IE 424
Process Quality Engineering
more aptly titled, Probability and Statistics for Engineers
Summer 2021 Course Syllabus

Instructor:
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Course Description:
This course will provide students with probabilistic and statistical methods required to improve the quality of products and processes. It will start with the introduction to quality culture and the key elements of quality improvement. Then the methods for data presentation and interpretation are discussed. Next, the basic probability concepts and commonly used probability distributions are taught followed by statistical concepts, such as sampling distributions, point and interval estimation, and hypotheses testing. The concepts and methods of statistical tools required for process selection and improvement such as process capability indexes and control charts are discussed next.

Prerequisites: Math 141 and Math 220 (co-requisite) or BE 301 (co-requisite).

Textbook:
There is no textbook for this course.

Course materials and communications:
Canvas will be used for all course communications (http://canvas.psu.edu). Please ensure that you regularly check the announcements or that you have these announcements forwarded to you. You can modify your notification settings in Canvas by clicking on your picture or the Account button, and then selecting Notifications.

Course materials including video lectures, lecture notes [partially completed with blanks], suggested problems, information about homework and solutions, etc. will be posted on Canvas. I suggest that you print out the blank, partially completed lecture notes and follow along as they are explained in the videos.

Lectures and Learning Journal:
All lectures for the course are available on our Canvas site. As students watch the lectures, they should follow along by completing the fill-in-the-blank notes also available on Canvas. We also encourage students to keep a "learning journal" file on their computer. At the end of many Canvas videos, we will ask reflection questions. We strongly encourage students to write the answers to these questions in their learning journal as research has shown that this increases students' retention and understanding of the material. At the end of the semester, this learning journal can be submitted for up to 50 points toward the homework score.

Exams:
Two exams will be given. This course will require you to take exams using proctoring software that uses your computer's webcam or other technology to monitor and/or record your activity during exams. The proctoring software may be listening to you, monitoring your computer screen, viewing you and your surroundings, recording and storing any and all activity (including visual and audio recordings) during the proctoring process. By enrolling in this course, you consent to the use of the

proctoring software selected by your instructor, including but not limited to any audio and/or visual monitoring which may be recorded. Please contact me with any questions.
The exams will be delivered online within a 48 hour window in Canvas. The dates of these exams are given on the schedule on pages 5-7 of the syllabus and cannot be moved or adjusted. More details will be forthcoming.

Each exam will have a single set of questions for each student, but will be administered in two parts:

- Part 1: A Canvas HW style portion where you enter answers to multiple choice questions, etc.
- Part 2: A file upload of your written work so that we will be able to award partial credit if the answers you submitted in part 1 are incorrect

Students will have 80 minutes to take each Part 1 of the exam, and an additional 20 minutes to complete Part 2. You will need to print and/or download an exam booklet for the exam before or during the exam. Your written work must be written in this exam booklet to earn partial credit. For students without printers, these booklets will be provided well in advance of the exam so that you can have them printed somewhere like a FedEx/Kinkos or Staples. Because of the proctoring software, you must make sure that if you use a tablet to write on a PDF copy, that the tablet has a fully functional, proctoring software compatible OS – of particular note, iPads do **not** meet this requirement. If we have difficulty reading your responses, we will not be able to grade them so please ensure that your writing and the scanned copy of your exam is legible and clear. Additional details about the exam will be discussed prior to Exam 1

Please do not wait until the last minute to schedule your exam. Also ensure that the room you will use to take the exam has the printer and scanner (if applicable) in the view of your webcam so you will be able to print the exam, work the problems directly on a copy of the exam, and scan and upload the exam so you can receive partial credit for any questions you miss.

Students must pass at least one exam to pass the course (i.e., students who earn less than 60 on both exams will not pass this class). There is no exception to this rule. Exams represent a solely individual effort. Students will not be permitted to collaborate in any way on exams or use unauthorized content, tools, or material in preparing for or completing exams as this constitutes academic dishonesty. The dates and times for these exams are given on the attached schedule.

Project:
There will be a group video project requiring students to apply the material from Note Sets 1 and/or 6 about process quality to a real world process, problem, or issue of their choosing. Students must research, investigate, and ultimately reach conclusions about how to improve a process and create a 5 minute video. All work must be completed in groups of three. Additional information will be forthcoming during week 2 of the semester. This project is intended to focus on the bigger picture, more holistic aspects of process quality as opposed to the homeworks and exams, which focus on the more precise, detail-oriented calculation problems.

