Business Analytics for Professionals (Non-Thesis) Program
Spring 2022
BAN821– Optimization and Simulation

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Web : SUCourse+
Office Hours : By appointment

Type	Time	Days	Where
Class	7:00pm – 10:00pm	Tuesday	Altunizade Room 201 & Zoom
Class	9:30am – 12:30pm	Saturday	Altunizade Room 201 & Zoom

Course Objective:
This course provides an introduction to solving managerial problems using two of the widely used analytics techniques, namely mathematical programming and monte carlo simulation. The aim is to show how mathematical models formulated to make use of these techniques can be used to assist decision makers make better decisions. Hence, emphasis will be on placed on modeling, interpretation of results and gaining insight. Problems from different domains of management, such as operations management, marketing and finance will be modelled and solved.

Learning Outcomes:
Upon successful completion of the course, the student should be able to:

1. Identify an opportunity to use mathematical modeling (linear/nonlinear optimization and/or Monte Carlo simulation) to solve a given decision problem.
2. Develop an appropriate decision model using MS Excel to solve a given decision problem.
3. Use add-in solver tools for MS Excel to solve a given optimization model.
4. Interpret and explain output of a decision model.
5. Explain how model-based decision support tools can be used for managerial decision making.

Course Material:
There is not any required textbook, however students may benefit from having access to any edition of the following books published since 2012:

- Albright, S.C. and Winston, W.L. *Management Science Modeling, Thomson-Southwestern*
- Albright, S.C. and Winston, W.L. *Practical Management Science*, CENGAGE Publishing.

Course Web:
SUCourse+ will be used as the course's web site. Course slides, Excel files, grades will be posted on this web site. Assignments and in-classes exercises will be distributed through the "assignments" posted there. Students will be expected to submit their solutions through the assignment tool. Emails to the class will be sent through the email

tool of SUCourse+ to your sabanciuniv.edu emails, so you are expected to monitor your Sabancı University email accounts.

Instructional Design:
The main goal of the instructional design is to maximize in-class learning through active participation of the students. All examples, in-class exercises and assignments will be done using Microsoft Excel. Students can use both Windows and Mac versions of Excel. We will use Excel's functions the Solver add-in, which comes pre-installed with Excel for Windows and Excel for Mac 2016.

When attending a class through Zoom, it is strongly recommended that students have an extended display (with a second computer screen connected to their computer), a single large screen or a tablet in addition to the laptop, so that they can have a window where they follow the lecture and another one where they work on exercises and problems using Excel.

Grading:

In-class exercises	: 30%
Individual assignments	: 20%
Team assignment 1	: 10%
Team assignment 2	: 10%
Exam 1	: 15%
Exam 2	: 15%

Peer Evaluation in Teamwork
Students will be asked to provide an evaluation of the members of their team in team assignments. Each student will divide 100 points between the members of her team, including herself. This division should reflect that person's judgment of the contribution of the members of her team. The scores should not be merely functions of time spent by each member, but they should be measures of the "contribution;" their relative contribution to the idea generation, research, analysis, writing, oral presentation, report writing, etc. If the team was highly functional, and each member did what they committed themselves to, then the student can assign the same mark to each member of the team. If, on the other hand, some members of the team did not fulfill their commitments and did not contribute as much as the others, then points can be distributed unevenly.

The points submitted by all members of the team will be aggregated by the instructor. Every student will be given his/her aggregate peer evaluation, without disclosing the individual peer evaluations to the students.

In case there is no consensus among the team, for example, if three students divide the marks evenly and the fourth one divides them unevenly, then the instructor will use his/her judgment to assign peer evaluation marks--possibly after meeting with the members of the team.

In cases where there are conflicting marks, it is most likely that the instructor will meet with the team members and provide a mark based on an interview. For example, in a group of four, if Students A and B believe they did most of the work, and Students C

and D believe otherwise, the team may be called in for an interview in order to be fair to everyone.

Past experience indicates that in most groups, points will be distributed evenly. There will be a few groups where peer evaluations will play a role in the marks. The primary goal of this exercise is to avoid giving undeserved credit to individuals who did not help their teams. However, it is possible to have upwards adjustments of marks in case of students who have done more than what the group expected of them.

The peer evaluation will have a direct impact on your team assignment marks. To give a simple example, if the group mark is 25 out of 30, and if your peer evaluation indicates that your contribution was less than what was expected, then your team assignment mark will be less than 25 out of 30. There are no simple rules for this adjustment.

Requirements:
There are three types of requirements of the course. In-class exercises, individual assignments, and team assignments.

