fee of \$25, which you will have to pay to get access to the course. That is the only fee associated with the course.
4. Once you have completed payment, you will have access to the course, and all its contents.

OLI Course Structure

Begin by logging in at <http://oli.cmu.edu/>. Remember to log in with your username and password that you created when registering for the course in the above section. Navigation should be self explanatory, but click on Syllabus, and then start at the beginning, *Introduction*, which explains the course and how it is set up. Description of a few key features that are supported for independent learning in the course is given below (<http://oli.cmu.edu/>):

- **Explanatory content:** This is the informational “meat” of every chapter. It consists of short passages of text with information, examples, images and explanations.
- **Learn By Doing activities:** Learn By Doing activities give you the chance to practice the concept that you are learning, with hints and feedback to guide you if you struggle.
- **Did I Get This? activities:** Did I Get This? activities are your chance to do a quick "self-check" and assess your own understanding of the material before doing a graded activity.

- **Many Students Wonder sidebars:** These short passages provide supplementary material that you may find interesting, but that is not necessary to understand the main concepts presented in the course.
- **Checkpoints:** Taking these short assessments will show your instructor how well you have understood the material. These assessments are **graded**, and are part of the score in determining your final letter grade.

Instruction

Students will spend significant time reading, learning, and practicing subject material online. In class lectures will supplement and clarify the online subject material. To make efficient use of in-class time, it is important that students learn the required online materials before coming to class. As such, remember to answer questions that indicate “*the instructor should address them in class.*” Further, during this time, short in-class questions will be given, answers to which may count toward your grade. While no attendance will be taken, students are encouraged to come to class.

Class Schedule

Week	Start Date	Chapters
Week 1	January 14	Introduction
	January 16	Learning Strategies, Big Picture
Week 2	January 21	<i>MLK day- No class</i>
	January 23	Module 1: Examining Distributions
Week 3	January 28	Module 1: Examining Distributions
	January 30	Module 1: Examining Distributions
Week 4	February 4	Module 2: Examining Relationships
	February 6	Module 2: Examining Relationships
Week 5	February 11	Module 3: Sampling
	February 13	Module 3: Sampling
Week 6	February 18	Module 4: Designing Studies
	February 20	Module 4: Designing Studies
Week 7	February 25	Module 5: Probability; Module 6: Random Variables
	February 27	Module 5: Probability; Module 6: Random Variables
Week 8	March 4	Module 7: Sampling Distributions
	March 6	Module 7: Sampling Distributions

Week 9	March 11	Module 8: Inference
	March 13	Module 9: Estimation
Week 10	March 18	Module 10: Hypothesis Testing
	March 20	Module 10: Hypothesis Testing
Week 11	March 25	<i>Spring recess- No class</i>
	March 27	<i>Spring recess- No class</i>
Week 12	April 1	Module 10: Hypothesis Testing
	April 3	Module 10: Hypothesis Testing
Week 13	April 8	Module 10: Hypothesis Testing
	April 10	Module 11: Inference for Relationships
Week 14	April 15	Module 11: Inference for Relationships
	April 17	Module 11: Inference for Relationships
Week 15	April 22	Module 11: Inference for Relationships
	April 24	Module 12: Inference for Relationships (cont.)
Week 16	April 29	Module 12: Inference for Relationships (cont.)
	May 1	Wrap up

Class Materials

Statistical Software: The OLI course, by default, uses Microsoft Excel. If you are comfortable using Excel for statistical analysis, you may do so. I would instead recommend **JMP statistical software**. JMP is free to all Kent State Students, and can read Excel files. You can even run JMP from within Excel, and I use JMP to illustrate statistical analysis. To get a copy of JMP please go to <http://www.kent.edu/is/helpdesk/sas.cfm>. Note that University licensing provides this software at no cost to you. Please access the extensive help menu system in JMP to learn how to use it. Also, the multimedia lectures show you how to use JMP for various topics. A complimentary webcast on learning JMP is being offered. Click [here](#) to register.

Book. This course does not use a book. As such, there is no required book. For reference, we use the “Introduction to the Practice of Statistics,” by David Moore and George McCabe, 7th edition. Versions 6 is equally suitable. There is no required book, and students have done well in these classes without a book. But, if you do want to get a book, here are some cost-effective options:

- a. The latest edition is the 7th, so the 6th edition is available cheaply.

