Course Profile

THIS IS THE DRAFT COURSE PROFILE FOR SEMESTER 2, 2005. THE FINAL PROFILE WILL BE HANDED OUT IN THE FIRST LECTURE.

Welcome to the course profile for MATH3202 in Semester 2, 2005.

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Course Overview

Operations research is essentially the study of optimal resource allocation. Mathematically, this can be described as the study of optimisation. Mathematical programs are the class of problems with an objective that is a function of a set of decision variables, and is to be optimised subject to constraints on those decision variables. Depending upon the particular options and constraints of the problem we may employ a particular programming or optimisation technique, for example linear-, quadratic-, nonlinear- and dynamic programming, or stochastic algorithms.

The techniques developed in this course form the basis of real world systems such as Transinfo and have been used for the optimal management of an array of processes, including populations and fires.

Course Unit Value

MATH3202 is a 2-unit course.

Resource Page

Learning Objectives

The aim of MATH3202 is to give students the necessary theoretical tools and practical experience to approach real problems in operations research and optimisation. At the end of the course you should be able to

- Select a suitable programming technique or algorithm to match the requirements of real problems in operations research and optimisation
- Implement methods using appropriate software to find solutions to real problems
- Write reports summarising the problem, the method adopted and the solution derived

Contents Overview

The course structure and contents will include

Section One

- Advanced linear and integer programming
- Quadratic and general nonlinear programming

Section Two

- Dynamic programming with applications to inventory models, network problems, games, and resource allocation, using Matlab and Excel
- Stochastic dynamic programming, with applications to mathematical ecology

Section Three

- Stochastic algorithms, including genetic algorithms and simulated annealing, and their use in operations research

Background

There are no formal prerequisites but MATH2200 is desirable, as is experience with Matlab.

Teaching Mode

Most learning will be done in the computer labs, through the practical implementation of theoretical tools to real problems. Each week there are four contact hours, three in the computer labs (67-542 and 67-442) and one in a lecture room (3-323). In the first week of each new section there will be a contact hour in the lecture room in place of the first computer lab, announced at least a week in advance in lectures and on the resource page.

References

Necessary course notes will be handed out in the lectures and made available on the resource page. There is other good reading in the library, including

as well as numerous books on Matlab.
Assessment

Each section of the course will be assessed by a project and an in-class test. In addition there will be a Scientific Paper Review assignment.

Projects (45%)

Each project involves analysing a problem and writing a report. Details will be handed out in the lectures and made available on the resource page. You will work in different pairs for each project. Each project counts for 15% of the final grade.

In the weekly computer session you will learn how to use various software tools for operations research, usually by working on an applied problem. There will be some time available for help with your projects, but you are expected to do most of the project work outside of class time.

Late project reports will not be accepted unless arrangements have been made with the course coordinator. This will typically require evidence of an illness or bereavement.

Class Tests (45%)

Each test will involve solving a small problem using the techniques learnt in the computer sessions. These will take place at the end of each section, with notice given at least two weeks in advance and will be advertised on the resource page. Each class test counts for 15% of the final grade.

Scientific Paper Review (10%)

This assignment involves finding a scientific paper through the library that uses a programming or optimisation technique discussed in the course. You will then critically review and discuss the article’s use of this method in relation to the aims of their study. You will also be required to compare and contrast the method used with another technique covered in the course in relation to the aims of their study. This assignment will be due in the final week of lectures. Further details will be handed out in lectures and made available on the resource page. This assignment counts for 10% of the final grade.

Late assignment reports will not be accepted unless arrangements have been made with the course coordinator. This will typically require evidence of an illness or bereavement.

Assessment Criteria

To earn a Grade of 7, you must achieve a final mark between 85-100% by demonstrating an excellent understanding of the course material. You will be able to model and analyse a broad range of practical settings, providing insight and thoroughness in the form of assumptions and parameters and other factors that might effect the modelling. You will show a high-level of confidence in describing and applying mathematical theory and methods, and excellent proficiency in communicating your methods and results in writing.

To earn a Grade of 6, you must achieve a final mark between 75-84% by demonstrating a comprehensive understanding of the course material. You will be able to model and analyse most practical settings, identifying important assumptions and parameters and other factors that might effect the modelling. You will show confidence in describing and applying mathematical theory and methods, and proficiency in communicating your methods and results in writing.

To earn a Grade of 5, you must achieve a final mark between 65-74% by demonstrating an adequate understanding of the course material. You will be able to model and analyse many practical settings, identifying the key assumptions and parameters that might effect the
modelling. You will be able to describe and apply most mathematical theories and methods in
the course, and be able to communicate your methods and results in writing.

To earn a Grade of 4, you must achieve a final mark between 50-64% by demonstrating
an understanding of the basic concepts in the course. You will be able to model and analyse
important practical settings, identifying some key assumptions and parameters that might ef-
fect the modelling. You will be able to describe and apply many mathematical theories and
methods in the course, and be able to communicate your methods and results in writing.

To earn a Grade of 3, you must achieve a final mark between 45-49% by demonstrating
some knowledge of the basic concepts in the course. You will be able to model and analyse
important practical settings. You will be able to describe and apply some mathematical theories
and methods in the course, and be able to communicate your methods and results in writing.

To earn a Grade of 2, you must achieve a final mark between 20-44% by demonstrating
some knowledge of the basic concepts in the course. You will be able to partially model and
analyse a few important practical settings. Written reports may be poor and the understanding
of the mathematical theories and applications may be weak.

