M&IS 24056:Fundamentals of Business Statistics

Fall 2015

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Office Hours: MW: 4:20 - 5:20 p.m.
Office Location A401 BSA

Lecture and Lab Times

Section	CRN	Room	Time	Day	Instructor	Office Hours & Location
Lecture		133 Bow	5:30 - 6:20 pm	MW	Murali Shanker	MW 4:20 - 5:20; A401 BSA
1	15763	209 BSA	8:50 - 9:40 am	M	Kishore K Raju	R 3:00 - 5:00 PM; Cubicle opp. A405 BSA
4	15764	110 BSA	8:50 - 9:40 am	T	Yegor Zyrianov	
5	15765	209 BSA	8:50 - 9:40 am	W	Dmitry Anokhin	
6	15766	110 BSA	8:50 - 9:40 am	R	Zhichao Lei	
7	15767	209 BSA	9:55 - 10:45 am	M	Ranjani G Varaghur	M 11AM -12.00 PM; A419 BSA
8	15768	110 BSA	3:20 - 4:10 pm	R	Zhichao Lei	
9	15769	206 BSA	3:20 - 4:10 pm	M	Mehdi Darban	M 4:10PM - 5:10PM; A419 BSA
10	15770	208 BSA	6:35 - 7:25 pm	R	Dmitry Anokhin	
11	15771	205 BSA	6:35 - 7:25 pm	W	Kishore K Raju	R 3:00 - 5:00 PM; Cubicle opp. A405 BSA
12	15772	206 BSA	4:25 - 5:15 pm	M	Matt H Lozykowski	M 5:15PM - 6:15PM; A417 BSA
13	15773	108 BSA	4:25 - 5:15 pm	T	Jessica A Peck	T 3:20PM - 4:20PM A409 BSA

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, 8 November 2015.

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, 6 September 2015 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/index.cfm for more information on registration procedures).

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. For group projects, all group members are responsible for the accuracy and integrity of work turned in by the group regardless of which member actually produced it. Groups, as they plan their work, should budget sufficient time for a thorough review by the team members before submitting an assignment. Plagiarism on a group assignment will impact the grade of all members of the group. 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.

Course Materials

Recommended books:

1. Introduction to the Practice of Statistics, **8th Edition**, David S. Moore, George P. McCabe, Bruce A. Craig. ISBN-10: 1-4641-5893-2, ISBN-13: 978-1-4641-5893-3, **or**
2. Introduction to the Practice of Statistics, **7th Edition**, David S. Moore, George P. McCabe, Bruce A. Craig.

There is no need to purchase an access card or Crunchit!. As such, you can purchase the most economical version. For my lectures, I will be using the 8th edition.

Course Structure

There are three main components to this course: Lecture, Lab, and Online.

Lecture

Time devoted to lectures will be on MW: 5:30 p.m. - 6:20 p.m. in room 133 Bowman Hall. Class time during these hours will be used to clarify and explain important statistical concepts. To make effective use of this time, students are expected to come prepared to class. As such, read the chapter, listen to any posted recordings, and complete the pre-class quizzes *before* coming to class.

Students have the option of also attending this class through Blackboard Collaborate. You will find a link to the Virtual Room on your website at http://learn.kent.edu. You can also click on the following link http://tiny.cc/mis24056. Note that there is also an app, Blackboard Collaborate, that will allow you to follow the lecture on a mobile device. In any case, if you are using the virtual room, please be considerate and use a headset to listen to the audio. This is mandatory if you are listening to it in the physical classroom.

You are required to attend all lectures, either in the physical classroom, or in a virtual setting. If you are absent when attendance is taken, you may be penalized, and receive a failing grade, unless your absence is excused. Please see the university policy on approved absences.

