# Statistics 533/637  
## 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.


### Syllabus

<table>
<thead>
<tr>
<th>Topics</th>
<th>Number of hours</th>
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<tbody>
<tr>
<td>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.</td>
<td>3</td>
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<tr>
<td>Right censoring. Left or interval censoring. Truncation. Likelihood construction for censored and truncated data. Basic ideas for counting processes and martingales.</td>
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<td>Nonparametric estimators of the survival and cumulative hazard functions. Kaplan-Meier estimator and Nelson-Allen estimator.</td>
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<td>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.</td>
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<tr>
<td>Estimators of the survival function for left-truncated and right-censored data. Summary curves for competing risks.</td>
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<tr>
<td>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.</td>
<td>4</td>
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</table>
Kernel smoothed distribution estimator and kernel smoothed hazard rate estimator.

Hypothesis testing. One-sample tests. Tests for two samples and more than two samples. Tests for trend. Stratified log-rank test.

Parametric models with covariates. The accelerated failure time (AFT) model. Some popular AFT models. Diagnostic methods for parametric models.

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.

Additional materials: Model building and high-dimensional data analysis using the Cox proportional hazards model.

TOTAL HOURS 36

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Date: August 12, 2013
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