Instructor's Guide

Module Title

Introduction to the Simplex Algorithm

Time management

The expected time to deliver this module is 50 minutes. 7 minutes are set aside for preparation, instructions etc., 15 minutes are reserved for team exercises (5 minutes are for the readiness assessment test). 28 minutes are reserved for lecturing.

Overview/motivation/topical background

The main objective of this module is to introduce the Simplex algorithm. The main focus of module is on the application of the rules and algebraic manipulations of the Simplex algorithm rather then the reason behind them. Another module of this series will focus on understanding the reason behind the steps followed by the Simplex.

The module is intended to be used as a regular lecture in an undergraduate introductory course to Operations Research, or a self-contained support lecture in a undergraduate/graduate course that requires a basic knowledge of linear programming.

The background knowledge required for the module is elementary knowledge of analytical geometry and linear algebra. In particular, it is necessary that the student know how to solve a system of linear equations and the general equation of the straight line.

The module is designed to make the students active participants in the lecture's exercises.

The module design is tailored for a class that has been divided into teams. The ideal size of the teams is three or four students. However, smaller or larger teams can also be accommodated without any changes to the module's structure.

Learning objectives

At the end of the lecture each student should be able to:

- Express a Linear Programming problem in a standard form
- Set up the simplex tableau for a standard LP problem
- Find the optimal solution for an LP problem using the simplex tableau

Materials

PowerPoint software and a computer screen projector.

Prerequisite knowledge for the students

It is necessary that the student know how to solve a system of linear equations. It is also recommended that student has covered the material related to the modeling and assumptions of a linear programming problem.

Preparation requirements for the instructor

Since part of the module is based on animation tools, it is necessary that the instructor become familiar with the timing and order of the animation steps before delivering the lecture

Hints, tips and traps for the instructor

There are two versions of the lecture's materials: the original notes to be given to the students (to download or copy before coming to class), and the instructor's notes. The student version of the notes should be given to the students before the class. The instructor's version of the notes could be given (at the discretion of the instructor) to the students after the class.

The instructor should be particularly careful to enforce the time scheduled for team exercises. The use of a timekeeper in each team is encouraged.

Reference materials (Generic materials, etc)

Almost any introductory Operations Research book has a chapter that covers the simplex algorithm. The students should read this chapter before coming to class. Two suggestions:

- Chapter 3 of Operations Research, by Hamdy A. Taha, Prentice Hall , 7th Edition
- Chapter 4 of Introduction to Operations Research by Hillier and Liberman, 7th Edition

The student also should read the self-contained module on the standard form of an LP problem. This module can be downloaded from:
http://enpc2675.eas.asu.edu/lobos/iie476/stdform.doc

Classroom resources/computer usage

To deliver this module properly, it is necessary to have a computer with PowerPoint and a screen projector. It is suggested to have proper tables for teamwork.

Suggested homework for the module

At the end of the module, a problem is left as a homework exercise. In addition, the following problems (from Hillier and Liberman 7th edition) are suggested as homework exercises: 4.2-1, 4.4-2, 4.4-5, 4.4-6, and 4.4-7