Grading:
The grade for this class will be determined by your performance on homework and exams.

Homework	15%
Midterm Exam	25%
Final Exam	30%
Project	20%

Highest Exam	10%

Homework assignments will be administered on Canvas and will be due roughly each week and are typically worth 100 points each. There will be a total of approximately 10 homework assignments over the course of the semester. Students may work on these homework assignments together and discuss the way to approach each homework together. However, the primary goal of homework assignments is to prepare students for the exam and to help students to understand the material. Each student is ultimately responsible for his or her understanding of the material and should therefore work the problems themselves. Each student may drop the grade of their lowest homework assignment. **However, we do not accept late assignments**. Solutions are posted promptly after homework assignments are due.

A student's highest exam score will be worth an additional 10% of the grade. For example, if the student scores higher on the midterm than the final, the midterm will be worth 35% instead of 25%. Conversely, if the student scores higher on the final exam, it will be worth 40% instead of 30%.

Student grades will be determined using the following grading scale, assuming they have earned passing grades on at least two exams. As explained above, students who do not pass at least one of the exams will receive a grade of F. Note that the instructor will not automatically round up grades in the event that a student is on the border between a grade (e.g., a student who earns a 92.5% will not automatically be given an A).

A	≥ 93	B+	$87 \leq x < 90$	C+	$77 \leq x < 80$	D	$60 \leq x < 70$
A -	$90 \leq x < 93$	B	$83 \leq x < 87$	C	$70 \leq x < 77$	F	$60 < x$
		B-	$80 \leq x < 83$				

Note that the instructor may adjust this grading scale upon the completion of the semester, moving the thresholds to earn each of the grades given lower.

Exam Accommodations:
Students with disabilities will be provided reasonable academic adjustments to ensure their equal access to course content. If you have a documented disability, please contact me privately and let me know at the *beginning of the semester to* make arrangements for necessary classroom adjustments. You must first verify your eligibility for these through the Student Disability Resources (contact (814) 863-1807 or visit http://equity.psu.edu for more information on registration procedures). If your academic adjustments will impact the arrangements that you will need for an exam (or other course assessment), it is your responsibility to notify me at least one week prior to <u>each</u> exam to ensure the time that we need to make the necessary logistical arrangements.

Regrade Requests:
If there is an **<u>error</u>** in the grading of one of your assessments (exam, project, etc.), you will need to submit a regrade request. Please note the difference between an error and a value judgement.

Error – a mistake on the part of the grader
Examples – adding up points incorrectly, writing on a problem -2 but deducting 3 points, etc.
Value judgement – an assessment of how many points something should be worth
Examples – how many points are deducted for not correctly defining a random variable

Regrade requests are for errors and **<u>not</u>** for differing value judgements. If you believe there is an **<u>error</u>** in the grading of your exam or homework, you must fill out the regrade form (available on

Canvas) within one week of the exams being returned explaining why you feel points were unfairly deducted, noting page numbers, explanations, and all other relevant information. If relevant, please staple your regrade request to the assignment or exam you would like regraded. I will handle all regrade requests and will return them to you. Note that any exam or assignment submitted for regarding will be *fully* regarded - all questions will be reviewed for accurate grading and points may be added or subtracted.

Academic Honesty:
Working together on homework assignments is ok – this includes discussing problems, answering each others' questions, sitting down together to work them together. Passing someone completed HW solutions or referencing completed solutions online is not ok and is an academic integrity violation. Of particular note, students should not share the content of course materials (exams, HW, etc.) via personal communications or posting for others to view on websites or communication forums. Similarly, you may not receive or access information about course content from other students or websites. Students who are found to be dishonest will receive academic sanctions and will be reported to the University's Office of Student Conduct for possible further disciplinary sanctions.

The University defines academic integrity as the pursuit of scholarly activity in an open, honest and responsible manner. All students should act with personal integrity, respect other students' dignity, rights and property, and help create and maintain an environment in which all can succeed through the fruits of their efforts (refer to Senate Policy 49-20. Dishonesty of any kind will not be tolerated in this course. Dishonesty includes, but is not limited to, cheating, plagiarizing, fabricating information or citations, facilitating acts of academic dishonesty by others, having unauthorized possession of examinations, submitting work of another person or work previously used without informing the instructor, or tampering with the academic work of other students. Students who are found to be dishonest will receive academic sanctions and will be reported to the University's Office of Student Conduct for possible further disciplinary sanctions (refer to Senate Policy G-9).

