

## **OR 644/MATH 698 Nonlinear Programming**

## **OR 750 Advanced Nonlinear Programming**

Fall 2015, Wednesday 4:30-7:10,  
West Building 1008

### **Professor**

[Ariela Sofer](#), Professor and Chair

Long Engineering Building Room 2100

Phone: (703) 993-1692 or 993-1670 (SEOR office)

Office hours: Wednesday 1:30--3:30, or by appointment

Electronic mail: [asofer@gmu.edu](mailto:asofer@gmu.edu)

Fax: (703) 993-1521 (on cover sheet put: A. Sofer, SEOR Dept.)

### **Text**

Igor Griva, Stephen G. Nash, and Ariela Sofer, [Linear and Nonlinear Optimization](#) (2<sup>nd</sup> Edition) SIAM Books, (2008).

### **Course description**

Nonlinear programming problems arise in a wide variety of applications, such as engineering design, finance, energy modeling, and medical diagnosis and treatment. This course provides an introduction to the theory and methodology of nonlinear programming. After a review of the required mathematical background, we will study the theory of unconstrained optimization. We will then discuss methods for minimizing unconstrained functions, including Newton's method, the steepest descent method, the conjugate gradient method and truncated Newton methods, and will discuss the merits and disadvantages of each of these methods. We will continue to study the theory of constrained optimization, and then discuss methods for constrained optimization, including active set methods and penalty and barrier methods.

Throughout this course we will solve a number of applied nonlinear programming problems using a variety of optimization software packages. These software packages (solvers) may be accessed via the internet through the [NEOS Server](#). The front end to the solvers will be the modeling language AMPL. A student edition of the software can be downloaded from [www.ampl.com](http://www.ampl.com). However since AMPL files are ASCII (text) files, there is no need for you to download the software especially since we will be using the NEOS nonlinear solvers. Some basic knowledge of Matlab is useful for the class but not a requisite.

### **Grading**

There will be an in-class midterm examination, and a take-home final. Each exam will be worth 25% of the grade. The midterm exam will be open book, open notes. Homeworks will be assigned regularly. In addition students will have to complete two projects. These projects will involve solving via a variety of nonlinear optimization algorithms, using AMPL as the modeling language. The homeworks will make up 20% of the grade and the two projects will make up 30% of the grade. In computing the final grade, the lowest homework grade will be dropped.

Students in the OR 750 will be assigned additional in-depth work on top of the OR 644 requirements.

### **Homeworks**

All homeworks and projects will be posted to the class through the Blackboard system

### **Exam Dates**

Midterm: Wednesday, October 21,

Final exam due: Wednesday December 16, 4:30 pm

## **Course Policies**

- Make-up exams will only be given for extreme situations, and only if I am contacted before the exam is given and full arrangements are established. Full adherence to this policy is the responsibility of the student.
- The exam dates above are tentative, and it is the students responsibility to keep abreast of changes.
- Homework will be assigned each class, and usually collected. All work must be clearly written. Illegible work will not be accepted.
- There will be a penalty of 10% of the total grade for every day the homework is late.

## **University Policies**

### **Honor Code:**

GMU is an Honor Code university; please see the Office for Academic Integrity for a full description of the code and the honor committee process. The principle of academic integrity is taken very seriously and violations are treated gravely. What does academic integrity mean in this course? Essentially this: when you are responsible for a task, you will perform that task. When you rely on someone else's work in an aspect of the performance of that task, you will give full credit in the proper, accepted form. Another aspect of academic integrity is the free play of ideas. Vigorous discussion and debate are encouraged in this course, with the firm expectation that all aspects of the class will be conducted with civility and respect for differing ideas, perspectives, and traditions. When in doubt (of any kind) please ask for guidance and clarification.

### **Disability Accommodations:**

If you have a learning or physical difference that may affect your academic work, you will need to furnish appropriate documentation to the Office of Disability Services. If you qualify for accommodation, the ODS staff will give you a form detailing appropriate accommodations for your instructor. In addition to providing your professors with the appropriate form, please take the initiative to discuss accommodation with them at the beginning of the semester and as needed during the term. Because of the range of learning differences, faculty members need to learn from you the most effective ways to assist you. If you have contacted the Office of Disability Services and are waiting to hear from a counselor, please tell me.

### **Email:**

Students must use their MasonLive email account to receive important University information, including messages related to this class. See <http://masonlive.gmu.edu> for more information. You will need an email account to get all notices that are posted on [mymason.gmu.edu](http://mymason.gmu.edu) (Blackboard).