



MATH48142 - 2008/2009

General Information

- Title: Survival Analysis
- Unit code: MATH48142
- Credits: 15
- Prerequisites: MATH20701, MATH38011 *Linear Statistical Models*.
- Co-requisite units: None
- School responsible: Mathematics
- Members of staff responsible: Dr. Eos Kyprianou

Specification

Aims

This course unit aims to familiarise students with the methodology and practical applications of standard techniques in modelling and analysing survival data.

Brief Description of the unit

In many studies interests lie in the time from a well defined time point of origin to the time of occurrence of an event of interest. The difference between these two time points is referred to as the failure time or survival time or the lifetime. Examples from medical studies include time from cure of an illness to relapse or the time from one stage of a disease to another. Examples in criminology include the time from release from prison to the time of re-offence whereas examples in social studies include the time from wedding to the time of the failure of the marriage. Two typical characteristics of survival data are that the failure times have a skewed distribution so that the statistical methods based on the assumption of Normality are not appropriate for their analysis and that some of the failure times are censored i.e. their exact value is not observed but they are known to be in excess of a value which is then recorded as the censored failure time. Further, for each individual in the study, apart from his/her failure time, there is information on a number of other variables (sometimes called risk factors) e.g. type of treatment received, age, socio-economic status, clinical measurements etc, each of which may affect the individual's survival. The methods of analysing and modelling survival data and their dependence on risk factors fall roughly in three categories: non-parametric, semi-parametric and fully parametric. The course looks at some of the more successful methods in each of these categories.

Learning Outcomes

On successful completion of this course unit students will be able to

- carry out exploratory non-parametric analysis of survival data;
- carry out more sophisticated analyses on survival data using either semi-parametric or fully parametric techniques and be aware of the variety of the statistical models and methods now available;
- explore and analyse survival data using using statistical packages;
- interpret the results of such analyses.

Future topics requiring this course unit

None.

Syllabus

1. Survival data. Censoring. The survivor, hazard, cumulative hazard functions and their inter-relationships. Kaplan-Meier and Nelson-Aalen estimators of the survivor and hazard functions, their plots and their standard errors. Log-rank and Wilcoxon type tests. [6 lectures]
2. The Cox proportional hazards (ph) model; Partial, marginal and profile likelihood function. Estimating the parameters of the ph model and their asymptotic properties. Comparing nested models. Estimating the hazard and survival function. [12]

3. Parametric modelling: The Weibull ph regression model; the log cumulative hazard plot; fitting the Weibull ph model. Comparing models. The accelerated hazard model. Other parametric models. [12]
4. Model diagnostics: Residuals and residual plots. [3]

Textbooks

- Collett, D., *Modelling Survival Data in Medical Research*, 2nd edition, Chapman and Hall 2004.
- Klein, J. P. and Moeschberger, M. L., *Survival Analysis*, 2nd edition, Springer 2003.
- Kalbfleisch, J. D., *The Statistical Analysis of Failure Time Data*, J. Wiley 1980.
- Hosmer, D. W. and Lemeshaw, *Applied Survival Analysis: Regression Modelling of Time to Event Data*, J. Wiley 1999.
- Lawless, J. F., *Statistical Models and Methods for Lifetime data*, J. Wiley 1982.

Teaching and learning methods

Three lectures and one examples class each week. In addition students should expect to spend at least six hours each week on private study for this course unit.

Assessment

Coursework: 20%

End of semester examination: two and a half hours weighting 80%

Arrangements

A link to any on-line course materials will appear here.