

DEPARTMENT OF MATHEMATICS, UNIVERSITY OF UTAH
Advanced Optimization
MATH 6880-004, 7875-017 – Spring 2022
Course Information and Syllabus
Updated January 4, 2022

Instructor: Akil Narayan
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Office: WEB 4666, LCB 116

Office hours: TBA
Office hours location: WEB 4666 and virtual

Class type: In Person

Class time and location: TTh, 3:40am-5:00pm, AEB 360

Attendance policy: Attendance is not required, but all course content will be delivered during class time, so I strongly recommend that you attend the classes.

Section webpage: <http://www.sci.utah.edu/~akil/math6880>

Course Information: This is a 3-credit course.

Learning objectives: Upon successful completion of this course, a student should be able to:

- understand, articulate, and identify various types of optimization problems
- formulate first- and second-descent-type algorithms
- understand optimization algorithms for convex problems at a high level
- recognize optimization examples in statistics, scientific computing, and data analysis

Prerequisites: There are no formal prerequisites, but I'll assume a solid foundation in linear algebra, probability/statistics, and basic optimization principles and algorithms at the beginning graduate level. E.g., much of this is covered in MATH 5770/6640.

Course description: Descent-based methods: quasi-Newton, stochastic, and accelerated variants; regularization, relaxation, and alternation in optimization; convex feasibility and best approximation; non-negative/bounded-variable least squares and matrix factorization; convex optimization: duality, subgradients, interior point methods, linear, quadratic, and conic programming.

Text: None. I will point to various texts and papers throughout the course for further reading and more detailed explanation.

Class meetings: This class meets in person twice per week. Class meetings will primarily be lecture-based, which will include a discussion of theory and practice examples.

Homework: There are no homework assignments for this course.

Exams: There are no exams for this course.

Final project: This course has a single end-of-semester project. Students can choose between the following options that culminate with a 20-minute presentation near the end of the semester: (a) Present work on a research project involving optimization, discussing theoretical and algorithmic considerations. (b) Present a research paper in optimization theory or algorithms. In either case, topics for presentation should be made in consultation with the instructor.

Grading: Grading for this course is based entirely on the project presentation.

Important dates:

Jan 21	Last day to add, drop, elect CR/NC or audit classes
Mar 4	Last day to withdraw from classes
Apr 22	Last day to reverse CR/NC option
Apr 27	Reading Day

Class communication: An email list is set up with which I shall send out information not communicated during class. This email list will also be used to communicate class information in the case of unusual circumstances affecting the the logistics of the class. If you are not officially registered for the class but wish to be on the roster, please discuss it with me.

If you are registered for the course, but do not receive the course email announcements to your University of Utah email address, please notify me immediately. You can forward your Utah emails to other email addresses. (Navigate to <http://www.cis.utah.edu>, login, and change your UMail settings.)

The section website will be used to communicate any materials for the class (e.g. lecture slides, extra resources, etc.).

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to change that may be necessitated by a revised semester calendar or other circumstances. The above two methods, in addition to the coursewide website, are reliable means of getting information about changes to the course.

Communication with the instructor: The most reliable and preferred means of contacting me is via email. One-on-one meetings can also be set up with me outside of office hours; please set up such meetings with me via email.

COVID-19 considerations: All class activities will take place in person. Except in cases of ADA accommodations or quarantining due to COVID-19 exposure or infection, you will be expected to attend class in person. University leadership urges all faculty, students, and staff to model the vaccination, testing, and masking behaviors we want to see in our campus community. These include:

Vaccination: Get a COVID-19 vaccination and the booster shot recommended for pairing with your vaccine if you have not already done so. Vaccination is proving highly effective in preventing severe COVID-19 symptoms, hospitalization and death from coronavirus. Vaccination is the single best way to stop this COVID resurgence in its tracks. University of Utah students are required (as of August 27, 2021) to complete a cycle of COVID-19 vaccination and booster shot with an approved vaccine, or complete an exemption form. The university provides three convenient vaccination options:

- Attend one of the regularly scheduled vaccine events at the Student Union on campus (<https://www.cns-cares.org/covid19>).
- Schedule an appointment with Student Health (<https://utah.medicatconnect.com/login.aspx>).
- Visit <http://mychart.med.utah.edu>, <http://alert.utah.edu/covid/vaccine>, or <http://vaccines.gov> to schedule your vaccination.

Masking: While masks are no longer required outside of Health Sciences facilities, on UTA buses or campus shuttles, CDC guidelines now call for everyone to wear face masks indoors.

- Check the CDC website periodically for masking updates (<https://www.cdc.gov/coronavirus/2019-ncov/vaccines/fully-vaccinated-guidance.html>). With high transmission rates in Salt Lake County, the CDC recommends: “Everyone should wear a mask in public indoor settings”.
- Treat masks like seasonal clothing (i.e., during community surges in COVID transmission, they should be worn indoors and in close groups outside).
- In cases of classroom exposure, masks should be worn for the quarantine period (see details below).

Testing: If you are not yet vaccinated, get weekly asymptomatic coronavirus tests. This is a helpful way to protect yourself and those around you because asymptomatic individuals can unknowingly spread the coronavirus to others. Asymptomatic testing centers are open and convenient:

- Online scheduling (<https://alert.utah.edu/covid/testing/>)
- Saliva test (no nasal swabs)
- Free to all students returning to campus (required for students in University housing)
- Results often within 24 hours
- Visit <https://alert.utah.edu/covid/testing/>

Self-reporting: All of us, including faculty, students, and staff, must self-report if we test positive for COVID-19 via this website: <https://coronavirus.utah.edu>.

