CONTACT INFORMATION

Instructor:  Fadel M. Megahed
E-mail:  fmegahed@auburn.edu
Office Hours:  TR from 3:30 pm – 5:00 pm in 3301L Shelby Center, or by appointment

I am available to answer your questions by email and will usually respond within one working day. It is often difficult to explain mathematical questions using email and therefore, I highly encourage you to take advantage of my availability to answer questions face-to-face during office hours.

TA CONTACT INFORMATION

Name:  Behnam Rasoolian  Name:  Chia-Chun Chiang  Name:  Lydia Petrenas Mann
E-mail:  bzr0014@auburn.edu  Email:  czc0061@auburn.edu  Email:  ljp0003@auburn.edu
Hours:  By appointment  Hours:  By appointment  Hours:  By appointment
Role:  TA  Role:  TA  Role:  Lead TA

COURSE OVERVIEW

As industrial engineers, we are involved in designing, implementing and improving integrated systems that involve people, materials and equipment. To be successful in integrating such systems, we are typically involved in projects that target a reduction of production/service cost, an increase in a product’s quality/reliability, and an increase in productivity/efficiency. In this course, we will explore how quality monitoring tools can play an important role towards achieving these goals. This will include a discussion of acceptance sampling, control charts, design of experiments, process capability measures, and a brief overview of some advanced topics in that field. At the end of the course, you will be better prepared to utilize available data to generate valuable information about the state of several production and service processes. More importantly, you will be able to use this information to make decisions that will result in improving their quality and efficiency.

COURSE OBJECTIVES

The primary objectives of the course are to teach you how: 1) to formulate quality control problems using data, and 2) to apply this understanding in an industrial/service setting. Upon completion of the course, you will be able to:

- Analyze and interpret quality control data, and communicate your findings to individuals who do not share your technical and statistical expertise.
- Design appropriate control charting methodologies that can be used to quickly detect the emergence of any quality control problems.
- Design and conduct experiments to further understand a process behavior and understand the process variables that contribute to optimizing its performance.
- Construct acceptance sampling plans for testing the incoming raw material quality.
- Apply appropriate techniques for solving representative quality control problems.
- Feel confident when asked to perform statistical analyses, knowing that you have the background and software skills needed to define, understand and solve most problems.
SPECIAL ACCOMMODATIONS

Students who need accommodations are asked to electronically submit their approved accommodations through AU Access and to arrange a meeting during office hours the first week of classes, or as soon as possible if accommodations are needed immediately. If you have a conflict with my office hours, an alternate time can be arranged. To set up this meeting, please contact me by e-mail. If you have not established accommodations through the Office of Accessibility, but need accommodations, make an appointment with the Office of Accessibility, 1228 Haley Center, 844-2096 (V/TT).

If you desire special accommodations for religious and cultural holidays, please contact me during the first two weeks of classes so that we can work together towards rescheduling any assignments that are affected by these holidays. I am also willing to arrange for extra office-hours to explain any of the course material missed during these holidays (if you inform me in the first two weeks of classes).

HONOR CODE

The faculty and students of Auburn University will not tolerate any form of academic dishonesty. We must adhere to the Auburn University student academic honesty code (Title XII), which can be found by clicking here. Anything less than complete adherence to its rules and intent is unacceptable and will be met with the processes defined therein. Honesty in your academic work will develop into professional integrity.

A PEDAGOGICAL PERSPECTIVE BEHIND THE ORGANIZATION OF THIS CLASS

With over 80 students in this class, I believe that we will have students with very different interests and career objectives. I am a firm believer that such diversity can be very enriching to the class. Therefore, the class will be structured different to any class that you have taken in Auburn (and possibly any other engineering institution). More specifically, you will select what work you complete and thus, have a strong control over your learning outcomes from the class. I will also promote the concept of a learning community, where the participants will be encouraged to share/develop resources that are relevant to the material covered in class. After all an industrial engineering class that does not efficiently and effectively utilize its resources in generating knowledge should not exist!!