Lab

An important learning objective for this course is the application of statistical methods to practical problems. During lab time, in a small group setting, you will use statistical software to solve practical problems. In addition, lab times will also be used to work on group projects. To ensure maximum learning, please note the following:

- You should only attend the lab for which you are registered. Please do not switch lab sections. You will not get any credit if you attend an incorrect lab session.
- Bring your laptop to every lab class. You will need it.
- Make sure you have JMP and the Teaching Modules Add-In installed (see section on Statistical Software).
- An approximate schedule of activities for each lab is given later in this syllabus.
- Attendance is mandatory for all Lab sessions, and you will receive points for attendance. If you have more than two unexcused absences, you will receive a failing grade for the course, regardless of your final score. The policy on university approved absences can be found at http://www2.kent.edu/policyreg/policydetails.cfm?customel_datapageid_1976529=2037744.

Online

We will be using Blackboard Learn as the online platform. Here, you will have access to:

- *Blackboard Collaborate*: With this, you can attend class in a virtual setting. Class lectures are also automatically recorded and posted.
- *Introductory Lectures*: These are short lectures providing you with an overview of a topic. You should listen to them before attending class for that topic.
- *Pre-Class Quizzes:* These graded quizzes are based on the *Introductory Lectures*, and will be available only before class.
- *Quizzes* and *Examinations*: These are assessments that cover specific chapters and topics. More information on assessments are detailed later in the syllabus.
- *In-Class Assignments* and *Projects*: At appropriate times, information on assignments and projects will be posted.
- *Student Information*: Grades, group assignments, and discussion boards.
- *Data*: Data files related to projects, assignments, and JMP add-ins.

Statistical Software

This course makes extensive use of statistical software. We will be using JMP Statistical software.

JMP is a very powerful, industry standard, and easy-to-use statistical software. JMP is free for all Kent State Students and has been developed for statistical analysis and data exploration. To get a copy of JMP, please go to http://www.kent.edu/is/helpdesk/sas.cfm. 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. A complimentary webcast on learning JMP is being offered. Click here to register. There is also an online library of tutorials on using JMP.

Please install the Teaching Modules Add-In for JMP. You can find this in the *Downloads Folder* on Blackboard Learn.

Assessments

Your total score for this course consists of points from *Attendance*, four types of graded individual assessments, *Pre-Class Quizzes, Quizzes, In-Class Assignments*, and *Examinations*, and one graded group assessment, *Projects*.

There will be **9** quizzes, **5** In-Class Assignments, a group Project with **three** milestones, and two examinations, a midterm, and a final examination, and **several** Pre-Class quizzes. All assessments, except the In-Class Assignments and Project, will be taken online, and are best taken using a standards-compliant web browser like Mozilla Firefox. Examinations, quizzes and pre-class quizzes will consist of multiple choice, true or false, fill-in-the blanks, short-answer, matching, and calculation type questions. All assessments are open-book, open notes, but cheating in any form will result in a failing grade for the course. As such, while you are allowed to use books and notes for the tests, it is cheating if you ask other students to help you while taking the tests.

Pre-Class Quizzes: There will be several pre-class quizzes. These quizzes will be based on the introductory lectures that provide you with an overview of the topic. These quizzes must be taken before class starts for that topic. You will have one attempt to complete each quiz, and the total maximum points that can be earned from pre-class quizzes for the course is 250.

Quizzes: There are 9 quizzes for this class. Each quiz is worth 100 points, and only the best 8 quizzes will be considered. The amount of time allotted for each quiz may vary, but will typically be around 40 minutes. You will have two attempts to take each quiz, and the average score of your attempts will be the score for the quiz. If you are satisfied with your score from your first attempt, you do not have to take the second attempt. While the score from the quizzes will be known immediately, the results will be available only after the quizzes close for all students. Quizzes are not proctored, but once a quiz has been started, you need to complete it in one sitting. The total maximum points that can be earned from quizzes is 800.

In-Class Assignments (ICA): These assignments involve the use of statistical software to solve problems. In most cases, these assignments will be started and completed during lab time. As such, it is important that you bring your laptop, with JMP installed, to each lab class. There will be a total of 5 such assignments, with each assignment worth 200 points. The total maximum points from In-Class Assignments is 1000.

