Math 524 University of South Carolina
D. Meade Fall 1998

Math 524 – Nonlinear Optimization

Instructor Professor Doug Meade

Office LeConte College 300E

Phone 777-6183

E-mail `meade@math.sc.edu`

WWW URL `http://www.math.sc.edu/~meade/math524/`

Meeting Times MWF 9:05am– 9:55am, LeConte College 401

Office Hours MW 11:00–12:00, 4:00–5:00 and by *prior* appointment

Text Peressini, Sullivan, Uhl, *The Mathematics of Nonlinear Programming*, Springer-Verlag, 1988.

Prerequisite Completion of Math 526 or 544 with a grade of C or better; or consent of the Mathematics Department.

Overview The basic problem that is addressed in any course in nonlinear programming is to find the optimal (maximum or minimum) values of a nonlinear function on a prescribed domain. ("Program" is a synonym for "problem" that gained popularity during World War II.)

Our investigation of these problems will make use of your background in Calculus and Linear Algebra. In particular, we will generalize the First and Second Derivative Tests for local and global extrema for functions of n variables. (This is the material in Chapter 1.)

The second major topic is convexity. You may know the difference between a convex lens and a concave lens. The mathematical usage of "convex" is similar. Once we become familiar with convex functions, we will develop techniques for solving optimization problems that involve convex functions.

To complement the direct algorithms discussed in Chapters 1 and 2, several iterative methods for the solution of optimization problems are presented in Chapter 3. For example, recall that Newton's Method can be used to find the zero of a function. We will develop a version of Newton's Method for functions of n variables and then see how this can be applied to find extrema of a function.

A common problem that is encountered in scientific, statistical, and business applications is to make predictions from a collection of data. If we knew the function that produced the data, the prediction would be available. The problem of finding the "best" function that is consistent with the data is a nonlinear optimization problem. The solution methods developed in Chapter 4 will be developed on a combination of ideas from geometry and linear algebra.

Course Content The majority of the semester will be spent understanding the first four chapters of the text. Additional material will be included as time permits.

Grading our grade in this course will be based on your performance on homework assignments, 2 mid-term exams, and a final exam. The weights assigned to each of these components will be:

Homework	25%
Mid-term exams (2)	50%
Final exam	25%

Course grades will be determined according to the following scale:

A	90 –100
B	80 – 89
C	70 – 79
D	60 – 69
F	0 – 59

Note that the deadline to drop this course with a grade of W is Thursday, October 1, 1998.

Exams The two (2) mid-term exams will be given in class. *Tentative* dates for these exams are:

Friday, September 25
Monday, November 23

Make-up exams will be given only for documented reasons of illness, family emergency or participation in a University sponsored event. Excuses such as oversleeping, forgetting the time or location of the exam, and lack of studying are explicitly noted as unacceptable grounds for the administration of a make-up exam.

A comprehensive final will be given at 9:00A.M. on Saturday, December 12, 1998.

Homework Assigned problems will be collected weekly, typically on Monday. Homework will be graded and returned as quickly as possible. Your homework grade will be determined by your nine (9) highest homework scores. *No late homework will be accepted.*

Study Hints Before each class, you should both review the material from recent sections and read the section to be discussed that day. This will allow you to both understand and participate in the presentation of new material and identify questions that you need to resolve before completing the homework.

Attendance Regular class attendance is important. Consistent with the USC Undergraduate Bulletin, a grade penalty may be applied to any student missing more than five classes (10%) during the semester.

Academic Honesty Cheating and plagiarism will not be tolerated in this course. You may discuss homework problems with others, but do not copy solutions from another student or from a book. Violations of this policy will be dealt with in a matter consistent with University guidelines.