

Prerequisites: An introductory course in statistics and familiarity with commonly-used distributions (e.g., normal, binomial, poisson, etc.).

Textbook: *Introduction to Statistical Quality Control* (6th or 7th edition), D. Montgomery. Wiley.

Instructor: John Borkowski

Phone: 994-4606

Class Room: Wilson 1-144

Class Time: M W F 12:00-12:50

Office: 2-263 Wilson

Office Hours: M 2:00-3:00, Tu 12:00-1:00, W 11:00-12:00

e-mail: jobo@math.montana.edu

Webpage: www.math.montana.edu/~jobo/st528

Product Quality Management (PQM) is a philosophy adopted by a continually growing number of companies with national and global customers. One major component of PQM in industrial and manufacturing production processes is Statistical Quality Control (SQC). In the corporate marketplace, businesses now require knowledge of SQC principles which, in turn, requires an integrated effort among its employees. Not only will statisticians be required to apply SQC techniques, but management, engineers, and all those involved in producing and marketing a product must be familiar with the benefits of SQC.

Increasingly, other disciplines have adopted the use of SPC tools to monitor processes (e.g. biological or ecological processes). Thus, although this course focuses on industrial applications, the methodology can be applied in other fields.

The purpose of this course is to present several of the most frequently used statistical techniques in SQC which are not covered in any currently offered course in the statistics curriculum. The graduate students interested in industrial statistics will receive instruction in another area of statistics which prepares them for employment in an area of high demand. Students who have taken this course will enter the job market as more attractive and viable job candidates than those who do not have any background in SQC.

COURSE GOAL: In this course, you will learn about many statistical methods commonly used by industry to monitor and ultimately improve the quality of products resulting from industrial processes. Although the course will emphasize the application of these methods, theoretical justification for the methods will also be provided.

Course Content

- Introduction to Statistical Quality Control (Chapter 1)
 - History and evolution of SQC.
 - Statistical definitions of quality.
- Modeling Process Quality (Chapter 3)
 - Useful discrete and continuous probability and distributions.
 - Describing variation and descriptive statistics.

- Methods and Philosophy of SPC (Chapter 5)
 - Choice of control limits.
 - Sample size, sample frequency, and rational subgroups.
 - Some simple and common SPC tools.
- Control Charts for Variables (Chapter 6)
 - Control charts for the sample mean (\bar{x}) and range (R), standard deviation (S), and pooled standard deviation S_p .
 - The Operating Characteristic Curve (OCC).
 - Determining Average Run Length (ARL).
 - Individual observation (IMR) charts.
- Control Charts for Attributes (Chapter 7)
 - Charts for fraction and number nonconforming (p - and np -charts).
 - Charts for total number of nonconformities (c -charts).
 - Charts for number of nonconformities per unit (u -charts).
- Process Capability Analysis (PCA) (Chapter 8)
 - Process capability based on fitted distributions.
 - Process capability indices (C_p , C_{pk} , C_{pkm}).
 - Introduction to gage capability studies.
- CUSUM and EWMA Charts (Chapter 9)
 - Cumulative Sum (CUSUM) charts.
 - Exponential Weighted Moving Average (EWMA) charts.
 - CUSUM for count data.
- An Introduction to Reliability Statistics (Course Notes)
- An Introduction to Accelerated Testing (Course Notes)

The material in Chapter 4 is an elementary statistics review and will not be covered. The material in Chapters 1 and 3 should be read when you have time, but will not be covered in detail.

Grading

Midterm Exam	75 points	(≈ 40 inclass, ≈ 35 take-home)
Final Exam	50 points	(take-home)
Final Project	50 points	
Homework	≈ 150 points	
Total	≈ 325 points	

We will be using the *SAS-QC* procedures in the *SAS* statistical package. Assignments can be completed using *R*, but you are on your own to learn it.