Carleton University | Department of Economics

Fall 2023

ECON 4004 A Operations Research I

Course Outline

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Brightspace Course Page: https://brightspace.carleton.ca/d2l/home/208441

Welcome to Operations Research I!

Prerequisites

The prerequisite for this course is ECON 1402 (or equivalent) with a grade of C- or higher, as outlined in the 2023-2024 Undergraduate Calendar. Students who believe that they have taken a similar background course or courses from another university must provide appropriate

documentation to the Department of Economics Undergraduate Administrator, Renee Lortie renee.lortie@carleton.ca

Please note that this course precludes additional credit for BUSI 2300 (no longer offered), MATH 3801, and SYSC 3200.

Introduction

Linear programming, duality, sensitivity analysis, transportation, and network problems. Both theory and a wide range of applications are studied.

Learning Outcomes

By the end of this course, students will:

1) have reviewed the basic principles of linear algebra
2) be conversant with and be able to define key linear programming (LP) terminology
3) understand the logic, structure, and graphical solution of LP models
4) have had significant experience in the formulation of basic LP problems
5) understand and be able to implement the simplex algorithm by hand
6) be able to solve LP problems and interpret their solutions using modern LP software
7) understand the concept of duality and the use and interpretation of sensitivity analysis
8) be familiar with common extensions of the basic LP model, such as transportation, assignment, and network models, together with a range of their specialized solution algorithms

Organization

This is an in-person course and is NOT suitable for online students. The class will meet once a week at 2:35 p.m. on Tuesdays for a 2 hour and 50 minute session with a short intermission. Log into Carleton Central to view the location on your timetable.

There will be three (3) required assignments and an in-person final exam.

Please note that Brightspace and the Carleton email system will be used extensively as a means of communication with students. Therefore, students are strongly advised to access Brightspace and to check their Carleton email at regular intervals in order to check for new information. To access Brightspace and the Carleton email system, students require a MyCarletonOne account. For questions about MyCarletonOne accounts, students should access carleton.ca/its/get-started/ (and then click on either New Students or New Grad Students, as appropriate) or contact the ITS Service Desk.

Attendance

If you plan to succeed in this course, then I cannot overstress the critical importance of regular class attendance, together with the allocation of regular and consistent study time outside the classroom. Due to the nature of the course material, many students find that it is very difficult to catch up, should they fall behind.

Academic Integrity and Plagiarism

Please ensure that you are familiar with and comply with the Academic Integrity Policy

And, more specifically, with regard to the written work required for this course, please be sure to avoid any form of plagiarism:

The Academic Integrity Policy defines plagiarism as "*presenting, whether intentionally or not, the ideas, expression of ideas or work of others as one's own."* This includes reproducing or paraphrasing portions of someone else's published or unpublished material, regardless of the source, and presenting these as one's own without proper citation or reference to the original source. Examples of sources from which the ideas, expressions of ideas or works of others may be drawn include but are not limited to: books, articles, papers, literary compositions and phrases, performance compositions, chemical compounds, artworks, laboratory reports, research results, calculations and the results of calculations, diagrams, constructions, computer reports, computer code/software, material on the internet and/or conversations.

Examples of plagiarism include, but are not limited to:

- any submission prepared in whole or in part, by someone else, including the unauthorized use of generative AI tools (e.g., ChatGPT);
- using ideas or direct, verbatim quotations, paraphrased material, algorithms, formulae, scientific or mathematical concepts, or ideas without appropriate acknowledgment in any academic assignment;
- using another's data or research findings without appropriate acknowledgement;
- submitting a computer program developed in whole or in part by someone else, with or without modifications, as one's own; and
- failing to acknowledge sources through the use of proper citations when using another's work and/or failing to use quotation marks.

Plagiarism is a serious offence that cannot be resolved directly by the course's instructor. The Associate Dean of the Faculty conducts a rigorous investigation, including an interview with the student, when an instructor suspects a piece of work has been plagiarized. Penalties are not trivial. They can include a final grade of "F" for the course.

