

ECE 490: Introduction to Optimization

Instructor: Bin Hu

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Office Hours: T/Th 3-4pm

Office: CSL 145

Class Hours: T/Th 11am-12:20pm

Class Room: 2017 ECEB

TA: Parisa Karimi

TA's Office Hours: T/Th 9-10am 5034/4034 ECEB

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Course Description

Basic theory and methods for the solution of optimization problems; iterative techniques for unconstrained minimization including gradient descent method, Nesterov's accelerated method, and Newton's method; convergence rate analysis via dissipation inequalities; constrained optimization algorithms including penalty function methods, primal and dual methods, penalty and barrier method; Lagrangian multiplier theory; duality theory

Required Materials

There is no required textbook for the class. All course material will be presented in class and/or provided online as notes. The following resources may be used as references.

- D. Bertsekas. Nonlinear Programming, Athena Scientific, 2016.
- J. Nocedal, S. Wright. Numerical Optimization, Springer, 2006.
- S. Bubeck. Convex Optimization: Algorithms and Complexity, 2015.
- Prof. Srikant's notes: <https://sites.google.com/site/ece490spring2017/lecture-notes>

Prerequisites

Basic knowledge of linear algebra and basic programming skills are required (ECE 190 and MATH 415). Also note that this class will require you to write rigorous mathematical proofs.

Grading

- Homework: There are roughly biweekly homework assignments (about 7 total). Homework will be due on at the end of the lecture that is given a week later. In-class and after-class discussions are strongly encouraged. However, copying of others' homework is not allowed. Homework problems will include mathematical derivations as well as coding tasks. Late homework will not be accepted, unless there is a valid reason. Examples of valid reasons include illnesses, job interviews and travel to conferences to present research papers. In all such cases, you have to provide proof that you missed the homework deadline for a valid reason.
- Two Midterm Exams: There will be two in-class midterm exams; in roughly the 6th and 12th week, respectively. In both midterms, you are allowed to use notes handwritten on one 8.5"x11" sheet of paper (you can write on the front and back of the paper).
- Final Exam: There will be one final exam that will be comprehensive. You are allowed to use notes handwritten on three 8.5"x11" sheet of paper (you can write on the front and back of the paper).
- Grades for the students in Section P3 (3 credits) will be weighted as follows: Homework (35%), two midterm exam (20% each), and Final Exam (25%).
- Grades for the students in Section P4 (4 credits) will be weighted as follows: Homework (28%), two midterm exam (15% each), Final Exam (20%), and Final Project (22%).
- Final Project: The students in Section P4 (4 credits) are required to work independently on an optimization project and submit a final report. One may use techniques developed in this course but are also encouraged to learn and apply new techniques. For example, one can use the dissipation inequality technique developed in the course to investigate the performance of an optimization algorithm that is not covered in the course. We will provide candidate algorithms for you to investigate. You can also explore other ideas you have. More details will be given later in the semester.
- Bonus points: You will earn bonus points if you solve bonus problems in the homework. When working on bonus problems, one has to be completely independent!

Disability Accommodations

To determine if you qualify for disability-related academic adjustments and/or auxiliary aids, students with disabilities must contact the course instructor and the Disability Resources and Educational Services (DRES) as soon as possible. To contract DRES, you may visit 1207 S. Oak St., Champaign, call 333-4603 (V/TTY), or email a message to disability@uiuc.edu.

Other Policies

- There is zero tolerance on academic misconduct. Individuals suspected of committing academic dishonesty will be directed to the Dean of Students Office as per University policy. **Penalty for academic misconduct** (up to 100%).

- We expect you to conduct yourselves in accordance with the University's Student Code. <http://studentcode.illinois.edu/>
- Emergencies can happen anywhere and at any time, so it's important that we take a minute to prepare for a situation in which our safety could depend on our ability to react quickly. Take a moment to learn the different ways to leave this building. If there's ever a fire alarm or something like that, you'll know how to get out and you'll be able to help others get out. Next, figure out the best place to go in case of severe weather - we'll need to go to a low-level in the middle of the building, away from windows. And finally, if there's ever someone trying to hurt us, our best option is to run out of the building. If we cannot do that safely, we'll want to hide somewhere we can't be seen, and we'll have to lock or barricade the door if possible and be as quiet as we can. We will not leave that safe area until we get an Illini-Alert confirming that it's safe to do so. If we can't run or hide, we'll fight back with whatever we can get our hands on. If you want to better prepare yourself for any of these situations, visit police.illinois.edu/safe. Remember you can sign up for emergency text messages at emergency.illinois.edu.

Run > Hide > Fight

Emergencies can happen anywhere and at any time. It is important that we take a minute to prepare for a situation in which our safety or even our lives could depend on our ability to react quickly. When we're faced with almost any kind of emergency – like severe weather or if someone is trying to hurt you – we have three options: Run, hide or fight.



Run

Leaving the area quickly is the best option if it is safe to do so.

- ▶ Take time now to learn the different ways to leave your building.
- ▶ Leave personal items behind.
- ▶ Assist those who need help, but consider whether doing so puts yourself at risk.
- ▶ Alert authorities of the emergency when it is safe to do so.



Hide

When you can't or don't want to run, take shelter indoors.

- ▶ Take time now to learn different ways to seek shelter in your building.
- ▶ If severe weather is imminent, go to the nearest indoor storm refuge area.
- ▶ If someone is trying to hurt you and you can't evacuate, get to a place where you can't be seen, lock or barricade your area if possible, silence your phone, don't make any noise and don't come out until you receive an Illini-Alert indicating it is safe to do so.



Fight

As a last resort, you may need to fight to increase your chances of survival.

- ▶ Think about what kind of common items are in your area which you can use to defend yourself.
- ▶ Team up with others to fight if the situation allows.
- ▶ Mentally prepare yourself – you may be in a fight for your life.

Please be aware of people with disabilities who may need additional assistance in emergency situations.

Other resources

- ▶ police.illinois.edu/safe for more information on how to prepare for emergencies, including how to run, hide or fight and building floor plans that can show you safe areas.
- ▶ emergency.illinois.edu to sign up for Illini-Alert text messages.
- ▶ **Follow the University of Illinois Police Department** on Twitter and Facebook to get regular updates about campus safety.