STAT379

Operations Research II

S1 Day 2017

Dept of Statistics

Contents

General Information

Unit convenor and teaching staff
Unit Convenor and Lecturer
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E7A Level 6 Room to be advised
TBA

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 steps, 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 be able 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 strategy for different situations.

Assessment Tasks

Name	Weighting	Hurdle	Due
Tutorial Participation	5%	No	Weekly
Class Test	20%	No	Week 7 tutorials
Assignment 1	5%	No	24 March 2017
Assignment 2	5%	No	12 May 2017
Assignment 3	5%	No	2 June 2016
Quiz 1	2%	No	Week 3 Lecture
Quiz 2	2%	No	Week 5 Lecture
Quiz 3	2%	No	Week 6 Lecture
Quiz 4	2%	No	Week 9 Lecture
Quiz 5	2%	No	Week 12 Lecture
Final Examination	50%	No	Exam Period

Tutorial Participation

Due: **Weekly**
Weighting: **5%**

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 steps, 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 be able 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 strategy for different situations.

Class Test

Due: **Week 7 tutorials**
Weighting: **20%**

This will be held during the week 7 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 Disruption to Studies request online within 5 working days of the test) will result in zero marks being awarded for the test. There will be NO supplementary class tests.

The procedure for submitting a Disruption to Studies online can be obtained by visiting ask.mq.edu.au.

The Class Test covers lecture material from Weeks 1 - 6 inclusive and 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 steps, 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 be able to

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

Assignment 1

Due: **24 March 2017**
Weighting: **5%**

Assignments must be submitted in **pdf format online via iLearn** by 2 pm on the due date. This can be done in Word or using freeware such as Cute PDF Writer. There is no "group work" assessment in this unit. All work is to be the student's own. Students who have not submitted the assignment prior to the deadline will be awarded a mark of 0 for the assignment, 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 determine which inventory model to use, obtain the solution (by hand and Excel) and provide an inventory policy.

Assignment 2

Due: **12 May 2017**
Weighting: **5%**

Assignments must be submitted in **pdf format online via iLearn** by 2 pm on the due date. This can be done in Word or using freeware such as Cute PDF Writer. There is no "group work" assessment in this unit. All work is to be the student's own. Students who have not submitted the assignment prior to the deadline will be awarded a mark of 0 for the assignment, 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 set up a transition matrix, draw a state diagram, classify the states of a Markov Chain, calculate the state vector at future steps, 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 be able 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.

Assignment 3

Due: **2 June 2016**

Weighting: **5%**

Assignments must be submitted in **pdf format online via iLearn** by 2 pm on the due date. This can be done in Word or using freeware such as Cute PDF Writer. There is no "group work" assessment in this unit. All work is to be the student's own. Students who have not submitted the assignment prior to the deadline will be awarded a mark of 0 for the assignment, except for cases in which an application for Disruption to Studies is made and approved.

On successful completion you will be able to:

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

Quiz 1

Due: **Week 3 Lecture**
Weighting: **2%**

Ten minutes during the lecture. Permitted materials for the quizzes are calculator, lecture notes, homework solutions and tutorial solutions. No textbooks are permitted. 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 Disruption to Studies request online within 5 working days of the quiz) will result in zero marks 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 quizzes are calculator, lecture notes, homework solutions and tutorial solutions. No textbooks are permitted. 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 Disruption to Studies request online within 5 working days of the quiz) will result in zero marks 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 steps, and when possible calculate the steady state probabilities.

Quiz 3

Due: **Week 6 Lecture**
Weighting: **2%**

Ten minutes during the lecture. Permitted materials for the quizzes are calculator, lecture notes, homework solutions and tutorial solutions. No textbooks are permitted. 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 Disruption to Studies request online within 5 working days of the quiz) will result in zero marks 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 be able to determine the mixed strategies either by formulating the game as a linear program or solving graphically.

Quiz 4

Due: **Week 9 Lecture**
Weighting: **2%**

Ten minutes during the lecture. Permitted materials for the quizzes are calculator, lecture notes, homework solutions and tutorial solutions. No textbooks are permitted. 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 Disruption to Studies request online within 5 working days of the quiz) will result in zero marks 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 quizzes are calculator, lecture notes, homework solutions and tutorial solutions. No textbooks are permitted. 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 Disruption to Studies request online within 5 working days of the quiz) will result in zero marks 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 strategy for different situations.

Final Examination

Due: **Exam Period**
Weighting: **50%**

The final examination will be held during the end-of-year Examination period. The final Examination is 3 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 not be of the text/programmable type.

The only exemptions to sitting the Examination at the designated time are because of documented illness or unavoidable disruption. In these circumstances you may wish to consider applying for Disruption to Studies. Information about unavoidable disruption and the special consideration process is available at http://students.mq.edu.au/student_admin/exams/disruption_to_studies/

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. If 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 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 steps, 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 be able 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 strategy for different situations.

Delivery and Resources

There are 3 hours of lectures and 1 tutorial each week in this unit. Lectures and tutorials commence in Week 1. 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 in iLearn. Cute PDF Writer (freewarre) can create pdf files from any printable document. Alternatively you can save the Word document as a PDF.

Unit Schedule

Week	Topic
1 (27 February)	Inventory Models
2 (6 March)	Inventory Models
3 (13 March)	Inventory Models Markov Processes
4 (20 March)	Markov Processes
5 (27 March)	Game Theory
6 (3 April)	Game Theory
7 (10 April)	Integer Programming
8 (1 May)	Integer Programming
9 (8 May)	Integer Programming
10 (15 May)	Decision Making
11 (22 May)	Decision Making
12 (29 May)	Decision Making
13 (5 June)	Revision

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 determine which inventory model to use, obtain the solution (by hand and Excel) and provide an inventory policy.
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- Know about decision making under uncertainty and be able to provide an optimal strategy for different situations.

Assessment tasks

- Tutorial Participation
- Class Test
- Assignment 1

- Assignment 2
- Assignment 3
- Quiz 1
- Quiz 2
- Quiz 3
- Quiz 4
- Quiz 5
- 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.
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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 steps, and when possible calculate the steady state probabilities.
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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 steps, and when possible calculate the steady state probabilities.
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- Quiz 4
- Quiz 5
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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 steps, and when possible calculate the steady state probabilities.
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- Assignment 3

- 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 steps, and when possible calculate the steady state probabilities.
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Changes since First Published

Date	Description
08/02/2017	Last outcome has certainty changed to uncertainty.