

Math 113 - Introduction to Applied Statistics

Summer 2011 Course Syllabus

James Jones, Professor of Mathematics
Mathematics & Sciences Division – Richland Community College

Course Meeting Information

Section 01 meets from 10:00 to 11:50 a.m. on Monday, Tuesday, Wednesday, and Thursday in room S137.

Instructor Information

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Office Hours

Office hours are not required of faculty during the summer term. If you need help please email the instructor or see him before or after class.

Text

Most of the material in the course will be presented through lecture and web pages. For those who wish to have a book for reference purposes, here is one that will work (and is inexpensive).

The Complete Idiot's Guide to Statistics, 2nd edition. Robert A. Donnelly, Jr. Copyright 2007, Alpha Books. ISBN 978-1-59257-634-0 (Optional).

Student Audience

Transfer students in all disciplines. This is a general education course that meets the mathematics requirements for graduation, it does not lead to another course in statistics.

Prerequisite

Successful completion (C or better grade) in Math 098 or satisfactory score on the Mathematics placement exam.

Course Description

MATH 113 - Introduction to Applied Statistics

Hours: 4 lecture - 0 lab - 4 credit

Math 113 is a beginning level course for the student in elementary applied statistics. Topics include basic statistical principles; graphic presentation; descriptive measures of central tendency, dispersion, and location; inferential statistics and hypothesis testing; analysis and inference of linear correlation coefficient and slope of regression line. Students will apply statistical concepts to real world situations. Current technology will be utilized in examining statistical information. A graphing calculator is required.

Applicable toward graduation where program structure permits.

- Certificate or degree: All certificates, A.A.S., A.L.S., A.A, A.S.
- Group requirement: Mathematics
- Area of Concentration: Not applicable.

Illinois Articulation Initiative (IAI)

The Illinois Articulation Initiative is a statewide transfer agreement. Their website is at <http://www.itransfer.org>.

Math 113, Introduction to Applied Statistics, satisfies the Illinois Articulation Initiative Definition of a General Education Mathematics Course. It corresponds to M1902, General Education Statistics.

General Course Objectives

While learning statistics is certainly one of the goals of this course, it is not the only objective. Upon completion of this course, the student should be able to ...

- demonstrate comprehension and understanding in the topics of the course through symbolic, numeric, and graphic methods
- demonstrate the use of proper mathematical notation
- use technology when appropriate and know the limitations of technology
- work with others towards the completion of a common goal
- use deductive reasoning and critical thinking to solve problems

Specific Course Objectives

In all of the following objectives, the student should be able to think, show, and tell what is happening. Concentration will not be on the memorization of formulas but on the conceptual understanding of the statistics. Technology will be heavily emphasized to obtain the results, but the emphasis is on the statistics, not the technology.

Upon successful completion of this course, the student should be able to ...

- describe a sample and know which statistics are appropriate for measuring center and spread
- display categorical and quantitative data using pie charts, histograms, contingency tables, frequency distributions, scatter plots, dot plots, and box plots as appropriate
- understand randomness, sampling techniques, and experiments
- determine probabilities using probability rules and simulation techniques
- find the mean and standard deviation of a probability distribution
- understand and use the binomial distribution
- work with the normal distributions and determine if populations are normally distributed
- understand the properties of the standard normal distribution
- understand the sampling distribution models for means and proportions
- find confidence intervals for proportions and means of one and two samples
- conduct hypothesis tests for proportions and means of one and two samples
- apply the classical, p-value, and confidence interval approaches to hypothesis testing
- find and test the significance of the linear correlation coefficient
- find and use the regression equation
- compare different models in multiple regression (time permitting).
- perform chi-square goodness of fit tests and test for independence
- conduct one-way and two-way (time permitting) analysis of variance problems
- understand the workings of the analysis of variance table and its application to simple regression, multiple regression, one-way ANOVA, and two-way ANOVA situations.

