CMSC 691 (Fall 2016)
Optimization
Syllabus

Catalog listing: CMSC 691
Course Level: Graduate
Prerequisites: CMSC 501 and background in linear algebra, or permission of instructor; graduate standing in computer science or acceptance into accelerated B.S. to M.S. program in computer science.
Instructor: Dr. Sevag Gharibian

Office: E4240
Phone: 804-828-0407
Email: sgharibian@vcu.edu
Classroom: Engineering West Hall 105
Class website:
http://www.people.vcu.edu/~sgharibian/courses/CMSC691/2016/CMSC691.html

Office Hours: TR 11:30-12:30

1.0 – Overview (Catalog Course Description):

NOTE: Non-CS majors are generally welcome to enroll if they have relevant background, but they will require permission from instructor to enroll.

Semester course; 3 lecture hours. 3 credits. Prerequisites: CMSC 501 or permission of instructor, Linear Algebra; graduate standing in computer science or acceptance into accelerated B.S. to M.S. program in computer science. Convex sets and functions. Convex optimization problems: Linear, quadratic, semidefinite, and cone programs. Duality theory. Approximation algorithms for NP-complete integer optimization problems via semi-definite relaxations and rounding schemes. Algorithms for optimization, such as gradient descent, Newton's method, interior point methods.

2.0 – Course Structure:

Lecture hours/week – 3

3.0 – Course Goals

Upon successful completion of this course, the student will be able to:

- Understand the basic mathematical theory of convex sets and functions
- Formulate convex optimization problems, such as linear programs, semidefinite programs, and conic programs.
- Apply linear and semi-definite relaxations to approximately solve NP-hard problems.
- Discuss algorithms for solving convex optimization problems.

4.0 – ABET Criteria Addressed:

a. An ability to apply knowledge of computing and mathematics appropriate to the program's student outcomes and to the discipline.

b. An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.

c. Recognition of the need for and an ability to engage in continuing professional development

5.0 – Major Topics Covered:

- Convex sets and functions; definitions, generalized inequalities, separating/supporting hyperplanes, dual cones.
- Convex optimization problems; linear programs, semidefinite programs, cone programs.
- Duality; Lagrange multipliers, weak/strong duality, optimality conditions.
- Approximate solutions to NP-complete problems; LP/SDP relaxations, sum of squares techniques, primal-dual algorithms.
- Algorithms for optimization; gradient descent, Newton's method, interior point methods.

6.0 – Textbook(s):

- Convex Optimization, Boyd and Vandenberghe, available online at http://stanford.edu/~boyd/cvxbook/.

7.0 – Class Schedule:

- Lecture: TR 12:30 pm – 1:45 pm, Engineering West Hall, Room 105

8.0 – Evaluation:

General Instructions:

Attendance policy:

I do not plan to associate grades with whether or not you attend class, unless a serious problem with attendance develops.

The grading scheme is below:

Grading:

Category	**% weight**
Problem sets	83.3%
Project	16.7%

Grading scheme:

A: >= 85%
B: >= 75% and < 85%
C: >= 65% and < 75%
D: >= 50% and < 65%
F: < 50%

Late Assignments

Collaboration and Cheating Policy:

Collaboration:
Collaboration on homework assignments and projects is encouraged. However, do *not* simply copy one another's work. Rather, feel free to brainstorm and discuss general ideas for solutions together. Then, individually write up your own solution in your own private time.

Citations:
You must cite your collaborators at the start of your assignment or project. For example, if collaborating with Tina Turner, write "Note: I completed this assignment in collaboration with Tina Turner" at the start of your assignment.

***Online Sources and Cheating**:*

1) The use of online sources which explicitly give solutions to the exact problems on assignments is strictly **forbidden**. You may of course reference online material for learning purposes and to see how *similar* examples might be solved. **All online sources from which solution ideas are gleaned must be cited on your assignment.**

2) Cheating is generally the act of taking credit for work you did not complete yourself. For example, if you collaborate with Angela Merkel and copy her solution rather than working through it yourself, then this constitutes cheating. Similarly, if you copy work from any source without citing it, this also constitutes cheating. Taking credit for work which is not your own is a **very serious offence** when it comes to writing research papers in academia – it can even ruin your career. The rule of thumb for assignments in this course is never to copy solutions, but rather to work through problems (possibly collaboratively) and to phrase your final answer in your own words.

   Cheating offenses are taken seriously. A first offense will result in a grade of 0 on the respective assignment or project and a warning. A second offence will result in a grade of F in the course.