COURSE ASSIGNMENTS

In this course, assignments are handled differently; you select what work you complete. Review the following options bearing these 3 simple rules in mind:
1- At least 75 percent of the total points possible for each individual assignment must be earned; otherwise, no points will be recorded for the assignment.
2- Once the due date for an assignment has passed, that assignment cannot be completed. All the due dates are at 23:59 of the day posted on the assignment sheet, or on the course calendar. Since all assignments are due during a weekday, the fact that the game went to triple overtime (and
yes, I know that Auburn is playing one game on a Thursday; I am a Hokie and we are used to it) should be irrelevant.

3- With the exceptions of exams, you are allowed/encouraged to ask your colleagues questions as long as you use Piazza for this purpose (i.e. if someone texts you question about class, your response should be look at my answer at Piazza). Therefore, it is good practice that you visit our class page at least a couple of times a week to benefit from the collective knowledge of your classmates. To access our Piazza page, please click here (you can also access the Piazza page through Canvas).

**Homework:** To help you measure your understanding of the material, review questions will be assigned at the end of each chapter. These questions will cover the SQC theory, its application and the use of software to implement it in real-life scenarios. I highly recommend reading the textbook chapter and reviewing your notes prior to tackling these problems. You may consult your classmates when solving these problems (see Rule 3); however, your solution should represent your own work and should not breach the honor code.

**Case Studies:** There will be at least 3 case studies that we will cover in class. The objective behind these case studies is to evaluate your “true” understanding of the course material by seeing that you can apply it to a real problem. Note that we will not grade the submission if you were not in class. Additionally, some of these case studies may have to be purchase from the Harvard Case-study group (each case study is under 7 dollars).

**Class Activities:** These will include a number of exercises that are meant to evaluate your understanding of topics that are typically covered in class that day/week. These activities will be unannounced and therefore, you are highly advised to bring your calculator, textbook and course notes to every class.

**Project 1: Non-invasive Image Inspection Tool for Additive Manufacturing:** Image inspection plays an important role in most industrial (food, paint, stamping, etc.) and medical processes. In Fall 2012, I have asked the class to “develop a 100% inspection visual tool that identified defects and their location on the work-in-progress (WIP) part at a pre-assigned work-cell in the 4,000 sq. ft. manufacturing facility located in the Shelby Center”. I honestly had no expectations since this was my first semester at Auburn. To my surprise, that senior class excelled at this project (e.g. see highlighted video on my website [http://www.eng.auburn.edu/users/fmm0002/QC.html](http://www.eng.auburn.edu/users/fmm0002/QC.html)). Due to the positive feedback that I continue to receive from that graduating class, I will provide you with an opportunity to do something similar but for an additive manufacturing process. This will require you to understand what are the most common defects for additive manufacturing, how are they typically inspected, and what cheap sensor(s) will need to be put in place to account for these defects either directly or indirectly. Note that in this project, you will be not only doing the research and design, but also the implementation. Therefore, your solutions should be also very cheap 😊. This is a group project that should involve no more than 5 individuals. **Functional Requirements:** a) capable of detecting over 90 percent of typical additive manufacturing defects; b) does not significantly reduce the speed of the build (by significant you have to show that the speed has not changed by more than 2 percent); c) any software used should be free or available to AU; d) cost of implementation to be less than $200 (to make it a fair-game); and e) more importantly, the inspection needs to be done layer-by-layer. **Deliverables:** a) a 6 page proposal (single-spaced, 12 font Times New Roman, 1 inch margins) highlighting your strategy. The proposal should include justification based on the scientific literature and other manufacturing domains where defects are similar for why your approach is going to work, why did you pick a particular sensor (or group of sensors) over the competition, etc. There are no
other formatting requirements since I do not want to limit your creativity and approach to the problem; b) a 10-15 minute video documenting your work in the project (preferably captured with a HD camera, which can be loaned from the department) showcasing the problem, your solution and your validation techniques. This video is to be uploaded to YouTube (or Dropbox if you do not want to use that in getting a job) and the link should be sent to me; and c) oral presentation in-front of class. Safety requirement: Prior to doing any work on the machine, you need to come up with a safety risk assessment plan with controls that should be approved by myself or someone else that I will designate. Note: Additive Manufacturing is a really big thing in our region (see e.g. http://www.geaviation.com/press/other/other_20140715.html).

