STAT278

Computer Simulation

S1 Day 2017

Dept of Statistics

Contents

General Information

Unit convenor and teaching staff
Unit Convenor
Thomas Fung
thomas.fung@mq.edu.au
12 Wally's Walk (E7A) Office 6.26
Wednesday 10 am - 12 pm

Lecturer
Ayse Bilgin
ayse.bilgin@mq.edu.au
12 Wally's Walk (E7A) Office 6.35
Monday 3 - 5 pm

Credit points
3

Prerequisites
STAT171 or STAT273 or ((STAT170(P) or STAT150) and 3cp from COMP units at 100 level)

Corequisites

Co-badged status

Unit description
This unit considers the use of computer simulation in problem solving. It emphasises the use of computer simulation as an investigative tool, especially where analytic methods are ineffective. Software packages used include the popular numerical package MATLAB and Microsoft Office products Excel and Access. The unit is very practical, with lectures, tutorials, test and exam held in a computer lab. This unit develops students' skills in analysis of systems, teamwork, communication, and formal reports of technical findings, and briefly introduces relational databases. This unit also develops practical skills which are useful in later statistics units.

Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at https://www.mq.edu.au/study/calendar-of-dates

Learning Outcomes

On successful completion of this unit, you will be able to:

Be able to decompose a system into simple elements for modelling and simulation purposes and implement them in Excel and Matlab

Be able to organise and summarise simulation data graphically and numerically

Be able to use multiple simulations systematically to make inferences and draw conclusions from the results

Be able to optimise stochastic system parameters by simulation

Be able to understand and simulate discrete event processes such as queues

Be able to understand and apply the concepts of correlation, time series and random walks

Be able to use basic SQL commands to interrogate databases

Be able to work collaboratively on a research project and report

Assessment Tasks

Name	Weighting	Hurdle	Due
Tutorial	8%	No	Weeks 2-12
ILearn	2%	No	18 March
Group Project	10%	No	Weeks 5, 9, 13
2 Individual Assignments	20%	No	Weeks 4 & 11
Mid-semester practical test	12%	No	Week 7
Final Practical Exam	48%	No	TBA

Tutorial

Due: **Weeks 2-12**
Weighting: **8%**

This mark is based on tutorial performance in the weekly tutorial exercises. There will be 10 tutorial exercises (no tutorial in Weeks 1, 7 and 13). For each exercise you submit on time, it will be mark out of 2. This marks for a maximum possible total of 20; your total will be multiplied by 8/20 to give your tutorial mark out of 8.

Each tutorial exercise should be submitted by 12pm on the Friday following the tutorial class. You may find you can usually submit your exercise during the tutorial class. Submission should be via *iLearn*.

No extension will be granted. Student who have not submitted the solution to the tutorial prior to the deadline will be awarded a mark of 0 for the task, except for the cases in which an application of disruption to studies is made and approved.

On successful completion you will be able to:

- Be able to decompose a system into simple elements for modelling and simulation purposes and implement them in Excel and Matlab
- Be able to organise and summarise simulation data graphically and numerically
- Be able to use multiple simulations systematically to make inferences and draw conclusions from the results
- Be able to optimise stochastic system parameters by simulation
- Be able to understand and simulate discrete event processes such as queues
- Be able to understand and apply the concepts of correlation, time series and random walks
- Be able to use basic SQL commands to interrogate databases

ILearn

Due: **18 March**
Weighting: **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.

No extensions will be granted. Students who have not submitted their post prior to the deadline will be awarded a mark of 0 for the task, except for cases in which an application for disruption to studies is made and approved.

On successful completion you will be able to:

- Be able to work collaboratively on a research project and report

Group Project

Due: **Weeks 5, 9, 13**
Weighting: **10%**

The group project will be completed in groups of about four. The focus is more on learning than assessment. 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.") Submission will be via *iLearn*, in stages, but details will be given at the end of Week 3. Notice that 50% of the mark will be awarded based on the various group report submissions and the remaining 50% will be awarded individually based on an oral presentation made in Week 13.

