STA 674 Syllabus

STA 674-201

Regression Analysis and Design of Experiments

Semester/Term: Spring 2022
Credit Hours: 3
Meeting Days/Time/Location: Online, with times/opportunities to discuss material with the instructor and TA as needed. There are no set class meetings.

Instructor Information

Instructor: Melissa Pittard, Ph.D.
Office Building & Room Number: Multidisciplinary Science Building 303A
Email: Melissa.pittard@uky.edu
Office Phone: (859) 257-6115
Virtual Office Hours: M 1-2pm in person, T 3-4pm on Zoom, and by appointment on Zoom
Preferred Method of Communication: email listed above

Teaching Assistant (TA): Jerry Xu
Email: jxu238@uky.edu
Virtual Office Hours: TBD and by appointment on Zoom

Preferred Method of Communication: email addresses listed above

Course Description

Course begins with an applied regression module that emphasizes analysis and interpretation of real data, and statistical computing. Second part of course focuses on principles and implementation of experimental design for scientific research purposes. Standard designs presented along with the proper kinds of analysis for each. Continued emphasis on real data and statistical computing using R and/or SAS.

Course Prerequisites

STA 570 or equivalent and graduate standing at the University of Kentucky or permission of the instructor.

Student Learning Outcomes

Activities in the first portion of the course are designed help you to develop a conceptual understanding of correlation and regression analysis, to implement these methods in various statistical software packages and to interpret the results, and to evaluate the use of these methods in your own work and in published literature in your field. In the second portion, activities are focused on developing a non-mathematical understanding of the concepts of experimental design, analyzing the resulting data with the various statistical software packages, and interpreting of the results.

The primary goals of this course are that you develop the skills necessary:

1. To perform a full regression analysis of simple data,
2. To interpret and summarize the results you obtain, and

3. To think critically about applications of regression methods in your field of study
4. Design simple experiments to test hypotheses about specified treatments,
5. Analyze the data you collect in a statistical software package and report on your results, and
6. Think critically about the design of experiments in your own work and in published work from researchers in your field.

Required Materials

No required textbooks, although these are optional and excellent and will be referred to occasionally:

For the regression analysis portion: Terry Dielman's *Applied Regression Analysis*, 4th ed.
ISBN 9780534465483.

For the design of experiments portion: Douglas Montgomery's *Design and Analysis of Experiments*, 10th ed.
ISBN 978-1-119-72210-6

Robert O. Kuehl's *Design of Experiments: Statistical Principles of Research Design and Analysis*, ISBN 978-1-119-58906-8. (This is out of print, but provided for reference)

Technology Information and Requirements

Technology Requirements

Minimum technical requirements for UK courses and suggested hardware, software, and internet connections are available at ITS Student Hardware & Software Guidelines.

This course is an online course and content, assignments and interactions rely on all students having computer hardware and software. While these are available on computers in student computer labs on UK's campus, most students will not be physically present and are responsible for gaining access themselves.

Hardware:

- Computer, a newer model with a recent operating system and a hard drive with at least 2-5 GB of free space (more can be useful).
- Webcam and a headset/microphone for online interaction
- A broadband internet connection
- Students are responsible for ensuring that their computer is smoothly operating (virus free, OS updates, etc.).

Software:

- PDF reader, such as Adobe Acrobat Reader
- Microsoft Office (Excel, Word, PowerPoint P available free through UK, https://download.uky.edu/)
- R and SAS (available free through UK, https://download.uky.edu/)
- Video Media player such as Windows Media Player, or Apple Quick Time
- An Internet Browser supporting HTML 5, we recommend Chrome

- In addition, as part of this course students will be expected to install various software programs, device drivers, etc. Specific instructions will be provided as part of the course.

Tests:

- **Check Your Computer** (https://www.whatismybrowser.com/) a quick test to see what browser version you are using, whether or not you have Java and JavaScript enabled, your version of Flash player, and several other items.
- **Speed Test** (http://www.speedtest.net/) Use this site to check what download speed you are getting. For videos to play, you need at least a 1 Mbps download speed. If higher, you will have less possibility of the videos having to stop and wait for more of the video to download.

