Unit Outline

MATH2011 Operations Research
Semester 1, 2016

Unit study package code: MATH2011
Mode of study: Internal
Tuition pattern summary: Note: For any specific variations to this tuition pattern and for precise information refer to the Learning Activities section.
Lecture: 1 x 2 Hours Weekly
Tutorial: 1 x 1 Hours Weekly
Workshop: 1 x 1 Hours Weekly
This unit does not have a fieldwork component.

Credit Value: 25.0
Pre-requisite units:
7063 (v.0) Mathematics 102 or any previous version
OR
7492 (v.0) Mathematics 104 or any previous version
OR
307538 (v.0) Engineering Mathematics 140 or any previous version
OR
307537 (v.0) Engineering Mathematics 130 or any previous version
OR
MATH1011 (v.0) Mathematics 2 or any previous version
OR
MATH1003 (v.0) Engineering Mathematics 2 or any previous version
OR
MATH1001 (v.0) Engineering Mathematics Specialist 2 or any previous version

Co-requisite units: Nil
Anti-requisite units: Nil
Result type: Grade/Mark
Approved incidental fees: Information about approved incidental fees can be obtained from our website. Visit fees.curtin.edu.au/incidental_fees.cfm for details.

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Consultation times: Tuesday, Thursday and Friday (9am to 5pm if not teaching), available via email everyday.

Teaching Staff:
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Administrative contact:
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Faculty of Science and Engineering
Department of Mathematics and Statistics

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Learning Management System: Blackboard (lms.curtin.edu.au)
Acknowledgement of Country

We respectfully acknowledge the Indigenous Elders, custodians, their descendants and kin of this land past and present.

Syllabus

This unit will consider problems arising in business and industry. The students will learn the necessary skills to model and solve such problems through mathematical modelling and operations research techniques. The topics covered include: Linear programming (LP): Linear Programming models, Two-variable LP problems, Basic theory of linear systems, The Simplex algorithm, Duality, Sensitivity Analysis. Transportation Problem: basic concepts, applications, algorithm. Project Planning: Basic concept, formulation and application of LP to analyse project scheduling). Quadratic Programming: Basic concepts, application, algorithm. Game Theory: basic concepts, application, modelling through LP.

Introduction

In this unit, the Operations Research (OR) discipline is introduced as a tool to deal with decision makings. Art of modelling for the purpose of mathematical formulation is discussed, then solution methods to finally appropriate decision making are taught. The main focus of the unit is on Linear Programming (LP) as a foundation for optimisation problems. Industrial applications of LP are considered. Some other problems like Quadratic Programming and its application in portfolio optimisation as well as Game Theory are part of the unit syllabus.

Unit Learning Outcomes

All graduates of Curtin University achieve a set of nine graduate attributes during their course of study. These tell an employer that, through your studies, you have acquired discipline knowledge and a range of other skills and attributes which employers say would be useful in a professional setting. Each unit in your course addresses the graduate attributes through a clearly identified set of learning outcomes. They form a vital part in the process referred to as assurance of learning. The learning outcomes tell you what you are expected to know, understand or be able to do in order to be successful in this unit. Each assessment for this unit is carefully designed to test your achievement of one or more of the unit learning outcomes. On successfully completing all of the assessments you will have achieved all of these learning outcomes.

Your course has been designed so that on graduating we can say you will have achieved all of Curtin’s Graduate Attributes through the assurance of learning process in each unit.

<table>
<thead>
<tr>
<th>On successful completion of this unit students can:</th>
<th>Graduate Attributes addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Demonstrate understanding of the nature and purpose of Operations Research for analysis of complex systems and operations</td>
<td>![Symbol] ![Symbol] ![Symbol]</td>
</tr>
<tr>
<td>2 Develop skills in the formulation and solution of Linear Optimization problems arising in engineering, management and business</td>
<td>![Symbol] ![Symbol] ![Symbol]</td>
</tr>
<tr>
<td>3 Comprehend the fundamental concepts of theory of Linear Programming (LP) and the ability to apply it</td>
<td>![Symbol] ![Symbol] ![Symbol]</td>
</tr>
<tr>
<td>4 Self-directed learning skills in using LINDO for the solution and analysis of LP problems</td>
<td>![Symbol] ![Symbol] ![Symbol]</td>
</tr>
<tr>
<td>5 Comprehend the basic formulations of Quadratic Programming (QP) and the ability to apply it</td>
<td>![Symbol] ![Symbol] ![Symbol]</td>
</tr>
</tbody>
</table>
Learning Activities

- Lectures
- Tutorials, normally begin in the second week of semester
- Computer Laboratory working with optimisation software, students work on their own time (outside the official lecture hours)

Learning Resources

Other resources

You do not have to purchase the following textbooks but you may like to refer to them.

