MSTI 130 – Mathematical Modeling & Quantitative Analysis

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Office:	Pioch 114B	Term:	Fall 2014
Office Hours:	TBA; drop-ins welcome	Class time:	MW 2:30 – 3:50
		Location:	Pioch 117

What is Mathematical Modeling and Quantitative Analysis?

This course will provide students with the background necessary to study both the quantitative aspects of business and the foundations of multivariable calculus. This is accomplished through various projects, which will provide a contextual framework to study the mathematical content of the course. The course topics include functions of several variables (both their representations and uses) and curve fitting (statistical analysis of data and a study of parameters). These topics will be tied together through the central idea of mathematical modeling. Throughout the course, technology (primarily *EXCEL*) will be integrated and used as a tool for the solving of problems. This course is designed to satisfy the "Scientific and Quantitative Literacy" component of the college core, Foundations Tier.

The goal of this course is…

To learn mathematical tools and models for the collection, organization, and analysis of data to inform business-related decisions, and to effectively communicate the results of these analyses.

SQ: Description for Scientific and Quantitative Literacy

The goal of this core area is to understand the nature of the applications and limitations of scientific and quantitative approaches to problem solving and communicate the results in a discipline-appropriate manner that emphasizes objectivity and precision in language. The scientific approach to learning about the world centers on the idea of asking questions and encompasses the notions that ideas must be testable and falsifiable, conclusions must be based on observations and be objective, and theories must be predictive rather than descriptive. This scientific approach is supported by quantitative methods include the representation of data, the use of numbers and scale, the understanding of perspectives and bias in data, the notion of uncertainty in data, and the knowledge of methods and tools for the analysis of data. SQ Courses are not only about specific scientific facts and mathematical methods, but rather explore the nature of science and mathematics and their role in helping us understand the world.

SQ Core Student Learning Goals

1. Students will understand how to use the quantitative method as a form of inquiry based on deductive reasoning.
2. Students will be able to reach an informed conclusion to a quantitative study.
3. Students will understand the strengths and weaknesses of quantitative reasoning.
4. Students will understand the importance of clear and accurate reporting in a quantitative study.

Course Material Requirements

Text: *Data Analysis through Modeling: Thinking and Writing in Context*, Fall 2011 Edition, by Kris Green and Allen Emerson; available online for download in PDF and HTML format from http://citadel.sjfc.edu/faculty/kgreen/MSTI130/index.htm

Other: Email and internet access are required

Software: Course work will be submitted electronically in MS Word format.
Data organization and analysis in the course will be completed in a combination of MS Excel and R, a freely available statistics package**.** In particular, we will use a package for R called R Commander. Download links and information are available through the link above. This software is available for all operating systems (Windows, Mac, Unix, etc.)

Outline of the Course

The following outline is a summary of all of the topics which are discussed within the required textbook for this course. To be successful within this course, it is imperative that students have a clear understanding of all of the topics that are covered and their relationship to each other. As we explore these topics throughout the semester, students should keep in mind this outline and attempt to make connections between each of these topics. It is important to realize that this is a tentative outline and topics may be added or removed at the instructor's discretion.

Unit 1: Quantifying the World
- Chapter 1: Problem Solving (Asking questions to understand a problem situation)
- Chapter 2: Understanding the Role of Data (Collecting and organizing data for exploring a problem)
- Chapter 3: Using Models to Interpret Data (Simple models of means, standard deviation and pivot tables)

Unit 2: Analyzing Data Through Spatial Models
- The key ideas from Chapters 4 – 6 will be condensed (One variable graphs to analyze a problem)

Unit 3: Analyzing Data Through Linear Models
- Chapter 7: Correlation (How two variables in the problem are related)
- Chapter 8: Simple Regression (Predicting how one variable will influence another)
- Chapter 9: Multiple and Categorical Regression (Predicting how several variables influence the results)
- Chapter 10: Is the model any good? (Making sure you have the best model)

Unit 4: Analyzing Data Through Nonlinear Models
- The key ideas in chapters 11 and 12 will be condensed (Alternative models that are not linear)

Unit 5: Analyzing Data Using Calculus Models
- Chapter 14: Extreme Calculus (Using rate of change to find optimum decisions)
- Chapter 16: Optimization in Several Variables (Using a model to get the best results possible)

Math Skills Assessment

The *Level B* Math Skills Assessment is a requirement for *MSTI130*. This assessment is designed to test the prerequisite skills necessary to succeed in this course. The test will be given during one of our class meeting times from Tuesday, Sept 9 through Monday, Sept 15. A Blackboard account under the heading **Math Assessment** has been set up to provide you with the necessary Math Skills Assessment information, including your assessment grade.

Those students who earn an *84% or higher* on the Math Skills Assessment will satisfy this requirement. You will then be awarded the maximum points (equal to 10% of the final course grade) toward this course component.

Those students who earn *below an 84%* will have up to three***** additional opportunities to fulfill the *Level B* Math Skills Assessment requirement. Retakes will be given from Tuesday, Sept 23 through Thursday, Oct 23. The times are as follows: Tuesday and Thursday afternoons from 12:30 – 1:30 and Tuesday evenings from 5:00 – 6:00. Those students who do not earn at least an 84% after three re-takes or after the final re-take opportunity on Thursday, Oct 23 will receive 0 points (equal to 10% of their final course grade) toward this course component.

