

# STATISTICS FOR GRADUATE BUSINESS STUDIES II (QA 605) WINTER QUARTER, 2011-2012 ACADEMIC YEAR

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Text(s):	Dean, Angela & Dan Voss, <i>Design and Analysis of Experiments</i> , Springer-Verlag Publishing, 1 <sup>st</sup> edition, 1999.
Other Suggested Texts:	Douglass C. Montgomery, <i>Design &amp; Analysis of Experiments</i> , John Wiley & Sons, 5 <sup>th</sup> edition, 2001.  B. J. Winer, <i>Statistical Principles in Experimental Design</i> , McGraw-Hill, 3 <sup>rd</sup> edition, 1991.  Robert O. Kuehl, <i>Design of Experiments</i> , Duxbury Press, 2000.  George A. Milliken & Dallas E. Johnson, <i>Analysis of Messy Data Volume 1: Designed Experiments</i> , Chapman & Hall, 1 <sup>st</sup> edition, 1992.  Keith E. Muller, Bethel A. Fetterman, <i>Regression and ANOVA: An Integrated Approach Using SAS Software</i> , John Wiley & Sons, 1 <sup>st</sup> edition, 2003.
Prerequisites:	QA 390 (Calculus, Linear/Matrix Algebra, Basic Probability and Probability Distributions)  QA 432 (Intermediate Business Statistics) - For a good review of basic statistics, please study the material provided on the <a href="#">QA 233 Virtual Classroom</a> that is hyperlinked to my internet home page. Material posted on this site that may be of interest to you includes pdf files of lecture slides for all material covered in this course. You should have a strong understanding of all concepts covered in QA 233, including (but not limited to): <ul style="list-style-type: none"><li>• levels of data<ul style="list-style-type: none"><li>○ nominal</li><li>○ ordinal</li><li>○ interval</li><li>○ ratio</li></ul></li><li>• descriptive statistics</li><li>• basic probability</li><li>• probability distributions (especially the Binomial and Normal distributions)</li><li>• unbiasedness, efficiency, and consistency</li><li>• interval estimation/confidence intervals (<i>including the correct interpretation</i>)</li></ul>

- means
- proportions
- sample size determination
- data collection
  - time series vs. cross-sectional
  - observational vs. experimental
- approaches to sampling
  - simple random sampling
  - stratified random sampling
  - cluster random sampling
  - systematic random sampling
  - nonprobability sampling
- one and two sample hypothesis testing
  - setting up null and alternative hypotheses
  - one or two means
  - one or two proportions
  - p-values (*including the correct interpretation*)
  - critical value approach
  - type I and type II errors
  - power of a test

QA 622 (Statistics for Graduate Business Studies I)

Computer Literacy (ability to learn and use SAS)

Grading:	Interim Exam	150 points
	Literature Review Project	150 points
	Comprehensive Final	200 points

Course Overview: This is the second of three courses in sequence (QA 622, QA 605, and QA 610). These courses will be linked through discussion of common material (statistical modeling) from various perspectives (linear regression, design of experiments, multivariate statistics, and categorical data analysis). During the first academic term, we completed our discussion of linear regression. During the second academic term, we will complete our discussion of the design of experiments. During the final academic term, we will discuss multivariate statistics. Note that this entire course sequence is cumulative - i.e., you will be responsible for material covered in QA 622 throughout the year (in QA 605 and QA 610) and you will be responsible for material covered in QA 605 in the spring (in QA 610).

Course Objectives: The purpose of this course is to provide the student with an understanding of how to design and analyze statistical experiments for basic business research. This purpose will be achieved through understanding:

- for what uses experimental designs are suitable and why they are appropriate for their intended use;
- the circumstances under which the use of particular analyses of experimental data are appropriate;
- the mathematical mechanics of each statistical model;
- how to interpret and explain the results achieved when using various statistical models; and
- how to perform these analyses using the computer (SAS).

You will be expected to do much more than simply solve textbook problems. Above all else, you must be able to determine the statistical courses of action that are most appropriate under various circumstances. This means you must **understand** the concepts (not just memorize them). In doing so, you will enhance your analytic and critical thinking skills.

