



# STAT278: Computer Simulation

## Unit Outline

Second semester 2007

Division of Economic and Financial Studies

Lecturer-in-charge: David Bulger

Students should read this outline carefully at the start of semester. It contains important information about STAT278. If anything in it is unclear, please consult the lecturer.

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ABOUT THIS UNIT

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**STAT278** is a three-credit-point unit offered by the Statistics Department in the Division of Economic and Financial Studies.

Simulation is a powerful investigative tool for understanding and predicting systems and processes of interest in a wide variety of applications, especially where analytical methods are ineffective. In this unit, using the software applications *Excel*, *Extend* and *Matlab*, you will gain an overview of the concepts and practicalities of simulation.

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TEACHING STAFF

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David Bulger is the lecturer for STAT 278. Tim Peters is the tutor. David and Tim are both available for consultation at regular times, which will be announced early in the semester at

[http://www.stat.mq.edu.au/ug/units/stat\\_units200/stat278/contact\\_info](http://www.stat.mq.edu.au/ug/units/stat_units200/stat278/contact_info).

If you wish to send email to David at [dbulger@efs.mq.edu.au](mailto:dbulger@efs.mq.edu.au), you **must** use your official Macquarie email address. All Macquarie students are issued with an official University email account. It is University policy that the University issued email account will be used for official University communication in conjunction with other communication methods. All students are required to access their University account frequently. Alternatively, email can be forwarded to another account but each student is responsible for the information sent to a non-Macquarie account and for managing mailbox size to ensure that the account remains active.

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CLASSES

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All lectures and tutorials will be held in the computer lab E4B 102.

Lectures:                      Wednesday 3pm–5pm and Friday 2pm–3pm, beginning 1 August

Tutorials:                     Fridays at 10am or 11am, for one hour, beginning 10 August

Attendance at the Tutorials is mandatory. Eight percent of your grade will be determined by your attendance at tutorials and completion of tutorial exercises.

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RECOMMENDED TEXTS AND MATERIALS

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STAT278 has **no** text. Lecture notes will be handed out at the beginning of each module, and are available on the unit website.

A little further reading will be necessary: in particular, you will need to do a little research on the internet, and you will also at times need to refer to the on-line help provided with *Excel*, *Matlab*, *Extend* and *Access*.

If you wish to do extra reading on simulation and modelling, the library has many relevant books. There are dozens of books with call numbers beginning QA76.9.C65 describing simulation and modelling from a mathematical or computer-scientific viewpoint—many of these are quite introductory and easy to read. Books with call numbers beginning T57.62 describe the same topic, but from a more managerial or business viewpoint. Gilbert & Doran’s *Simulating Societies* addresses the topic from the sociologists’ perspective, but is probably a bit erudite; this book will mainly

be of interest in the applications it describes. Also possibly of interest are Emshoff & Sisson's *Design and Use of Computer Simulation Models*, Naylor & al.'s *Computer Simulation Techniques* and Gordon's *System Simulation*. Many of these books are surprisingly old—just ignore all the talk of *FORTRAN* and so forth; the basic concepts of computer simulation haven't really changed.

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UNIT WEB PAGE

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The web page for this unit can be found at

<http://www.stat.mq.edu.au/units/stat278/>

and is an important part of this unit. It contains the hyperlink to the *WebCT* online discussion facility. Lecture notes, assignments, tutorial exercises and solutions can be downloaded from the web page. Unit information appears there too, including this unit outline. During the semester, you should visit the web page and the discussion facility at least weekly.

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LEARNING OUTCOMES

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After STAT278, you should be able to

- decompose a system into simple elements for modelling and simulation purposes,
- implement models in *Excel*, *Matlab* and *Extend*,
- interpret the results of a single simulation run,
- use multiple simulations *systematically* to make inferences,
- organise and summarise simulation data graphically and numerically,
- analyse data, using confidence intervals and basic hypothesis testing where appropriate,
- draw conclusions from the results of data analysis,
- optimise stochastic system parameters by simulation,
- understand and simulate discrete event processes such as queues,
- understand and apply the concepts of correlation, time series and random walks,
- use basic SQL commands to interrogate databases.

Moreover, like any unit at Macquarie, STAT278 will extend your “generic” skills, for instance in problem-solving, communication, teamwork, use of the information technology, time management, taking responsibility for your own learning and so forth.

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TEACHING AND LEARNING STRATEGY

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STAT278's lectures will be complemented by several other learning opportunities.

In the tutorials you will use specialised software to solve exercises in simulation and related topics. You will be given an exercise sheet at each tutorial. During the tutorial you will work on this

exercise. You may submit your solution to the exercise at the tutorial, or if you need longer than an hour, you have until the following tutorial to submit it to your tutor.

In both the tutorials and the *WebCT* online discussion facility, you will be able to discuss the unit content with your classmates and tutor.

Furthermore, the unit includes a group project, in which you and a few of your classmates will pretend to be a consulting team. You will apply the unit's simulation and analysis techniques to an invented problem, and compose a report to submit to your fictional client.

