



Division of Economic and Financial Studies

STAT320 – Linear Models & Quality Improvement
First Semester 2007

Unit Outline

Unit Conveners: Sue Crowe and Jenny Middledorp

Students in this unit should read this unit outline carefully at the beginning of semester. It contains important information about the unit. If anything in it is unclear, please consult one of the teaching staff in the unit.

ABOUT THIS UNIT

This unit consists of two separate modules.

The Quality Improvement module is concerned with aiding management of organisations to ensure that their process output meets customer requirements. To manage and improve the processes, it is essential that the quality of output be measured, and that the measurements be analysed and interpreted to provide information and process performance. This section will primarily consider statistical methods and techniques that aid in detection of changes in the quality of output brought about, either by unintentional changes in the process, or by a deliberate attempt to improve the process. These will include the following: control charts, process capability, acceptance sampling and reliability.

The Linear Models module discusses statistical modelling in general and in particular demonstrates the wide applicability of linear models. The emphasis is on practical issues in data analysis using multiple regression models demonstrated by the use of statistical packages for modelling and diagnostic testing.

Prerequisites: Stat270 (P) or Stat271 (P) or Biol235 (P) or Psy222 (P)

TEACHING STAFF

Sue Crowe:	E4A 539	Tel: 9850 8560	email: scrowe@efs.mq.edu.au
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Please note that any communication with staff via email should only be conducted using your official university email address or the mail facility under WebCT.

CLASSES

Students should attend the following classes each week:

- ❖ 3 hours of lectures beginning in Week 1
- ❖ 1 hour tutorial beginning in Week 2

The timetable for classes can be found on the University web site at:

<http://www.timetables.mq.edu.au>

Students can change their tutorial classes by using estudent at:

<https://student1.mq.edu.au/t1tbmain.asp>

REQUIRED AND RECOMMENDED TEXTS AND/OR MATERIALS

Prescribed texts:

Quality Management: Montgomery, D.C.(2005) *Introduction to Statistical Quality Control*, 5th ed. Wiley.

Linear Models: Chatterjee, S. & Hadi, A.S. (2006) *Regression Analysis by Example*, 4th ed. Wiley

Recommended texts:

Quality Management: Mitra, A. (2000) *Fundamentals of Quality Control and Improvement*, 2nd ed. Pearson.

Linear Models: Kleinbaum, D.G., Kupper, L.C., Muller, K.E.& Nizam, A. (1998) *Applied Regression Analysis and other Multivariable Methods*. Duxbury Press.

General: Anderson, J. & Poole, M. (1994) *Thesis and assignment writing*, Wiley.

HO KAM-CHIU STATISTICS PRIZE FOR OVERALL PROFICIENCY IN 300 LEVEL STATISTICS

The prize is open to all students who, at the end of 2007, qualify for a degree with a major in Statistics. The prize of \$1000 will be awarded to the most proficient student meeting these criteria. Full details of this and other prizes in the department can be found from the Statistics Department website:

<http://www.stat.mq.edu.au>

UNIT WEB PAGE

Information relating to Stat320 can be found by visiting the Macquarie University Statistics Department web site. The URL for this site is:

<http://www.stat.mq.edu.au/>

Alternatively, the URL to access WebCT directly is:

<http://online.mq.edu.au>

Use the Discussions Forum on WebCT to communicate with other students and the lecturers.

LEARNING OUTCOMES

The learning outcomes of this unit are to:

- understand the principles underlying linear modelling in data analysis and quality management
- choose the appropriate statistical analysis, for a given data set, from a wide range of methods based on the linear model
- choose appropriate statistical techniques for use in quality management
- use a statistical computer package to carry out chosen analyses and interpret the results with understanding
- present the results of analyses in a form which is suitable for publication

In addition to the discipline-based learning objectives, all academic programs at Macquarie seek to develop students' generic skills in a range of areas. One of the aims of this unit is that students develop their skills in the following:

- problem solving skills
- written communication skills, particularly report writing
- critical analysis skills

TEACHING AND LEARNING STRATEGY

Students in Stat320 will attend 3 hours of lectures and a one hour tutorial each week.