No extensions will be granted. Late tasks will be accepted up to 72 hours after the submission deadline. There will be a deduction of 20% of the total available marks made from the total awarded mark for each 24 hour period or part thereof that the submission is late (for example, 25 hours late in submission – 40% penalty). This penalty does not apply

for cases in which an application for disruption to studies is made and approved.

On successful completion you will be able to:

- Be able to decompose a system into simple elements for modelling and simulation purposes and implement them in Excel and Matlab
- Be able to organise and summarise simulation data graphically and numerically
- Be able to use multiple simulations systematically to make inferences and draw conclusions from the results
- Be able to optimise stochastic system parameters by simulation
- Be able to understand and simulate discrete event processes such as queues
- Be able to understand and apply the concepts of correlation, time series and random walks
- Be able to work collaboratively on a research project and report

2 Individual Assignments

Due: **Weeks 4 & 11**
Weighting: **20%**

You will be issued two assignments during the semester to be completed individually and submitted via *iLearn*.

No extensions will be granted. Students who have not submitted the task prior to the deadline will be awarded a mark of 0 for the tast, except for cases in which an application for disruption to studies is made and approved.

On successful completion you will be able to:

- Be able to decompose a system into simple elements for modelling and simulation purposes and implement them in Excel and Matlab
- Be able to organise and summarise simulation data graphically and numerically
- Be able to use multiple simulations systematically to make inferences and draw conclusions from the results
- Be able to optimise stochastic system parameters by simulation
- Be able to understand and simulate discrete event processes such as queues
- Be able to understand and apply the concepts of correlation, time series and random walks

Mid-semester practical test

Due: **Week 7**

Weighting: **12%**

In the Week 7 lecture you will sit a 50-minute practical test. 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.

The only exception to sitting the mid-semester practical test at the designated time is because of documented illness or unavoidable disruption. In these circumstances you may wish to consider applying for Disruption to Studies. For more information, follow the links on the Policies and Procedures page.

On successful completion you will be able to:

- Be able to decompose a system into simple elements for modelling and simulation purposes and implement them in Excel and Matlab
- Be able to organise and summarise simulation data graphically and numerically
- Be able to use multiple simulations systematically to make inferences and draw conclusions from the results
- Be able to understand and apply the concepts of correlation, time series and random walks

Final Practical Exam

Due: **TBA**
Weighting: **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.

Students are expected to present themselves 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.

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.

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 Disruption to Studies. For more information, follow the links on the Policies and Procedures page.

If you notify the University of your disruption to studies for your final examination, you must make yourself available for the week of July 24 – 28, 2017. In you are not available at that time, there is no guarantee an additional examination time will be offered. Specific examination dates and times will be determined at a later date.

On successful completion you will be able to:

- Be able to decompose a system into simple elements for modelling and simulation purposes and implement them in Excel and Matlab
- Be able to organise and summarise simulation data graphically and numerically
- Be able to use multiple simulations systematically to make inferences and draw conclusions from the results
- Be able to optimise stochastic system parameters by simulation
- Be able to understand and simulate discrete event processes such as queues
- Be able to understand and apply the concepts of correlation, time series and random walks
- Be able to use basic SQL commands to interrogate databases

Delivery and Resources

RECOMMENDED TEXTS AND MATERIALS

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 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, Gordon's System Simulation and Robinson's 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.

Three software applications are used in STAT278: Excel, Access and Matlab. You will have access to all three of these applications in the computer labs in E4B. Additionally, the first two (Excel and Access) are Microsoft Office products, and therefore available on most computers throughout the University; moreover, although they are not freeware, you very possibly have

these applications installed on your computer already.

Matlab is also available for download for free, please refer to the STAT278 iLearn site for instruction. Matlab may also be available in some other labs (for instance the Faculty of Science labs). The unit material assumes you will use Matlab, but if you prefer to complete some or all of these assessments in Scilab, that can be accommodated.