Project 2: A Designed Experiment to Understand the Impact of Game Settings on Score Differential in Madden

Based on my experience teaching seniors for the past two years, I have come to notice that several students have interest in sports statistics. Since Auburn is a football town, you may be interested in applying one of the concepts we stress in experimental design to NFL Madden (since NCAA does not allow you to control the in-game simulator). In particular, I want you to address several questions (do not look at more than 3 factors, and make sure that these factors are binary and independent while making all other factors constant). Make sure that you have thoroughly read and understood Ch. 13.3 prior to running your experiment (hold everything else constant, randomize, make sure that the experiment is large enough, etc.). Deliverables: a) An initial report with the experimental plan (prior to conducting the experiment); b) a 10-15 minute video documenting your work in the project (preferably captured with a HD camera, which can be loaned from the department) showcasing the problem, your solution and your validation techniques. This video is to be uploaded to YouTube (or Dropbox if you do not want to use that in getting a job) and the link should be sent to me; and c) oral presentation in-front of class. Side Note: Read http://espn.go.com/college-football/story/_/id/11121315/florida-state-seminoles-coach-jimbo-fisher-use-gps-technology-win-national-championship for some insights on some of the latest work in this area.

Mini Project: A Spreadsheet based application (or a Phone App) to guide practitioners to implement control charts in their facility. Requirements: a) A pre-data collection guide that can be skipped if the practitioner has already collected the data. The guide should ask the practitioner if their data is variable or attribute through checking a box (or something similar) and then recommend a suitable sample size such that the effect of estimation error can be neglected and decide on how wide the control limits should be to achieve a certain average run length performance; b) Phase I Analysis: Let the user input the data in an easy way that they cannot mix up (e.g. if using x-bar and s chart, the program should generate and name the rows and column headings such that it is clear what are the samples and what are the subgroups within the sample). In Phase I, the program should check for process stability, ensure that there are no change-points, and estimate the true in-control parameters for the process; c) Phase II: Using the limits established in Phase I, to do real-time monitoring. The user should input how many data points that he/she wants to show; and d) Provide a capability that if an out-of-control chart signals, you send an email/text-message/some sort of a signal alerting the user. Deliverables: The program with a well-done user manual and a walk-through with the TA!!! This project can be done by teams of up to three individuals.

Exams (×3): There will be two midterm exams and a final exam. The midterms will be similar in style to the homework questions. The final exam is to evaluate your ability to synthesize the subject matter and apply it to real-life problems. The scientific method of defining, analyzing and solving quality control problems will be assessed in the final.
DEVELOPING A GAME PLAN FOR THE COURSE

For the purposes of planning, highlight the assignments that you are considering, and then total the points possible. Be realistic. It is highly unlikely that you will get all the points possible for the assignments. Check your total with point totals needed for each grade. Be sure that you are planning to do enough assignments to get the grade you desire in the course. Also keep track of your points as the course progresses so that you know if you need to add more assignments.

The points total for each assignment group is provided below:

- Homework, at least 8 total at 12 points per homework: 96 points
- Case Studies, at least 3: 75 points
- Class Activities, about 7: 70 points
- Project 1: 200 points
- Project 2: 200 points
- Min-Project: 100 points
- Exam I: 100 points
- Exam II: 100 points
- Exam III: 100 points

Total points: 1041 points

Letter grades will be assigned using the following scale:

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>Points</th>
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<tbody>
<tr>
<td>A</td>
<td>550 and above</td>
</tr>
<tr>
<td>B</td>
<td>495-549</td>
</tr>
<tr>
<td>C</td>
<td>460-494</td>
</tr>
<tr>
<td>D</td>
<td>430-459</td>
</tr>
<tr>
<td>F</td>
<td>429 and below</td>
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*Please note that I will round your grades to the nearest integer at the end of the course.
SCHEDULE

Will be published on Canvas Prior to 8/26/2014!!