STAT798Y, SURVIVAL ANALYSIS - Fall, 2012

Tu-Th 9:30-10:45 AM, Room EGR 3106

Instructor: Professor G. Yang, Statistics Program, Math Dept
link to course outline
Prerequisites: Minimum background is Stat 410 and Stat 700 or equivalent (with consent of the instructor).

Course Description: Survival analysis concerns the statistical theory and methods for the analysis of time-to-event data or lifetime data. Lifetime data are commonly studied by researchers from diverse scientific fields including physics, biology, medicine, public health, actuaries, epidemiology, economics and engineering reliability. Measure of lifetime requires the knowledge of both its beginning and its end points. These end points are not always possible to measure. For example, typically a detector can record the time at which a neutron disintegrates, but not the time it is generated, and this results in a left-censored neutron lifetime. Just the opposite in clinical trials, the survival time of a patient after a treatment might be right-censored if the patient withdraws from the trial before his/her death or if the trial terminates before the patient dies. There are numerous other forms of incomplete lifetimes such as doubly censored, interval censored, randomly truncated and current status data. Sampling methods, sampling subjects, experimental designs and limitations in recording instruments are among the contributing factors to the incomplete data. Proper treatment of incomplete data is necessary for eliminating bias in data analysis. The course is mainly about the statistical analysis of incomplete lifetime data. The topics to be presented include stochastic modeling of censored and random-truncation data, parametric and nonparametric methods, the Kaplan-Meier estimator of a survival function, the Lynden-Bell estimator, construction of confidence bands, the Cox regression model, logistic models, the Fix-Neyman competing risks model, asymptotic statistical inference. Emphasis will be on statisical methods with examples drawn from applications.
Required Text: Kalbfleisch, J. and Prentice, R. (2002) The Statistical Analysis of Failure Time Data, 2nd ed. John Wiley ISBN: 0-471-36357-X
Recommended Text: Miller, R. Jr. (1980) Survival Analysis. Wiley-Classics

Library 1998, ISBN: 0471255483

Syllabus
The course covers material selected from ch. 1- 8 of the text book and from literature.

1. Introduction: Terminology
Survival Functions, Hazard Rates, Cumulative Hazard Functions. Mean Residual Life (Life Expectancy), Inversion Formulas
2. Parametric Models
Exponential Distribution, Weibull Distribution, The Proportional Hazards (the Cox Regression) Models, Accelerated Failure Time Model, Log Transformations and Others
3. Modeling Incomplete Data,
Type 1 and Type II Censoring, Right Censoring, Interval Censoring, Random Truncation, Doubly Censored Data
4. Inference in Parametric Models
Log Likelihoods, Large-sample theory. Review of inference procedures for complete samples, Inference for Right-Censored Data. Log Logistic Model Subject to Right Censoring.
5. Nonparametric Method: Right Censored Data
The Kaplan-Meier Estimator of a Distribution Function, Influence Functions, Asymptotic Theory, Martingale Theory, Confidence Bands, Construction of Confidence Intervals Using Empirical Likelihoods, Self-Consistency Criterion, The EM Algorithm, Examples From Biostatistics
6. Nonparametric Estimation: Random Truncation
The Lynden-Bell Estimator of a Distribution Function, Examples from Astronomy, The Scott Bias, Asymptotic Methods
7. The Cox Regression Model
Partial likelihoods, Estimation and Hypothesis Testing, Asymptotic Methods, Log Rank Tests, Variable Selection
8. The Fix-Neyman Competing Risks Model
Finite Markov Chains, Comparison of Medical Treatments, Examples of Non-Monotone Hazard Functions with Applications to Disease Incidence
9. Goodness of Fit Tests and Diagnostic Methods