Statistics 567
Applied Reliability

Course Home page: http://web.utk.edu/~leon/rel/

Meeting Time
Tuesdays and Thursdays 5:05 - 6:20

Location
Glocker 237

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Office Hours
Tuesdays and Thursdays, 12:45 - 1:45 p.m.
(and by appointment)
Course Information

Course overview:
This course deals with the statistics and probability methods used in reliability engineering. The primary focus of the course is on the statistical methods used to estimate a product’s reliability from product failure data and covariate information. The course also touches on the probability modeling methods that use knowledge of system architecture and system component reliability to calculate system reliability. The probability and statistics methods covered in the course include those that are part of the Certified Reliability Engineer (CRE) exam.

Course objectives:
• Learn to analyze complete and censored reliability data with and without covariates
• Learn some key methods in system reliability modeling
• Learn to write professional reliability analysis reports
• Learn the probability and statistics methods covered in the Certified Reliability Engineer (CRE) exam.

Catalog course description:

Course outline:
Unit 1: The role of reliability in engineering practice
Unit 2: Probability distributions in reliability
Unit 3: Statistical methods for single samples
Unit 4: Regression models for reliability data
Unit 5: Proportional hazards modeling
Unit 6: The Bayesian approach
Unit 7: Models for system reliability

1 To pass the CRE exam the student also needs to learn about reliability program management, a subject not covered in this course. However, the reliability management material needed to pass the exam is not difficult and can be easily learned through self study. See references below. In addition to the exam, certification requires several years of experience.
Course prerequisites:

What the graduate catalog says:

• Statistics 563 or Mathematics 425

What you need to know:

• Knowledge of the integral and differential calculus

• Knowledge of probability including continuous random variables, probability density functions, and conditional probability

• Knowledge of elementary statistics including linear regression

Course pedagogical philosophy:
This course aims to increase the student’s professional competency in an important area of statistics application, namely, reliability engineering. The notion of competency used in this course involves three elements: conceptual understanding, ability to do, and ability to communicate and sell. The table below summarizes how mastery of these three elements will be measured in the course.

<table>
<thead>
<tr>
<th>Element of Competency</th>
<th>How it is measured in this course</th>
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<tbody>
<tr>
<td>Conceptual understanding</td>
<td>Exam</td>
</tr>
<tr>
<td>Ability to do</td>
<td>Analysis of reliability data</td>
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<tr>
<td>Ability to communicate and sell</td>
<td>Written project report</td>
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Course grade:
The course grade will be determined using the following formula:

Course grade = (Midterm1 + Midterm2 + Final + Project report + Homework) / 5
Course project:
A course requirement is to conduct a reliability study. The student will write a project report on how the study was conducted and on what were the results of the study. The study must be conducted using high scientific standards of experimental practice such as the use of good experimental controls.

Some ideas for the reliability study:
• Number of stretch-relaxation cycles to brake a rubber band as a function of rubber band size.
• Number of times a paper clip can be bent before it brakes.

Credit will be given for the creativity and richness of the study. Students are encouraged to work in teams of two.

Expected quality of the project report:
A statistician using the reliability analysis method covered in this course is likely to have an engineer as his or her customer. Engineers like to have the results of a reliability analysis presented to them in a written report. Therefore, the project report should meet the highest possible standards of professionalism - statistical correctness, quality of writing, and appearance. You will not get an A for this report unless it is good enough to be used in a top corporation or consulting firm.

Homework policy:
All homework is due on the Tuesday after it is assigned unless otherwise specified.

Textbook:

Course software support:
• JMP