Canvas Learning Management System:

This course uses the Canvas Learning Management System or LMS. The course online system is available via Canvas (https://uk.instructure.com/). Use your LinkBlue account to login and you will see this course under the courses menu (top of the page towards the left). This course - https://uk.instructure.com/courses/1096339 offers an orientation to Canvas and the Help button in the top right corner provides quick access to the guides, ask the community and the phone number for 24/7 support. Course materials (syllabus, readings, assignments, discussions, exams, etc.) will all be posted here and you are responsible for any changes in assignments, readings and due dates posted on the course blog.

Other Technical Complaints:

If the student is having difficulty with their own computer or software, they will be responsible for resolving these as soon as possible.

Special Resources for Online Students: See UK's Distance Learning Webpage for a complete listing of services and contacts. http://www.uky.edu/DistanceLearning/ or call (859) 257-3377 or email distancelearn@lsv.uky.edu. Additional material will be distributed on online services from UK will be distributed as appropriate.

Distance Learning Library Services:

The goal of Distance Learning Library Services is to provide access to information resources for the students who take classes through the Distance Learning Programs. Services include:

- Access to the *University's* circulating collections
- Document Delivery & Interlibrary Loan
- Research Assistance
- Information on Distance Learning Library Services:
- http://www.uky.edu/DistanceLearning/current/DLLS/
- Distance Learning Librarian: Carla Cantagallo
- Local phone number: 859 257-0500, ext. 2171
- Long-distance phone number: (800) 828-0439 (option #6)
- Email: dllservice@email.uky.edu
- Distance Learning Interlibrary Loan Service: http://www.uky.edu/Libraries/libpage.php?lweb_id=253&llib_id=16

Technical Support

For account help, contact UK's Information Technology Customer Services online, by email, or by phone at 859-218-HELP (4357).

Activities and Assignments

Provide textual information that describes course activities – examples available below.

Course Assignments

This is a tentative listing of required assignments for your course grade.

- 2 Exams at 100 points each – 30 + 30 = 60%
- 6 graded homework assignments at 20 points each – 36%
- "Initiative taken with statistical software" – 4%

Summary Description of Course Assignments

Each exam may consist of a portion done offline, doing data analysis at the student's own pace, using statistical analysis package(s), summarizing results, etc. A second portion may consist of a scheduled online portion wherein the student provides answers to questions that may or may not depend on the outcome of that offline analysis—in any instance, **previous coursework together with the analysis will completely prepare the student for the online portion (and may be accessed during it.)**

The homework assignments will be short questions of the sort seen in the lectures—code needed will be an easy adaptation of code seen in the lectures (which will be provided on Canvas.) Points toward "Initiative taken with statistical software" will be earned on the last four homework assignments. Because code will be provided for each assignment, we want to incentivize the process of personalizing, running, and submitting the code and its results for credit. As an example, it is easy to see the difference between the following two sections of code:

```
DATA ORANGE;
  INPUT METHOD BLOCK WEIGHT;
  CARDS;
1 1 450
!
6 8 98
RUN;

title "Analysis of orange growth data
w/blocks--MAGebert";

/* Analysis with blocks */;
PROC GLM DATA=ORANGE;
    CLASS method block;
    MODEL weight=method block;
    LSMEANS method / CL;
    OUTPUT OUT=ORANGEPRED1P
           PREDICTED=fittedweight;
RUN;
```

```
DATA data1;
  INPUT x1 x2 y;
  CARDS;
1 1 450
!
6 8 98
RUN;

PROC GLM DATA=data1;
    CLASS x1 x2;
    MODEL y=x1 x2;
    LSMEANS x1 / CL;
    OUTPUT OUT=data2
           PREDICTED=fittedy;
RUN;
```

The point is (and this point is earned by): even though you will be given SAS and R code that is fully functional, you want to make sure that you turn in code that, through the use of comments and titles (on pages of output or graphs) tells your "statistical consumer," even if it is you, what they are looking at. And you get the first two assignments to practice on.

Submission of Assignments

Assignment submissions will be on Canvas with *no late submissions accepted for unexcused absences.* **Formatting for submission will be .pdf, .sas, .r, and .Rmd files. If other formatting is required, students will be notified in advance of the due date.**

Note: if you are new to programming and/or online courses, failure to anticipate challenges at the last minute with submitting your assignment is not an excused absence.