A detailed topical outline of the content covered in this course is at the end of this syllabus.

Type of Instruction

Discussion, problem solving, activities, individual and group work, student questions, student participation, and lecture. Students are expected to have read the material before class and are strongly encouraged to come to class with a list of questions and to ask these questions. A substantial portion of this class will involve collaborative work with other students.

Method of Evaluation

Could include any of the following: problem solving exams, objective exams, essays, research papers, oral presentations, group projects, individual projects, classroom participation, classroom activities, quizzes, and homework.

Grading Policy

Letter grades will be assigned to final adjusted scores as follows:

A: 90-100% B: 80 - 89% C: 70-79% D: 60-69% F: below 60%

The instructor will give you a grade sheet so that you can record your scores and keep track of your progress in the course. There is also a web page that you can use to check your grades throughout the semester. If you are concerned about your grades, see the instructor.

There is no rounding of grades or extra credit in this course. The course is a marathon, not a sprint at the end. You must perform consistently throughout the semester to earn a good grade. If you are one point short of the next higher grade at the end of the semester, you will get the lower grade.

Assignments are due at the beginning of the class period on the date they are due. The instructor may be gracious and allow you to turn them in later that day without counting them late, but do not count on his graciousness. Late assignments lose 20% of their value per class period. The instructor reserves the right to apply this rule to missed exams as well as regular assignments. No late work will be accepted after the final.

The student must notify the instructor that late work has been submitted. The instructor will not go looking for it.

Written Work

All written work should be in a typed (word processor) format. There should be a cover page with the title of the assignment and the student's name. All work should be double spaced. Papers are to be stapled together in the upper left hand corner. All reference works used, including books, videos, etc., are to be cited using APA (preferred) or MLA notation. All work is to utilize the English language correctly. It is suggested that the Student Learning Center be utilized for assistance in the preparation of written work. If written work is submitted late, the instructor may take appropriate deductions from the grade.

Attendance Policy

The summer moves at a very fast pace as we cover twice as much every day as in a normal semester. Missing even one day can seriously impact your success in the course. The term will begin with (at least) a week-long project designed to give an overview of the entire course and the technology used in the course. It is extremely important that you be there for this or you will be behind the entire semester.

If you miss the first day of class or any two consecutive days after that without communicating with the instructor, you may be dropped. If you plan on taking a week off during the summer, go ahead and drop now and get your money back.

Attendance is recorded every class period. Since the course does not directly follow a textbook, attendance is the primary method of obtaining the information in the course. Statistics is a cumulative subject and each day builds on the previous day's material.

Students who, because of excessive absences, cannot complete the course successfully, are required to be administratively dropped from the class at midterm. If a student stops attending after midterm, it is the student's responsibility to withdraw to avoid an "F". Do not stop attending and assume that you will be withdrawn from the class by the instructor.

The student is responsible for all assignments, changes in assignments, or other verbal or written information given in the class, whether in attendance or not.

If a student must miss class, a call to the instructor (RCC's phone system has an answering system) should be made or an email message (preferred) sent. When a test is going to be missed, the student should contact the instructor ahead of time if at all possible. Arrangements can usually be made to take the test before the scheduled time. If circumstances arise where arrangements cannot be made ahead of time, the instructor should be notified and a brief explanation of why given by either voice or email. This notification must occur before the next class period begins.

Calculators

A calculator is required for this course. It does not have to be a graphing calculator, but it should be a scientific calculator with the ability to square a number and find the square root of a value. You are responsible for knowing how to use your calculator. If you do not know, then ask. Bring the calculator every day to class.

Additional Supplies

The student should bring a pencil, paper, and calculator to class each day. You may occasionally want a ruler or graph paper. There will be a paper punch and stapler in the classroom.

Collaborative Work

This is an *applied* statistics course. We will be doing several activities and projects in this course that require group work. Much of this time will be spent in the classroom, but there will also be time outside of class required. Computer software will be used for analysis of the data.

