Unit Outline
INDE3000 Industrial Modelling and Optimisation
Semester 1, 2016

Unit study package code: INDE3000
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 3 Hours Weekly
Tutorial: 1 x 1 Hours Weekly
This unit does not have a fieldwork component.
Credit Value: 25.0
Pre-requisite units: MATH2011 (v.0) Operations Research or any previous version
OR
MATH2010 (v.0) Linear Algebra 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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Location: Building: 311 - Room: 345
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 with a focus on using binary and integer variables. The topics covered include: Industrial Modelling: In this part of the unit, several examples of mathematical models will be presented and analysed. Dual Simplex Algorithms: the Simplex and the Dual Simplex Algorithms used for linear programming problems will be revised and analysed from a different perspective. Their features will be thoroughly investigated. This part is crucial to the development of the second part of this unit, i.e., Integer Linear Programming. Integer Linear Programming: The Simplex Algorithm and the Dual Simplex Algorithm studied in the first part of the unit will be used as the building blocks of more complex algorithms to solve Linear Programming Problems where all or some of the variables are constrained to be integer. Two methods will be presented: the Gomory Cuts and the Branch-and-Bound Algorithms. Branch-and-Bound Algorithms: In this part of the subject, Branch-and-Bound algorithms will be addressed from a more general perspective, to the end of solving other Integer Linear Programming problems, including the Knapsack Problem 0-1

Introduction
The Department of Mathematics and Statistics offers a range of courses and units which will equip students with the necessary mathematical expertise to deal with problems encountered in an increasing technological world. This unit considers two fundamental aspects which arise from science and engineering areas. The first is the mathematical modelling of systems. Thus, the first part of this unit will consider different types of mathematical models used to describe systems. The second part considers problems of optimisation, and in particular integer linear programming problems which arise in industrial mathematics.

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 Integer Programming as a branch of Operations Research for analysis of complex systems</td>
<td>📚💡💡</td>
</tr>
<tr>
<td>2 Develop skills in modelling, formulation and solution of Integer Linear Optimization problems arising in engineering, management and business</td>
<td>📚💡💡</td>
</tr>
<tr>
<td>3 Comprehend the fundamental concepts of theory of Mixed Integer Linear Programming (MILP) and the ability to apply it</td>
<td>📚💡💡</td>
</tr>
<tr>
<td>4 Self-directed learning skills in using AIMMS for the solution and analysis of MILP problems</td>
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</tbody>
</table>
Curtin’s Graduate Attributes

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apply discipline knowledge</td>
<td></td>
</tr>
<tr>
<td>Thinking skills</td>
<td>(use analytical skills to solve problems)</td>
</tr>
<tr>
<td>Information skills</td>
<td>(confidence to investigate new ideas)</td>
</tr>
<tr>
<td>Communication skills</td>
<td></td>
</tr>
<tr>
<td>Technology skills</td>
<td></td>
</tr>
<tr>
<td>Learning how to learn</td>
<td>(apply principles learnt to new situations)</td>
</tr>
<tr>
<td>(confidence to tackle unfamiliar problems)</td>
<td></td>
</tr>
<tr>
<td>International perspective</td>
<td>(value the perspectives of others)</td>
</tr>
<tr>
<td>Cultural understanding</td>
<td>(value the perspectives of others)</td>
</tr>
<tr>
<td>Professional Skills</td>
<td>(work independently and as a team)</td>
</tr>
<tr>
<td>(plan own work)</td>
<td></td>
</tr>
</tbody>
</table>

Find out more about Curtin’s Graduate attributes at the Office of Teaching & Learning website: ctl.curtin.edu.au

Learning Activities

- Lectures
- Tutorials
- Self-directed software learning

Learning Resources

Other resources

It is helpful, but not essential, that students have access to a computer with an Internet connection. Students who do not have a computer at home can also access the computing facilities on campus.

Learning resources will be provided on BB.
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 percent</td>
<td>Week: 8 Day: TBA Time: TBA</td>
<td>2,3,4</td>
</tr>
<tr>
<td>Test</td>
<td>30 percent</td>
<td>Week: 11 Day: TBA Time: TBA</td>
<td>1,2,3</td>
</tr>
<tr>
<td>Final Exam</td>
<td>50 percent</td>
<td>Week: Exam Weeks Day: TBA Time: TBA</td>
<td>1,2,3</td>
</tr>
</tbody>
</table>

Detailed information on assessment tasks

1. Details will appear on BB.
2. Details will appear on BB.
3. The details will be announced on BB.

Pass requirements

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:

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:

N/A
<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>PART ONE - Modelling: Introduction to Integer Programming</td>
</tr>
<tr>
<td>2.</td>
<td>7 March</td>
<td>PART ONE - Modelling: Applications</td>
</tr>
<tr>
<td>3.</td>
<td>14 March</td>
<td>PART ONE - Modelling: Applications</td>
</tr>
<tr>
<td>4.</td>
<td>21 March</td>
<td>PART ONE - Modelling: Better Formulations and Preprocessing</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>PART ONE - Modelling: Better Formulations and Preprocessing</td>
</tr>
<tr>
<td>7.</td>
<td>11 April</td>
<td>PART TWO - Review of Linear Programming and Dual Simplex Algorithm</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>PART TWO - Review of Linear Programming and Dual Simplex Algorithm</td>
</tr>
<tr>
<td>10.</td>
<td>2 May</td>
<td>PART THREE - Solutions</td>
</tr>
<tr>
<td>11.</td>
<td>9 May</td>
<td>PART THREE - Solutions</td>
</tr>
<tr>
<td>12.</td>
<td>16 May</td>
<td>PART THREE - Solutions</td>
</tr>
<tr>
<td>13.</td>
<td>23 May</td>
<td>PART THREE - Solutions</td>
</tr>
<tr>
<td>14.</td>
<td>30 May</td>
<td>PART THREE - Solutions</td>
</tr>
<tr>
<td>15.</td>
<td>6 June</td>
<td>Study Week</td>
</tr>
<tr>
<td>16.</td>
<td>13 June</td>
<td>Examinations</td>
</tr>
<tr>
<td>17.</td>
<td>20 June</td>
<td>Examinations</td>
</tr>
</tbody>
</table>