Students with Learning Disabilities:

A student with a diagnosed learning disability should advise me of any special considerations (a documented need for extra time for exams, exam proctors, etc.) immediately so that we can make proper arrangements for exams, etc. Please do not hesitate to see me about such issues. Louisiana Tech University is subject to the Department of Health, Education, and Welfare regulations implementing Section 504 of the Rehabilitation Act of 1973. Section 504 provides that *No otherwise qualified handicapped individual in the United States ... shall, solely by reason of his handicapped be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance.* This regulation includes students with hearing, visual, motor, or learning disabilities and states that colleges and universities must make "reasonable adjustments" to ensure that academic requirements are not discriminatory. Modifications may require rescheduling classes from inaccessible to accessible buildings, providing access to auxiliary aids such as tape recorders, special lab equipment, or other services such as readers, note takers, or interpreters. It further requires that exams actually evaluate students' progress and achievement rather than reflect their impaired skills. This may require oral or taped tests, readers, scribes, separate testing rooms, or extension of time limits.' A student who has a disability that qualifies under the Americans with Disabilities Act and Section 504 of the Rehabilitation Act of 1973 should contact the Office of Disability Services (<http://www.latech.edu/ods/>) in 318 Wyly Tower at (318) 257-4221 (hours: 8:00 a.m. - 5:00 p.m.)

Webpage:

All course material and documents will be posted on the Louisiana Tech University Moodle website ([www.latech.edu/cit/moodle/index.shtml](http://www.latech.edu/cit/moodle/index.shtml)). Every student is issued a Moodle account that will provide you with access to the QA 605 Moodle site that I will maintain. Moodle is maintained off campus and serves as the foundation of the university's disaster plan (that will enable courses to continue in the event the campus must be closed for a protracted period due to a natural disaster or other cause).

Literature Review:

You are required to review **at least** eight academic papers published in refereed journals in business disciplines that use experimental design. This assignment is intended to help you familiarize yourself with the journals in business and how researchers in various business disciplines use statistical experiments. In your report you should

1. summarize each paper and explain how experimental design is used within the context of the research;
2. critically evaluate the use of experimental design in each paper, i.e.,
  - what was done correctly;
  - what was done incorrectly; and
  - what else could have been done.
3. identify trends or specific areas of application (i.e., in management, is experimental design used frequently in studies of strategic management? organizational behavior? industrial psychology?); and
4. suggest other fruitful areas for the application of experimental design in business research (especially in your discipline).

Begin collecting papers early - talk to faculty in your discipline and ask them to recommend journals and/or papers (try to look at seminal papers in your discipline - you will learn the most from these). Your analysis should be **typed and double spaced** (with one inch margins and 10 or 12 point font). You may review the papers you find sequentially (but try to group similar papers) or you may write a narrative that describes the uses of experimental design in business research and cite the papers you have found (**this is the preferred approach!**). I will evaluate your final analysis on the basis of i) how well you

explain each paper and its use of experimental design, ii) the quality of your written presentation (grammar, style, etc.), and iv) the succinctness of your written analysis in determining your grade on this assignment. You will be expected to submit a pdf copy of your literature review electronically (i.e., as an attachment to an email sent to me at [jcochran@latech.edu](mailto:jcochran@latech.edu)) **so that I receive your literature review by the deadline provided in the instructions for the exam.**

Homework

All textbook problems listed on the tentative outline are assigned. Homework problems assigned from the text will not be collected and will be discussed only if questions are asked. This does not imply that I believe these problems to be unimportant. On the contrary, I believe that these problems are a critical component of your learning experience in these courses. I suggest that you form study groups and share the burden of working these problems.

Class Participation:

Participation in classroom discussion of course material, homework problems, and cases is **essential** for good understanding, particularly in graduate studies. Questions and comments are encouraged. However, discussion of anything (including course material) with other students during class is rude and disruptive and will not be tolerated. Repeated late arrivals to class are also rude and disruptive and will not be allowed. Reading newspapers (or other non-class related material) during class is also rude and disruptive and will not be permitted. Unless silent, cell phones and pagers must be turned off prior to the beginning of class and remain off for the duration of the class.

