Deterministic Methods in Operations Research
ESI6314 - Section 231B

Class Periods:

August 18, 2018* (1:00pm-5:00pm) [1]
September 8-9, 2018 (8:00am-noon)
October 13-14, 2018 (8:00am-noon)
November 10-11, 2018 (1:00-5:00pm)
December 1, 2018 (1:00-4:00pm)

Location: Lake Nona, Orlando
Academic Term : Fall 2018

Instructor:
Jean-Philippe P. Richard
(Please use e-learning email)
Office hours (E-learning):
▶ Sundays 9:00-10:00pm,
▶ Tuesdays 9:00-10:00pm

Teaching Assistants:
Yanan Yu
(Please use e-learning email)
Office hours (E-learning):
▶ Mondays 8:00-9:00pm,
▶ Wednesdays 8:00-9:00pm

Course Description:

▶ *Catalog description:* Credits: 4; Introduction to basic models and their solution with modern computer packages. Emphasis on modeling, computer solution, and sensitivity analysis with minimal reference to model theory and development of algorithmic methods.

▶ *Layman description:* Operations Research (also called Management Science) is the study of scientific approaches to decision-making. Through mathematical modeling, it seeks to design, improve and operate complex systems in the best possible way. The mathematical tools used for the solution of such models are either deterministic or stochastic, depending on the nature of the system modeled. In this class, we focus on deterministic models and methods in Operations Research. Stochastic models and methods are described in ESI6912 (Decision Making under Uncertainty). In this class, you will learn very powerful modeling and solution techniques for decision-making problems that are used today by many successful companies to help them save/earn millions of dollars.

Course Pre-Requisites/Co-Requisites:
Although there is no formal prerequisite for this class, students should have a knowledge of basic programming techniques, linear algebra (linear independence, solving systems of equations, basic matrix algebra) and basic knowledge of differential calculus.

Course Objectives:
At a high level, ESI6314 seeks to introduce students to models commonly used in the analysis of complex

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[1] in Gainesville

decision-making problems. Specifically, students will obtain knowledge and skills in Linear programming, Network optimization and Integer programming. In particular, students will know how to formulate engineering, production, design, and management problems as mathematical models, and how to use software to solve them in a reasonable amount of time. Students will also understand the fundamental mathematical principles on which these methods are built, and how to analyze the results of a model, interpret them, and present the insights obtained from their analysis.

Materials and Supply Fees:
NA.

Required Textbooks and Software:

▶ Lecture notes will be provided that can be augmented with the textbook listed below.

▶ Models will be developed in Excel and solved with Excel solver. Excel Solver is an add-in that is available within most versions of excel. Excel Solver will be used throughout the class.

Recommended Materials:

▶ Ronald L. Rardin, *Optimization in Operations Research*, First Edition, Prentice-Hall 1998.

▶ Ronald L. Rardin, *Optimization in Operations Research*, Second Edition, Pearson 2016.

Online resources:
Virtually all of the material for this class will be available on e-learning. To access e-learning, type in your web browser the address `http://elearning.ufl.edu/`, click on the "log in to e-learning" icon, enter your UF log-in and passwords to access the site, and Select the class "ESI6314 - Deterministic Methods in Operations Research - Fall 2018". Most of the relevant class material will be found in the `Files` folder. In particular, there are the following categories in this folder: *Administrative info* (contains the syllabus and the class schedule for this course); *Slides* (contains the slides that are used for every one of the classes); *Prework* (contains statement and solution to the prework); *Homework & solutions* (contains the statements, and solutions to the homework assignments); *Models & spreadsheets* (contains the models studied in the class); *Final Exam* (contains information relative to the final including the rules of the final as well as the material that will be tested). There are also tools that you will find handy to use: *Chat* (chatroom where office hours will be held) ; *Mail* (e-mail system for the class participants - it is very easy to use and it is the preferred way to communicate with the instructor; *Gradebook* (contains the grades you obtained for the class so far). All communications relative to the course will be made on e-learning. When possible, these announcements will be reiterated in class. Students are therefore responsible to check e-learning regularly for possible updates.

