STAT379

Operations Research II

S1 Day 2018

Dept of Statistics

Contents

General Information

Unit convenor and teaching staff
Unit Convenor & Lecturer
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Credit points
3

Prerequisites
6cp at 200 level including STAT279(P)

Corequisites

Co-badged status

Unit description
This unit complements STAT279 with the main emphasis again being on application of techniques to problems which arise in business and industry. Students are expected to use a computer package to find solutions to formulated problems. Topics include integer programming (modelling, branch-and-bound), goal programming, inventory models, decision analysis, game theory, and Markov Processes.

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 determine which inventory model to use, obtain the solution (by hand and Excel) and provide an inventory policy.

Be able to set up a transition matrix, draw a state diagram, classify the states of a Markov Chain, calculate the state vector at future transitions, and when possible calculate the steady state probabilities.

Be able to identify a zero sum or constant sum game, set up a payoff matrix, if a saddle point exists find the optimal strategy and if a saddle point does not exist to determine the

mixed strategies either by formulating the game as a linear program or solving graphically.

Be able to formulate linear programming problems involving integers and indicator variables using a computer package as well as interpret the output and write up a conclusion.

Know about decision making under uncertainty and be able to provide an optimal solution for different situations.

General Assessment Information

In the case of a late submission for an assignment, if no special consideration has been granted, 10% of the earned mark will be deducted for each day that an assignment is late, up to a maximum of 50%. After 5 days, counted including weekends and public holidays, a mark of 0% will be awarded. NOTE: It is not the intention of this late penalty policy to cause a student to fail the unit when they have submitted their assignment no more than 5 days after the due date and they would have otherwise passed. In this case, if deductions for late assignments result in the final unit mark for a student being less than 50, when otherwise it would have been 50 or greater, the student's final mark will be exactly 50.

Assessment Tasks

Name	Weighting	Hurdle	Due
Tutorial Participation	10%	No	Weekly
Class Test 1	20%	No	Week 6 tutorials
Class Test 2	20%	No	Week 11 tutorials
Assignment 1	5%	No	2pm 12 April 2018
Assignment 2	5%	No	2pm 7 June 2018
Quiz 1	2%	No	Week 4 Lecture
Quiz 2	2%	No	Week 5 Lecture
Quiz 3	2%	No	Week 7 Lecture
Quiz 4	2%	No	Week 10 Lecture
Quiz 5	2%	No	Week 12 Lecture
Final Examination	30%	No	Exam Period

Tutorial Participation

Due: **Weekly**
Weighting: **10%**

To obtain full marks you need to participate in every tutorial and hand in one handwritten page from your homework solutions at the beginning of each tutorial.

On successful completion you will be able to:

- Be able to determine which inventory model to use, obtain the solution (by hand and Excel) and provide an inventory policy.
- Be able to set up a transition matrix, draw a state diagram, classify the states of a Markov Chain, calculate the state vector at future transitions, and when possible calculate the steady state probabilities.
- Be able to identify a zero sum or constant sum game, set up a payoff matrix, if a saddle point exists find the optimal strategy and if a saddle point does not exist to determine the mixed strategies either by formulating the game as a linear program or solving graphically.
- Be able to formulate linear programming problems involving integers and indicator variables using a computer package as well as interpret the output and write up a conclusion.
- Know about decision making under uncertainty and be able to provide an optimal solution for different situations.

Class Test 1

Due: **Week 6 tutorials**
Weighting: **20%**

This will be held in the week 6 tutorials.

Permitted materials for the class test are a calculator, lecture notes, assignments, assignment solutions, homework solutions, and tutorial solutions. There is no computer access during the class test. No electronic devices are allowed (e.g. iPhones, iPads, tablets, laptops, mobile phones) apart from nonprogrammable calculators.

Failure to attend the test without relevant documentation to explain the absence (submitted as a Special Consideration request within 5 working days of the test) will result in zero marks being awarded for the test.

The procedure for submitting a Special Consideration online can be obtained by visiting ask.mq.edu.au.

Class Test 1 will be of 50 minutes duration.

On successful completion you will be able to:

- Be able to determine which inventory model to use, obtain the solution (by hand and Excel) and provide an inventory policy.
- Be able to set up a transition matrix, draw a state diagram, classify the states of a Markov Chain, calculate the state vector at future transitions, and when possible calculate the steady state probabilities.

Class Test 2

Due: **Week 11 tutorials**
Weighting: **20%**

This will be held in the week 11 tutorials.

Permitted materials for the class test are a calculator, lecture notes, assignments, assignment solutions, homework solutions, and tutorial solutions. There is no computer access during the class test. No electronic devices are allowed (e.g. iPhones, iPads, tablets, laptops, mobile phones) apart from nonprogrammable calculators.

