STAT 855. Lifetime Data Analysis

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Spring 2022

B. Part I. Preliminaries

What to do today?

A. Course Syllabus

B. Part I. Preliminaries

STAT-855. Lifetime Data Analysis (Spring 2022)

Instructor: X. Joan Hu (Tel: 778-782-6714)

Lecture: TueThu 16:30 - 18:20 (PT), AQ5046 (*Remote learning during Jan 10 - 24, 2022 via* ZOOMA for Tue and ZOOMB for Thu)

Office Hour: Thu 15:30 - 16:20, or by appointment; SSC K10555 (*Use* ZOOMC *during Jan 10 - 24, 2022*)

Course Web Page/Canvas Page: URL http://www.sfu.ca/ joanh/stat855web.html URL http://canvas.sfu.ca/courses/65992

Computer Software: *R* and *SAS* are recommended; *R* will be used in class (URL http://www.r-project.org/)

STAT-855: Reference Books

- Statistical Models Based on Counting Processes, by Andersen, Borgan, Gill and Keiding
- The Statistical Analysis of Failure Time Data (2nd Ed), by Kalbfleisch and Prentice
- Survival Analysis (2nd Ed), by Klein and Moeschberger
- Statistical Models and Methods for Lifetime Data (2nd Ed), by Lawless
- The Statistical Analysis of Recurrent Events, by Cook and Lawless
- Multistate Models for the Analysis of Life History Data, by Cook and Lawless

STAT-855: COURSE EVALUATION

Grading Scheme:

- Homework Assignments (the best three out of four marks; 15% per assignment)
- Course Project: Phase I. (proposal) 10%; Phase II. (in class presentation) 20%; Phase III. (final report) 20%
- Participation (5%)

Remarks:

- No late homework/project will be accepted unless due to illness evidenced by a medical note: please turn in the available portion, if you cannot complete the whole homework/project in time.
- Group discussions are encouraged; however, the homework/projects to be evaluated should be independent work.
- Discussions in-class are highly encouraged. The whole class will participate in evaluating the presentations.

Why to study STAT-855. LIDA?

What is lifetime (survival) data analysis?

• continuous r.v. $T \ge 0$: time to event

special features:

e.g. medical settings => various data structures

The wide range of applications.

Beyond the classic survival analysis:

- binary process
- recurrent events
- multistate process
- time series, longitudinal data, spatio-temporal analysis, stochastic process, ...

What to study in STAT-855. LIDA?

Part I. Preliminaries

- Introduction
- Review of likelihood based approaches

Part II. Parametric Inference

- Commonly used parametric models
- Incomplete data structures

What to study in STAT-855. LIDA?

Part III. Nonparametric/Semiparametric Approaches

- Kaplan-Meier estimator
- Logrank test
- Cox proportional hazards model

Part IV. Further Topics

- Counting process framework
- More on incomplete data structures
- Recurrent events and multistate processes
- Alternative regression models
- Other selected topics

How to study STAT-855. LIDA?

Master the basic concepts and inference procedures,

- the basic statistics studied before, and
- the method for the simplest case in a class of problems and then move on
- Understand the ideas of the modeling/methods, know when to use what procedures/models, and able to implement them via R/SAS
- Follow the theoretical derivations

Don't fall behind.

Part I. Preliminaries

► 1.1 Introduction

I.2 Review of likelihood based approaches

r.v. $Y \sim f(y; \theta), \theta \in \Theta$ a random sample from the population: iid Y_1, \ldots, Y_n the likelihood function

$$L(\theta|\mathsf{data}) = \prod_{i=1}^n f(y_i; \theta)$$

Part I.1 Review of likelihood based approaches Estimation of θ

maximum likelihood estimator (MLE):

 $\hat{\theta} = argmax_{\theta \in \Theta}L(\theta|\mathsf{data})$





Part I.1 Review of likelihood based approaches

Procedures of testing on θ

Wald-type





What to study next?

Part I. Preliminaries

- I.1 Introduction
- I.2 Review of likelihood based approaches

Part II. Parametric Inference

- II.1 Some basic concepts
- II.2 Commonly used parametric distributions
- II.3 Various incomplete data structures
- ▶ II.4 Parametric analysis with right-censored data