RUTGERS
Rutgers Business School
Newark and New Brunswick

26:711:653: Discrete Optimization
Index: 14495 and 21381
Spring 2018
1WP 302 (Newark Campus)
BRR 4087 (Livingston Campus)
Monday 10am – 12:50pm

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Office Hours: 1WP Monday 12:50pm – 2pm
BRR 5180 by appointment

COURSE DESCRIPTION

We frequently have to make decisions in real life so that we achieve our goals. Many times that involves making choices, sometimes hard, among available alternatives. Almost always we are limited by some of the resources that we need to achieve our goals, and our decisions are about the "best" utilization of these resources in order to achieve our goals. Mathematical optimization is an area that offers tools and techniques to formulate precise mathematical models for our decision problems. In this course, we are going to learn some of the basic types of models, a high level modeling language to encode our models in a computer interpretable way, and the use of professional optimization packages to solve our models in order to obtain the "best" possible decisions.

The course will introduce you to the basics of complexity theory and the analysis of algorithms, dynamic programming and shortest paths, greedy algorithms, matroids and polyhedral techniques, network flows and related polyhedra, matching theory, stable matchings, knapsack problems and approximation algorithms, cutting stock problems, set covering and approximations, cutting planes, Chvatal-Gomory cuts and lift-and-project methods.

The course is self-contained supported by weekly handouts. It is highly interactive, with some homework assignments and two take home exams. We learn together modeling techniques, AMPL encoding, and the use of the solver packages via a series of examples. AMPL is a high level modeling language that allows us to formulate even complicated mathematical optimization models in an elegant and short way. The course utilizes full versions of top of the art solver packages, that are made available by AMPL Inc., in time limited course packets, which are distributed via the course's blackboard site.

COURSE MATERIALS

- No textbook is mandatory. The course will have weekly handouts that cover all needed materials. Check Blackboard (blackboard.rutgers.edu) and your official Rutgers email account regularly. Handouts are posted every week before class.
- Suggested textbooks include:
- B. Korte and J. Vygen: Combinatorial Optimization: Theory and Algorithms (Springer, 2000)
- G.L. Nemhauser and L.A. Wolsey: Integer and Combinatorial Optimization (Wiley, 1988)

- C.H. Papadimitriu and K. Steiglitz: Combinatorial Optimization: Algorithms and Complexity (Prentice-Hall, 1982)
- A. Schrijver: Combinatorial Optimization (vols. I-III) (Springer, 2002)
- AMPL: A modeling language for mathematical programming. See http://www.ampl.com/

PREQUISITES

The course has no formal prerequisites. Knowledge of linear optimization and some computer language is a plus.

EXAM DATES AND POLICIES

There are two take home exams in this course: Midterm on March 5 (due on March 11th), and Final exam on April 30 (due on May 6th).

All exams are open book, and require the submission of solutions via email to me (make sure I can read what you submit; AMPL codes must run on computer as they are.) All exams will be individualized, made available via the course's blackboard site, and can be taken any place where you have peace and access to internet.

GRADING POLICY

Course grades are determined as follows:

All exams are graded on a scale of 0 – 100. The final score is the average of the two take home exams. Both exams worth 50%. Some of the exams will have problems to earn extra points.

Grading will be based on the average score according to the following scale:

A	91+
B+	86-90
B	76-85
C+	71-75
C	61-70
D	51-60
F	50-

LEARNING GOALS AND OBJECTIVES

- This course is designed to help students develop skills and knowledge in the following area(s): Analyze decision problems and available data; build discrete optimization problems for certain standard types of problems, encode these problems in AMPL and solve them by the available solver packages that include CPLEX, XPressMP, and other state for the art optimization software.

- Students who complete this course will demonstrate the following: The ability to analyze real life decision problems, evaluate the data need for the decision maker, and interpret solutions provided by optimization methods and softwares.

- Students develop these skills and knowledge through the following course activities and assignments: By following the class regularly, participating in the common model building and solving activity, working on the homework assignments, and by solving the two take home exams.

ACADEMIC INTEGRITY

I do NOT tolerate cheating. Students are responsible for understanding the RU Academic Integrity Policy (https://slwordpress.rutgers.edu/academicintegrity/wp-content/uploads/sites/41/2014/11/AI_Policy_2013.pdf)
I will strongly enforce this Policy and pursue all violations. On all examinations and assignments, students must sign the RU Honor Pledge, which states, "On my honor, I have neither received nor given any unauthorized assistance on this examination or assignment." Don't let cheating destroy your hard-earned opportunity to learn. See business.rutgers.edu/ai for more details.

ATTENDANCE AND PREPARATION POLICY

- Expect me to attend all class sessions. I expect the same of you. If I am to be absent, my department chair or I will send you notice via email and Blackboard as far in advance as possible. If you are to be absent, report your absence in advance at https://sims.rutgers.edu/ssra/ and send email to Endre.Boros@rutgers.edu. If your absence is due to religious observance, a Rutgers-approved activity, illness, or family emergency/death and you seek makeup work, indicate it in your email to me and provide supporting documentation.

- For weather emergencies, consult the campus home page. If the campus is open, class will be held.

CLASSROOM CONDUCT

Be present, ask questions when you feel so, answer questions when asked. Please do not use mobile phones – they are not needed to follow the class. NO, they are not helping.

SUPPORT SERVICES

If you need accommodation for a *disability*, obtain a Letter of Accommodation from the Office of Disability Services. The Office of Disability Services at Rutgers, The State University of New Jersey, provides student-centered and student-inclusive programming in compliance with the Americans with Disabilities Act of 1990, the Americans with Disabilities Act Amendments of 2008, Section 504 of the Rehabilitation Act of 1973, Section 508 of the Rehabilitation Act of 1998, and the New Jersey Law Against Discrimination. https://ods.rutgers.edu

If you are a military *veteran* or are on active military duty, you can obtain support through the Office of Veteran and Military Programs and Services. http://veterans.rutgers.edu/

If you are in need of *mental health* services, please use our readily available services.
Rutgers Counseling and Psychological Services – New Brunswick: http://rhscaps.rutgers.edu/

If you are in need of *physical health* services, please use our readily available services.
Rutgers Health Services – New Brunswick: http://health.rutgers.edu/

If you are in need of *legal* services, please use our readily available services: http://rusls.rutgers.edu/

If you are in need of additional *academic assistance*, please use our readily available services.
Rutgers University-New Brunswick Learning Center: https://rlc.rutgers.edu/