To earn a Grade of 1, you must achieve a final mark between 0-19%. You will be able to
partially model and analyse very few important practical settings. Written reports will be poor
and the understanding of the mathematical theories and applications may be missing.

Assessment Policy

Students should be familiar with the rules which relate to assessment in their degrees as well
as general university policy such as found in the General Award Rules. These are all set out on
the Program and Course Information page on the UQ website

http://www.uq.edu.au/student/courses

Graduate Attributes

The University has a statement of Graduate Attributes which describes core attributes to be
developed in an undergraduate program.


The following graduate attributes, taken from the University statement, will be emphasized
in this course. Brief comments on how these will be developed are given.

In-Depth Knowledge of the Field of Study

Through theory given in the lectures and hands-on learning in the computer lab you will develop

• A comprehensive and well-founded knowledge of the field of study.

Effective Communication

Communication skills will be developed through informal interactions in tutorials and in
group project work. Written communication will be emphasised in writing project reports,
which will also require the use of information resources. Through these activities you should develop

• The ability to collect, analyse, and organise information and ideas, and to convey those ideas clearly and fluently, in both written and spoken forms.
• The ability to interact effectively with others in order to work towards a common outcome.

• The ability to select and use the appropriate level, style and means of communication.

• The ability to engage effectively and appropriately with information and communication technologies.

**Independence and Creativity**
Project work is designed to encourage independence and creativity and develop

• The ability to identify problems, create solutions, innovate and improve current practices.

**Critical Judgement**
Activities in the computer lab and project work will develop

• The ability to define and analyse problems

• The ability to apply critical reasoning to issues through independent thought and informed judgement

• The ability to evaluate opinions, make decisions and to reflect critically on the justifications for decisions.

**Plagiarism**
Below is the University’s definition of plagiarism:

Plagiarism is the action or practice of taking and using as one’s own the thoughts or writings of another (without acknowledgement). The following practices constitute acts of plagiarism and are a major infringement of the University’s academic values:

• where paragraphs, sentences, a single sentence or significant part of a sentence which are copied directly, are not enclosed in quotation marks and appropriately footnoted;

• where direct quotations are not used, but are paraphrased or summarised, and the source of the material is not acknowledged either by footnoting or other simple reference within the text of the paper;

• where an idea which appears elsewhere in print, film or electronic medium is used or developed without reference being made to the author or the source of that idea.

When a student knowingly plagiarises someone’s work, there is intent to gain an advantage and this may constitute misconduct.

Students are encouraged to study together and to discuss ideas, but this should not result in students handing in the same or similar project work (unless the students are working as a pair). Do not allow another student to copy your work. While students may discuss approaches to tackling an assignment problem, care must be taken to submit individual and different reports. Submitting the same or largely similar reports for a project may constitute misconduct.

For more information on the University policy on plagiarism, please refer to http://www.uq.edu.au/hupp/contents/view.asp?s1=3&s2=40&s3=12
Supplementary examinations

In some programs, a supplementary examination may be awarded in one course to students who obtain a grade of 2 or 3 in the final semester of their program and require this course to finish their degree. You should check the rules for your degree program for information on the possible award of supplementary examinations. Applications for supplementary examinations must be made to the Director of Studies in the Faculty.

Special examinations

If a student is unable to sit a scheduled examination for medical or other adverse reasons, she/he can and should apply for a special examination. Applications made on medical grounds should be accompanied by a medical certificate; those on other grounds must be supported by a personal declaration stating the facts on which the application relies.

Applications for special examinations for central and end-of-semester exams must be made through the Student Centre. Applications for special examinations in school exams are made to the course coordinator.

More information on the University’s assessment policy may be found at http://www.uq.edu.au/hupp/contents/view.asp?s1=3&s2=30&s3=5

Feedback on assessment

You may request feedback on assessment in this course progressively throughout the semester from the course coordinator. Feedback on assessment may include discussion, written comments on work, model answers, lists of common mistakes and the like.

Students may peruse examinations scripts and obtain feedback on performance in a final examination provided that the request is made within six months of the release of final course results. After a period of six months following the release of results, examination scripts may be destroyed.

Information on the University’s policy on access to feedback on assessment may be found at http://www.uq.edu.au/hupp/contents/view.asp?s1=3&s2=30&s3=6

Students with Disabilities

Any student with a disability who may require alternative academic arrangements in the course is encouraged to seek advice at the commencement of the semester from a Disability Adviser at Student Support Services.

Assistance for Students

Students with English language difficulties should contact the course coordinator or tutors for the course.

Students with English language difficulties who require development of their English skills should contact the Institute for Continuing and TESOL Education on extension 56565.

The Learning Assistance Unit located in the Relaxation Block in Student Support Services. You may consult learning advisers in the unit to provide assistance with study skills, writing assignments and the like. Individual sessions are available. Student Support Services
also offers workshops to assist students. For more information, phone 51704 or on the web at http://www.sss.uq.edu.au/index.html.

**Student Liaison Officer**

The School of Physical Sciences has a Student Liaison Officer as an independent source of advice to assist students with resolving academic difficulties.

The Student Liaison officer during 2005 will be Dr Peter Adams, Room 547 Priestley building (email pa@maths.uq.edu.au).

**Library Contact**

The liaison librarian for the physical sciences disciplines is located in the Physical Sciences and Engineering Library in the Hawken Building and may be consulted for assistance in the course:

Leith Woodall
Email: l.woodall@library.uq.edu.au
Extension: 52367