Principles of Optimization – Spring 2018

This syllabus is subject to change at the discretion of the instructor.

Course:	Math 364 (3 credits)
Website:	http://www.math.wsu.edu/faculty/tasaki/...
Times:	Tu/Th 9:10–10:25
Location:	Wilson 6
Instructor:	Tom Asaki (tasaki@wsu.edu), Neill 228
Office Hours:	T W Th, 11:30-12:30; and by appointment
Text:	*The Basics of Practical Optimization* by Adam Levy

Description

In this course, we will learn the optimization techniques used to model and solve problems from various disciplines such as business, engineering, sciences, sports, etc. In this course students will be introduced to optimization methods for linear, nonlinear, and integer programming. We will emphasize techniques that expand your understanding of Linear Algebra and Calculus concepts as well as how to formulate a model; interpret problems mathematically and geometrically; solution techniques in cases where Calculus cannot be used. We will also emphasize the theory behind solution techniques; sensitivity analysis; and how to use Octave/Matlab to solve problems.

Course Goals

In this course, you will achieve the following:

- Be able to model real-world decision-making as mathematical optimization problems.
- Strengthen your understanding of mathematical tools from Calculus & Linear Algebra.
- Be able to use software solvers.
- Develop geometric intuition for mathematical models.
- Strengthen your mathematical discourse: become more conversant with optimization language, improve collaboration skills, improve mathematical writing skills.

Topics

We will cover some (possibly all) of the following optimization topics. The particular topics covered on any day will vary depending on progress through the material and student interests and needs.

- Syntax & language of optimization
- Philosophy of Optimization
- Building Mathematical models

- Linear Programming
- Techniques in nonlinear optimization
- Convergence of solution method
- Constrained and unconstrained optimization
- Integer Programming
- Simplex Method
- Sensitivity Analysis

Requirements for Success

In-Class Participation. In-class participation will be an important part of your learning in this course. We will work through problems to better understand how to create mathematical models, how to solve optimization problems, and how to create these solution paths. Because these interactions are key to learning optimization, participation will be 20% of your grade. This means that attendance is required. For each missed class 3% of your attendance grade will be automatically deducted.

Homework. Homework will be assigned weekly. This homework will help prepare you for class time as well as give you practice of necessary skills to move forward in your understanding. Because of this, late homework will not be accepted. You may not collaborate with students from LCSC nor should you use any resources besides me, the math learning center, your book, and your immediate classmates to do these problems. It will be considered academic dishonesty to go against this last rule. Your graded homework will be 30% of your grade.

Project. Optimization is most useful when you can apply it to real-world problems. It is also very interesting when investigating new optimization strategies and theories. In this class you will have the opportunity to collaborate on a group project (including student collaborators from LCSC) that interests you. This project will give you the opportunity to strengthen your mathematical discourse. The grade for this project will be broken into two parts: Project design and project write-up.

You will write a project proposal discussing the problem to be addressed and your plan. A rubric for your proposal will be discussed later.

Your project write-up will discuss the project design and your results. A rubric for your write-up will be discussed later.

Both parts are required to be written in LaTeX.

Required Problems

To be sure you have gained the necessary understanding from this class, you will be required to write good solutions for each of the required problems. You will receive a "good" or "not good" rating for each of these problems. You can resubmit corrections to any problems

labeled "not good" as many times as needed. If any of your problems received a "not good" rating twice, you must see me to discuss the problem before resubmitting. Your grade, as described under the evaluation scale, will be weighted according to the number of "good" problems that you have completed by the end of the semester, as follows.

You will be given 30 required problems. Your required problem weight (RPW) will be $\frac{1.1N}{30}$, where N is the number of "good" problems that you complete. Your final grade will be the product of RPW and your total percentage earned through participation, graded homework, and your project. That is, your final grade (G) will be

$$G = \frac{1.1N}{30} \cdot (H + D + W + P),$$

where N is the number of "good" required problems completed, H is your homework percent, D is your project design percent, W is your project write-up percent, and P is your participation percent.

Solutions to the required problems are due at the beginning of the last class period. You can always turn in solutions early. It is important for you to complete solutions and submit them in a timely manner. If you (and your classmates) turn in many problems within a few days of the due date, I will not have adequate time to provide feedback and you run the very great risk of receiving many "not good" evaluations, seriously impacting your grade.

Most, if not all, students are surprised by my required-problem grading standards and will need at least a second chance to meet these standards. A good solution includes the full problem statement, details all steps taken, provides explanations, clearly indicates an answer, uses proper mathematical language, and is legible. Your goal is to convince me that you know what you are doing.

Evaluation Scale

Homework	30%
Project Design	30%
Project Write-up	20%
Participation	20%
Required Problems	*

Grade	Class Percent Range
A	90-100%
B	80-89%
C	70-79%
D	60-69%
F	0-59%

It is possible to also receive a grade with a "+" or a "−" attached to it. Because some professors do not use them and others do, I will only use them if your class percentage is borderline and I feel your work shows enthusiasm toward learning. For example, if your class percentage is say 89% and you show enthusiasm for learning (not just mimicking methods, but truly learning), then I'm likely to give you an A- instead of a B. Another example is

if your class percentage is say 82% and you have shown very little willingness to think for yourself, then you will likely earn a B-. Note: these are only an examples and all results are dependent on individual personalities and work. The best way to be sure you are showing me that you want to learn and think, is to communicate with me. In the end, I may not use "+" or "−" at all.

WSU Reasonable Accomodation

Students with Disabilities: Reasonable accommodations are available for students with a documented disability. If you have a disability and need accommodations to fully participate in this class, please either visit or call the Access Center to schedule an appointment with an Access Advisor. All accommodations MUST be approved through the Access Center.

Academic Integrity

Academic integrity is the cornerstone of higher education. As such, all members of the university community share responsibility for maintaining and promoting the principles of integrity in all activities, including academic integrity and honest scholarship. Academic integrity will be strongly enforced in this course. Students who violate WSUs Academic Integrity Policy (identified in Washington Administrative Code (WAC) 504-26-010(3) and -404) will receive a failing grade on any relevant assignment (and possbily for the course), will not have the option to withdraw from the course pending an appeal, and will be reported to the Office of Student Conduct.

Cheating includes, but is not limited to, plagiarism and unauthorized collaboration as defined in the Standards of Conduct for Students, WAC 504-26-010(3). You need to read and understand all of the definitions of cheating. If you have any questions about what is and is not allowed in this course, you should ask course instructors before proceeding.

If you wish to appeal a faculty member's decision relating to academic integrity, please use the form available at conduct.wsu.edu.

Safety and Emergency

Classroom and campus safety are of paramount importance at Washington State University, and are the shared responsibility of the entire campus population. WSU urges students to follow the "Alert, Assess, Act," protocol for all types of emergencies and the "Run, Hide, Fight" response for an active shooter incident. Remain ALERT (through direct observation or emergency notification), ASSESS your specific situation, and ACT in the most appropriate way to assure your own safety (and the safety of others if you are able).

Please sign up for emergency alerts on your account at MyWSU. For more information on this subject, campus safety, and related topics, please view the FBIs Run, Hide, Fight video and visit the WSU safety portal.