ASSESSMENT

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 Grading, below) for STAT278 will be a weighted average of marks for tutorial participation, iLearn contribution, your Group Project, two individual assignments, and the practical test and exam in the computer labs. Requests for extensions to the due dates of any assessment in STAT278 should be made to either of the lecturers, in person or via email.

GRADING

Your final Standardised Numerical Grade (SNG) and grade in Stat278 will be based on your work during semester and in the final examination as specified in the Assessment section above. Note, from its definition in the Undergraduate Handbook, SNG “is called a grade as it does not represent the raw marks, it reflects where within the grading structure the student sits.” The grades allocated (HD, D, Cr, et cetera) are as set out in the Grading Policy (see the Policies and Procedures page).

UNIT WEBSITE

Enrolment in STAT278 should automatically make the STAT278 iLearn site available to you from the start of semester. To access it, log in at https://ilearn.mq.edu.au/login/MQ/ and select STAT278 from your list of iLearn units. Not every unit at Macquarie uses iLearn, so don’t be alarmed if this list doesn’t contain all of your units. If STAT278 doesn’t appear, though, and you enrolled in the unit more than 24 hours ago, please contact the Unit Convenor immediately.

The iLearn site is an important part of this unit, giving you access to the online discussion facility, lecture notes, assignments, tutorial exercises and solutions. Unit information appears there too, including this unit outline. During the semester, you should visit the iLearn site at least twice per week.

Unit Schedule

Please visit the unit's *iLearn* site for a weekly schedule of lecture topics, assessments et cetera.

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central. Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy http://mq.edu.au/policy/docs/academic_honesty/policy.html

Assessment Policy http://mq.edu.au/policy/docs/assessment/policy_2016.html

Grade Appeal Policy http://mq.edu.au/policy/docs/gradeappeal/policy.html

Complaint Management Procedure for Students and Members of the Public http://www.mq.edu.au/policy/docs/complaint_management/procedure.html

Disruption to Studies Policy (in effect until Dec 4th, 2017): http://www.mq.edu.au/policy/docs/disruption_studies/policy.html

Special Consideration Policy (in effect from Dec 4th, 2017): https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policies/special-consideration

In addition, a number of other policies can be found in the Learning and Teaching Category of Policy Central.

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/support/student_conduct/

Results

Results shown in *iLearn*, or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit ask.mq.edu.au.

Student Support

Macquarie University provides a range of support services for students. For details, visit http://students.mq.edu.au/support/

Learning Skills

Learning Skills (mq.edu.au/learningskills) provides academic writing resources and study strategies to improve your marks and take control of your study.

- Workshops
- StudyWise
- Academic Integrity Module for Students
- Ask a Learning Adviser

Student Services and Support

Students with a disability are encouraged to contact the Disability Service who can provide appropriate help with any issues that arise during their studies.

Student Enquiries

For all student enquiries, visit Student Connect at ask.mq.edu.au

IT Help

For help with University computer systems and technology, visit http://www.mq.edu.au/about_us/

offices_and_units/information_technology/help/.

When using the University's IT, you must adhere to the Acceptable Use of IT Resources Policy. The policy applies to all who connect to the MQ network including students.

Graduate Capabilities

Creative and Innovative

Our graduates will also be capable of creative thinking and of creating knowledge. They will be imaginative and open to experience and capable of innovation at work and in the community. We want them to be engaged in applying their critical, creative thinking.

This graduate capability is supported by:

Learning outcomes

- Be able to organise and summarise simulation data graphically and numerically
- Be able to work collaboratively on a research project and report

Assessment tasks

- Tutorial
- ILearn
- Group Project
- 2 Individual Assignments
- Mid-semester practical test
- Final Practical Exam

Capable of Professional and Personal Judgement and Initiative

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

Learning outcome

- Be able to work collaboratively on a research project and report

Assessment tasks

- ILearn
- Group Project

Commitment to Continuous Learning

Our graduates will have enquiring minds and a literate curiosity which will lead them to pursue knowledge for its own sake. They will continue to pursue learning in their careers and as they participate in the world. They will be capable of reflecting on their experiences and relationships with others and the environment, learning from them, and growing - personally, professionally and socially.

