Applied Survival Analysis, Spring 2016

Description:

This course will cover topics in analysis of failure time data. We will begin with an introduction to the central functions of survival analysis: the hazard, survival, and cumulative hazard functions. We will then consider nonparametric estimation of survival curves using Kaplan-Meier and actuarial estimation methods, and comparison of survival distributions using the logrank and other tests. The course will then turn to regression models for survival outcomes, with a heavy emphasis on aspects of the Cox proportional hazards model. Alternative models such as the accelerated failure time model and use of parametric distributions (exponential, Weibull) will also be considered. Class material will include presentation of statistical methods for estimation and testing, along with current software (mostly Stata, some SAS) for implementing analyses of survival data. Applications to real data will be emphasized.

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Software:	Mostly R, some Stata
Homework	There will be three homework assignments each made up of a section corresponding to each lecture. Assignments will be due at the second class each week and will cover material from the previous week.

Grade policy

Percent of final grade	
Homework assignments	30%
Participation	10%
Final examination	60%
Total	100%

Note: A failing grade (4/10) will be given if a student fails the final even if the combined grade adds up to a passing grade. Passing grade for the final is 5/10 (50%).

Lectures:

#	Topic
0	**Review: Maximum Likelihood Methods**
1	**Introduction to Survival Analysis:** definitions of survival concepts, examples of survival data, empirical survival estimate
2	**Estimating the Survival Function:** Kaplan Meier estimator, lifetable estimator, Nelson-Aalen estimator of cumulative hazard
3	**Comparison of Survival Functions:** Logrank test, linear logrank test, Wilcoxon test, P-sample logrank, stratified logrank
4	**Modeling of Survival Data:** Introduction to the Cox Proportional Hazards model, understanding the partial likelihood, adjustment for ties
5	**More on the Cox Model:** interpretation and inference (confidence intervals), estimating the baseline survival function, prediction of survival for subgroups.

#	Topic
6	**Model Section in Survival Analysis:** Model selection, residuals, goodness of fit
7:	**Assessing the PH Assumption:** Assessing assumption through graphical approaches, goodness of fit test statistics with interactions
8:	**Parametric Survival Analysis:** Exponential and Weibull models, Accelerated Failure time (AFT) model, comparison with Cox model
9:	**Time-dependent covariates**
10:	**Multiple failure-times**
11:	**Designing a Survival Study:** Total number of events needed, accounting for staggered entry, loss to follow-up and interim monitoring

Some useful references:

- Collett: *Modelling Survival Data in Medical Research*

- Cox and Oakes: *Analysis of Survival Data*

- Kleinbaum: *Survival Analysis: A self-learning text*

- Klein & Moeschberger: *Survival Analysis: Techniques for censored and truncated data*

- Allison: *Survival Analysis Using the SAS System*