Operations Research, Spring 2017
The Self-teach Week

Ling-Chieh Kung*

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1 Motivation

In this semester, we have gone through twelve lectures. We talked about Linear Programming, Integer Programming, and Nonlinear Programming. Very few one-semester courses are able to cover these topics in such depth and completeness. Good job!

If this course is successful, you should now be able and willing to learn advanced materials by yourself. One way to test this is to see whether you take relevant courses in the future and how well you do in those courses. Most of these courses are in Information Management, Business Administration, Industrial Engineering, Economics, and Computer Science. If you want to know advanced courses of Operations Research, please feel free to talk with the instructor. Alternatively, we may leave you one week for self-study. For the materials that we will provide to you, if many (or some, or at least one) student find it interesting and learn it by herself/himself, we can really say that this course is a good course.

There is another reason of doing this. Obviously, there are always so many subjects that cannot all be covered in a course. We really need to let one teach herself/himself without an instructor. Moreover, these subjects are of different topics and applications, and one actually does not need to learn them all. We really need to let one select for herself/himself. I would like to give it a try to let you self-teach. That is why we have a self-teach week.

2 Things to happen on June 1

There will no lecture on 6/1. Instead, materials of three subjects will be given to you for you to self-teach at home. Beside studying the given materials, you are encouraged to search for relevant materials by yourselves (libraries, Internet, senior students, etc.). In any case, the instructor will not talk about them. He will also be in the classroom during the lecture time of 6/1 to answer students' any question.

3 The subjects and materials

The three subjects are the following:

*Department of Information Management, National Taiwan University. E-mail: lckung@ntu.edu.tw.

1. **Network flow models.** There are some very fundamental problems, including the well-known shortest path and maximum flow problems), can be formulated as integer programs. Interestingly, these integer programs are special as solving their linear relaxation will result in an integer solution immediately. In this subject, we introduce a class of these problems, the minimum cost network flow problem, and an interesting property called total unimodularity. We will see that network flow models connects Linear Programming and Integer Programming.

   - The slides are at `https://tinyurl.com/mkhzp8h`;
   - The lecture videos are at `https://tinyurl.com/l9pmqny`.
   - Textbook chapters: Chapters 8 and 9.
   - On `http://www.im.ntu.edu.tw/~lckung/courses/OR16/` you may find pre-lecture problems and its solutions and the timing we introduced it in 2016.

2. **Inventory theory.** As one of the four classic applications of Operations Research (location, scheduling, routing, and inventory), researchers establish inventory theory to support inventory decisions. One inventory model we introduced in class is the EOQ model. Obviously, there are some other inventory models for different situations. We will introduce some variants of the EOQ model to expand its applicability. Moreover, to deal with demand uncertainty, we will introduce the newsvendor model. One may view these models as applications of Nonlinear Programming.

   - The slides are at `https://tinyurl.com/k45h7se`.
   - The lecture videos are at `https://tinyurl.com/yc6hj4bq`.
   - Textbook chapters: Chapter 18.
   - On `http://www.im.ntu.edu.tw/~lckung/courses/OR15/` you may find pre-lecture problems and its solutions and the timing we introduced it in 2015.

3. **Game theory.** In this semester, we introduced only decision problems with a single decision maker. In many cases, however, one makes decisions by considering how other decision makers may act and how their decisions affect her/his own payoff. We then needs game theory to expand the scope of our analysis. One special type of game is the two-player zero-sum game, which possesses some nice properties that connect to Linear Programming duality. We will introduce the definition of the two-player zero-sum game, the properties, and the derivation.

   - The slides are at `https://tinyurl.com/k45h7se`.
   - There is no lecture video.
   - Textbook chapters: Chapter 14.
   - On `http://www.im.ntu.edu.tw/~lckung/courses/OR13/` you may find pre-lecture problems and its solutions and the timing we introduced it in 2013.

Hope you will enjoy it!