Students are expected to

- attend all the lectures and the tutorials
- hand in at the tutorial their solutions to weekly practical exercises for weeks 2 to 7
- complete laboratory exercises in the tutorial in weeks 8 to 13 and bring solutions to these to the following week's lecture

While attendance at classes is important it is only a small proportion of the total workload for the unit: reading, working with other students in groups, completing assignments, using the computer and private study are all part of the work involved. At Macquarie it is expected that the average student should spend four hours per week per credit point. This means that for Stat320 you should expect to spend approximately 12 hours per week in both formal classes and independent work.

Refer to end of handout for week-by-week list of topics to be covered.

Tutorials

Tutorials will start in the second week. In weeks 2 to 7 you will be required to prepare material for tutorials and this work will count towards your assessment. Weeks 8 to 13 will be in a computer laboratory in E4B. In weeks 8 to 12 you will be required to bring solutions to the tutorial exercises to the following week's lecture.

RELATIONSHIP BETWEEN ASSESSMENT AND LEARNING OUTCOMES

The assessment is based on the project, performance in the tutorials (including homework), class test, assignment and the final examination.

Assessment	Weighting	Due
Quality Management Project Proposal	2%	11:00am Friday 16 th March
Quality Management Project	13%	11:00am Friday 1 st June
Linear Models Assignment 1	5%	11:00am Friday 18 th May
Linear Models Assignment 2	10%	11:00am Friday 8 th June
Homework and Tutorial Participation	10%	Each week's tutorial
Final Examination	60%	As timetabled

The assignments, project proposal and project should be handed in, with the appropriate cover sheet, to ERIC (Economic Resource & Information Centre) E4B 106. Marked assessments will be available for collection from ERIC (Economic Resource & Information Centre) E4B 106 approximately two weeks after the due date.

If illness or misadventure prevents you from completing an assessment task during semester you should contact Sue Crowe and submit your documentation with the 'Advice of Absence or other Circumstances' form to the Student Centre as soon as possible and no later than the last teaching day of semester. This form is available from:

<http://www.reg.mq.edu.au/Forms/USSAbsence.pdf>

Late assessments will only be accepted with the agreement of the lecturer and may be subject to the deduction of some marks.

Details of the quality improvement project are given on page 7 of this outline.

Final Examination:

This will examine any material covered throughout the unit. Students may bring into the examination **one** A4 sheet which may have material **handwritten** on both sides.

The University Examination period in First Half Year 2007 is from 13th June to 29th June.

You are expected to present yourself for examination at the time and place designated in the University Examination Timetable. The timetable will be available in Draft form approximately eight weeks before the commencement of the examinations and in Final form approximately four weeks before the commencement of the examinations.

<http://www.timetables.mq.edu.au/exam>

The only exception to not sitting an examination at the designated time is because of documented illness or unavoidable disruption. In these circumstances you may wish to consider applying for Special Consideration. Information about unavoidable disruption and the special consideration process is available at:

<http://www.reg.mq.edu.au/Forms/APSCon.pdf>

If a Supplementary Examination is granted as a result of the Special Consideration process the examination will be scheduled after the conclusion of the official examination period.

Note that there is a Division policy regarding requests for special consideration for examinations and the granting of supplementary examinations, which can be found at:

http://www.efs.mq.edu.au/student_support/important_processes/special_consideration

You are advised that it is Macquarie University policy not to set early examinations for individuals or groups of students. All students are expected to ensure that they are available until the end of the teaching semester, that is the final day of the official examination period.

NOTE: To obtain a passing grade in Stat320, both coursework and exam performance must be satisfactory.

PLAGIARISM

The University defines plagiarism in its rules: "Plagiarism involves using the work of another person and presenting it as one's own." Plagiarism is a serious breach of the University's rules and carries significant penalties. You must read the University's practices and procedures on plagiarism. These can be found in the *Handbook of Undergraduate Studies* or on the web at:

<http://www.student.mq.edu.au/plagiarism/>

The policies and procedures explain what plagiarism is, how to avoid it, the procedures that will be taken in cases of suspected plagiarism, and the penalties if you are found guilty. Penalties may include a deduction of marks, failure in the unit, and/or referral to the University Discipline Committee.

UNIVERSITY POLICY ON GRADING

Academic Senate has a set of guidelines on the distribution of grades across the range from fail to high distinction. Your final result will include one of these grades plus a standardised numerical grade (SNG).