<http://www.chegg.com/details/introduction-to-the-practice-of-statistics/1429216220/>

- b. Ultimately, whether you want to buy a book, and which edition you want, is up to you.
The book is **not** required.

Assessments

There are two types of online assessments, Checkpoints and Examinations. Checkpoints are short assessments, between 5 to 10 questions each, and can be taken at <http://oli.cmu.edu> (Open Learning Initiative). Examinations are similar to Checkpoints, but typically contain about 20 questions, and are taken online at <http://learn.kent.edu> (Blackboard Learn). The following table summarizes the information regarding Checkpoints and Examinations.

Topic	Checkpoints	Examinations
Number of assessments	22	3
Questions per assessments	3 to 9	About 20
Number of points per assessment	Varies	200 points
Time required to complete assessment	60 minutes	90 minutes
Attempts allowed per assessment	1	1
Physical location from where the assessments can be taken	Anywhere you have access to the internet	Only from the Second Floor BSA Computer Labs
Website to access the assessment	http://oli.cmu.edu	http://learn.kent.edu
Display of results	After you finish the assessment	When the assessment closes for ALL students

Note that once an online assessment has been started, you must finish it in one sitting.
The next section indicates the availability and points possible for each assessment.
Assessments may be taken anytime during its available period.

Availability

Checkpoint	Points	Availability
Examining Distributions Checkpoint 1	60	Available 1/14/14 12:01 AM Due 1/28/14 11:59 PM
Examining Distributions Checkpoint 2	70	Available 1/28/14 12:01 AM Due 2/4/14 11:59 PM
Examining Relationships Checkpoint 1	50	Available 2/4/14 12:01 AM Due 2/11/14 11:59 PM
Examining Relationships Checkpoint 2	70	Available 2/4/14 12:01 AM Due 2/11/14 11:59 PM
Sampling Checkpoint	70	Available 2/11/14 12:01 AM Due 2/18/14 11:59 PM
Designing Studies Checkpoint 1	70	Available 2/11/14 12:01 AM Due 2/18/14 11:59 PM
Designing Studies Checkpoint 2	40	Available 2/11/14 12:01 AM Due 2/18/14 11:59 PM
Random Variables Checkpoint	30	Available 2/25/14 12:01 AM Due 3/4/14 11:59 PM
Sampling Distributions Checkpoint 1	60	Available 3/4/14 12:01 AM Due 3/11/14 11:59 PM
Sampling Distributions Checkpoint 2	40	Available 3/4/14 12:01 AM Due 3/11/14 11:59 PM
Estimation Checkpoint	70	Available 3/11/14 12:01 AM Due 3/18/14 11:59 PM
Overview Checkpoint	50	Available 3/18/14 12:01 AM Due 4/1/14 11:59 PM
Hypothesis Testing for a Population Proportion Checkpoint	30	Available 3/18/14 12:01 AM Due 4/1/14 11:59 PM
Hypothesis Testing for a Population Mean Checkpoint	80	Available 4/1/14 12:01 AM Due 4/8/14 11:59 PM
Hypothesis Testing Checkpoint	70	Available 4/1/14 12:01 AM Due 4/8/14 11:59 PM

Type I and Type II Checkpoint	60	Available 4/1/14 12:01 AM Due 4/15/14 11:59 PM
Two Independent Samples Checkpoint	50	Available 4/8/14 12:01 AM Due 4/15/14 11:59 PM
Matched Pairs Checkpoint	70	Available 4/15/14 12:01 AM Due 4/22/14 11:59 PM
ANOVA Checkpoint	40	Available 4/22/14 12:01 AM Due 4/29/14 11:59 PM
Case C→Q Checkpoint	90	Available 4/29/14 12:01 AM Due 5/6/14 11:59 PM
Case C→C and Q→Q Checkpoint	70	Available 4/29/14 12:01 AM Due 5/8/14 11:59 PM
Inference for Relationships Checkpoint	80	Available 4/29/14 12:01 AM Due 5/8/14 11:59 PM
Total (Maximum Points Possible)	1320	

Proctoring Hours

Monday - Thursday: 9 a.m. to 9 p.m. All examinations must be completed by 9 p.m. No student will be allowed to start the examination after 8 p.m.

Friday: 9 a.m. to 5 p.m. All examinations must be completed by 5 p.m., and started no later than 4 p.m.

Weekend: No examinations can be taken during the weekend.

