Advanced Reliability Analysis (STAT701600)

Semester: Fall 2023

Classroom and Time: General Building III, 840 Room/Wednesday 9–12 AM

Instructor: Chien-Yu Peng (彭健育, Institute of Statistical Science, Academia Sinica)

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Office Hours: Wednesday 1–2 PM; by e-mail or appointment

☐ **Prerequisites**: Reliability Analysis (STAT557000) and Linear Models (STAT541000) (or permission of instructor)

☐ **Required Texts and Other Readings**

There is no required textbook but course notes will be posted. Useful references are as follows:

(1) Lawless, J. F. (2003), *Statistical Models and Methods for Lifetime Data* (2nd Edition), New York: John Wiley & Sons.

(2) Meeker, W. Q., Escobar, L. A., and Pascual, F. G. (2022), *Statistical Methods for Reliability Data* (2nd Edition), New York: John Wiley & Sons.

(3) Nelson, W. B. (2004), *Accelerated Testing: Statistical Models, Test Plans, and Data Analysis* (3rd Edition), New York: John Wiley & Sons.

☐ **Course Description**

This course goes beyond the fundamental reliability concepts and methods learned in the Reliability Analysis course. The course includes the fundamentals of regression modeling of (censored) failure-time data, accelerated life/degradation test models, planning accelerated life/degradation tests, stress-strength analysis, (Bayesian) zero failure analysis and related topics.

☐ **Course Requirements**

Homework: There will be approximately 8–9 HW assignments throughout the whole semester. Signed hard copies of each homework will be due at the beginning of the class on the due date. Late homework will NOT be accepted without a reasonable and advance notice. You may discuss the homework problems with

other students. However, such collaboration should be clearly acknowledged, by listing the names of the students with whom you have had discussions concerning your solution. You may not, however, share written work or code after discussing a problem with others. The final work you turn in must be your own.

Exam: A midterm exam will be in class. One A4 sheet with your formulas and notes (you can write on both sides), calculators, and (electronic) dictionary are allowed. You are responsible for bring your own calculator and (electronic) dictionary.

☐ Grading Procedures

Homework (45%)

Midterm Exam (25%)

Final Project (30%): 30 minutes presentation (An eight-page report is due within one week after the presentation)

Table 1: Tentative Class Schedule

Week	Date	Topics	Remark
1	2023/9/13	Course Introduction	
		Reliability Concepts and Reliability Data	
		Review of Statistical Theories	
2	9/20	Censoring, Likelihood and Fitting for Failure-time Distributions	HW1 Due
		Probability Plotting and Simulation Methods	
3	9/27	Maximum Likelihood: Log-location-scale Distribution	
4	10/4	Failure-time Regression Analysis	HW2 Due
5	10/11	Accelerated Life Tests and Data Analysis	
6	10/18	Accelerated Life Tests and Censored Data Analysis	HW3 Due
7	10/25	Planning Life Tests	
8	11/1	Planning Accelerated Life Tests	HW4 Due
9	11/8	(Bayesian) Zero Failure Analysis	
10	11/15	**University Holiday—Sports Day**	HW5 Due
11	11/22	**Midterm Exam (9:00–13:00)**	
12	11/29	Degradation Test and Data Analysis	
13	12/6	Degradation Test and Data Analysis	HW6 Due
14	12/13	Accelerated Degradation Tests, Models and Data Analysis	
15	12/20	Planning Degradation Tests	HW7 Due
16	12/27	Planning Accelerated Degradation Tests	
17	2024/1/3	Project Presentations and Discussions	HW8 Due
18	1/10	Project Presentations and Discussions	