



HANYANG UNIVERSITY

2019 HISS Syllabus (Introduction to Operations Research)

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

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| 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. |
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| Objective: | <ul style="list-style-type: none"> • 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. |
| Preparations: | (Textbook) Not Required. (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 |

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| Schedule: | Week 1 | Modeling Linear Programming / Solving LP: Simplex Method / Sensitivity Analysis |
| | Week 2 | Integer Programming |
| | Week 3 | Mixed Integer Linear Programming (MILP) / Transportation and Assignment Problems |
| | Week 4 | Network Optimization Models |

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| Evaluation: | Midterm (%) | Final (%) | Attendance (%) | Assignments (%) | Participation (%) | Etc. (%) |
| | 30 | 35 | 10 | 25 | 00 | 00 |



Course Title: INTR TO OPERATIONS RESEARCH
Course Code: TBA (section#)
Meeting times: TBA
Office: TBA
Office Hours: TBA

Semester: Summer 2019
Instructor: K.G. Mun
Meeting location: TBA
Email: kwongimun@gmail.com
Voicemail: TBA

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.

Prerequisite: 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.

Required Text: None.

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:

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| HWs | 25% (15% & 10%) |
| 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.

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| 10% | ≤ 2 absence |
| 9% | for 3 absences |
| 8% | for 4 absences |
| 7% | for 5 absences |
| 0% | for more than 6 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).

Important Dates:

- HW 1: TBA
- Midterm: TBA
- HW 2: TBA
- Final: TBA

Course Schedule:

| Date | 1st half | 2nd half |
|-----------------|---|--|
| Class 1. | <u>Introduction</u> Course policy, Overview <u>Intro to OR I</u> History, Applications | <u>Intro to OR I</u> History, Applications HW 1 |
| Class 2. | <u>Intro to OR II</u> Modeling Linear Programming | <u>Intro to OR II</u> Modeling Linear Programming |
| Class 3. | <u>Linear Programming: Modeling & Solution</u> Geometry | <u>Linear Programming: Modeling & Solution</u> Simplex Method |
| Class 4. | <u>Linear Programming: Modeling & Solution</u> Dual Theory / Sensitivity Analysis | <u>Linear Programming: Modeling & Solution</u> Solving LP with Python |
| Class 5. | <u>Linear Programming: Modeling & Solution</u> | <u>Linear Programming: Real-World Applications</u> |

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| | Big-M Method Linear Programming Tricks | Production Problem, Optimization of Energy Supply Chain (Solving LP with Python) |
| Class 6. | <u>Review Session I</u> Midterm | <u>Review Session I</u> Midterm HW 1 Due |
| Class 7. | Midterm Examination - In Class - Two and half Hours | Midterm Examination - In Class - Two and half Hours |
| Class 8. | <u>Integer Programming</u> Modeling & Formulation: Branch-and bound algorithm for Mixed Integer Programming | <u>Integer Programming</u> Project selection, Logistics network design Solving MIP with Python HW 2 |
| Class 9. | <u>Integer Programming</u> Project selection Solving MIP with Python | <u>Integer Programming</u> Logistics network design Solving MIP with Python |
| Class 10. | <u>Transportation Problems</u> Transportation Problems | <u>Transportation Problems</u> A streamlined simplex method for the transportation problem |
| Class 11. | <u>Assignment Problems</u> Assignment problems | <u>Assignment Problems</u> A special algorithm for the assignment problem |
| Class 12. | <u>Network Optimization Models</u> Shortest-path problem | <u>Network Optimization Models</u> Maximum Flow problem |
| Class 13. | <u>Review Session II</u> Final | <u>Review Session II</u> Final HW 2 Due |
| Class 14. | Final Examination - In Class | Final Examination - In Class |



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| | - Two and half Hours | - Two and half Hours Class Summary Due |
| Class 15. | <u>Review Session III</u> Discussion: Final Exam & Grade | <u>Review Session III</u> Discussion: Final Exam & Grade |