Course Schedule:
A tentative list of topics for the class is given next. This list might be shortened or lengthened depending on the pace of the class.

Chapter 1: Intro to Optimization models, methods and solvers (August, September)
Decision problems - Optimization models - Excel solver - Tractability - Local and global optima - Convexity - Local and global solutions techniques - Examples (distribution planning, inventory management, vehicle routing, portfolio optimization, . . .).

Chapter 2: Linear Programming Models (September)
Production planning - Financial planning - Shift scheduling - Revenue management - . . . .

Chapter 3: Linear Programming Methods and Analysis (October)
LP geometry - Extreme points and extreme rays - Standard form - Basic solutions - Simplex algorithm - Two-Phase Method - Duality - Sensitivity and post-optimal analysis - Complementarity slackness.

Chapter 4: Network Programming (November)
Networks - Network flow models (project scheduling, transportation, . . .) - Shortest path - Maximum flow - Assignment - Algorithms.

Chapter 5: Integer Programming (November)
Integer variables - IP models (facility location, line balancing, project selection) - Enumeration - LP and rounding techniques - Branch-and-bound.

Attendance Policy, Class Expectations, and Make-Up Policy:

Attendance is mandatory. Students are expected to attend class and to notify the instructor when they are not able to. Repeated unexcused absences might result in a penalty of up to 10% of the class grade. In the event a student is unable to attend the final exam because of a valid reason (UF-imposed curriculum requirement, religious holiday, jury duty, or a family/medical emergency), a make-up exam will be organized as soon as feasible for both the instructor and the student, provided that the instructor was given advanced notice of the situation. Students who miss an exam without advanced notice to the instructor (or without a valid reason for which such notice could not be given) will receive a F for the exam and will not be given a make-up exam. Make-up will not be given for homework. The instructor might extend the deadline or forgo homework for a student who has a valid reason (see above), provided that the instructor is given advanced notice.

Evaluation of Grades:

Class grades will be based on: homework average grade (50%), and final exam grade (50%).

▶ Six homework assignments will be given during the course of the semester. You will need to answer and turn in all problems. All homework will count equally towards your homework average grade, except that the homework with the lowest grade will be excluded from the computation. You will receive solutions to all the homework sets. The questions will range from theoretical to practical aspects. Some will be simple applications of material seen in class, some will be challenging. Some questions will involve the use of the Excel solver that will be introduced in class. Homework are typically due Thursdays at 10:00pm. Late homework will be accepted with a grade deduction proportional to their lateness up until solutions are posted (on Monday). (upto -1.5%/ 4 hour + one hour grace period). Students in the class are encouraged to find the answers to the problems by themselves. Collaboration with one other student is tolerated as long as it is acknowledged on the homework submission. Operations Research is a fairly mathematical discipline. Finding solutions by yourself testifies that you do have a good understanding of the material. `Understanding someone else's solution does not prove that you understand the material`. Be aware that the final exam will seek to evaluate your understanding of the material, not the ability to mimic the solution of problems you have seen before.

▶ All students are required to take a final exam. The goal is to test the general knowledge and understanding of the class material. The final exam is cumulative. The final exam willl contain modeling problems that will verify that you can convert world problems into quantitative models, solution methodologies problems that will verify that you know and understand the algorithms described in class, and common sense/analysis problems that verify how well you can make sense of solutions you obtain from models. The final will be held December 1, 2018. No cooperation is allowed on the final.

Your performance in these two evaluation categories will determine your grade in the class. I do not hand out extra projects/homework to help students that did poorly on an assignment. Such projects/homework are unfair to the rest of the class.

