COMPUTER SCIENCES DEPARTMENT
UNIVERSITY OF WISCONSIN-MADISON
SPRING SEMESTER 2002

COURSE NO.	COURSE TITLE	INSTRUCTOR
CS/IE 730	Nonlinear Programming Algorithms	O. L. Mangasarian
3 credits	Section Lecture 1	Office: Room 6393
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COURSE DESCRIPTION

This course will emphasize computer-oriented algorithms for optimization problems in finite dimensional spaces. Approximately 10 algorithms will be covered. Typically each algorithm will be presented as follows:

1. Precise statement of problem and assumptions
2. Convergence theorem and proof
3. Convergence rate (if available) and proof
4. Special features, such as quadratic termination

Some proofs will be omitted because of time limitation. The following algorithms will be covered:

1. One Dimensional Optimization

(a) Golden section and Fibonacci search
(b) Newton and secant methods
(c) Armijo's method

2. Unconstrained Optimization

(a) Gradient methods (linear convergence)
(b) Newton methods (quadratic convergence)
(c) Conjugate gradient methods (n-step superlinear convergence and quadratic termination)

(d) Quasi-Newton methods (superlinear convergence and quadratic termination)

3. Constrained Optimization

(a) Asymptotic penalty methods

(b) Exact penalty methods

(c) Augmented Lagrangian methods

(d) Sequential quadratic programming methods

(e) Gradient projection methods

LECTURES

Two 1.25-hour lectures per week.

WRITTEN ASSIGNMENTS

Approximately 6 homework assignments.

One programming project and one open-book final exam.

GRADING SYSTEM Approximately as follows:

Homework	30%
Project	30%
Exam	40%

TEXTBOOK

None required. Occasional reference will be made to:

1. M. S. Bazaraa, H. D. Sherali & C. M. Shetty: "Nonlinear Programming Theory and Algorithms", Second Edition, Wiley, New York, 1993.

2. D. P. Bertsekas: "Nonlinear Programming", Second Edition, Athena Scientific, Belmont, MA 1999.

3. J. Nocedal and S. J. Wright: "Numerical Optimization", Springer, New York, 1999.

4. G. P. McCormick: "Nonlinear Programming Theory Algorithms and Applications", Wiley, New York, 1983.

5. B. T. Polyak: "Introduction to optimization", Optimization Software, Inc., New York, 1987.

PREREQUISITES

Advanced calculus and familiarity with MATLAB or some programming language such as C, or consent of instructor.