Please also note that any personal issues (i.e., you wish to make an appointment to see me, you want me to look at your homework or equation sheet, you want me to sign a drop slip, etc.) must be handled in my office and *not in the classroom immediately before or after the lecture.*

Interim Exam:

The Interim Exam may consist of essay questions and problems covering the assigned material. Essay questions will ask you to explain important concepts to which you have been exposed. The problems will test your ability to i) select and apply the appropriate statistical model to the problem, ii) possibly use the computer to develop the statistical model, and iii) interpret the results obtained using the chosen model. These problems will test your ability to apply the techniques presented in the readings and lectures and **will not necessarily be similar to the assigned homework problems.** You will be expected to submit a pdf copy of your exam electronically (i.e., as an attachment to an email sent to me at [jcochran@latech.edu](mailto:jcochran@latech.edu)) **so that I receive your exam by the deadline provided in the instructions for the exam.**

Comprehensive Final:

The format of the comprehensive final exam will be similar to the format of the Interim Exam; that is, the comprehensive final exam may consist of essay questions and problems covering the assigned material. Essay questions will ask you to explain important concepts to which you have been exposed. The problems will test your ability to i) select and apply the appropriate statistical model to the problem, ii) possibly use the computer to develop the statistical model, and iii) interpret the results obtained with the chosen model. These problems will test your ability to apply the techniques presented in the readings and lectures and **will not necessarily be similar to the assigned homework problems.** You will be expected to submit a pdf copy of your exam electronically (i.e., as an attachment to an email sent to me at [jcochran@latech.edu](mailto:jcochran@latech.edu)) **so that I receive your exam by the deadline provided in the instructions for the exam.**

Final Grades:

I will only consider adjusting grades (i.e., "curving") when assigning the final grades. If you wish to receive your final grade before official grade reports are mailed, you may leave a stamped, self-addressed envelope with me by

the day of your final exam and I will mail your grade to you. I cannot, under any circumstances, send your grade to you through e-mail or give a grade out over the telephone. I will also retain your formula sheets and final exams for you to review for the first three weeks of the following (Winter) quarter. The **only** justifications for changing final grades are i) mistakes in grading and ii) mistakes in recording your grade(s). **No second chances** (i.e., incompletes or retakes) will be given once you have taken your final exam.

You may stop by my office and review your graded final exam during the quarter following the exam. However, you must submit (in writing) any questions you have regarding the grading of your exam for a re-grade. Again, I will re-grade whatever you question (be specific - I will re-grade everything you ask me to look at, and this could result in an adjustment in either direction to your grade). Such questions must be submitted within one week of the first day of the quarter immediately following the final exam for possible grade adjustment - I certainly will attempt to explain the grade at any point, but will not consider making an adjustment after this deadline.

#### Extra Credit

No opportunities to gain extra credit are provided.

#### Policy on Late Assignments and Missed Exams

Late assignments **will not be accepted**. If you know you will miss a class meeting when an assignment is due you may submit the assignment early, give the assignment to a classmate to turn in for you on the due date, or mail the assignment to me on or before the due date so that the postmark shows that the assignment was completed on time. If you miss a midterm exam, prior arrangements have been made with me, and documentation of an acceptable reason (medical emergency, death in family, automobile accident) is provided, I will re-weight your final examination so that it counts for both the missed midterm and the final exam.

#### Disaster Plan (i.e., Hurricane Policy)

All QA 622 classroom material will be posted on the Louisiana Tech University Moodle website ([www.latech.edu/cit/moodle/index.shtml](http://www.latech.edu/cit/moodle/index.shtml)). This website is maintained independently at an off campus site and so should be available in the event of disruption of classes by a natural or manmade disaster occurs in north central Louisiana. I also maintain a gmail account ([jcochranprof@gmail.com](mailto:jcochranprof@gmail.com)) that you may use to contact me by email in the event of such an emergency (please do not use this account unless such an emergency has occurred - I generally only check my Louisiana Tech University email account regularly). Finally, I maintain a *SKYPE* account (james.j.cochran) that you may also use to contact me (if you have a *SKYPE* account and a computer with a microphone, you may call me at no charge using the *SKYPE-to-SKYPE* calling function).

If an exam is scheduled or an assignment is due on a day when the university is closed due to severe weather or other similar reasons, the assignment will be due or exam given on the next class meeting for which the university is open. If a disaster forces closure of Louisiana Tech University for more than two days, university policy mandates that i) I offer a means of continuing the course electronically and ii) you check my account on the university Blackboard system within forty-eight hours of when the university closes.

#### Policy on Reporting Grades

In accordance with the *Family Education Rights & Privacy Act (FERPA)*, I am not permitted to:

- post a physical list of your grades;
- give a grade over the telephone; or
- give a grade through e-mail.