Some of these projects will be designed by the instructor and involve the entire class. One of the projects will be a capstone project designed by each individual group and approved by the instructor. This final project will include a written paper and oral presentation of the results to the class of their findings.

Technology

In this course, we will concentrate on understanding the statistics and relegate the roll of finding the statistics to technology. We are going to embrace the technology, but the course is not about the technology, it's about the statistics. You may feel overwhelmed, especially if you're not comfortable

around computers, but we will try to make it as friendly as possible without stifling those power users who want to really enhance their material.

Most of the technology we're going to use is free, open source, or web-based so that there is no additional cost to the students and you can use them after you leave this course. Some software is commercial, but in those cases, Richland Community College has a license to use them. Here is a list of some of the computer packages we may use in this course.

Minitab

Minitab is the statistical software package of choice for this class. It is powerful and makes nice graphs. Minitab is fairly easy to use if you are familiar with a spreadsheet like Excel.

Minitab is installed on the computers in S137, the Student Learning Center, and the Open Computer Lab. Richland's license for Minitab does not allow for home use, but students will be able to get most of their work done at school. There is a 30 day trial version of Minitab available on the web for downloading at <http://www.minitab.com/>. You may also purchase a six month copy that will last the entire semester. Minitab is available only for Windows.

The number one suggestion from former students is to rent Minitab so that you don't have to stay at school to do your work.

MediaWiki

Much of the collaboration within this class will be done inside of a Wiki. Most students have used a Wiki (Wikipedia.org), but we will be creating the content rather than just looking it up. MediaWiki is the wiki software that Wikipedia uses.

MediaWiki is a web-based application, so students may use it from anywhere they have Internet access. More information about MediaWiki is available at <http://www.mediawiki.org>

Other Software and Websites

This course is fluid and other software packages or websites may be incorporated into the class.

Additional Help

The student is encouraged to seek additional help when the material is not comprehended. Mathematics is a cumulative subject; therefore, getting behind is a very difficult situation for the student. There are several places where you can seek additional help in your classes.

Instructor

I try to make myself as available to the students as I can. My office hours are listed at the beginning of this syllabus, but those are just the times I'm scheduled to be in my office. Grab me and ask me questions if you see me in the hallway. Ask questions before or after class. If I'm in my office and it's not my scheduled office hours, go ahead and stop in.

The instructor should be considered the authoritative source for material related to this class. If a tutor or other student says something that disagrees with the instructor, believe the instructor.

Study Groups

Probably the best thing you can do for outside help is to form a study group with other students in your class. Work with those students and hold them accountable. You will understand things much better if

you explain it to someone else and study groups will also keep you focused, involved, and current in the course.

Video tapes

There is a video tape series called "The High Stakes World of Statistics" that is on reserve in the Learning Resources Center. While not specifically tailored for our text, they do present an overview of statistics in a non-classroom setting. Celebrity guests and college students make statistics exciting and understandable. Sometimes there are problems with the accuracy of the videos, but generally speaking, they are a good resource.

Student Learning Center

The Student Learning Center provides professional or peer tutoring and is located in room S117. There is also a computer lab with the software used in this class. They also provide reading and writing assistance to students. Their services are provided free of charge to the student.

Learning Accommodation Services

There are accommodations available for students who need extended time on tests, note takers, readers, adaptive computer equipment, braille, enlarged print, accessible seating, sign language interpreters, books on tape, taped classroom lectures, writers, or tutoring. If you need one of these services, then you should see Learning Accommodation Services in room C136.

If you request an accommodation, you will be required to provide documentation that you need that accommodation.

Some of you will need additional time on tests. There is no need to go to learning accommodation services to request that. If you need additional time, just let me know and in most cases, I'll allow you to continue working past the allotted time. You may need to move to another room as there may be another class coming into your room. If you're unable to finish the test by staying late, it may be possible to start the test earlier to gain additional time. There may be circumstances where extra time is not allowed.