****You may only retake the Math Skills Assessment once during any given week. You must complete your FIRST retake on or before Thursday, Oct 2. Those who do not retake the assessment on or before this date will only have <u>two</u> additional opportunities.***

Objectives and Grading in This Course

OBJECTIVE AREA	DESCRIPTION
Mechanics & Techniques (M&T)	Covers definitions, formulas, computational procedures/algorithms and computer procedures.
Applications & Reasoning (A&R)	Covers decision making, interpretation, analysis, making inferences, and applications.
Communication & Professionalism (C&P)	Covers writing, reading, argumentation, discipline and business-related behaviors, such as attendance and meeting deadlines.

Attendance	It is expected that you will attend each and every class session. Attendance is identified under Communication & Professionalism as one of the criteria for passing this course. More than two absences and/or excessive tardiness/leaving class early and/or disruptive behavior may result in your final course average being lowered.
Late Work	Late work will not be accepted for grading purposes.
Grading Philosophy	In this course, everyone is assumed to start at an average level of ability, defined to be at the border between a C+ and a B-. Performance above the minimum expected levels of understanding and competency will improve your grade, while missing these targets will lower your grade.
Determination of Final Course Letter Grade	Your "raw score" grade for this course is computed as a weighted average of letter grades, A = 4.0, A/B = 3.5, B = 3.0, B/C = 2.5, C = 2.0, C/D = 1.5, D = 1.0, D/F = 0.5, F = 0.0: ❑ 20% Final exam grade (week of December 8) ❑ 10% Midterm exam grade (scheduled for Wed, Oct 15) ❑ 30% Memo assignments (3 at 10% each) ❑ 10% Reading quizzes ❑ 10% In class activities and small homework ❑ 20% Project: Data Collection Activity In addition, if you do not pass the **Math Skills Assessment**, your final course grade **will be lowered** by one whole letter grade (from A to B, B+ to C+, etc.) Grades of C-, D+ and D- will NOT BE GIVEN as final course grades.
In Class Activities and Homework	Most classes will involve one or more activities that will be collected. There will also be small, regular outside of class assignments. These will be drawn from the Explorations, Problems, and Memo assignments in the textbook, and similar problems. These will give you a chance to practice the skills, reinforce the concepts, and apply the techniques and thinking we develop during the semester.
Reading Quizzes	In this class, you will be expected to read assigned material AHEAD of discussing it in class. This means that your <u>first-exposure</u> to the material will be when you read a section of the textbook. This will give you an opportunity to (a) preview the main ideas that will be used in class and (b) become familiar with the definitions and formulas that will be used. You will be required to complete an online quiz through Blackboard to assess your understanding of the material. These quizzes are designed to make sure that you come to class prepared, so they are due PRIOR to the beginning of the class during which we discuss the content. You are expected to be familiar with, understand and bring your knowledge of the material to class – **the material will not always be repeated in a lecture**. However, if you have questions, be sure to note them and ask them in class or during office hours. Most regular class time will be centered on structured activities that facilitate <u>processing</u> the material – you will be asked to apply, analyze, discuss, and solve problems using this information. Many classes will center on the memos at the end of each chapter; these pull together the ideas and place them into the context of a real business situation. Other classes will center on problems from the end of the chapters or other examples that apply the material and give you opportunities to practice the mechanics and techniques you need to be successful. If you are having trouble understanding material in the assigned readings, you should plan to visit with me or the Math Center tutor PRIOR to class. You should prepare for each class by reading the material assigned and completing the online reading quiz associated with the material. These quizzes will consist mostly of questions that you can easily answer based on the reading; a few questions will require a little deeper thinking; and one or two questions will require deeper analysis and application of the content.
Memo Assignments	The memo assignments will tie together all aspects of the course (Mechanics and Techniques, Application and Reasoning, and Communication and Professionalism) by giving you a chance to participate in realistic business settings with the techniques and skills from the course. These will combine several chapters of material at a time and focus on a consistent context.

Project – Data Collection Activity	The DCA will be a major project that carries through the entire course. It is submitted in phases, with you revising and improving the earlier phases based on feedback from your instructor. This project will give you the chance to explore a topic of interest to you and to apply all the tools and techniques of the course to the investigation of this topic.
Getting Help	We will have tutors in the Math Center this semester during the week in order to assist you with homework, reading, and reviewing the material. However, the math center and the tutors are not there to do the work for you. You should make every attempt to complete your work before going to the Math Center. This will give the tutors a better chance of helping you with the material.
Cheating & Plagiarism	While you are encouraged to share your ideas and talk with other classmates about the homework assignments, it is imperative that you WRITE YOUR OWN RESPONSES TO EACH ASSIGNMENT! One of the objectives of this course is to help you improve your skills at writing professional reports, so you must prepare your own response to each memo in your own words. If cheating or plagiarism becomes a problem, I will follow the college procedures as stated in the *Student Handbook* for the college. This could result in anything from not receiving credit for an assignment, to a grade "F" in the course, to expulsion from the college.

Statement Concerning Students with Disabilities

In compliance with St. John Fisher College policy and applicable laws, appropriate academic accommodations are available to students with disabilities. All requests for accommodations must be supported by appropriate documentation/diagnosis and determined reasonable by St. John Fisher College. Students with documented disabilities (physical, learning, psychological) who may need academic accommodations are advised to refer to the Disability Services website http://home.sjfc.edu/AcademicAffairs/Disabilities/DisabilityOverview.asp
Questions should be directed to the Coordinator of Disability Services in the Office of Academic Affairs, Kearney 202. Late notification will delay requested accommodations.

Disclaimers

- Please be aware that I am free to retain photocopies or electronic copies of any work you complete for this course. I am then free to distribute these copies to future students as sample work. I will remove the names from such sample work and/or rename the files for electronic work to protect your identity.
- The course schedule provided here is a rough outline for the semester. Due to the nature of inquiry-based learning, lessons may run over and this may require an adjustment of the schedule as we go.