Course Grading

Expectations for graduate students beyond the expectations for undergraduates

For 400G- and 500-level courses only.

Grading scale for undergraduates	88 – 100% = A 78 – 89% = B 68 – 79% = C 58 – 69% = D Below 60% = E
Grading Scale for graduate students (no D for Grad Students)	90 - 100% = A 80 – 89% = B 70 – 79% = C Below 70%= E

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Resources

Distance Learning Library Services
Carla Cantagallo, Distance Learning Librarian, 859-218-1240

Tentative Course Schedule

Dates	Topics	Assignments, Notes
1/10-1/14	Measuring Association between Two Variables Scatterplots Correlation	Includes course introduction. Note: Chapter information refers to recommended text Dielman (D): chapter 2
1/17-1/28	Fitting Simple Linear Regression Models Least Squares Estimation Confidence Intervals and Significance Tests Prediction	Assignment 1: Due 1/28 D: chapter 3
1/31-2/4	Fitting Multiple Linear Regression Models Estimation with Several Predictors Confidence Intervals and Significance tests ANOVA Tables Prediction Multi-Collinearity	D: chapter 4
2/7-2/11	Fitting Curves to Data and using indicator variables	D: Chapters 5,7
2/14-2/18	Checking Model Assumptions Assumptions of a Regression Model Checking Assumptions and Fixing Problems	Assignment 2: Due 2/18 D: chapter 6
2/21-3/4	Comparing and Selecting Models Tests for Comparing Two Models Stepwise Model Selection All Possible Regressions	Assignment 3: Due 3/4 D: chapter 8
3/9-3/10	Exam 1: Regression Analysis Material	Open book, open note, online exam* Dates 3/9-3/10
3/21-3/23	Basic Principles of Experimental Design Planning of an Experiment Types of Experiments and Terminology Replication and Randomization	Note: section information refers to recommended text Montgomery (M): Chapter 1

3/24-3/31	Experiments with a Single Factor Completely Randomized Design Model and Estimation Analysis of Variance Inference	Assignment 4: Due 3/31 M: 3.1-3.4, 3.10
4/1-4/6	Treatment Comparisons Introduction Planning Comparisons Adjusting for Multiple Comparisons Unplanned Comparisons	M: 3.5
4/7-4/13	Experiments with Multiple Factors Factorial Designs Experiments with Two Factors Experiments with Three or More Factors	Assignment 5: Due 4/13 M:5.1-5.4
4/14-4/20	Blocking Introduction to Blocking Completely Randomized Block Designs	M:4.1
4/21-4/27	Split-Plot Designs Different Sized Experiment Units Model and Estimation Power Analysis	Assignment 6: Due 4/27 M:14.4
5/3-5/4	Exam 2: Experimental Design Material	Open notes, open book, online exam* Dates 5/3-5/4

*All or a portion of exams may be proctored using the Respondus lockdown browser and webcam monitor.

Final Exam Information

Week of 5/10. Details TBA.

Other Policies

Syllabus Changes: This syllabus schedule is subject to change. Any such changes will be announced online.

Midterm Grades for Undergraduate Students (Senate Rules 6.1.3.1)

Mid-term grades will be posted in myUK by the deadline established in the Academic Calendar.

Excused Absences (Senate Rules 5.2.4.2)

Senate Rules 5.2.4.2 defines the following as acceptable reasons for excused absences: (a) significant illness, (b) death of a family member, (c) trips for members of student organizations sponsored by an educational unit, trips for University classes, and trips for participation in intercollegiate athletic events, (d) major religious holidays, (e) interviews for graduate/professional school or full-time employment post-graduation, and (f) other circumstances found to fit "reasonable cause for nonattendance" by the instructor of record. Students should notify the professor of absences prior to class when possible.

If a course syllabus requires specific interactions (e.g., with the instructor or other students), in situations where a student's total EXCUSED absences exceed 1/5 (or 20%) of the required interactions for the course, the student shall have the right to request and receive a "W," or the Instructor of Record may award an "I" for the course if the student declines a "W." (Senate Rules 5.2.4.2.1)

Verification of Absences (Senate Rules 5.2.4.2.1 – 6)

Students may be asked to verify their absences in order for them to be considered excused. *Senate Rule 5.2.4.2* states that faculty have the right to request appropriate verification when students claim an excused absence due to: significant illness; death in the household, trips for classes, trips sponsored by an educational unit and trips for participation related to intercollegiate athletic events; and interviews for full-time job opportunities after graduation and interviews for graduate and professional school. (Appropriate notification of absences due to University-related trips is required prior to the absence when feasible and in no case more than one week after the absence.)