Student responsibilities and integrity: All students are expected to maintain professional behavior in the classroom setting, according to the Student Code, spelled out in the Student Handbook. Students have specific rights in the classroom as detailed in Article III of the Code. The Code also specifies proscribed conduct (Article XI) that involves cheating on tests, plagiarism, and/or collusion, as well as fraud, theft, etc. Students should read the Code carefully and know they are responsible for the content. According to Faculty Rules and Regulations, it is the faculty responsibility to enforce responsible classroom behaviors, and I will do so, beginning with verbal warnings and progressing to dismissal from and class and a failing grade. Students have the right to appeal such action to the Student Behavior Committee.

<http://regulations.utah.edu/academics/6-400.php>

Inclusivity: It is my intent that students from all diverse backgrounds and perspectives be well served by this course, that students’ learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is my intent to present materials and activities that are respectful of diversity: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. Your suggestions are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups. In addition, if any of our class meetings conflict with your religious events, please let me know so that we can make arrangements for you.

Discrimination and Harassment: If you or someone you know has been harassed or assaulted, you are encouraged to report it to the Title IX Coordinator in the Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801-581-8365, or Office of the Dean

of Students, 270 Union Building, 801-581-7066. To report to the police, contact the Department of Public Safety, 801-585-2677(COPS). Please see Student Bill of Rights, section E <http://regulations.utah.edu/academics/6-400.php>. I will listen and believe you if someone is threatening you.

Names/Pronouns: Canvas allows students to change the name that is displayed AND allows them to add their pronouns to their Canvas name. Class rosters are provided to the instructor with the student's legal name as well as "Preferred first name" (if previously entered by you in the Student Profile section of your CIS account, which managed can be managed at any time). While CIS refers to this as merely a preference, I will honor you by referring to you with the name and pronoun that feels best for you in class or on assignments. Please advise me of any name or pronoun changes so I can help create a learning environment in which you, your name, and your pronoun are respected. If you need any assistance or support, please reach out to the LGBT Resource Center: https://lgbt.utah.edu/campus/faculty_resources.php

English Language Learners: If you are an English language learner, please be aware of several resources on campus that will support you with your language and writing development. These resources include: the Writing Center (<http://writingcenter.utah.edu/>); the Writing Program (<http://writing-program.utah.edu/>); the English Language Institute (<http://continue.utah.edu/eli/>). Please let me know if there is any additional support you would like to discuss for this class.

Undocumented Student Support: Immigration is a complex phenomenon with broad impact—those who are directly affected by it, as well as those who are indirectly affected by their relationships with family members, friends, and loved ones. If your immigration status presents obstacles to engaging in specific activities or fulfilling specific course criteria, confidential arrangements may be requested from the Dream Center. Arrangements with the Dream Center will not jeopardize your student status, your financial aid, or any other part of your residence. The Dream Center offers a wide range of resources to support undocumented students (with and without DACA) as well as students from mixed-status families. To learn more, please contact the Dream Center at 801-213-3697 or visit dream.utah.edu.

Veterans: If you are a student veteran, the University of Utah has a Veterans Support Center located in Room 161 in the Olpin Union Building. Hours: M-F 8-5pm. Please visit their website for more information about what support they offer, a list of ongoing events and links to outside resources: <http://veteranscenter.utah.edu/>.

The Americans with Disabilities Act: The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability & Access, 162 Olpin Union Building, 801-581-5020, <https://disability.utah.edu>. CDA will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in alternative format with prior notification to the Center for Disability & Access.

Student wellness: Personal concerns such as stress, anxiety, relationship difficulties, depression, cross-cultural differences, etc., can interfere with a student's ability to succeed and thrive at the University of Utah. For helpful resources contact the Center for Student Wellness at www.wellness.utah.edu or 801-581-7776.

University Counseling Center (UCC): The UCC staff is committed to supporting the mental health needs of our campus community. Their phone number is 801-581-6826. Their hours are Monday-Friday, 8:00am-5:00pm. For after-hours emergencies, contact the 24/7 Crisis

Line: 801-587-3000 . More information is at <https://counselingcenter.utah.edu/>. **Student Success Advocates:** The mission of Student Success Advocates is to support students in making the most of their University of Utah experience (ssa.utah.edu). They can assist with mentoring, resources, etc. Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact a Student Success Advocate for support (<https://asuu.utah.edu/displaced-students>).

Addressing Sexual Misconduct: Title IX makes it clear that violence and harassment based on sex and gender (which includes sexual orientation and gender identity/expression) is a Civil Rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, color, religion, age, status as a person with a disability, veteran's status or genetic information. If you or someone you know has been harassed or assaulted on the basis of your sex, office for equal opportunity and affirmative action including sexual orientation or gender identity/expression, you are encouraged to report it to the University's Title IX Coordinator; Director, Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801-581-8365, <https://oeo.utah.edu/contact-us/index.php> or to the Office of the Dean of Students, 270 Union Building, 801-581-7066, <https://deanofstudents.utah.edu>. For support and confidential consultation, contact the Center for Student Wellness, 426 SSB, 801-581-7776. To report to police, contact the Department of Public Safety, 801-585-2677(COPS), <https://police.utah.edu>.

Campus Safety: The University of Utah values the safety of all campus community members. To report suspicious activity or to request a courtesy escort, call campus police at 801-585-COPS (801-585-2677). You will receive important emergency alerts and safety messages regarding campus safety via text message. For more information regarding safety and to view available training resources, including helpful videos, visit safeu.utah.edu.

Office of the Dean of Students: The Office of the Dean of Students is dedicated to being a resource to students through support, advocacy, involvement, and accountability. It serves as a support for students facing challenges to their success as students, and assists with the interpretation of University policy and regulations. To contact the Office of the Dean of Students, please email deanofstudents@utah.edu or call 801-581-7066. There is more information at <https://deanofstudents.utah.edu>.