Sunday, 5 May 2013: Examinations can be taken from Noon to 6 p.m. All examinations must be completed by 6 p.m., and started no later than 5 p.m.

Examination	Points	Availability
Exam 1: Unit I and II	200	Available 2/24/14 Due 2/28/14
Exam 2: Unit I, II, II, & Modules 8 and 9	200	Available 3/17/14 Due 3/21/14
Exam 3: All Units	200	Available 5/4/14

		Due 5/8/14
Total (Maximum Points Possible)	600	

Grades

The following table summarizes the maximum points that can be earned in the course.

Description	Maximum Points
Online Examinations (Learn)	600
Checkpoints (OLI)	1320
Course	1920

Your grade will depend on your total score, and the grading scale given below. Your total score is the sum of scores from each of the Checkpoints, Examinations, and In-Class Assessments.

Grade	A	A-	B+	B	B-	C+	C	C-	D+	D
Minimum Score Required	1785	1728	1670	1593	1536	1478	1401	1344	1286	1152

- Scores below 1152 results in an “F”.
- None of the assessments can be made up. You will receive a score of zero (0) for any missed assessment.
- Please print and keep a copy of your tests. That will be the proof I will require if there are any disputes about test scores.
- You will have **one week** after receiving the score for each assessment to request any corrections.

Extra Credit

Statistical literacy, reasoning, and thinking are important aspects of this course. By statistical literacy we refer to the basic understanding of the language and tools of statistics. Statistical reasoning refers to the way students understand and make sense of statistical information, and finally, statistical thinking refers to why and how statistical investigations are carried out. By taking this course, I am hoping that your statistical literacy, reasoning, and thinking will improve. To determine this, you will have the opportunity to take two surveys. Details are given below, but please note the following:

- While these surveys are scored, the score **does not** affect your grade for the course.

- You will be given 25 extra credit points for taking each survey. To ensure accuracy of credit, please do the following on the survey:
 - When requested to enter your name on the survey, enter your Kent UserID instead. For example, a person named *Snares Gentoo*, with Kent UserID *sgentoo2*, will enter *sgentoo2*, rather than Snares Gentoo. So, please put your **username** on the survey **exactly** as you have on your Kent account. That way, I can give credit to the right student.
- Each survey takes between 30 and 40 minutes.

Pretest Survey: Please take this survey before you start work on your course. This is a pretest survey, that is, it measures your knowledge before you learn the concepts in this course. To access this :survey

- Go to https://apps3.cehd.umn.edu/artist/user/scale_select.html
 - Enter **EVW3892JTA** for Access Code.

This survey is available only between **01-13-2014 and 01-27-2014 (EASTERN)**.

Posttest Survey: Please take this survey after you have completed all assessments. This is a posttest survey. To access this survey:

1. Go to https://apps3.cehd.umn.edu/artist/user/scale_select.html
2. Enter **CTU2781HSY** for Access Code

This survey is available only between **04-21-2014 to 05-06-2014**.

Academic Honesty

Cheating means to misrepresent the source, nature, or other conditions of your academic work (e.g., tests, papers, projects, assignments) so as to get undeserved credit. In addition, it is considered cheating when one cooperates with someone else in any such misrepresentation. The use of the intellectual property of others without giving them appropriate credit is a serious academic offense. It is the University's policy that cheating or plagiarism result in receiving a failing grade for the work or course. Repeat offenses result in dismissal from the University.

Unless noted, all assessments are open-book, open notes, but please remember that academic dishonesty will result in a failing grade, and may result in dismissal from the University. As part of the instructor tools, I can observe the progress of each student, and also of the class. As such, it is within my right to ask any student suspected of cheating to establish the validity of their work. Failure to do so will result in failing grade.

Please Do The Following Immediately

- Create an account at <http://oli.cmu.edu>
- Pay and join our course. Course Key is **15051-201410**
- Take the pretest survey at http://app.gen.umn.edu/artist/user/scale_select.html, with access code **EVW3892JTA**

Course Content Outline

Introduction and Learning Strategies

1. Introduction
 - a. Welcome!
2. Learning Strategies
 - a. Strategies for Learning
 - b. Developing Skills for Independent Learning
3. The Big Picture