Failure to attend the test without relevant documentation to explain the absence (submitted as a Special Consideration request within 5 working days of the test) will result in zero marks being awarded for the test.

The procedure for submitting a Special Consideration online can be obtained by visiting ask.mq.edu.au.

Class Test 2 will be of 50 minutes duration.

On successful completion you will be able to:

- Be able to identify a zero sum or constant sum game, set up a payoff matrix, if a saddle point exists find the optimal strategy and if a saddle point does not exist to determine the mixed strategies either by formulating the game as a linear program or solving graphically.
- Be able to formulate linear programming problems involving integers and indicator variables using a computer package as well as interpret the output and write up a conclusion.
- Know about decision making under uncertainty and be able to provide an optimal solution for different situations.

Assignment 1

Due: **2pm 12 April 2018**

Weighting: **5%**

Assignments must be submitted in **pdf format online via iLearn** by 2pm on the due date. This can be done in Word. There is no "group work" assessment in this unit. All work is to be the student's own.

Please refer to **General Assessment Information** for lateness penalty.

On successful completion you will be able to:

- Be able to determine which inventory model to use, obtain the solution (by hand and Excel) and provide an inventory policy.
- Be able to set up a transition matrix, draw a state diagram, classify the states of a Markov Chain, calculate the state vector at future transitions, and when possible calculate the steady state probabilities.
- Be able to identify a zero sum or constant sum game, set up a payoff matrix, if a saddle point exists find the optimal strategy and if a saddle point does not exist to determine the mixed strategies either by formulating the game as a linear program or solving graphically.

Assignment 2

Due: **2pm 7 June 2018**
Weighting: **5%**

Assignments must be submitted in **pdf format online via iLearn** by 2pm on the due date. This can be done in Word. There is no "group work" assessment in this unit. All work is to be the student's own.

Please refer to **General Assessment Information** for lateness penalty.

On successful completion you will be able to:

- Be able to formulate linear programming problems involving integers and indicator variables using a computer package as well as interpret the output and write up a conclusion.
- Know about decision making under uncertainty and be able to provide an optimal solution for different situations.

Quiz 1

Due: **Week 4 Lecture**
Weighting: **2%**

Ten minutes during the lecture. Permitted materials for the class test are a calculator, lecture notes, assignments, assignment solutions, homework solutions, and tutorial solutions. No

electronic devices are allowed (e.g. iPhones, iPads, tablets, laptops, mobile phones).

Failure to attempt Quiz 1 without relevant documentation to explain the absence (submitted as a Special Consideration online within 5 working days of the quiz) will result in a mark of 0 being awarded for Quiz 1.

On successful completion you will be able to:

- Be able to determine which inventory model to use, obtain the solution (by hand and Excel) and provide an inventory policy.

Quiz 2

Due: **Week 5 Lecture**
Weighting: **2%**

Ten minutes during the lecture. Permitted materials for the class test are a calculator, lecture notes, assignments, assignment solutions, homework solutions, and tutorial solutions. No electronic devices are allowed (e.g. iPhones, iPads, tablets, laptops, mobile phones).

Failure to attempt Quiz 2 without relevant documentation to explain the absence (submitted as a Special Consideration online within 5 working days of the quiz) will result in a mark of 0 being awarded for Quiz 2.

On successful completion you will be able to:

- Be able to set up a transition matrix, draw a state diagram, classify the states of a Markov Chain, calculate the state vector at future transitions, and when possible calculate the steady state probabilities.

Quiz 3

Due: **Week 7 Lecture**
Weighting: **2%**

Ten minutes during the lecture. Permitted materials for the class test are a calculator, lecture notes, assignments, assignment solutions, homework solutions, and tutorial solutions. No electronic devices are allowed (e.g. iPhones, iPads, tablets, laptops, mobile phones).

Failure to attempt Quiz 3 without relevant documentation to explain the absence (submitted as a Special Consideration online within 5 working days of the quiz) will result in a mark of 0 being awarded for Quiz 3.

On successful completion you will be able to:

- Be able to identify a zero sum or constant sum game, set up a payoff matrix, if a saddle point exists find the optimal strategy and if a saddle point does not exist to determine the mixed strategies either by formulating the game as a linear program or solving

graphically.

Quiz 4

Due: **Week 10 Lecture**
Weighting: **2%**

Ten minutes during the lecture. Permitted materials for the class test are a calculator, lecture notes, assignments, assignment solutions, homework solutions, and tutorial solutions. No electronic devices are allowed (e.g. iPhones, iPads, tablets, laptops, mobile phones).

Failure to attempt Quiz 4 without relevant documentation to explain the absence (submitted as a Special Consideration online within 5 working days of the quiz) will result in a mark of 0 being awarded for Quiz 4.