Projects: There will be a group project with three milestones. Each group will consist of between two and three students. Group assignments will be specific to each Lab Section, and will be done by your instructor. Please do not switch lab sections, or join groups on your own.

The number of points for each project milestone will vary, but the maximum possible points for the project will be 1000. The project will be assigned during class time, and will involve an analysis and report of a practical problem. Peer evaluation of each group member will be an integral part of each student's grade for the project.

Examinations: There will be a midterm, and a final examination, each worth 400 points. You will have one attempt to take each exam, and once you start the examination, you need to complete it in one sitting. Each exam will take approximately 90 minutes. While the score from the examinations will be known immediately, the results will be available only after the examination close for all students.

Attendance: Attendance is mandatory for Lab Sessions. You will get 15 points for each lab class you attend, and no points for any missed lab sessions. Unexcused absences for more than two lab sessions will result in a failing grade for the course, regardless of your total points. There are 15 lab sessions for the semester, so the maximum points from attendance is 225.

Grades

The maximum possible score for this class is 4075 (250 from pre-class quizzes, 800 from quizzes, 1000 from in-class assignments, 1000 from projects, 800 from examinations, and 225 from attendance). Your final grade will depend on the grading scale given below.

Grade	A	A-	B+	B	B-	C+	C	C-	D+	D
Minimum Score Required	3831	3668	3545	3423	3260	3138	3016	2853	2730	2608

- Scores below 2608 results in an "F".
- None of the assessments can be made up. Missed assessments will receive a score of zero.
- Please print and keep a copy of your assessments. That will be the proof I will require if there are any disputes about 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:

- You will be given 50 extra credit points for taking the pre-test survey. The number of points for the post-test survey depends on how well you perform in the post-test.
- To ensure accuracy of credit, please enter your first and last name in the survey exactly as given in your Kent records. That way, I can give credit to the right student.
- Each survey takes between 30 and 40 minutes.

Pretest Survey: You will take this survey during your first lab session. This is a pretest survey, that is, it measures your knowledge before you learn the concepts in this course. You will get 50 extra credit points for this survey. The number of points is not affected by your performance in the survey. To access this survey:

- Go to https://apps3.cehd.umn.edu/artist/user/scale_select.html
- Your lab instructor will provide the access code for the survey

Posttest Survey: You will take this survey during your last lab session for the semester. This is a posttest survey. The number of extra credit points you will receive depends on your performance on the survey. Students receiving less than 50% will receive no points. Students with more than 80% score will receive 100 extra credit points. Scores between 50% and 80% will receive between 50 and 100 points interpolated linearly. To access this survey:

1. Go to https://apps3.cehd.umn.edu/artist/user/scale_select.html
2. Your lab instructor will provide the access code for the survey

Course Schedules

Lectures

Topic	Dates
Part I: Looking at Data	August 31 - September 30
Chapter 1: Looking at Data - Distributions	August 31 - September 14
Chapter 2: Looking at Data - Relationships	September 16 - September 23
Chapter 3: Producing Data	September 28 - September 30
Part II: Probability and Inference	October 5 - November 16
Chapter 4: Probability (Sections 4.1 and 4.3)	October 5 - October 7

Chapter 5: Sampling Distributions	October 12 - October 19
Chapter 6: Introduction to Inference (Sections 6.1, 6.2, and 6.3)	October 21 - October 28
Chapter 7: Inference for Distributions (Section 7.1)	November 2 - November 4
Chapter 8: Inference for Proportions (Section 8.1)	November 9 -November 16
Part III: Topics in Inference	November 18 - December 9
Chapter 10: Inference for Regression	November 18 - November 30
Chapter 11: Multiple Linear Regression	December 2 - December 9

Online Assessments: Quizzes, and Examination

The following table gives the topics covered, the assessments given over those topics, the maximum points for **each** assessment, and the due dates for quizzes and examinations. Due dates for pre-class quizzes will be announced on Blackboard Learn, and through email. Please note the following: **All quizzes and exams end at 11:55 p.m. ET on their scheduled due date**.

