Statistics 533	Survival Models

Nature and properties of survival models; methods of estimating tabular models from both complete and incomplete data samples including actuarial, moment and maximum likelihood techniques; estimations of life tables from general population data; Kaplan-Meier estimator and Nelson-Aalen estimator; the accelerated failure time model; the Cox proportional hazards model; model building and high-dimensional survival data analysis.
Course Hours: H(3-1T)

Prerequisite(s): Statistics 323, Mathematics 353, and Actuarial Science 327.

Suggested Text: 1. Survival Analysis – Techniques for Censored and Truncated Data, Second Edition, by Klein and Moeschberger, Springer 2003; 2. Estimation, Evaluation and Selection of Actuarial Models, by Klugman (Chpts 2 and 5), SOA Study manual 2002.

Syllabus

Topics	**Number of hours**
Basic quantities. The survival function. The hazard function. The mean residual life time function and median life. Common parametric models for survival data. Models for competing risks.	3
Right censoring. Left or interval censoring. Truncation. Likelihood construction for censored and truncated data. Basic ideas for counting processes and martingales.	3
Nonparametric estimators of the survival and cumulative hazard functions. Kaplan-Meier estimator and Nelson-Allen estimator.	3
Pointwise confidence intervals for the survival and cumulative hazard functions. Confidence bands for the survival function. Point and interval estimates of the mean and median survival time, and quantiles.	3
Estimators of the survival function for left-truncated and right-censored data. Summary curves for competing risks.	3
Estimating the survival function for left, double and interval censoring. Estimation of the survival function for right-truncated data. Estimation in the cohort life table or grouped data.	4

Kernel smoothed distribution estimator and kernel smoothed hazard rate estimator.	3
Hypothesis testing. One-sample tests. Tests for two samples and more than two samples. Tests for trend. Stratified log-rank test.	3
Parametric models with covariates. The accelerated failure time (AFT) model. Some popular AFT models. Diagnostic methods for parametric models.	3
The Cox proportional hazards model. Partial likelihoods for distinct-event time data. Partial likelihood when ties are present. Local tests. Estimation of the survival function.	5
Additional materials: Model building and high-dimensional data analysis using the Cox proportional hazards model.	3

TOTAL HOURS   **36**

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