Assessment

Assessment schedule

<table>
<thead>
<tr>
<th>Task</th>
<th>Value %</th>
<th>Date Due</th>
<th>Unit Learning Outcome(s) Assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignment</td>
<td>20%</td>
<td>Week: 8, Day: TBA, Time: TBA</td>
<td>1,2,3</td>
</tr>
<tr>
<td>Test</td>
<td>30%</td>
<td>Week: 11, Day: TBA, Time: TBA</td>
<td>2,3,4</td>
</tr>
<tr>
<td>Final Exam</td>
<td>50%</td>
<td>Week: Exam Weeks, Day: TBA, Time: TBA</td>
<td>3,4,5</td>
</tr>
</tbody>
</table>

Detailed information on assessment tasks

1. Details will appear on BB.
2. Details will appear on BB.
3. Exam will be centrally scheduled.

Pass requirements

To pass this unit students must:
1 - achieve a grade/mark greater than or equal to 50/100
2 - Obtain a minimum of 50% in the final examination

Fair assessment through moderation

Moderation describes a quality assurance process to ensure that assessments are appropriate to the learning outcomes, and that student work is evaluated consistently by assessors. Minimum standards for the moderation of assessment are described in the Assessment and Student Progression Manual, available from policies.curtin.edu.au/policies/teachingandlearning.cfm

Late assessment policy

This ensures that the requirements for submission of assignments and other work to be assessed are fair, transparent, equitable, and that penalties are consistently applied.

1. All assessments students are required to submit will have a due date and time specified on this Unit Outline.
2. Students will be penalised by a deduction of ten percent per calendar day for a late assessment submission (eg a mark equivalent to 10% of the total allocated for the assessment will be deducted from the marked value for every day that the assessment is late). This means that an assessment worth 20 marks will have two marks deducted per calendar day late. Hence if it was handed in three calendar days late and given a mark of 16/20, the student would receive 10/20. An assessment more than seven calendar days overdue will not be marked and will receive a mark of 0.

Assessment extension

A student unable to complete an assessment task by/on the original published date/time (eg examinations, tests) or due date/time (eg assignments) must apply for an assessment extension using the Assessment Extension form (available from the Forms page at students.curtin.edu.au/administration/) as prescribed by the Academic Registrar. It is the responsibility of the student to demonstrate and provide evidence for exceptional circumstances beyond the student’s control that prevent them from completing/submitting the assessment task.

The student will be expected to lodge the form and supporting documentation with the unit coordinator before the
assessment date/time or due date/time. An application may be accepted up to five working days after the date or due date of the assessment task where the student is able to provide an acceptable explanation as to why he or she was not able to submit the application prior to the assessment date. An application for an assessment extension will not be accepted after the date of the Board of Examiners’ meeting.

Deferred assessments
If your results show that you have been granted a deferred assessment you should immediately check your OASIS email for details.

Supplementary assessments
Supplementary assessments are not available in this unit.

Referencing style
The referencing style for this unit is Chicago.
More information can be found on this style from the Library web site: http://libguides.library.curtin.edu.au/referencing.

Copyright
© Curtin University. The course material for this unit is provided to you for your own research and study only. It is subject to copyright. It is a copyright infringement to make this material available on third party websites.

Academic Integrity (including plagiarism and cheating)
Any conduct by a student that is dishonest or unfair in connection with any academic work is considered to be academic misconduct. Plagiarism and cheating are serious offences that will be investigated and may result in penalties such as reduced or zero grades, annulled units or even termination from the course.
Plagiarism occurs when work or property of another person is presented as one's own, without appropriate acknowledgement or referencing. Submitting work which has been produced by someone else (e.g. allowing or contracting another person to do the work for which you claim authorship) is also plagiarism. Submitted work is subjected to a plagiarism detection process, which may include the use of text matching systems or interviews with students to determine authorship.
Cheating includes (but is not limited to) asking or paying someone to complete an assessment task for you or any use of unauthorised materials or assistance during an examination or test.
From Semester 1, 2016, all incoming coursework students are required to complete Curtin’s Academic Integrity Program (AIP). If a student does not pass the program by the end of their first study period of enrolment at Curtin, their marks will be withheld until they pass. More information about the AIP can be found at: https://academicintegrity.curtin.edu.au/students/AIP.cfm
Refer to the Academic Integrity tab in Blackboard or academicintegrity.curtin.edu.au for more information, including student guidelines for avoiding plagiarism.

Information and Communications Technology (ICT) Expectations
Curtin students are expected to have reliable internet access in order to connect to OASIS email and learning systems such as Blackboard and Library Services.
You may also require a computer or mobile device for preparing and submitting your work.
For general ICT assistance, in the first instance please contact OASIS Student Support: oasisapps.curtin.edu.au/help/general/support.cfm
For specific assistance with any of the items listed below, please contact The Learning Centre: life.curtin.edu.au/learning-support/learning_centre.htm

- Using Blackboard, the I Drive and Back-Up files
Introduction to PowerPoint, Word and Excel

Additional information

Enrolment

It is your responsibility to ensure that your enrolment is correct - you can check your enrolment through the eStudent option on OASIS, where you can also print an Enrolment Advice.

