Reliability Engineering

DE-7600015, Spring 2024

Engineering Building 10-301, Mon/Wed 15:00–16:15

Instructor

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Office: Engineering Building 207–10527
Office Hours: 12:00 – 12:50pm (M/W); or by appointment
(No office hours on the first Monday of each month).

Textbook

Reliability Engineering by Elsayed A. Elsayed, Wiley, 2nd edition (2012).

Web Page

https://appliedstat.github.io/class/2024S-teaching1-reliability/

Software

R Language (http://www.r-project.org).

Prerequisite

DE-7600044 (Mathematical Statistics) is recommended before taking this course. The expectation is that you have already been exposed to the basic probability and statistics.

Policy

- Attendance Policy: Class attendance is mandatory. If you miss a class for some reason, it is your responsibility to get notes, *etc.* from someone in class. I will not repeat lectures during my office hours.
- Tardy Professor Policy: If the instructor has not arrived within 15 minutes of the scheduled class time, you may assume that class has been canceled.
- All drop/add procedures are your responsibility.

Description and Learning Objectives

The course goals are to develop an understanding of the concepts of reliability theory and their applications to practical problems from engineering, life science, etc. Students will learn analytical methods and some numerical techniques thru computer software, R. The following major topics will be covered.

(i) Review of old material: probability, random Variables, expectation, variance, etc.
(ii) System reliability.
(iii) Parametric estimation methods.
(iv) Types of censoring.
(v) Parametric lifetime models.
(vi) Linear models.
(vii) Basic accelerated lifetime models.

Upon successful completion of this course, a student will be able to:

1 Understand basic concepts about probability and hazard.
2 Understand basic concepts about system reliability.
3 Understand parameter estimation methods.
4 Understand censoring schemes.
5 Utilize basic probability theories in various lifetime data applications.
6 Construct various parametric lifetime models.
7 Analyze and develop lifetime models.
8 Do statistical inference on various lifetime models.
9 Use R language.

Grading

The final grade will be curved and calculated as follows:

Homeworks:	5%
Attendance:	5% (will be checked at random and can count 3 points)
Midterm :	45%
Final:	45%

– The lowest one of your mid-term exam grades can be replaced by the final exam if the final grade is better.

Rough Grading Guide:

- A+: 95 ∼ 100 A: 90 ∼ 95-
- B+: 85 ∼ 90- B: 80 ∼ 85-
- C+: 70 ∼ 80- C: 60 ∼ 70-
- D+: 50 ∼ 60- D: 40 ∼ 50-
- F : below 40.

Exams

Midterm:	T.B.A.	In class
Final:	T.B.A.	

– All the exams will be closed-book.

– The final exam will be comprehensive. For the final exam, you are allowed to bring in *one* A4-size formula sheet made up by yourself.

– During the exams, a basic calculator will be permitted but cannot be shared with others.

– Calculators in smart phones, tablet PC and laptops are prohibited.

– No early or late exams will be allowed without a written and legitimate excuse.

Homeworks

– The students can collaborate on their homework problems, but they should submit their homeworks separately.

– Late homeworks will **not** be accepted.

– Up to 1 ∼ 3 problems, selected at random, will be graded in detail, on a scale of 0–5 each.

– To get full credit, you must show all work on the homework problems, which must be handed in in the same order as they are assigned.

Tentative Schedules

1 Review of basic probability theories.
2 Reliability and hazard functions.
3 Introduction to evaluation of system reliability.
4 Systems in series.
5 Systems in parallel.
6 k-out-of-n system.
7 Reliability of k-out-of-n system.
8 Complex systems.
9 Time and failure-dependent reliability.
10 Introduction to parameter estimation methods.
11 Types of censoring.
12 Basics on parametric reliability models.
13 Various parametric reliability models.
14 Introduction to linear models.
15 Introduction to accelerated life testing models.
16 Final Exam.