

Syllabus

Term 2 Winter 2021: 11 Jan 11 - 24 Feb (no class on 2/15 or 2/17)

Course info

Instructor:

Daniel J. McDonald
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Website: <https://dajmcdon.github.io/>
Email: daniel@stat.ubc.ca

Office hours:

TBA

Course webpage:

WWW: <https://ubc-stat.github.io/stat-535-convexoptim/>

Lectures:

Mon/Wed 13:30 - 15:00 UTC-7 Vancouver local time on Zoom (link in Canvas)

Textbooks:

Convex Optimization, Boyd and Vandenberghe, 2004, Cambridge University Press.

Prerequisites:

STAT 560, 561, and 547c (lightly enforced)

Course content

This course focuses on algorithms for solving convex optimization problems and the implications for statistical estimation.

Necessary background:

linear algebra (vectors, matrices, inverse, eigenvalues/decompositions, positive (semi)definiteness)
multivariable calculus (gradient, hessian)

undergraduate statistics (basic estimation and inference, linear regression, probability theory)

R/Python (loops and flow control, functions)

Topics:

1. convex sets and functions
2. canonical problems
3. first order numeric optimization
4. Duality and KKT conditions
5. Glimpse of 0th/2nd order methods
6. Coordinate descent, ADMM
7. Path algorithms and regularized statistical models

Lectures and homeworks will focus on both mathematical understanding and coding techniques.

Course assessment opportunities

In-class activities max, 20 points

Little quiz, 5 points

2 Homework assignments, 40 points

Project, 30 points (+ 5 bonus in rare cases)

The maximum score is 95 unless you achieve the bonus.

Lectures and In-class activities

Lectures will be live on Zoom (see Canvas for the link). Each period will consist of ~50 minutes of lecture and ~30 minutes of group activities (in random break out rooms). Group activities are intended to help you learn better through discussion and also to give you a chance to interact with other students. Each group activity will be worth 1-4 points. You can accumulate up to 20 points for completing these.

Little quiz

On February 22 (at the beginning of class) there will be a little quiz. It will be entirely multiple choice and T/F. You will have 30 minutes to take it.

Homework assignments

There will be 2 individual homework assignments. The first is due at the end of the 3rd week (January 31 23:59) and the second is due at the end of the 5th week (February 12). Each is worth 20 points. You will have up to 1 week to complete

any requested revisions. Initial submissions will receive 5/10/15/20 points with revisions allowing you to get back 80% of missed credit. Late submissions will receive $\text{score} * (.8)^n$ where n is the number of days late unless I am notified in advance of the due date and approve the reason for the delay.

Group/individual project

There will be a project. You may choose to complete it in a group of your choosing or individually. The group can contain at most 4 individuals. The group project will have 2 checkpoints on 22 January and 24 February with a short presentation on 24 February.

Important considerations

University policies UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious, spiritual and cultural observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions. Details of the policies and how to access support are available [here](#).

Academic honesty and standards UBC Vancouver Statement

Academic honesty is essential to the continued functioning of the University of British Columbia as an institution of higher learning and research. All UBC students are expected to behave as honest and responsible members of an academic community. Breach of those expectations or failure to follow the appropriate policies, principles, rules, and guidelines of the University with respect to academic honesty may result in disciplinary action.

For the full statement, please see the 2020/21 Vancouver Academic Calendar

Course specific

Several commercial services have approached students regarding selling class notes/study guides to their classmates. Please be advised that selling a faculty member's notes/study guides individually or on behalf of one of these services using UBC email or Canvas, violates both UBC information technology and UBC intellectual property policy. Selling the faculty member's notes/study guides to fellow students in this course is not permitted. Violations of this policy will be considered violations of UBC Academic Honesty and Standards and will be

reported to the Dean of Science as a violation of course rules. Sanctions for academic misconduct may include a failing grade on the assignment for which the notes/study guides are being sold, a reduction in your final course grade, a failing grade in the course, among other possibilities. Similarly, contracting with any service that results in an individual other than the enrolled student providing assistance on quizzes or exams or posing as an enrolled student is considered a violation of UBC's academic honesty standards.

Some of the problems that are assigned are similar or identical to those assigned in previous years by me or other instructors for this or other courses. Using proofs or code from anywhere other than the textbooks (with attribution), this year's course notes (with attribution), or the course website is not only considered cheating (as described above), it is easily detectable cheating. Such behavior is strictly forbidden.

Academic Concessions These are handled according to UBC policy. Please see * UBC student services * UBC Vancouver Academic Calendar * Faculty of Science Concessions

Censorship During this pandemic, the shift to online learning has greatly altered teaching and studying at UBC, including changes to health and safety considerations. Keep in mind that some UBC courses might cover topics that are censored or considered illegal by non-Canadian governments. This may include, but is not limited to, human rights, representative government, defamation, obscenity, gender or sexuality, and historical or current geopolitical controversies. If you are a student living abroad, you will be subject to the laws of your local jurisdiction, and your local authorities might limit your access to course material or take punitive action against you. UBC is strongly committed to academic freedom, but has no control over foreign authorities (please visit this link for an articulation of the values of the University conveyed in the Senate Statement on Academic Freedom). Thus, we recognize that students will have legitimate reason to exercise caution in studying certain subjects. If you have concerns regarding your personal situation, consider postponing taking a course with manifest risks, until you are back on campus or reach out to your academic advisor to find substitute courses. For further information and support, please visit this link.

Take care of yourself Course work at this level can be intense, and I encourage you to take care of yourself. Do your best to maintain a healthy lifestyle this semester by eating well, exercising, avoiding drugs and alcohol, getting enough sleep and taking some time to relax. This will help you achieve your goals and cope with stress. I struggle with these issues too, and I try hard to set aside time for things that make me happy (cooking, playing/listening to music, exercise, going for walks).

All of us benefit from support during times of struggle. If you are having any problems or concerns, do not hesitate to speak with me. There are also many resources available on campus that can provide help and support. Asking for support sooner rather than later is almost always a good idea.

If you or anyone you know experiences any academic stress, difficult life events, or feelings like anxiety or depression, I strongly encourage you to seek support. UBC Counseling Services is here to help: call 604 822 3811 or visit their website. Consider also reaching out to a friend, faculty member, or family member you trust to help get you the support you need.

A dated PDF is available at [this link](#).