Topics Covered	Assessments	Due Date	Points / Assessment
Chapter 1: Looking at Data - Distributions	Quiz 1	20 Sep	100
Chapter 2: Looking at Data - Relationships	Quiz 2	27 Sep	100
Chapter 3: Producing Data	Quiz 3	4 Oct	100
Chapter 4: Probability (4.1, 4.3)	Quiz 4	11 Oct	100
Chapter 5: Sampling Distributions	Quiz 5	25 Oct	100
Chapters 1 - 5	Mid-Term Exam	25 Oct	400
Chapter 6: Introduction to Inference (6.1, 6.2, 6.3)	Quiz 6	1 Nov	100
Chapter 7: Inference for Distributions (7.1)	Quiz 7	8 Nov	100
Chapter 8: Inference for Proportions (8.1)	Quiz 8	22 Nov	100
Chapter 10: Inference for Regression	Quiz 9	6 Dec	100
All topics for the course	Final Exam	18 Dec	400

Lab Schedule (In-Class Assignments, and Project)

Week Beginning	Monday Lab	Tuesday Lab	Wednesday Lab	Thursday Lab
31 August	Pre-Test / JMP Installation	Pre-Test / JMP Installation	Pre-Test / JMP Installation	Pre-Test / JMP Installation
7 September	No class	Using JMP for descriptive statistics	Using JMP for descriptive statistics	Using JMP for descriptive statistics

14 September	Using JMP for descriptive statistics	Milestone 1	Milestone 1	Milestone 1
21 September	Milestone 1	ICA - Chapters 1,2	ICA - Chapters 1,2	ICA - Chapters 1,2
28 September	ICA - Chapters 1,2	Review	Review	Review
5 October	Review	ICA - Chapter 3	ICA - Chapter 3	ICA - Chapter 3
12 October	ICA - Chapter 3	Milestone 2	Milestone 2	Milestone 2
19 October	Milestone 2	ICA - Chapter 5	ICA - Chapter 5	ICA - Chapter 5
26 October	ICA - Chapter 5	Milestone 2	Milestone 2	Milestone 2
2 November	Milestone 2	ICA - Chapters 6,7	ICA - Chapters 6,7	ICA - Chapters 6,7
9 November	ICA - Chapters 6,7	Review	No Class	Review
16 November	Review	ICA - Chapter 8	ICA - Chapter 8	ICA - Chapter 8
23 November	ICA - Chapter 8	Milestone 3	No Class	No Class
30 November	Milestone 3	Milestone 3	Milestone 3	Milestone 3
7 December	PostTest	PostTest	PostTest	PostTest

Project

1. Milestone 1 - Due 30 September
2. Milestone 2 - Due 25 November
3. Milestone 3 - Due 12 December

Appendix

Web Links

- JMP Tutorials (http://www.jmp.com/academic/learning_library.shtml)
- Blackboard Learn (https://learn.kent.edu.)

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.
10. Inference for Regression. Construct the simple linear regression model, and develop confidence intervals and significance tests for the parameter estimates. Introduce the analysis of variance for regression.
    a. Introduce the statistical model for linear regression, and estimate the regression parameters.
    b. Develop confidence interval and significance tests for the intercept and slope in a linear regression.
    c. Develop confidence intervals for a mean response and a prediction interval for a future observation
    d. Develop the analysis of variance for regression, including the partitioning of sums of squares, degrees of freedom and mean squares. Present the ANOVA *F* test.
11. Multiple Regression. Present the multiple linear regression model, and the estimation of its parameters. Obtain confidence intervals and significance tests for the regression coefficients. Present the ANOVA table for multiple regression.
    a. Present the multiple linear regression model, and the estimation of the model parameters.
    b. Present the confidence interval and significance tests for the regression coefficients.
    c. Present the ANOVA table for multiple regression. Discuss the *F* test, and the interpretations of the *t* and *F* tests.