If you are not in class when I distribute a graded assignment or exam, you

must come to my office (either during office hours or by appointment) to receive your grade. If you wish to receive your final grade before the Registrar records and posts it, you must give me a SASE by the time you take your final exam so that I can mail your final grade to you. I will not be in my office during the academic break, so **the only way to receive your final grade early is to provide me a SASE by the time you take your final exam.** For more information on FERPA, please see [www.latech.edu/registrar/ferpa.shtml](http://www.latech.edu/registrar/ferpa.shtml).

Student  
Responsibilities

1. Be seated and ready to begin when class starts.
2. Remain seated throughout the class (unless you have an **emergency**).
3. Remain attentive throughout the class.
4. Refrain from disruptive behavior throughout the class.
  - a. Don't talk to other classmates (**about anything**) during class.
  - b. Don't talk to other classmates (about anything) during class.
  - c. Turn cell phones and beepers with audible signals off.
5. Take responsibility for your education:
  - a. Come to class prepared (i.e., with your assignments completed).
  - b. Ask questions when you don't understand.
  - c. Do your own work (i.e., don't cheat).
  - d. Be concerned about understanding and learning - your grade will take care of itself.
  - e. Take initiative to work out problems on your own.
6. Complete all prerequisites before enrolling for this class.
  - a. Have an appropriate level of mathematical maturity.
  - b. Be computer literate at the necessary level.

Instructor  
Responsibilities

1. Arrive to and begin class promptly.
2. Don't keep class beyond the dismissal time.
3. Be prepared and organized for each lecture.
4. Attempt to give students a perspective that differs from the textbook.
5. Encourage students to i) ask questions and ii) think about the course material.
6. Provide students with i) concrete examples and ii) opportunities to work on realistic applications.
7. Maintain reasonable availability to discuss questions with students outside of class.
  - a. Have a reasonable amount of accessible office hours.
  - b. Be available, with reasonable advance notice, for appointments of reasonable i) length and ii) time.

If we all meet our respective responsibilities (as outlined here), we will have a productive, enjoyable, and constructive academic term of learning. If you do not meet your responsibilities (as outlined here), you will suffer the obvious consequences (a poor grade). If I do not meet my responsibilities (as outlined here), you have the right (and obligation) to complain to the appropriate administrative authority (Department Chair, Dean, etc.). **Continued enrollment in this course constitutes agreement to these terms.**

Potential Augmentations to  
the Class Schedule

Because of some of my professional commitments, we may need to reschedule some class meetings or extend some class meetings in order to make up for the time lost during my travel. Currently my travel plans include:

- January 3 – February 4 16 to i) give the plenary presentation at the 2012 Conference of the Operational Research Society of Nepal (ORSN, <http://orsn.org.np/>).

I will notify you immediately if I need to travel on other dates for professional reasons, and I appreciate your willingness to work with me to reschedule classes that I have to miss due to my other professional obligations.

## FAQ's

- Q. Why do we need to spend so much time on linear algebra? I am not working toward a Ph.D. in statistics, and I only want to learn how to use statistics.
- A. There are three reasons for our focus on the mathematics of statistical modeling:
1. You will need to understand the mathematics in order to be able to learn additional statistical techniques after you have completed this sequence of courses. A primary goal of this sequence of courses is to help you to become autodidactic;
  2. You will need to understand the mathematics in order to read and understand the research literature in your field (keep in mind that this sequence of courses is required of all DBA students at Louisiana Tech University and must meet everyone's needs); and
  3. You will not be able to compete with graduates from other business doctorate programs if you are unable to do anything other than use SAS and read printouts.
- Q. Why do we work so much with 'theory' and 'abstract formulas' that I will never use in my research?
- A. First, understand that we really **never** discuss statistics on a theoretical level in this course. We may discuss the basic foundations of a method or why a method works or doesn't work under certain circumstances, but this is not **statistical theory**. The formulas that we discuss are not abstract, either - understanding them yields tremendous insight into how and why these formulas work. If you feel that the formulas are abstract, you need to spend more time carefully reviewing them so that you better understand them.
- Q. This course is taught at a much higher level than I need in my major area of study - why can't we focus on SAS and leave the mathematics to mathematicians?
- A. Please see the response to the first FAQ.

