960-542– Life Data Analysis– Spring, 2023

Course Information

Instructor: John E. Kolassa

Office: Hill Center 565

Hours: 2:30 - 3:30 PM Tue 1:00 - 2:00 PM Wed 9:00 - 10:00 PM via zoom; see course web page for zoom link.

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☎ 848-445-7674, but please email rather than call.

CRN: 13873

Course Meeting Time: Mo 6:00 – 8:50 PM HLL 009

Dates: See schedule.

Text:

Required:

1. Klein, J.P., and Moeschberger, M.L. (2013), *Survival Analysis: Techniques for Censored and Truncated Data*, New York: Springer. (KM in reading list)

Other texts I will consult:

2. Collett, D. (1994), *Modeling Survival Data in Medical Research*, Boca Raton: Chapman and Hall. (C in reading list)
3. Cox, D.R., and Oakes, D. (1984), *Analysis of survival data*, New York: Chapman and Hall. (CO in reading list)
4. Hettmansperger, T.P., and McKean, J.W. (1998), *Robust nonparametric statistical methods*, New York: J. Wiley & Sons. (HM in reading list)
5. Kleinbaum, D.G. (1995), *Survival Analysis: A Self–Learning Text*, New York: Springer. (K in reading list)

Objectives: To be able to perform complete survival analyses, including estimation of survival functions and multivariate regression parameters, and diagnostic checking.

Requirements:

Homework: Homework will be assigned approximately biweekly, and will be graded. Solutions will be supplied. Students are encouraged to consult with each other and the instructor when contemplating these problems but are expected to draft their solutions themselves. Students who submit correct homework solutions without fully understanding them can expect substantially lower grades on exams. The lowest homework grade will be dropped. This provision is meant to accommodate personal emergencies, *and constitutes all such indulgence I expect to give in most cases.* Homeworks will constitute 30% of the final grade. Students are responsible for locating computing resources needed for homeworks. I expect (but do not require) that students will perform calculations using *R*.

Exams: Exams will be closed–book. Except possibly in the case of a *bona fide* emergency no makeup exams will be given. Please notify the instructor of for predictable conflicts with exam times during the first two weeks of class.

Midterm: in class, accounting for 30% of the final grade, on the course schedule.

Final: accounting for 40% of the final grade, on the course schedule.

Classroom participation: will not be explicitly graded. Students are responsible for any information and assignments discussed in class.

Prerequisites: Calculus and introductory statistics, 960-484.

Web Page: http://statweb.rutgers.edu/kolassa/960-542

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Projected Schedule and Syllabus

Wk	Day	Date	*Topics*	*Homework*	*Readings*
1	MO	23 Jan	Introduction, Describing life distributions, Survival function, Hazard rate, Mean residual life, Common survival distributions, Censoring, Interval censoring, Truncation		KM §1, 2.1, 2.2, 2.3, 2.4, 2.5, 3.1-2, 3.3, 3.4
2	MO	30 Jan	Likelihood for censored data, Product – Limit Estimation of the Survival Function, Variance of the survival function, Survival function confidence intervals		KM §3.5, 4.1-4.2a, 4.2b, 4.3
3	MO	6 Feb	Estimating the Cumulative Hazard, Simultaneous bounds, Quantile confidence intervals, Estimating means, Estimation with truncation, Life table estimates, Introduction to survival curve hypothesis testing, One sample testing, Log rank statistic variance	HW-1 due	KM §4.2c, 4.4, 4.5a, 4.5b, 4.6, 5.4, 7.1, 7.2, 7.3b
4	MO	13 Feb	Ordered Groups, Two–sample hypothesis testing with survival curves using ranks, Tests for $K > 2$ groups, Stratified tests, Matched Pairs, Multi-sample tests based on curve differences, Procedures based on tests of means and medians		C §2.8, KM §7.3a, 7.3b, 7.5a, 7.5b, 7.6
5	MO	20 Feb	Sample size calculations, Regression models, Tests based on integrated differences, Cox model, Proportional hazards likelihood	HW-2 due	C §9.1–9.3, KM §2.6a, 7.7, 8.1a, 8.3
6	MO	27 Feb	Confidence intervals, Justification of partial likelihood, Hazard Ratios, Computing the estimator, Infinite Estimators, Ties, Likelihood testing		C §3.4, CO §7.2, KM §8.1b, 8.3pn1, 8.3pn2, 8.4, Appendix B
7	MO	6 Mar	Model Building, Estimating the baseline survival function, Late Entry	HW-3 due	KM §8.7, 8.8, 9.4
8	MO	13 Mar	No Class		
9	MO	20 Mar	Exam		
10	MO	27 Mar	Cox Regression diagnostics, Cox and Snell Residuals, Assessing Cox and Snell Residuals, Interpretation, Time dependent covariates, Stratification in Proportional Hazards Estimation		KM §11.1, 11.2a, 11.2b, 5.3, 9.1–9.2, 9.3
11	MO	3 Apr	Martingale Residuals, Proportional Hazards Plots, Deviance Residuals, Measuring influence, Location-Scale family for log lifetime distributions, Weibull distribution, Log logistic distribution, Log normal and generalized gamma distributions, Parametric Failure Time Models, Counting Process, Log Normal as a member of the Generalized Gamma Family, Proportional Hazards and the Weibull Distribution	HW-4 due	KM §11.3, 11.4, 11.5, 11.6, 12.1, 12.2, 12.3, 12.4, 2.6b, 3.6, L §1.3.4-5
12	MO	10 Apr	Fitting Models via Maximum Likelihood, Accelerated failure diagnostics		KM §12.2b, 12.5
13	MO	17 Apr	Dependent survival times, Multiple events of same type per individual, Competing Risk, Threshold Models	HW-5 due	KM §13.1, 13.2-13.3, 2.7
14	MO	24 Apr	Bayesian Methods, Multi-State Models		KM §6.4, 9.5
15	MO	1 May	Review	HW-6 due	

16 MO 8 May Exam