



HANYANG UNIVERSITY

Hanyang International Winter School

Introduction to Operations Research

Professor: **Kwon G. Mun**
 E-mail: kwongimun@gmail.com
 Home Univ.: Fairleigh Dickinson University, NJ, USA
 Dept.: Decision Science and Supply Chain Management

Description: Operations Research (OR) is the science of decision making. The course emphasizes model formulation. Linear and Integer Programming techniques will be introduced. OR approach involves forming models, analyzing these models, and then deciding on some optimal course of action. In this course, we will start with the classical Simplex Method and graph theoretic applications are then introduced. At the end of this course, students will have the skills to build their own formulations, to expand existing formulations, to critically analyze the impact of model assumptions and to choose an appropriate solution technique.

Objective:

- Introduce concepts and methodology for the solution of Linear and Integer Programming.
- Understand of model formulation and critical decisions.
- Provide the opportunity of using various software package for solving LP/IP models.
- Introduce the advanced methods for solving transportation and assignment problems.

 (Textbook) Not Required.

Preparations: (Software) EXCEL, Python, and Gurobi Solver (free for academic users)
 (References) 1. Introduction to Operations Research, by Hillier and Lieberman
 2. Linear Programming and Network Flows, by Bazaraa, Jarvis and Sherali

Credits		Contact Hours	
Schedule:	Week 1	Modeling Linear Programming / Solving LP: Simplex Method / Sensitivity Analysis	
	Week 2	Integer Programming / Transportation and Assignment Problems	

Evaluation(%)	Midterm	Final	Attendance	Assignments	Participation	Etc.
	30%	35%	10%	20%	5%	%

Course Title: INTR TO OPERATIONS RESEARCH
Course Code: TBA (section#)
Meeting times: M~FRI 9:00AM to 12:00 PM & 1PM to 2:30PM
Office: TBA
Office Hours: M/TH 12:30PM to 1:30 PM and appointment

Semester: WINTER 2018
Instructor: K.G. Mun
Meeting location: TBA
Email: kwongimun@gmail.com
Voicemail: TBA

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Prerequisite: None. Linear Algebra (Not strongly required.)

Instructional Resources: Lecture Materials, EXCEL, Python, and Gurobi Solver (free for academic users). Lecture Slides, HWs, Exams, etc. have been uploaded at Class website([HY-in-portal](#)).

References:

- Introduction to Operations Research, by Hillier and Lieberman.
- Linear Programming and Network Flows, by Bazaraa, Jarvis and Sherali.
- Case 1: Kwon G. Mun (2017) Designing Energy Supply Chain for Prosperity
- Case 2: Kwon Gi Mun (2016) Designing Hydro Supply Chain for Energy, Food, and Flood

Required Text: None. Do not purchase textbook or references. Cases will be uploaded at the class webpage.

Examination:

There will be two exams: one two-hours In-Class Midterm exam and one two-hours In-Class final examination. The final exam is comprehensive. All In-Class exams will be closed book, and closed note. You may bring two pages (two sided) formula sheet (cheat sheet) written by your own hands for all of two exams. If you have a conflict for the exam, notify me **at least one week ahead. No Makeup Exam is allowed.**

Homework:

Homework will be assigned to help you understand the material and practice. There will be written problems and computer assignments that require the use of EXCEL/Python with Gurobi Solver. **If you submit one week later after the due date, then you get 60% (40% of penalty). More than one week (0%)**

Grade Weights:

Student's course grade will be based on the final course average, in computing which the graded work will be weighted as follows:

HWs	20% (each 10%)
Class Summary/Participation	5%
Class Attendance	10%
Midterm	30%
Final exam	35%

Class Attendance and Absences

Regular attendance is expected and considered mandatory. Each student is allowed a one absence from class for the entire semester without direct penalty to his or her grade.

10%	< 1 absence
9%	for 2 absences
8%	for 3 absences
7%	for 4 absences
6%	for 5 absences
4%	for more than 5 absences

Software Package:

It will be used for solving LP/IP problems. You or your team may use your own laptop for solving these problems. EXCEL is required. Python and Gurobi Solver are introduced (free for academic users).

Class Summary:

At the last class, hand in a hard copy of your class summary. It should include answers to following questions:

- (1) What have you learned in this class?
- (2) How you apply OR in your domain?

Two- or three-pages summary. Once you submit it on time, you get a full score.

Important Dates:

- HW 1: Due on Jan 3, 2019
- Midterm: Jan 4, 2019
- HW 2: Due on Jan 9, 2019
- **Class Summary: Due on Jan 10, 2019**
- **Final: Jan 10, 2019**

Course Schedule:

Date	(9:00AM~12:00PM)	(1:00PM~2:30PM)
Class 1. Dec 28	<u>Introduction</u> Course policy, Overview <u>Intro to OR I</u> History, Applications	<u>Intro to OR II</u> Modeling Linear Programming HW 1
Class 2. Dec 31	<u>Linear Programming Modeling & Solution</u> Geometry, Simplex Method, Dual Theory / Sensitivity Analysis	<u>Linear Programming Modeling & Solution</u> Excel solution Solving LP with Python
Class 3. Jan 2	<u>Linear Programming Modeling & Solution</u> Big-M Method Linear Programming Tricks: Linearization	<u>Linear Programming Real-World Applications</u> Production Problem, Optimization of Energy Supply Chain Solving LP with Python
Class 4. Jan 3	<u>Review Session I</u> Midterm	<u>Review Session I</u> Midterm HW 1 Due

Class 5. Jan 4	Midterm Examination - In Class - Two and half Hours	Midterm Examination - In Class - Two and half Hours
Class 6. Jan 7	<u>Integer Programming</u> Modeling & Formulation: Branch-and bound algorithm for Mixed Integer Programming HW 2	<u>Integer Programming</u> Project selection, Logistics network design Solving MIP with Python
Class 7. Jan 8	<u>Transportation Problems</u> Transportation Problems, a streamlined simplex method for the transportation problem	<u>Assignment Problems</u> Assignment problems, a special algorithm for the assignment problem
Class 8. Jan 9	<u>Review Session II</u> Final	<u>Review Session II</u> Final HW 2 Due
Week 9. Jan 10	Final Examination - In Class - Two and half Hours	Final Examination - In Class - Two and half Hours Class Summary Due
Class 10 Jan 11	<u>Review Session III</u> Grade	<u>Review Session III</u> Grade