An **approximate** schedule of the topics covered each week is as follows:

| Week | Lecture dates   | Topic                         | Remarks                                                                                       |
|------|-----------------|-------------------------------|-----------------------------------------------------------------------------------------------|
| 1    | 1 & 3 August    | Intro, overview, hyp. testing | No tutorial                                                                                   |
| 2    | 8 & 10 August   | Hypothesis testing            |                                                                                               |
| 3    | 15 & 17 August  | Random variables              | Assignment 1 set; Online Task due Tuesday 14 August; Project Groups assigned Friday 17 August |
| 4    | 22 & 24 August  | Stochastic processes          | Assignment 1 due Friday 24 August                                                             |
| 5    | 29 & 31 August  | Queue systems                 | Group Project Stage I due Friday 31 August                                                    |
| 6    | 5 September     | Queues/Optimisation           | No tutorial or Friday lecture                                                                 |
| 7    | 12 September    |                               | <b>Test</b> instead of Wednesday lecture; no tutorial or Friday lecture                       |
| 8    | 3 & 5 Octobr    | Optimisation                  | Assignment 2 set                                                                              |
| 9    | 10 & 12 October | Databases and <i>SQL</i>      | Group Project Stage II due Friday 12 October                                                  |
| 10   | 17 & 19 October | Practice problems             | Assignment 2 due Friday 19 October                                                            |
| 11   | 24 & 26 October | Practice problems             |                                                                                               |
| 12   | 31 Oct & 2 Nov  | Practice problems             | Group Project Stage III due Friday 2 November                                                 |
| 13   | 7 & 9 November  | Practice problems             | Attend tutorial as usual, but don't hand in the exercise                                      |

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RELATIONSHIP BETWEEN ASSESSMENT AND LEARNING OUTCOMES

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Because STAT278 is a practically-oriented unit, you will sit a practical exam in the computer lab at the end of the semester, rather than a traditional paper-based exam. Your total assessment will be on the basis of your performance of a variety of practical exercises and projects. Your final raw mark (see UNIVERSITY POLICY ON GRADING, below) for STAT278 will be a weighted average of marks for tutorial participation, *WebCT* contribution, your Group Project, two individual assignments, and the practical test and exam in the computer labs.

### Tutorials (8%)

This mark is based on tutorial attendance and performance in the weekly tutorial exercises. There will be 10 tutorials (no tutorials in Weeks 1, 6 or 7) and 9 tutorial exercises (no exercise to be handed in from the Week 13 tutorial). For each exercise you hand in on time, you'll receive a mark of 1 or 2, and also you'll receive one mark for each tutorial you attend. This makes for a maximum possible total of 28; your total will be multiplied by 8/28 to give your tutorial mark out of 8.

### **WebCT (2%)**

This mark is based on your contribution to the unit's online discussion forum. In particular, these marks are gained by completing the 'online task', assigned in the first lecture.

### **Group Project (10%)**

The group project will be completed in groups of about four. The focus is more on learning than assessment. Every group ought to be able to get a high mark here; group members who pull their weight will have a much easier time with the remainder of the unit. (Let's disprove the words of William Lowe Bryan: "Education is one of the few things a person is willing to pay for and not get.")

### **Individual assignments (10% + 10%)**

You will be issued two assignments during the semester to be completed individually.

### **Mid-semester practical test (12%)**

In Week 6 you will sit a fifty-minute practical test in one of the computer labs. The test will be conducted under exam conditions, that is, silently and with no communication between students. It is, however, an open-book test; you may bring in your lecture notes, crib sheets, calculator and so forth, as you see fit. You should **not** bring a cellphone to the test.

Details of the exact time and location of the test will be announced to students within the first few weeks of semester.

### **Final practical exam (48%)**

At the end of semester you will sit a three-hour practical exam in the computer labs. The second half of the semester will be more emphasised (because the first half will have been tested in the mid-semester test), but the entire unit will be considered examinable in this exam. The conditions will be the same as for the mid-semester test, that is, open-book and exam conditions. The date and location of this test will be announced.

**Illness or Misadventure:** If illness or misadventure prevents you from completing an assessment task during semester you should contact the lecturer as soon as possible, 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>.

The University Examination period in Second semester 2007 is from 14 November to 30 November.

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—refer to

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

The only exception to 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>.

Please note that this form and the appropriate documentation must be submitted before the end of the examination period.

Note that there is a Division policy regarding requests for special consideration for examinations and the granting of supplementary examinations on

<http://www.efs.mq.edu.au/supexams.htm>.

Please be aware that you will not be contacted to be advised that you have been granted a supplementary examination—you will need to consult the website for this information. To be eligible for a supplementary exam in STAT278, you must have completed (or been excused from) all previous assessment tasks.

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.

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PLAGIARISM

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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 referral to the University Discipline Committee.

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UNIVERSITY POLICY ON GRADING

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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 (i.e., 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/MQUonly/Issues/Guidelines2003.doc> or  
<http://www.mq.edu.au/senate/MQUonly/Issues/detailedguidelines.doc>.

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STUDENT SUPPORT SERVICES

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

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

Other information for Macquarie students is available from the Student Portal

<https://my.mq.edu.au>.

This includes access to your official university email.

The Numeracy Centre (C5A 225) may also be able to offer assistance.