This graduate capability is supported by:

Learning outcome

- Be able to work collaboratively on a research project and report

Assessment tasks

- ILearn
- Group Project

Discipline Specific Knowledge and Skills

Our graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

This graduate capability is supported by:

Learning outcomes

- Be able to decompose a system into simple elements for modelling and simulation purposes and implement them in Excel and Matlab
- Be able to organise and summarise simulation data graphically and numerically
- Be able to use multiple simulations systematically to make inferences and draw conclusions from the results
- Be able to optimise stochastic system parameters by simulation
- Be able to understand and simulate discrete event processes such as queues
- Be able to understand and apply the concepts of correlation, time series and random walks
- Be able to use basic SQL commands to interrogate databases

Assessment tasks

- Tutorial

- Group Project
- 2 Individual Assignments
- Mid-semester practical test
- Final Practical Exam

Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and systemically in relation to scholarly activity, in the workplace, and in the world. We want them to have a level of scientific and information technology literacy.

This graduate capability is supported by:

Learning outcomes

- Be able to decompose a system into simple elements for modelling and simulation purposes and implement them in Excel and Matlab
- Be able to use multiple simulations systematically to make inferences and draw conclusions from the results
- Be able to optimise stochastic system parameters by simulation
- Be able to understand and simulate discrete event processes such as queues
- Be able to understand and apply the concepts of correlation, time series and random walks
- Be able to use basic SQL commands to interrogate databases

Assessment tasks

- Tutorial
- Group Project
- 2 Individual Assignments
- Mid-semester practical test
- Final Practical Exam

Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

Learning outcomes

- Be able to decompose a system into simple elements for modelling and simulation purposes and implement them in Excel and Matlab
- Be able to optimise stochastic system parameters by simulation
- Be able to understand and simulate discrete event processes such as queues
- Be able to understand and apply the concepts of correlation, time series and random walks
- Be able to use basic SQL commands to interrogate databases
- Be able to work collaboratively on a research project and report

Assessment tasks

- Tutorial
- ILearn
- Group Project
- 2 Individual Assignments
- Mid-semester practical test
- Final Practical Exam

Effective Communication

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication technologies as appropriate.

This graduate capability is supported by:

Learning outcome

- Be able to work collaboratively on a research project and report

Assessment tasks

- ILearn
- Group Project

Engaged and Ethical Local and Global citizens

As local citizens our graduates will be aware of indigenous perspectives and of the nation's historical context. They will be engaged with the challenges of contemporary society and with knowledge and ideas. We want our graduates to have respect for diversity, to be open-minded, sensitive to others and inclusive, and to be open to other cultures and perspectives: they should have a level of cultural literacy. Our graduates should be aware of disadvantage and social

justice, and be willing to participate to help create a wiser and better society.

This graduate capability is supported by:

Learning outcome

- Be able to work collaboratively on a research project and report

Assessment tasks

- ILearn
- Group Project

Socially and Environmentally Active and Responsible

We want our graduates to be aware of and have respect for self and others; to be able to work with others as a leader and a team player; to have a sense of connectedness with others and country; and to have a sense of mutual obligation. Our graduates should be informed and active participants in moving society towards sustainability.

This graduate capability is supported by:

Assessment tasks

- Tutorial
- Group Project
- 2 Individual Assignments
- Mid-semester practical test
- Final Practical Exam

Changes from Previous Offering

50% of the group project will now be individually assessed.

Learning and Teaching Strategy

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 to complete at each tutorial. During the tutorial you will work on this exercise. You should submit your solution to the exercise via *iLearn*, during the tutorial or any time before the end of the weekend.

In both the tutorials and the *iLearn* 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.