On occasion your raw mark for a unit (ie. the total of your marks for each assessment item) may not be the same as the SNG which you receive. Under the Senate guidelines, results may be scaled to ensure that there is a degree of comparability across the university, so that units with the same past performances of their students should achieve similar results.

It is important that you realise that the policy does not require that a minimum number of students are to be failed in any unit. In fact it does something like the opposite, in requiring examiners to explain their actions if more than 20% of students fail in a unit.

The process of scaling does not change the order of marks among students. A student who receives a higher raw mark than another will also receive a higher final scaled mark.

For an explanation of the policy see

<http://www.mq.edu.au/senate/rules/Guidelines2003.doc> or

<http://www.mq.edu.au/senate/rules/detailedguidelines.doc>

Your final grade in Stat320 will be based on your work during semester and in the final examination as specified in the Assessment section above. The grades allocated are as set out in the Bachelor Degree Rules 10(2) as follows:

HD	High Distinction	denotes performance which meets all unit objectives in such an exceptional way and with such marked excellence that it deserves the highest level of recognition
D	Distinction	denotes performance which clearly deserves a very high level of recognition as an excellent achievement in the unit
Cr	Credit	denotes performance which is substantially better than would normally be expected of competent students in the unit
P	Pass	denotes performance which satisfies unit objectives
PC	Conceded Pass	denotes performance which meets unit objectives only marginally
F	Fail	denotes performance which does not meet unit objectives

STUDENT SUPPORT SERVICES

Macquarie University provides a range of Academic Student Support Services. Details of these services can be accessed at:

<http://www.student.mq.edu.au>.

COMPUTER LABS AND CONDITIONS OF USE

All EFS Student Computing Labs are located in Building E4B. Useful information regarding the computing laboratories can be found at:

http://www.efs.mq.edu.au/student_support/student_resources/student_computing_labs

Project: As part of the project in quality management, you are required to collect daily records over a period of 42 days and analyse them using methods taught in this course:

- i) **21 days measuring whether the system is in control,**
- ii) **implementing a change in the process and**
- iii) **a further 21 days to see if the change has affected the process**

The project is designed to give you practical experience in collecting suitable data and analysing and reporting on that data in a fashion that can be understood by management. The intention is that you firstly see whether or not the system is in control, and then see whether it is possible to change the parameters of the system to ones that are more favourable to the intended outcome.

Details of further work relating to the project will be given in the course and will be available under WebCT. The report is to be handed in to ERIC (Economic Resource & Information Centre) E4B 106 by 11am, Friday 1st June.

Suggestions for suitable data

1. Daily measurements of electricity used
2. Daily measurements of water usage
3. Amount of liquid consumed every day
4. Time to run 2000m
5. Daily sales in a shop before and during a birthday sale
6. Comparison of car usage between cricket and off seasons
7. Internet usage as result of typing emails before logging in rather than after logging in

Your report should be no longer than three pages with all computing output included in an Appendix. You should submit the report with the appropriate cover page.

You should refer to the book by Anderson and Poole listed under 'Recommended Texts' the setting out of your report.

Unit Schedule

WEEK	TOPIC	WORK DUE
1 (26 Feb)	Q: Introduction Discussion of project Variation, Common causes and special causes Management ideas Control charts for variables.	
2 (5 Mar)	Q: Type I error, Binomial Distribution Pareto diagrams Control charts for variables	
3 (12 Mar)	Q: Poisson Distribution Control charts for attributes	Project Proposal (2%)
4 (19 Mar)	Q: Process capability Guest speaker	
5 (26 Mar)	Q: Acceptance sampling/Reliability	
6 (2 April)	Q: Reliability	
MIDSEMESTER BREAK – 6 APRIL – 22 APRIL		
7 (23 April)	LM: Review of simple and multiple regression	
8 (30 April)	LM: Hypothesis tests Correlations	
9 (7 May)	LM: Confounding and interaction Diagnostics	
10 (14 May)	LM: Diagnostics continued Categorical Predictors	Assignment 1 (5%)
11 (21 May)	LM: Analysis of Covariance Introduction to Logistic regression	
12 (28 May)	LM: Logistic regression ctd	Project (13%)
13 (4 June)	LM & Q: Summary and revision	Assignment 2 (10%)

Note the above schedule is an approximate guide to the timing of topics in this unit.

LM: Modelling component

Q: Quality management component