Religious Observances (Senate Rules 5.2.4.2.1.4)

Students anticipating an absence for a major religious holiday are responsible for notifying the instructor in writing of anticipated absences due to their observance of such holidays. Please check the course syllabus for the notification requirement. If no requirement is specified, two weeks prior to the absence is reasonable and should not be given any later. Information regarding major religious holidays may be obtained through the Ombud's website or calling 859-257-3737.

Make-Up Work (Senate Rule 5.2.4.2.2)

Students missing any graded work due to an excused absence are responsible: for informing the Instructor of Record about their excused absence within one week following the period of the excused absence (except where prior notification is required); and for making up the missed work. The instructor must give the student an opportunity to make up the work and/or the exams missed due to the excused absence, and shall do so, if feasible, during the semester in which the absence occurred. The instructor shall provide the student with an opportunity to make up the graded work and may not simply calculate the student's grade on the basis of the other course requirements, unless the student agrees in writing. It is the instructor's policy that late work is NOT accepted without a valid University excuse (Tier 1 excuses are not accepted).

Excused Absences and W/I, All Students (Senate Rule 5.2.4.2.3.1)

If a student has excused absences for more than one-fifth of the required interactions for a course, the student can request a "W." If the student declines a "W," the Instructor of Record may award an "I" for the course.

Excused Absences Due to Military Duties (Senate Rule 5.2.4.2.3.1)

If a student must be absent for one-fifth or less of the required course interactions (e.g., class meetings) due to military duties, the following procedure apply:

1. Once a student is aware of a call to duty, the student shall provide a copy of the military orders to the Director of the Veterans Resource Center. The student shall also provide the Director with a list of her/his courses and instructors.
2. The Director will verify the orders with the appropriate military authority and on behalf of the military student, notify each Instructor of Record via Department Letterhead as to the known extent of the absence.
3. The Instructor of Record shall not penalize the student's absence in any way and shall provide accommodations and timeframes so that the student can make up missed assignments, quizzes, and tests in a mutually agreed upon manner.

Accommodations Due to Disability

If you have a documented disability that requires academic accommodations, please see me as soon as possible during scheduled office hours. In order to receive accommodations in this course, you must provide me with a Letter of Accommodation from the Disability Resource Center (DRC). The DRC coordinates campus disability services available to students with disabilities. Visit the DRC website, email the DRC, contact them by phone at (859) 257-2754, or visit their office on the corner of Rose Street and Huguelet Drive in the Multidisciplinary Science Building, Suite 407.

Non-Discrimination Statement and Title IX Information

UK is committed to providing a safe learning, living, and working environment for all members of the University community. The University maintains a comprehensive program which protects all members from discrimination, harassment, and sexual misconduct. For complete information about UK's prohibition on discrimination and harassment on aspects such as race, color, ethnic origin, national origin, creed, religion, political belief, sex, and sexual orientation, please see the electronic version of UK's *Administrative Regulation 6:1* ("Policy on Discrimination and Harassment") . In accordance with Title IX of the Education Amendments of 1972, the University prohibits discrimination and harassment on the basis of sex in academics, employment, and all of its programs and activities. Sexual misconduct is a form of sexual harassment in which one act is severe enough to create a hostile environment based on sex and is prohibited between members of the University community and shall not be tolerated. For more details, please see the electronic version of *Administrative Regulations 6:2* ("Policy and Procedures for Addressing and Resolving Allegations of Sexual Assault, Stalking, Dating Violence, Domestic Violence, and Sexual Exploitation"). Complaints regarding violations of University policies on discrimination, harassment, and sexual misconduct are handled by the Office of Institutional Equity and Equal Opportunity (IEEO), which is located in 13 Main Building and can be reached by phone at (859) 257-8927. You can also visit the IEEO's website.