Statistical Reasoning

Unit 1: Exploratory Data Analysis

1. Exploratory Data Analysis
2. Introduction (EDA)

Module 1: Examining Distributions

1. Examining Distributions
2. One Categorical Variable
3. One Quantitative Variable
 - a. Graphs
 - i. Histogram
 - ii. Stemplot
 - b. Numerical Measures
 - i. Measures of Center
 - ii. Measures of Spread
 - iii. Boxplot
 - iv. Standard Deviation
4. Wrap-Up (Distributions)

Module 2: Examining Relationships

1. Examining Relationships
2. Role-Type Classification
 - a. The Role-Type Classification (1 of 2)
 - b. The Role-Type Classification (2 of 2)
3. Case $C \rightarrow Q$
4. Case $C \rightarrow C$
5. Case $Q \rightarrow Q$
 - a. Scatterplot
 - b. Linear Relationships
 - c. Causation
 - d. Wrap-Up (Relationships)

6. Summary (EDA)

Unit 2: Producing Data

1. Producing Data
2. Introduction (Producing Data)

Module 3: Sampling

1. Sampling
2. Wrap-up (Sampling)

Module 4: Designing Studies

1. Designing Studies
2. Introduction
3. Identifying Study Design
4. Causation and Observational Studies
5. Causation and Experiments
6. Experiments with More Than One Explanatory Variable
7. Modifications to Randomization
8. Sample Surveys
9. Wrap-Up (Designing Studies)
10. Summary (Producing Data)

Unit 3: Probability

1. Probability

Module 5: Introduction (Probability)

1. Introduction
2. Relative Frequency

Module 6: Random Variables

1. Introduction
2. Discrete Random Variables
3. Continuous Random Variables
4. Probability Distribution
5. Normal Random Variables
6. Standard Normal Table
7. Applications
8. Wrap-Up (Random Variables)

Module 7: Sampling Distributions

1. Sampling Distributions

2. Parameters vs Statistics
3. Behavior of Sample Proportion
4. Behavior of Sample Mean
5. Wrap-Up (Sampling Distributions)
6. Summary (Probability)

Unit 4: Inference

1. Statistical Inference

Module 8: Introduction (Inference)

1. Introduction to Inference
2. Inference For One Variable

Module 9: Estimation

1. Point Estimation
2. Interval Estimation
 - a. Confidence Interval for the Population Mean
 - b. Confidence Interval for the Population Proportion

Module 10: Hypothesis Testing

1. Hypothesis Testing
2. Overview
3. Overview Wrap Up
4. Hypothesis Testing for the Population Proportion
5. Hypothesis Testing for the Population Mean
6. Hypothesis Testing Wrap Up
7. Wrap-Up (Hypothesis Testing)
8. Type I and Type II Errors
9. Wrap up Type I and Type II Errors

Module 11: Inference for Relationships

1. Introduction
2. Case $C \rightarrow Q$ (1 of 2)
3. Case $C \rightarrow Q$ (2 of 2)
4. Two Independent Samples
5. Matched Pairs
6. ANOVA
7. Conclusion of Case $C \rightarrow Q$

Module 12: Inference for Relationships Continued

1. Case $C \rightarrow C$
2. Case $Q \rightarrow Q$

3. Wrap-Up (Inference for Relationships)
4. Summary (Inference)

Creating a Student Account

Follow the steps below to register for academic course materials offered by the Open Learning Initiative.

- Go to the Open Learning Initiative (OLI) website: <http://oli.cmu.edu>.

In the upper right hand corner of the site, click “Register” and fill out the form.

- On the “**Confirm Your Account Information**” page, review the account information you entered. If everything is correct, click the "Confirm Account" button. If not, click "Edit Account" to make your changes.

Important Note: the only account setting that can't be changed after you confirm your account is your Account ID.

- Read the statements in the “**Online Consent Form**” and select “I Agree” or “I Do Not Agree” then select “Submit.”
- Under “My Academic Courses” enter your Course Key and click “Go.”

Your Course Key is 15051-201410

- Review the course details to make sure that you are registering for the correct course, and click “Register.”
- You will reach the “**Payment Required**” page. Click on the "pay by credit card" button.
- On the Carnegie Mellon credit card payment page enter your billing information and click “Submit.” If your transaction is successful, you will see a receipt page. Save this page for your records.
- Click the return link at the bottom of the receipt page and you will be taken back to your OLI home page.
- Under “**My Courses**” you will see your registered course. You can double-check to make sure the correct course appears by confirming that the correct Course Key and instructors are listed.