Student Rights and Responsibilities

It is the responsibility of every student to be aware of all relevant legislation, policies and procedures relating to their rights and responsibilities as a student. These include:

- the Student Charter
- the University's Guiding Ethical Principles
- the University’s policy and statements on plagiarism and academic integrity
- copyright principles and responsibilities
- the University’s policies on appropriate use of software and computer facilities

Information on all these things is available through the University's "Student Rights and Responsibilities" website at: students.curtin.edu.au/rights.

Student Equity

There are a number of factors that might disadvantage some students from participating in their studies or assessments to the best of their ability, under standard conditions. These factors may include a disability or medical condition (e.g. mental illness, chronic illness, physical or sensory disability, learning disability), significant family responsibilities, pregnancy, religious practices, living in a remote location or another reason. If you believe you may be unfairly disadvantaged on these or other grounds please contact Student Equity at eesj@curtin.edu.au or go to http://eesj.curtin.edu.au/student_equity/index.cfm for more information.

You can also contact Counselling and Disability services: http://www.disability.curtin.edu.au or the Multi-faith services: http://life.curtin.edu.au/health-and-wellbeing/about_multifaith_services.htm for further information.

It is important to note that the staff of the university may not be able to meet your needs if they are not informed of your individual circumstances so please get in touch with the appropriate service if you require assistance. For general wellbeing concerns or advice please contact Curtin's Student Wellbeing Advisory Service at: http://life.curtin.edu.au/health-and-wellbeing/student_wellbeing_service.htm

Recent unit changes

Students are encouraged to provide unit feedback through eVALUate, Curtin’s online student feedback system. For more information about eVALUate, please refer to evaluate.curtin.edu.au/info/.

To view previous student feedback about this unit, search for the Unit Summary Report at https://evaluate.curtin.edu.au/student/unit_search.cfm. See https://evaluate.curtin.edu.au/info/dates.cfm to find out when you can eVALUate this unit.

Recent changes to this unit include:

There has not been very recent changes to the unit.
## Program calendar

<table>
<thead>
<tr>
<th>Week</th>
<th>Begin Date</th>
<th>Lecture/ Tutorial</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>29 February</td>
<td>The nature of operations research (OR). An overview of the OR modelling approach. The contents of an OR course. Linear programming (LP) models and optimization problems.</td>
</tr>
<tr>
<td>2.</td>
<td>7 March</td>
<td>Two variable LP problems: geometry of LP problems – polyhedral sets, feasible region, objective function level curves, unique and infinitely many optimal solutions, inconsistent LP problems.</td>
</tr>
<tr>
<td>3.</td>
<td>14 March</td>
<td>Basic theory of linear systems: standard equality, standard inequality and general forms and their equivalence, the Gauss and Gauss-Jordan elimination methods, basic and non-basic variables, feasible solutions and basic feasible solutions.</td>
</tr>
<tr>
<td>4.</td>
<td>21 March</td>
<td>Basic theory of linear systems (continued): moving from one basic feasible solution to another basic feasible solution. The minimum ratio test. The simplex algorithm of LP: basic ideas and elements. The LINDO computer package.</td>
</tr>
<tr>
<td>5.</td>
<td>28 March</td>
<td>Tuition Free Week</td>
</tr>
<tr>
<td>6.</td>
<td>4 April</td>
<td>The simplex algorithm of LP (continued): The two-phase method (phase I and phase II). The simplex algorithm in matrix form.</td>
</tr>
<tr>
<td>7.</td>
<td>11 April</td>
<td>Duality: the primal-dual LPs, economic interpretation of the primal and dual problems, weak duality property, duality theorem (strong duality property), identifying the optimal dual solution from the optimal primal tableau. Duality by LINDO.</td>
</tr>
<tr>
<td>8.</td>
<td>18 April</td>
<td>Tuition Free Week</td>
</tr>
<tr>
<td>9.</td>
<td>25 April</td>
<td>Sensitivity analysis: sensitivity analysis by LINDO and duality.</td>
</tr>
<tr>
<td>10.</td>
<td>2 May</td>
<td>The transportation problem: formulation; the transportation tableau; balancing a transportation problem; initial basic feasible solution (the “North-West” corner rule), the transportation simplex algorithm (the u-v method). Test 1.</td>
</tr>
<tr>
<td>11.</td>
<td>9 May</td>
<td>Introduction to network analysis.</td>
</tr>
<tr>
<td>12.</td>
<td>16 May</td>
<td>Sensitivity analysis (continued): computation.</td>
</tr>
<tr>
<td>13.</td>
<td>23 May</td>
<td>Quadratic programming: introduction, solution using Simplex method and application to portfolio selection.</td>
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<tr>
<td>14.</td>
<td>30 May</td>
<td>Introduction to games theory and revision.</td>
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<tr>
<td>15.</td>
<td>6 June</td>
<td>Study Week</td>
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<tr>
<td>16.</td>
<td><strong>13 June</strong></td>
<td>Examinations</td>
</tr>
<tr>
<td>17.</td>
<td><strong>20 June</strong></td>
<td>Examinations</td>
</tr>
</tbody>
</table>