MATH 9880 Selected Topics in Operations Research: Conic Programming

Fall 2021

Instructor: Boshi Yang (boshiy@clemson.edu)

Class Times: MW 2:30-3:45pm **Office:** Martin O-204
Office Hours: TBD **Office Phone:** (864) 656-5198

Prerequisites: MATH 8100 (Mathematical Programming) or MATH 4400 (Linear Programming) or equivalent. MATH 8110 (Nonlinear Programming) is recommended but not required.

Textbook: A. Ben-Tal and A. Nemirovski, *Lectures on Modern Convex Optimization: Analysis, Algorithms, and Engineering Applications*, SIAM, 2001. (Lecture notes available online at https://www2.isye.gatech.edu/~nemirovs/Lect_ModConvOpt.pdf)

Objectives: Conic optimization has become an important component in the optimization society in recent decades. This course covers fundamental concepts in conic optimization, including conic duality, second-order cone programming, semidefinite programming, copositive programming, and their applications. Upon successful completion of the course, students are expected to be able to formulate conic programming problems, understand conic duality theory, and solve moderate-scale conic programs using available software. Students should also be comfortable to apply conic programming techniques to nonconvex optimization problems such as quadratically constrained quadratic programms and mixed integer programs.

Materials covered: The course will cover most of the theoretical work in the first 4 chapters of the textbook. A selection of research articles will be provided to supplement the textbook. A tentative list of topics is as follows.

- Convex cones and geometry

- Conic programming duality

- Second-order cone representability

- Semidefinite representability

- Copositive programming and relaxation

- Solvers for conic programming

- Conic relaxations for combinatorial problems

- Conic relaxations for quadratically constrained quadratic programs

Course evaluation: Homework will be assigned throughout the semester. Students will be required to give presentations to the class on selected topics. A computational project involving using solvers for conic programs will be due at the end of the semester.

	Homework	Presentation	Final Project
Points	40	30	30

Class cancellation: The class will be dismissed in the case when the instructor or the invited lecturer is not present within 15 minutes of the scheduled start time.

Final grade:

	Over 85	70-84	60-69	Below 60
Grade	A	B	C	F

Academic Integrity: As members of the Clemson University community, we have inherited Thomas Green Clemson's vision of this institution as a "high seminary of learning." Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form.

Accessibility: Clemson University values the diversity of our student body as a strength and a critical component of our dynamic community. Students with disabilities or temporary injuries/conditions may require accommodations due to barriers in the structure of facilities, course design, technology used for curricular purposes, or other campus resources. Students who experience a barrier to full access to a class should let the professor know, and make an appointment to meet with a staff member in Student Accessibility Services as soon as possible. You can make an appointment by calling 864-656-6848 or by emailing `studentaccess@lists.clemson.edu`. Students who receive Academic Access Letters are strongly encouraged to request, obtain and present these to their professors as early in the semester as possible so that accommodations can be made in a timely manner. It is the student's responsibility to follow this process each semester. You can access further information here: `http://www.clemson.edu/campus-life/campus-services/sds/`.

Sexual Harassment: Title IX Policy: Clemson University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy, national origin, age, disability, veteran's status, genetic information or protected activity (e.g., opposition to prohibited discrimination or participation in any complaint process, etc.) in employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sexual harassment and sexual violence as mandated by Title IX of the Education Amendments of 1972.

The University is committed to combatting sexual harassment and sexual violence. As a result, you should know that University faculty and staff members who work directly with students are required to report any instances of sexual harassment and sexual violence, to the University's Title IX Coordinator. What this means is that as your professor, I am required to report any incidents of sexual harassment, sexual violence or misconduct, stalking, domestic and/or relationship violence that are directly reported to me, or of which I am somehow made aware.

There are two important exceptions to this requirement about which you should be aware:

- Confidential Resources and facilitators of sexual awareness programs such as "Take Back the Night and Aspire to be Well" when acting in those capacities, are not required to report incidents of sexual discrimination.

- Another important exception to the reporting requirement exists for academic work. Disclosures about sexual harassment, sexual violence, stalking, domestic and/or relationship violence that are shared as part of an academic project, a research project,

classroom discussion, or course assignment, are not required to be disclosed to the University's Title IX Coordinator.

This policy is located at http://www.clemson.edu/campus-life/campus-services/access/title-ix/. Ms. Alesia Smith is the Executive Director for Equity Compliance and the Title IX Coordinator. Her office is located at 223 Holtzendorff Hall, phone number is 864.656.3181, and email address is alesias@clemson.edu.