During the in-class exercises students will be able to receive help from each other since these are not meant to be quizzes. Their main purpose is to provide feedback to both the students and the professor during the lecture and facilitate learning by doing. 10% of the exercises with the lowest grade (or missed) will be dropped from grade calculation.

There will be individual assignments. Students will be expected to carry out the required work individually. To clarify this point, the students can talk to each other about how they tackle the assignments, but they should work on it individually. Since all these assignments are going to be delivered as a MS Excel or a MS Word file, students should not give their own files to others. It is very tempting for the receiving student to submit that file as his/her own and that would clearly be cheating; in that case both students would be held responsible not just the receiving one. If you want to help a fellow student, discuss your approach to the problem but do not give your file.

Team assignments will be for teams of two students (in case of odd number of students, one team will have three students). Teams need not be the same for the two team assignments. Each student is expected to not only contribute to the solutions of every single question but also fully knowledgeable about the team's solutions in these assignments.

Examinations will be given in the classroom. Students will work on the assigned questions on their own laptops. A student can look up any file on his/her own laptop (lecture slides, example files etc.) but any form of communication with other people during the exam is considered cheating.

Academic Honesty:
Learning is enhanced through cooperation and as such you are encouraged to work in groups, ask for and give help freely in all appropriate settings. At the same time, as a matter of personal integrity, you should only represent your own work as yours. Any work that is submitted to be evaluated in this class should be an original piece of writing, presenting your ideas in your own words. Everything you borrow from books,

articles, or web sites (including those in the syllabus) should be properly cited. Although you are encouraged to discuss your ideas with others (including your friends in the class), it is important that you do not share your writing (slides, MS Excel files, reports, etc.) with anyone. Using ideas, text and other intellectual property developed by someone else while claiming it is your original work is *plagiarism*. Copying from others or providing answers or information, written or oral, to others is *cheating*. Unauthorized help from another person or having someone else write one's paper or assignment is *collusion*. Cheating, plagiarism and collusion are serious offenses that could result in an F grade and disciplinary action. Please pay utmost attention to avoid such accusations.

Classroom Policies and Conduct:
Active and participatory learning is very important for achieving the learning goals of this course. Establishing the necessary social order such a learning environment requires that you follow the guidelines listed below:

- You must attend the synchronous Zoom lectures, recitations, etc. with your SU email account.
- Come to class on time.
- Keep your video on during online lectures. If you have a legitimate reason for not doing this, contact the instructor before the first lecture, explaining your reason.
- You are recommended to keep your microphone off when you are not speaking during online lectures.
- Come prepared to make helpful comments and ask questions that facilitate your own understanding and that of your classmates.
- In-class exercises will produce the maximum benefit for everyone, if everyone contributes, whether through asking questions to each other or answering them.
- Use your phones and laptops during class only for class activities such as taking notes or referring to a spreadsheet.
- Do not let e-mails and other messaging services distract you and others.

Course Schedule:

3-hour Session	Date	Content
1	Tue, April 12	1. Introduction to linear programming • LP assumptions • Spreadsheet engineering
2	Sat, April 16	2. LP models • Graphical method for solving LP models • Ad Purchasing model
3	Tue, April 19	3. Network Models • Minimum cost network flow models
No class on Saturday, April 23rd		
4	Tue, April 26	4. Introduction to Integer programming (IP) • Selection (combinatorial) models • Capital budgeting models
5	Sat, April 30	5. IP models – logical constraints in IP • Supply chain location decision
No class on Tuesday, May 3rd		
6	Sat, May 7	6. IP models • Set covering
Team Assignment 1 Due Sunday May 8th		
7	Tue, May 10	7. Introduction to nonlinear programming • Basic ideas of nonlinear optimization • Pricing decisions and portfolio optimization
8	Sat, May 14	Exam 1
9	Tue, May 17	8. Evolutionary algorithms • Introduction to genetic algorithms • Assignment Model
10	Sat, May 21	9. Evolutionary algorithms • Traveling salesperson model • K-means clustering
11	Tue, May 24	10. Monte Carlo simulation using Excel • Law of large numbers • Simulation Modeling: One-period inventory planning
12	Sat, May 28	11. Input probability distributions • Random number generation • Generating random variates: Bernoulli, Normal
13	Tue, May 31	12. Simulation models • Discrete and Empirical distributions • Hotel booking risk analysis
14	Sat, June 4	13. Simulation optimization • Common random numbers • Bidding for a contract
Team Assignment 2 Due Tue June 7		
Exam Saturday June 11		