The University of Southern Queensland

Course Specification

Description: Statistical Models						
Subject	Cat-Nbr	Class	Term	Mode	Units	Campus
STA	3301	14398	2, 2002	ONC	1.00	TWMBA

Academic Group: FOSCI
Academic Org: FOS003
HECS Band: 2
ASCED Code: 010103

STAFFING

Examiner: Paul Fahey
Moderator: Henry Eastment

PRE-REQUISITES

Pre-requisite: STA 2302 and STA 3300

RATIONALE

Linear Models are very widely used statistical tools. This course gives the student an introduction to the theory of linear models and their applications. An appropriate computer package is used to give students practice at handling many data sets. There are many situations where the usual model assumptions are not satisfied and special techniques are required and this course also introduces some of these techniques.

SYNOPSIS

This course introduces the student to statistical linear modelling utilising an appropriate computer package. The topics include linear statistical models, fitting the full rank model, inferential procedures, residuals and outliers, multicollinearity, autocorrelation, generalised linear models, and analysis of categorical data.

OBJECTIVES

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

- specify a linear model, including the assumptions;
- describe how least square and maximum likelihood estimators are calculated and specify the least squares and maximum likelihood estimators for the parameters of the linear model;
- describe the characteristics (such as mean and variance) of the least square and maximum likelihood estimators of the parameters of the linear model;

- describe an appropriate estimator of the error variance;
- fit linear models using an appropriate software package;
- use the resulting model for prediction;
- calculate and interpret the coefficient of determination and multiple and partial correlations for the model;
- test hypotheses about the significance of individual regression coefficients and combinations of regression coefficients;
- test the goodness of fit of the model;
- describe and apply a range of criteria for selecting the 'best' model;
- conduct appropriate diagnostic checks on the model, such as analysis of residuals, checks for outliers and influential points and checks for multicollinearity and suggest possible solutions to any problems identified;
- describe the exponential family of distributions and check whether specific distributions are members of this family;
- find the mean and variance of a member of the exponential family of distributions;
- specify the generalised linear model;
- describe the role of the link function and how it is derived;
- fit generalised linear models using appropriate software;
- calculate the deviance and find the 'best' model using analysis of deviance;
- fit logistic regression models to binary variables using appropriate software;
- calculate the goodness of fit of the fitted model;
- fit appropriate models to contingency table counts and test the significance of potential regressors.

TOPICS

Description	Weighting (%)
1. Review of multiple regression: specifying the model, least squares estimators of regression parameters and variance, maximum likelihood estimators of the regression parameters and variance, interval estimation of the regression parameters and variance, prediction of future responses, analysis of variance, coefficient of determination, multiple and partial correlation, regression through the origin.	15.00
2. Inference on the normal model: tests on single regression coefficients, confidence regions, tests on a subset of the regression coefficients, tests on the general linear model, test of goodness fit.	15.00
3. Model selection and checking: criteria for selecting regressors, procedures for model selection, residual analysis, data transformations, weighted least squares, detecting outliers and influential observations, multicollinearity, detecting multicollinearity.	15.00
4. Generalised linear models: the exponential family of distributions, the mean and variance of the exponential family, specifying the generalised linear model, the link function, estimation of the regression parameters, adequacy of the model, the deviance, analysis of deviance and model selection.	25.00

5. Binary variables and logistic regression: probability distributions, generalised linear models, logistic regression model, deviance, Pearson's Chi-Square test, residuals and other diagnostics.	15.00
6. Count data, Poisson regression and log-linear models: Poisson regression, probability models for contingency tables, log-linear models, inference for log-linear models.	15.00

TEXT and MATERIALS required to be PURCHASED or ACCESSED:

Books can be ordered by fax or telephone. For costs and further details use the 'Book Search' facility at http://bookshop.usq.edu.au by entering the author or title of the text.

USQ Mathematics and Computing CDROM available from the USQ bookshop.

