

MIT BLOSSOMS INITIATIVE

Optimizing Your Diet: What Linear Programming Can Tell You!

Taught by Aysegul Topcu, Ph.D.

Senior Operations Researcher at Structured Decisions Corporation, West Newton, MA

TEACHER'S GUIDE

Thank you for choosing this learning video for your class. I hope both you and your students enjoy the lesson.

The main goal of this lesson is to provide students with a brief understanding of linear programming. Its application goes back to World War II to solve planning problems to reduce costs to the army. A broad range of other industries such as airline, entertainment, manufacturing, uses linear programming as a tool to allocate limited resources in the most efficient way.

The lesson starts with the getting dressed example by Saul Gass. I find this in-class exercise quite fascinating! Remember that students need to know about permutations to come up with the possible orderings of putting on four items of clothes. To familiarize your students on the topic of permutations, you can refer to the lecture notes on the fine art of counting on MIT's OpenCourseWare website in the classroom, or provide it as a reading assignment. Working in groups in the classroom, you can let students guess the orderings and then eliminate the impractical or inefficient ones. As a challenge, you can also ask students to choose the most efficient one, and explain how they came up with that answer.

The rest of the lesson covers the famous Stigler's diet problem posed by George Stigler. First a history on the Stigler's diet problem and also Dantzig's solution to the problem is given. Based on his problem, students first formulate their own diet problem, and then solve it using the graphical method. They will need graphing paper and pencil to graph the inequalities as an in-class exercise. You might want to pause after each inequality and let students graph it as a group. You might also want to assign additional homework problems before this lesson where students practice graphing inequalities.

As a supplementary material, we included solving our diet problem using the simplex algorithm. You could cover this material in a separate class period or provide it as a handout for student to go over outside of the class. A whole class period of one hour is probably required to go over this material if covered in the classroom. The prerequisite to this section involves matrices. In addition, there is some terminology being used that students probably have never seen before such as "coefficient", "constant" and "duality". A thorough explanation of this terminology is required prior to the lesson. The online resources provide a good list of reading material for students to familiarize themselves with this terminology.

Thank you for your interest in this lesson. Please feel free to contact us with any questions or ideas on how to improve it.