

Hong Kong Baptist University
Faculty of Science
Department of Mathematics

Title (Units): STAT 3840 SURVIVAL ANALYSIS (3,3,0)

Course Aims: This course aims to provide students with a good understanding of techniques for the analysis of survival data, including methods for estimating survival probabilities, comparing survival probabilities across two or more groups, and assessing the effect of covariates on survival. The emphasis will be on practical skills for data analysis using statistical software packages. Students will form groups to do projects involving the analysis of real data.

Prerequisite: STAT1131 and STAT1132 and STAT2110 and STAT2120

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Learning Outcomes (LOs):

Upon successful completion of this course, students should be:

No.	Learning Outcomes (LOs)
	Knowledge
1	Able to understand the basic models for survival data
2	Able to understand different censoring and truncation mechanisms
3	Able to distinguish different models for survival data
4	Able to evaluate the performance of different models for survival data
5	Able to know the general procedures of statistical inference (including parameter estimation and hypothesis testing) for survival data
6	Able to know basic procedures for confidence interval construction for survival data
	Skills
7	Able to manipulate the software SAS
8	Able to build up models for survival data based on different assumptions
9	Able to perform statistical computations involving parameter estimation, hypothesis testing and confidence interval construction in the presence of survival data
10	Able to examine some model assumptions
11	Able to extend their knowledge of statistical techniques for survival data
	Attitudes
12	Able to work effectively in a team
13	Able to solve problems independently

Assessment:

No.	Assessment Methods	Weighting	Remarks
1	Continuous Assessment (assignments, test, and mini-project)	40%	Assignments are designed to measure how well the students have learned various techniques for survival data analysis. The students will learn to use the software SAS to solve real survival data problems. The team-project is designed to stimulate students' interest in furthering understanding and analyzing survival data problems in real life situations.
2	Final Examination	60%	Final Examination is designed to see how far students have achieved their intended learning outcomes in both Knowledge and Skills domains. Students should have a thorough understanding to apply statistical methods to lifetime data and draw inference. They are also expected to identify steps in the modeling process, understand the underlying assumptions implicit in each family of models, and recognize which assumptions are applicable.

Learning Outcomes and Weighting:

Content	LO No.	Teaching (in hours)
I. Introduction	1	1
II. Concepts And Models	1, 3	3
III. Censoring And Truncation	1-2, 7	3
IV. Nonparametric Methods: One Sample	5-6, 7-9	8
V. Nonparametric Methods: Two Or More Samples	5-6, 7-9	6
VI. Proportional Hazards Regression Model: Fixed Covariates	3, 5-6, 7-9, 12-13	8
VII. Proportional Hazards Regression Model: Further Topics	3, 5-6, 7-9, 11-13	3
VIII. Regression Diagnostics	4, 7, 10, 12-13	4
IX. Alternative Regression Models	3, 11	4

Textbook: John P. Klein and Melvin L. Moeschberger, Survival Analysis: techniques for Censored and Truncated Data, Springer-Verlag, New York, 1997.

References: Paul D. Allison, Survival Analysis Using the SAS System: A Practical Guide, SAS Institute Inc., 1995.
J.D. Kalbfleisch and R.L. Prentice, The Statistical Analysis of Failure Time Data, Wiley, New York, 1980.
E.T. Lee, Statistical Methods for Survival Data Analysis, 2nd Ed., Wiley, New York, 1992.

Software: SAS

Course Content in Outline:

	<u>Topic</u>	<u>Hours</u>
I.	Introduction A. Time to event data; Examples	1
II.	Concepts And Models A. Survival function, hazard function, and related quantities B. Common parametric models: exponential, Weibull, log-logistic	3
III.	Censoring And Truncation A. Types of censoring B. Random truncation C. Likelihood construction	3
IV.	Nonparametric Methods: One Sample A. Kaplan-Meier's estimator for right censored data B. Confidence intervals: Greenwood's formula C. Confidence bands: Equal precision band; Hall-Wellner bands D. Estimation of the median survival time: Brookmeyer and Crowley's method E. Extension to left-truncated and right-censored data, and interval-censored data	8
V.	Nonparametric Methods: Two Or More Samples A. Tests for equalities: Log-rank test; Gehan's test; etc.	6
VI.	Proportional Hazard Regression Model: Fixed Covariates A. Model B. Partial likelihood C. Model building D. Estimation of the baseline hazard and survival functions	8
VII.	Proportional Hazard Regression Model: Further Topics A. Time-dependent covariates B. Left-truncation	3
VIII.	Regression Diagnostics A. Residuals B. Time-covariate interactions C. Graphical check for proportionality	4

- IX. Alternative Regression Models
 - A. Accelerated failure time models
 - B. Other regression models

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