Assignments

Assignments will be posted on Brightspace and will be submitted through Brightspace according to the following schedule:

	Posted	Due
Assignment 1	October 3	October 17
Assignment 2	November 7	November 21
Assignment 3	November 21	December 5

Final Exam

The final exam will be in-person and comprehensive, and will be scheduled by Examination Services during the regular final examination period (December 10-22). Note that students should not make travel plans during this final examination period as this would not be a valid reason for missing a final exam.

Evaluation

The final % grade for this course will be calculated as follows:

Assignments	40%	(3 assignments, equally weighted)
Final Examination	60%	

This % grade will then be converted into the alphabetical grade system using the standard equivalences, as outlined in Section 5.4 of the Academic Regulations of the University in the 2023-2024 Undergraduate Calendar.

In the event that one or more components of the term work are not completed, the weight of the incomplete component(s) will not be transferred to the final examination without a documented and compelling reason. In place of a doctor's note or medical certificate, students are advised to complete the self-declaration form, which is available on the Registrar's Office website https://carleton.ca/registrar/wp-content/uploads/self-declaration.pdf

Students who do not write the final examination because of illness or other circumstances beyond their control may apply to write a deferred final examination. In order to write a deferred final examination, students must contact the Registrar's Office. (For further details, see Section 4.3 of the Academic Regulations of the University in the 2023-2024 Undergraduate Calendar.) In the event that a student writes a deferred examination, the deferred examination will carry the same weight as the final examination in determining the course grade. Needless to say, any deferred examination will not be identical to the original final examination.

Finally, please note that: "Standing in a course is determined by the course instructor subject to the approval of the Faculty Dean. This means that grades submitted by an instructor may be subject to revision. No grades are final until they have been approved by the Dean."

Required Textbook

Winston, Wayne L. (2004), Operations Research: Applications and Algorithms (4th Edition), Nelson/Brooks/Cole Duxbury Press. ISBN-10: 0534380581, ISBN-13: 9780534380588 (hardcover)

Please note that one fairly inexpensive option for obtaining access to an electronic version of the textbook is to purchase it directly from the publisher at:
https://www.cengage.ca/c/isbn/9780357337769/

The textbook may also be obtained through the Carleton University bookstore
https://www.bkstr.com/carletonstore/shop/textbooks-and-course-materials

Computer Package

The use of the LINDO linear programming package will be an integral part of this course.

A free copy of LINDO 6.1 Educational may be downloaded by students who have acquired a copy of the Winston textbook. See

https://www.lindo.com/index.php/help/textbook-materials/wayne-winston

Information as to how to use LINDO will be provided in class.

NOTE: The hardcopy of the Winston textbook comes with a CD-ROM that includes a copy of this same LINDO package, as well as various other software packages referred to in the textbook. For this course, you will ONLY need the LINDO package. Moreover, if you have the CD-ROM, then you should be careful NOT just to install all of the programs on the CD-ROM. (There is one program on the CD-ROM that may be required for ECON 4005. This program only has a 120-day evaluation period and you do not want to start this 120-day period prematurely.)

Course Content

1. Basic Linear Algebra, Winston Ch. 2
2. Introduction to Linear Programming. Winston Ch. 3
3. Simplex Algorithm, Winston Ch. 4
4. Sensitivity Analysis and Duality, Winston Chs. 5 and 6
5. Transportation, Assignment, and Transshipment Problems, Winston Ch. 7
6. Network Models (Shortest Path, Critical Path Methods), Winston Ch. 8

Mental Health Resources and Academic Accommodations

Please note that you are responsible for reading and being aware of the information relating to Carleton University and other resources for mental health and academic support, as well as academic accommodations, found HERE

IF YOU HAVE PROBLEMS WITH THIS COURSE, PLEASE LET ME KNOW!

IF I DON'T KNOW THAT YOU HAVE PROBLEMS, I CAN'T FIX THEM!