Grades will only be available on the e-learning site. For reasons regarding privacy protection, grades are not communicated by phone and/or e-mail. Furthermore, grades posted on e-learning are those recorded for you. Therefore, if you note any discrepancy between the grade of one of your papers and the grade posted on e-learning or if one of your grades is missing from e-learning, you should let the TA know. Ideally, re-grades should be requested when the reasons for such re-grades are obvious (the sums of the marks you got on every part do not add up to the total you received, etc.). Be aware that if the grader misunderstood your answer during the first grading, it is probably that it was not clear. Explaining what you meant afterwards will not earn you additional credit. You can ask for a re-grade every time you feel it is appropriate. You should submit by e-mail the reason you believe such re-grade is appropriate. Re-grade requests for homework should be addressed to the TA. All other re-grade requests should be directed to the

instructor. No re-grade will take place on the spot nor will be considered face-to-face. Every re-grade request should be entered within one week of the time at which the assignment is returned to the class. This clause is to ensure that all grades are given when the grading scale used by the grader is still fresh in his/her mind.

If you conduct any dishonest act (*e.g.*, cheating on an exam, bringing in extra material not allowed during the exams, or copying someone else's homework), you will get a F on that assignment/exam. Further action is possible depending on the severity of cheating; see University Honesty Policy below.

Grading Policy:
You will receive numerical grades for homework, and final exam. Your class grade will be determined by the following grading scale: (90-100] A, (80-90] A-, (70-80] B+, (60-70] B, (50-60] B-, (40,50] C+, (30,40] C, (20,30] C-, (10,20] D, [0,10] E. The cut-off points however might be lowered in the case of a particularly hard final exam. More information on UF grading policy may be found at: `http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades`

In order to graduate, graduate students must have an overall GPA and an upper-division GPA of 3.0 or better (B or better). Note: a B- average is equivalent to a GPA of 2.67, and therefore, it does not satisfy this graduation requirement. For more information on grades and grading policies, please visit: `http://gradschool.ufl.edu/catalog/current-catalog/catalog-general-regulations.html#grades`

Students Requiring Accommodations:
Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565), `https://www.dso.ufl.edu/drc`) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Course Evaluation:
Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at `https://evaluations.ufl.edu/evals`. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at `https://evaluations.ufl.edu/results/`.

Teaching Improvement:
I am interested in being the best instructor possible. In particular, I would like to know of the problems you face during the semester as soon as they occur. It is a waste for us to learn at the end of the semester that I was not speaking sufficiently loud to be heard, that my handwriting was not readable, or that nobody understood the pictures that were drawn on the board. I want you to feel free to make suggestions to improve the content of the class, and its exposition. I will consider carefully all these suggestions and if necessary, I will address them in class.

University Honesty Policy:
UF students are bound by The Honor Pledge which states, We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: On my honor, I have neither given nor received unauthorized aid in doing this assignment. The Honor Code (`https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/`) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Software Use:
All faculty, staff, and students of the University are required and expected to obey the laws and legal agree-

ments governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy:

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: `http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html`.

Campus Resources:

Health and Wellness

> **U Matter, We Care:** If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575 so that a team member can reach out to the student.
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> **Counseling and Wellness Center:** `http://www.counseling.ufl.edu/cwc`, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.
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> **Sexual Assault Recovery Services (SARS):** Student Health Care Center, 392-1161.
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> **University Police Department:** at 392-1111 (or 9-1-1 for emergencies), or `http://www.police.ufl.edu/`.

Academic Resources

> **E-learning technical support:** 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. `https://lss.at.ufl.edu/help.shtml`.
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> **Career Resource Center:** Reitz Union, 392-1601. Career assistance and counseling. `https://www.crc.ufl.edu/`.
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> **Library Support:** `http://cms.uflib.ufl.edu/ask`. Various ways to receive assistance with respect to using the libraries or finding resources.
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> **Teaching Center:** Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. `https://teachingcenter.ufl.edu/`.
>
> **Writing Studio, 302 Tigert Hall:** 846-1138. Help brainstorming, formatting, and writing papers. `https://writing.ufl.edu/writing-studio/`.
>
> **Student Complaints Campus:** `https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf`.
>
> **On-Line Students Complaints:** `http://www.distance.ufl.edu/student-complaint-process`.