I take academic honesty very seriously and will be happy to clarify any questions you have about this issue. However, **it is your responsibility to understand and abide by the academic honesty policy** for this class, as academic dishonesty will not be tolerated in this course.

Students who commit any academic integrity violation will not be eligible to have their highest exam score emphasized; their grades will instead be taken out of 90%.

IE 424 Summer 2021 Schedule

Week	Dates	Topics	Deliverables
1	May 17 - 23	NS 1 – Statistical Thinking and Quality Culture 1.1. Statistical Thinking Overview 1.2. Impact of Process Variation and Process Improvement 1.3. Measuring and Tracking Quality NS 2 – Mean, Variance, and Spread 2.1. Introduction to Population and Sample ***Drop Deadline – May 21 @ 11:59 PSU time***	HW 1
2	May 24 - 30	NS 2 – Mean, Variance, and Probability (cont.) 2.1. Measures of Central Tendency 2.2. Measures of Spread 2.3. Probability and Set Definitions and Relationships 2.4. Definitions and Background about Probability	HW 2 *Project Teams assigned*
3	May 31 – June 6	NS 2 – Mean, Variance, and Probability (cont.) 2.5. Ways to Determine Probabilities of Events and Counting Techniques 2.6. Calculating Basic Probabilities 2.7. Conditional Probability	HW 3
4	June 7 - 13	NS 3 – Discrete Random Variables 3.1. What are Random Variables? 3.2. Properties of Discrete Probability Distributions 3.3. Expected Value and Variance of Discrete Random Variables 3.4. Discrete Uniform Random Variables 3.5. Bernoulli Trials and Binomial Distribution	HW 4 *Project Proposal must be submitted*
5	June 14 - 20	NS 3 – Discrete Random Variables (cont.) 3.5. Bernoulli Trials and Binomial Distribution (cont.) 3.6. Negative Binomial Distribution 3.7. Hypergeometric Distribution 3.8. Review of and differences between binomial, negative binomial, and hypergeometric distributions 3.9. Poisson Distribution	HW 5

Week	Dates	Topics	Deliverables
6	June 21 - 27	NS 4 – Continuous Random Variables 4.1. Probability Density Functions 4.2. Cumulative Density Functions 4.3. Expected Values and Variance 4.4. Uniform Random Variables	HW 6 ***Exam 1 – must be taken June 27 or 28***
7	June 28 – July 4	NS 4 – Continuous Random Variables (cont.) 4.1. Normal Distribution 4.2. Exponential Distribution and the Poisson Process	HW 7
8	July 5 – 11	***July 4 Week*** – work with your project team to make progress	No HW
9	July 12 - 18	NS 6 – Data, Charts, and Quality Tools 6.1. Types of Data and Data Collection 6.2. Process Maps 6.3. Fishbone Diagrams and Scatter Plots 6.4. Histograms and Pareto Charts 6.5. Percentiles 6.6. Box Plots	No HW – *work on project*
10	July 19 - 25	NS 5 – Central Limit Theorem, Confidence Intervals, Sample Size Determination 5.1. Inferential Statistics and Sampling Distribution 5.2. Central Limit Theorem 5.3. Confidence Intervals Overview and constructing Confidence Intervals with Z distribution 5.4. Constructing Confidence Intervals with t distribution; When to use t and Z distribution summary 5.5. Sample size determination	HW 8
11	July 27 – August 2	NS 7 – Hypothesis Testing 7.1. What are hypothesis tests and setting up a hypothesis test; Steps to conduct a hypothesis test 7.2. Concept of Type I and Type II error 7.3. Single mean hypothesis test with Z distribution 7.4. Single mean hypothesis test with t distribution ***Late Drop Deadline – July 24 @ 11:59 PSU time***	HW 9

Week	Dates	Topics	Deliverables
12	August 3 - 9	NS 7 – Hypothesis Testing 7.5. P value 7.6. Calculating Type II error 7.7. Paired vs. Unpaired Data – overview of two mean hypothesis testing 7.8. Two mean unpaired hypothesis test 7.9. Two mean paired hypothesis test	HW 10 *Final Project due @ end of week*
13	August 9-12	*Spend time reviewing for Final*	***Final Exam – must be taken August 13 or 14*** No homework due to compressed week