On successful completion you will be able to:

- Be able to formulate linear programming problems involving integers and indicator variables using a computer package as well as interpret the output and write up a conclusion.

Quiz 5

Due: **Week 12 Lecture**
Weighting: **2%**

Ten minutes during the lecture. Permitted materials for the class test are a calculator, lecture notes, assignments, assignment solutions, homework solutions, and tutorial solutions. No electronic devices are allowed (e.g. iPhones, iPads, tablets, laptops, mobile phones).

Failure to attempt Quiz 5 without relevant documentation to explain the absence (submitted as a Special Consideration online within 5 working days of the quiz) will result in a mark of 0 being awarded for Quiz 5.

On successful completion you will be able to:

- Know about decision making under uncertainty and be able to provide an optimal solution for different situations.

Final Examination

Due: **Exam Period**
Weighting: **30%**

The final examination will be held during the Examination period. The Final examination is 2 hours long (with an additional 10 minutes reading time).

The final examination covers all topics in the unit. Students may take into the final examination ONE A4 page of notes handwritten(not typed) on BOTH sides. Calculators will be needed but must be of the nonprogrammable type.

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

If documented illness or unavoidable disruption prevent you from sitting the examination you may wish to consider applying for a Special Consideration. Failure to sit the final examination without relevant documentation to explain the absence (submitted as a Special Consideration online within 5 working days of the final examination) will result in a mark of 0 being awarded for the final examination.

Students need to apply for Special Consideration online at https://ask.mq.edu.au

If you receive special consideration for the final exam, a supplementary exam will be scheduled in the interval between the regular exam period and the start of the next session. By making a special consideration application for the final exam you are declaring yourself available for a resit during the supplementary examination period and will not be eligible for a second special consideration approval based on pre-existing commitments. Please ensure you are familiar with the policy prior to submitting an application. You can check the supplementary exam information page on FSE101 in iLearn (bit.ly/FSESupp) for dates, and approved applicants will receive an individual notification one week prior to the exam with the exact date and time of their supplementary examination.

On successful completion you will be able to:

- Be able to determine which inventory model to use, obtain the solution (by hand and Excel) and provide an inventory policy.
- Be able to set up a transition matrix, draw a state diagram, classify the states of a Markov Chain, calculate the state vector at future transitions, and when possible calculate the steady state probabilities.
- Be able to identify a zero sum or constant sum game, set up a payoff matrix, if a saddle point exists find the optimal strategy and if a saddle point does not exist to determine the mixed strategies either by formulating the game as a linear program or solving graphically.
- Be able to formulate linear programming problems involving integers and indicator variables using a computer package as well as interpret the output and write up a conclusion.
- Know about decision making under uncertainty and be able to provide an optimal solution for different situations.

Delivery and Resources

There are 3 hours of lectures and 1 tutorial each week in this unit. Lectures commence in Week 1 and Tutorials commence in Week 2. Lecture material will be put up on iLearn.

Technologies used and required

Lecture material will be placed on iLearn. Microsoft Excel and Microsoft Excel Add-in Solver will be used in some of the lectures. Students will need to use a calculator for the final examination and some of the other assessments. Students will need to use Microsoft Excel and the Microsoft Excel Add-in Solver. All assignments must be word processed and converted to pdf files for online submission (you can save a Word document as PDF).

Unit Schedule

Week	Topic
1 (26 Feb)	Inventory Models
2 (5 Mar)	Inventory Models
3 (12 Mar)	Inventory Models
4 (19 Mar)	Markov Processes
5 (26 Mar)	Markov Processes / Game Theory
6 (2 Apr)	Game Theory
7 (9 Apr)	Integer Programming
8 (30 Apr)	Integer Programming
9 (7 May)	Integer Programming
10 (14 May)	Decision Making
11 (21 May)	Decision Making
12 (28 May)	Decision Making
13 (4 June)	Review

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- Academic Appeals Policy
- Academic Integrity Policy
- Academic Progression Policy
- Assessment Policy
- Fitness to Practice Procedure

- Grade Appeal Policy
- Complaint Management Procedure for Students and Members of the Public
- Special Consideration Policy *(**Note:** The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.)*

Undergraduate students seeking more policy resources can visit the Student Policy Gateway (https://students.mq.edu.au/support/study/student-policy-gateway). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

If you would like to see all the policies relevant to Learning and Teaching visit Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/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/study/getting-started/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 determine which inventory model to use, obtain the solution (by hand and Excel) and provide an inventory policy.
- Be able to set up a transition matrix, draw a state diagram, classify the states of a Markov Chain, calculate the state vector at future transitions, and when possible calculate the steady state probabilities.
- Be able to identify a zero sum or constant sum game, set up a payoff matrix, if a saddle point exists find the optimal strategy and if a saddle point does not exist to determine the mixed strategies either by formulating the game as a linear program or solving graphically.
- Be able to formulate linear programming problems involving integers and indicator variables using a computer package as well as interpret the output and write up a conclusion.
- Know about decision making under uncertainty and be able to provide an optimal solution for different situations.