Faculty members are obligated to forward any report made by a student related to IEEO matters to the Office of Institutional Equity and Equal Opportunity. Students can *confidentially* report alleged incidences through the Violence Intervention and Prevention Center, Counseling Center, or University Health Services.

Academic Integrity– Prohibition on Plagiarism (Senate Rules 6.3.1)

Per University policy, students shall not plagiarize, cheat, or falsify or misuse academic records. Students are expected to adhere to University policy on cheating and plagiarism in all courses. The minimum penalty for a first offense is a zero on the assignment on which the offense occurred. If the offense is considered severe or the student has other academic offenses on their record, more serious penalties, up to suspension from the University may be imposed.

Plagiarism and cheating are serious breaches of academic conduct. Each student is advised to become familiar with the various forms of academic dishonesty as explained in the Code of Student Rights and Responsibilities. Complete information can be found on the Academic Ombud page. A plea of ignorance is not acceptable as a defense against the charge of academic dishonesty. It is important that you review this information as all ideas borrowed from others need to be properly credited.

Senate Rule 6.3.1 (see current *Senate Rules*) states that all academic work, written or otherwise, submitted by students to their instructors or other academic supervisors, is expected to be the result of their own thought, research, or self-expression. In cases where students feel unsure about a question of plagiarism involving their work, they are obliged to consult their instructors on the matter before submission.

When students submit work purporting to be their own, but which in any way borrows ideas, organization, wording, or content from another source without appropriate acknowledgment of the fact, the students are guilty of plagiarism.

Plagiarism includes reproducing someone else's work (including, but not limited to a published article, a book, a website, computer code, or a paper from a friend) without clear attribution. Plagiarism also includes the practice of employing or allowing another person to alter or revise the work which a student submits as his/her own, whoever that other person may be, except under specific circumstances (e.g. Writing Center review or peer review) allowed by the Instructor of Record or that person's designee. Plagiarism may also include double submission, self-plagiarism, or unauthorized resubmission of one's own work, as defined by the instructor.

Students may discuss assignments among themselves or with an instructor or tutor, except where prohibited by the Instructor of Record (e.g. individual take-home exams). However, the actual work must be done by the student, and the student alone, unless collaboration is allowed by the Instructor of Record (e.g. group projects).

When a student's assignment involves research in outside sources or information, the student must carefully acknowledge exactly what, where and how he/she has employed them. If the words of someone else are used, the student must put quotation marks around the passage in question and add an appropriate indication of its origin. Making simple changes while leaving the organization, content, and phraseology intact is plagiaristic. However, nothing in these Rules shall apply to those ideas, which are so generally and freely circulated as to be a part of the public domain.

Please note: Any assignment you turn in may be submitted to an electronic database to check for plagiarism.

Academic Integrity – Prohibition on Cheating (Senate Rules 6.3.2)

Cheating is defined by its general usage. It includes, but is not limited to, the wrongfully giving, taking, or presenting any information or material by a student with the intent of aiding himself/herself or another on any academic work which is considered in any way in the determination of the final grade. The fact that a student could not have benefited from an action is not by itself proof that the action does not constitute cheating. Any question of definition shall be referred to the University Appeals Board.

Collaboration is not the same as turning in a group assignment. If you turn in an assignment that has a high resemblance to another student, you may be charged with an academic offense. You MUST turn in your own work that is unique to you.

Academic Integrity – Prohibition on Falsification/Misuse of Academic Records (SR 6.3.3)

Maintaining the integrity, accuracy, and appropriate privacy of student academic records is an essential administrative function of the University and a basic protection of all students. Accordingly, the actual or attempted falsification, theft, misrepresentation or other alteration or misuse of any official academic record of the University, specifically including knowingly having unauthorized access to such records or the unauthorized disclosure of information contained in such records, is a serious academic offense. As used in this context, "academic record" includes all paper and electronic versions of the partial or complete permanent academic record, all official and unofficial academic transcripts, application documents and admission credentials, and all academic record transaction documents. The minimum sanction for falsification, including the omission of information, or attempted falsification or other misuse of academic records as described in this section is suspension for one semester.

Diversity, Equity, and Inclusion (SR 6.1.1)

Please see https://www.uky.edu/universitysenate/syllabus-dei

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