Academic Dishonesty

Each student is expected to be honest in his/her class work or in the submission of information to the College. Richland regards dishonesty in classroom and laboratories, on assignments and examinations, and the submission of false and misleading information to the College as a serious offense.

A student who cheats, plagiarizes, or furnishes false, misleading information to the College is subject to disciplinary action up to and including failure of a class or suspension/expulsion from the College.

Non-Discrimination Policy

Richland Community College policy prohibits discrimination on the basis of race, color, religion, sex, marital or parental status, national origin or ancestry, age, mental or physical disability (except where it is a bonafide occupational qualification), sexual orientation, military status, status as a disabled or Vietnam-era veteran.

Electronic Communication Devices

The Mathematics and Sciences Division prohibits the use of cell phones, pagers, and other non-learning electronic communication equipment within the classroom. All equipment must be turned off to avoid disturbances to the learning environment. If a student uses these devices during an examination, quiz, or

any graded activity, the instructor reserves the right to issue no credit for these assignments. The instructor needs to approve any exceptions to this policy.

Topical Outline

This course is going to be data driven and fluid. Instead of having a textbook that defines how much time is spent on each topic, it will be the data that defines how much time is spent. We will take a data set and fully explore it, beginning with the context of the data, describing it visually and numerically, and then using inferential statistics to perform confidence intervals and hypothesis tests. When we have exhausted one set of data, we will move on to another and repeat the process to learn new material.

That makes defining how much time will be spent on each topic very difficult. The following topical outline is an estimate of how much time will be spent on each topic and is aligned with the chapters in the textbook. However, we won't be using learning the material in this order.

Descriptive Statistics – 14 hours

- Introduction to statistics and data
- Ways of classifying data, levels of measurement
- Critical thinking skills
- Charts and graphs: Frequency distributions, bar charts, stem and leaf plots
- Describing a distribution: shape, center, spread
- Measures of center: mean, median, mode, midrange
- Measures of spread: range, variation, variance, standard deviation
- Empirical rule, Chebyshev's rule
- Measures of relative position: quartiles, percentiles, interquartile range

Probability – 14 hours

- Fundamentals
- Classical, empirical, and subjective probabilities
- Unions and intersections
- Addition rule for "or" and multiplication rule for "and"
- Tree diagrams
- Conditional probabilities
- Counting techniques
- Random variables
- Mean, variance, and standard deviation of a discrete random variable
- Binomial distributions
- Mean, variance, and standard deviation for binomial distribution
- Standard normal distribution. Finding areas from z-scores and z-scores from areas.
- Applications of the normal distribution. Converting from and to raw scores.

Inferential Statistics – 15 hours

- Types of sampling and sampling errors
- Sampling distributions and the Central Limit Theorem
- Student's t distribution
- Sampling distributions for proportions
- Confidence intervals for the population mean and population proportion
- Hypothesis testing fundamentals
- Classical approach comparing test statistic to critical value
- Probability value approach comparing p-value to significance level

- Confidence interval approach comparing claimed value to confidence interval
- Types of errors, significance level, p-value
- Decisions vs conclusions
- Testing a claim about a single population mean and proportion
- Testing a claim about two population means and proportion
- Paired samples t-test

Advanced Inferential Statistics – 18 hours

- Linear correlation
- Hypothesis test for correlation
- Regression analysis, finding regression equation from summary statistics and correlation coefficient
- Explained, unexplained, and total deviations
- Coefficient of determination
- Table of coefficients and Analysis of Variance. F distribution.
- Multiple regression, adjusted R squared (time permitting)*
- Chi-square distributions
- Chi-square goodness of fit test (multinomial experiments)
- Chi-square test for independence, test for homogeneity
- One-Way Analysis of Variance
- Two-Way Analysis of Variance (time permitting)*

* The multiple regression and two-way ANOVA sections are not covered in the optional textbook. They will be covered in class if time permits.