Dobson, A.J. 1990, *An Introduction to Generalized Linear Models*, Chapman and Hall (or 2001 2nd edition of such), London.

Introductory Book 2002, *Course STA3301 Statistical Models*, USQ Distance Education Centre, Toowoomba.

Study Book 2002, *Course STA3301 Statistical Models*, USQ Distance Education Centre, Toowoomba.

REFERENCE MATERIALS

Reference materials are materials that, if accessed by students, may improve their knowledge and understanding of the material in the course and enrich their learning experience.

Cox, D.R 1989, *Analysis of Binary Data*, 2nd edition, Chapman & Hall, London.

Draper, N. & Smith, H 1998, *Applied Regression Analysis*, 3rd edition, Wiley, New York.

Everitt, B.S 1980, *The Analysis of Contingency Tables*, Chapman Hall, London.

Graybill, F.A 1961, *An Introduction to Linear Statistical Models*, McGraw-Hill, New York.

Krzanowski, W.J 1998, *An Introduction to Statistical Modelling*, Arnold, London.

McCullagh, P. & Nelder, J.A 1989, *Generalised Linear Models*, 2nd edition, Chapman & Hall:, London, New York.

Montgomery, D.C. & Peck, E.A. 1992, *Introduction to Linear Regression Analysis*, 2nd edition, Wiley, New York.

Myers, R.H 1990, *Classical & Modern Regression with Applications*, 2nd edition, Duxbury Press, Belmont.

Searle, S.R 1971, *Linear Models*, Wiley, New York.

Weisberg, S 1985, *Applied Linear Regression*, 2nd edition, Wiley, New York.

STUDENT WORKLOAD REQUIREMENTS

ACTIVITY	HOURS
Assessment	30
Examinations	3
Lectures	26
Private Study	75
Tutorial	26

ASSESSMENT DETAILS

Description	Marks Out of	Wtg(%)	Required	Due Date
ASSIGNMENT 1	10.00	10.00	Y	23 Aug 2002
ASSIGNMENT 2	10.00	10.00	Y	16 Sep 2002
ASSIGNMENT 3	10.00	10.00	Y	18 Oct 2002
3 HR RESTRICTED EXAMINATION	70.00	70.00	Y	END S2 (see note 4)

NOTES:

4. Examination dates will be available during the Semester. Please refer to Examination timetable when published.

OTHER REQUIREMENTS

1 Attendance: It is the student's responsibility to attend classes and activities to ensure that they have the best chance to meet the objectives of the course and be well informed of course-related activities and administration.

2 Minimum Requirements to Pass the Course: To be certain of obtaining a passing grade in this course, students must gain at least 50% of the marks available for each assessment item.

3 Supplementary and Deferred Examinations: Any supplementary or deferred examinations for this course will be held during the semester 3, 2002 examination period.

4 Assignments: The due date for an assignment is the date by which the student must dispatch it to USQ. The onus is on the student to provide proof of the dispatch date, if required by the examiner. Students must retain a copy of any assignment submitted. This must be produced within 48 hours if required by the examiner. Assignments submitted after the due date will be penalised 10% for each working day late unless the student can convince the examiner that such a penalty is not warranted. In accordance with University's Assignment Extension Policy (Regulation 5.6.1), the examiner of a course may grant an extension of the due date of an assignment in extenuating circumstances. This policy may be found in the USQ Handbook, the Distance Education Student Guide and the Faculty of Sciences'

Orientation Handbook for new on-campus students. All students are advised to study and follow the guidelines associated with this policy.

5 Examinations: Restricted Examination: a restricted examination is an examination where only those materials specified in the examination paper are permitted during the examination. The only materials that students may bring into the examination room and use in the restricted examination are : (a) writing materials (non-electronic and free from materials which could give the student an unfair advantage in the examination); (b) calculators which cannot hold textual information (students must indicate on their exam paper the make and model of any calculator(s) they use during the examination). These details may be checked by the invigilator of the examination.