<b>Tentative Schedule</b>		
<b>Meeting Date</b>	<b>Tentative Reading Assignment(s)</b>	<b>Tentative Assigned Homework Problem(s)</b>
Class 1 - Thursday, December 1	Dean & Voss chapters 1 & 2 (Introduction to Design of Experiments)	Exercises for Chapter 2, problems 1 - 9
Class 2 - Tuesday, December 6	Dean & Voss chapter 3 (Designs with One Source of Variation)	Exercises for Chapter 3, problems 1 - 5, 8, 10, 12 - 13 (using SAS)
Class 3 - Thursday, December 8	Dean & Voss chapter 4 (Inferences for Contrasts and Treatment Means)	
Class 4 - Tuesday, December 13	Dean & Voss chapter 4 (Inferences for Contrasts and Treatment Means)	Exercises for Chapter 4, problems 1 - 2, 3 - 11 (using SAS)
Class 5 - Thursday, December 15	Dean & Voss chapters 5 & 6 (Checking the Model Assumptions and Experiments with Two Crossed Treatment Factors)	Exercises for Chapter 5, problems 1 - 9 (using SAS)
Class 7 - Tuesday, December 20	Dean & Voss chapter & 6 (Experiments with Two Crossed Treatment Factors)	Exercises for Chapter 6, problems 1 - 4, 5 - 11 (using SAS)
Friday, December 21 - Tuesday, January 3	<b>Holiday Break</b>	
Class 7 - Thursday, January 5	Dean & Voss chapter 7 (Several Crossed Treatment Factors)	
Class 8 - Tuesday, January 10	Dean & Voss chapter 7 (Several Crossed Treatment Factors)	Exercises for Chapter 7, problems 1 - 4, 5 - 9 (using SAS)
Class 9 - Thursday, January 12	Dean & Voss chapter 8 & 9 (Polynomial Regression & Analysis of Covariance)	Exercises for Chapter 8, problems 2 - 6 (using SAS)
Monday, January 16	<b>Martin Luther King, Jr. Holiday</b>	
Class 10 - Tuesday,	Dean & Voss chapter 9 (Analysis	

January 17	of Covariance)	
Class 11 - Thursday, January 19	Dean & Voss chapter 9 (Analysis of Covariance)	Exercises for Chapter 9, problems 1 – 5 (using SAS)
Class 12 - Tuesday, January 24	Dean & Voss chapter 10 (Complete Block Designs)	
Class 13 – Thursday, January 26	Dean & Voss chapter 10 (Complete Block Designs)	Exercises for Chapter 10, problems 1 – 2, 3 – 9 (using SAS) <b>Interim Exam #1 (Chapters 1 – 9 Due)</b>
Class 14 - Tuesday, January 31	Dean & Voss chapter 11 (Incomplete Block Designs)	
Class 15 – Thursday, February 2	Dean & Voss chapter 11 (Incomplete Block Designs)	Exercises for Chapter 11, problems 1 – 6, 8 – 12 (using SAS)
Friday, February 3	<b>Last Day to Drop with a Grade of 'W'</b>	
Class 16 – Tuesday, February 7	Dean & Voss chapter 12 (Designs with Two Blocking Factors)	Exercises for Chapter 12, problems 1 – 5, 6 – 10 (using SAS)
Class 17 – Thursday, February 9	Dean & Voss chapter 13 (Confounded Two-Level Factorial Experiments)	
Class 18 - Tuesday, February 14	Dean & Voss chapter 13 (Confounded Two-Level Factorial Experiments)	Exercises for Chapter 13, problems 1 – 2, 3 - 10 (using SAS)
Class 19 – Thursday, February 16	Dean & Voss chapter 14 (Confounding in General Factorial Experiments)	Exercises for Chapter 14, problems 1 – 2, 3 – 7 (using SAS) <b>Literature Reviews Due</b>
Monday, February 20- Wednesday, February 22	<b>Mardi Gras Holiday</b>	
Class 21 – Thursday, February 23	Dean & Voss chapter 15 (Fractional Factorial Designs)	Exercises for Chapter 15, problems 1 - 2, 3 – 8 (using SAS)
Class 22 - Tuesday, February 28	Dean & Voss chapter 16 (Response Surface Analysis)	Exercises for Chapter 16, problems 1 - 7 (using SAS) Design of Experiments Comprehensive Final <b>Exam (Chapters 1 – 16) Due</b>