Assessment tasks

- Tutorial Participation
- Class Test 1
- Class Test 2
- Assignment 1
- Final Examination

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 outcomes

- Be able to determine which inventory model to use, obtain the solution (by hand and Excel) and provide an inventory policy.
- Be able to set up a transition matrix, draw a state diagram, classify the states of a Markov Chain, calculate the state vector at future transitions, and when possible calculate the steady state probabilities.
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- Know about decision making under uncertainty and be able to provide an optimal solution for different situations.

Assessment tasks

- Tutorial Participation
- Class Test 1
- Class Test 2
- Assignment 1
- Final Examination

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:

Assessment task

- Tutorial Participation

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 determine which inventory model to use, obtain the solution (by hand and Excel) and provide an inventory policy.
- Be able to set up a transition matrix, draw a state diagram, classify the states of a Markov Chain, calculate the state vector at future transitions, and when possible calculate the steady state probabilities.
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- Know about decision making under uncertainty and be able to provide an optimal solution for different situations.

Assessment tasks

- Tutorial Participation
- Class Test 1
- Class Test 2
- Assignment 1
- Assignment 2
- Quiz 1
- Quiz 2

- Quiz 3
- Quiz 4
- Quiz 5
- Final Examination

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 determine which inventory model to use, obtain the solution (by hand and Excel) and provide an inventory policy.
- Be able to set up a transition matrix, draw a state diagram, classify the states of a Markov Chain, calculate the state vector at future transitions, and when possible calculate the steady state probabilities.
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Assessment tasks

- Tutorial Participation
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- Class Test 2
- Assignment 1
- Assignment 2
- Quiz 1
- Quiz 2
- Quiz 3

- Quiz 4
- Quiz 5
- Final Examination

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 determine which inventory model to use, obtain the solution (by hand and Excel) and provide an inventory policy.
- Be able to set up a transition matrix, draw a state diagram, classify the states of a Markov Chain, calculate the state vector at future transitions, and when possible calculate the steady state probabilities.
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Assessment tasks

- Tutorial Participation
- Class Test 1
- Class Test 2
- Assignment 1
- Assignment 2
- Quiz 1
- Quiz 2
- Quiz 3
- Quiz 4

- Quiz 5
- Final Examination

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 outcomes

- Be able to determine which inventory model to use, obtain the solution (by hand and Excel) and provide an inventory policy.
- Be able to set up a transition matrix, draw a state diagram, classify the states of a Markov Chain, calculate the state vector at future transitions, and when possible calculate the steady state probabilities.
- Be able to identify a zero sum or constant sum game, set up a payoff matrix, if a saddle point exists find the optimal strategy and if a saddle point does not exist to determine the mixed strategies either by formulating the game as a linear program or solving graphically.
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Assessment tasks

- Tutorial Participation
- Class Test 1
- Class Test 2
- Assignment 1
- Assignment 2
- Quiz 1
- Quiz 2
- Quiz 3
- Quiz 4
- Quiz 5

- Final Examination

Changes from Previous Offering

The number of assignments has been reduced to two from three and the number of class tests increased from one to two. The final examination is now worth 30% instead of 50% and is now only two hours long (plus 10 minutes reading time).

Changes since First Published

Date	Description
25/01/2018	Asked to add the following two paragraphs: In the case of a late submission for an assignment, if no special consideration has been granted, 10% of the earned mark will be deducted for each day that an assignment is late, up to a maximum of 50%. After 5 days, counted including weekends and public holidays, a mark of 0% will be awarded. NOTE: It is not the intention of this late penalty policy to cause a student to fail the unit when they have submitted their assignment no more than 5 days after the due date and they would have otherwise passed. In this case, if deductions for late assignments result in the final unit mark for a student being less than 50, when otherwise it would have been 50 or greater, the student's final mark will be exactly 50. If you receive special consideration for the final exam, a supplementary exam will be scheduled in the interval between the regular exam period and the start of the next session. By making a special consideration application for the final exam you are declaring yourself available for a resit during the supplementary examination period and will not be eligible for a second special consideration approval based on pre-existing commitments. Please ensure you are familiar with the policy prior to submitting an application. You can check the supplementary exam information page on FSE101 in iLearn (bit.ly/FSESupp) for dates, and approved applicants will receive an individual notification one week prior to the exam with the exact date and time of their supplementary examination.