Numerical Methods for Optimization Problems

CSC 466/2305 Course Description Winter 2020

Numerical methods for unconstrained optimization problems, in particular line search methods and trust region methods. Topics include steepest descent, Newton's method, quasi-Newton methods, conjugate gradient methods and techniques for large problems. This course will normally be offered every other year.

Instructor: Ken Jackson, BA 4228, 416–978–7075, krj@cs.toronto.edu

Office Hours: by appointment

Email: I'll try to answer your email within a day or so. If my reply will be long, I'll probably ask you to talk to me instead about your question. If the answer to your question will benefit many other students in the class, I will likely copy my reply to the whole class (after removing anything from it that will identify you).

I get a lot of email, so it is a good idea to start the Subject line of your email with "CSC 466/2305" so that I can easily distinguish it from other email.

Course Webpage: `http://www.cs.toronto.edu/~krj/courses/466-2305/`

Bulletin Board: The URL for the course Bulletin Board (BB) is

`https://bb-2020-01.teach.cs.toronto.edu/c/csc466`

However, I tend not to use bulletin boards. If you have a question for me, it is better to email me at krj@cs.toronto.edu

Prerequisites:

1. an undergraduate numerical methods course, such as CSC 336.
2. an undergraduate numerical linear algebra course, such as MAT 221, MAT 223 or MAT 240.
3. an undergraduate multi-variate calculus course, such as MAT 235, MAT 237, MAT 257.
4. good programming skills,
5. previous experience with MatLab will be helpful, but not essential.

Lectures: Mondays, Wednesdays and Fridays 1–2 PM in SS 1087.

Course Starts: Monday, 6 January 2020.

Course Textbook:

Numerical Optimization, **Second Edition**, Jorge Nocedal and Stephen J. Wright, Springer, 2006.

The eBook version of the textbook is available for free on the UofT Library webpage
http://go.utlib.ca/cat/8012557
Alternatively, you can purchase it at one of the online bookstores (such as Amazon or Chapters-Indigo). It may also be available at the UofT Bookstore.
Make sure you get the **Second Edition**.

For the first few lectures, we'll also use parts of Chapter 6 of
Michael T. Heath, *Scientific Computing: An Introductory Survey*,
Revised Second Edition, SIAM, 2018.

We use the Heath textbook in CSC 336 and CSC 436. If you don't already have it, you may be able to borrow a copy from a friend. Alternatively, you can purchase it at the UofT Bookstore or at one of the online bookstores (such as Amazon or Chapters-Indigo).

The SIAM Revised Second Edition is a slightly revised version of the McGraw Hill, Second Edition, 2002, that we used previously in CSC 336 and CSC 436. You may be able to get a copy of the McGraw Hill, Second Edition, from a student who took CSC 336 or CSC 436 prior this academic year. You can either get the full book or the Custom Printed version that we asked the Bookstore to produce to lower the cost of the book for students. There are some small differences between the McGraw Hill, Second Edition, and the SIAM, Revised Second Edition, but you can probably get by with the Second Edition if you are careful about monitoring the changes between editions.

If you get the book elsewhere, make sure that you get the **Revised Second Edition** or the **Second Edition**.

Grading: The grade for the course will be based on

1. Term Assignments: 30%
   (There will be five assignments with due dates Jan. 24, Feb. 14, Feb. 28, Mar. 20 and Apr. 3.)
2. Midterm Test (Feb. 28): 30%
3. Final Exam or Project: 40%.
   (You can choose to do a Final Exam or a Course Project of your own choosing. If you prefer to do a Course Project, talk to me about it before you start to ensure that it is suitable.)

To pass this course, undergraduates need a final grade of at least 50% and graduates students need a final grade of at least B– (i.e., 70%). In addition, you must receive a mark of at least 33% on the Final Exam or your Course Project to pass the course.

The Midterm Test and Final Exam are both closed-book: no aids, no calculators, no computers, no tablets, no phones, etc. allowed.

Late Policy: Completed assignments must be submitted at the **beginning** of the lecture on the date that they are due. Note that the due dates are all Fridays. Late assignments will be accepted at the **beginning** of the lecture on the following Monday (the "late deadline") with a **late penalty of 25%**. For the second assignment, which is due on Feb. 14, the following Monday is a holiday (Family Day). In this case, late assignments will be accepted by email to me at krj@cs.toronto.edu until 1:10 PM on Monday, Feb. 17 (the "late deadline").

For example, if you hand in your assignment late, the assignment is out of 60 and you get 48/60 before the late penalty is applied, then you will get a final mark of 33/60 for the assignment. That is,

$$\max(48 - 60 \times 0.25, 0) = 33$$

The max above ensures that you won't get a negative mark for an assignment.

Assignments will not be accepted after the "late deadline" unless you have a very good reason for being late.

Moreover, if you have a very good reason for being late with an assignment, it's best to talk to me about an extension before the assignment is due.

MatLab: See our course webpage for some MatLab primers.
MatLab is now free for UofT students through the UofT Licensed Software Office: `https://onesearch.library.utoronto.ca/ic/licensed-software`

Academic Integrity: Please read
`http://www.cs.toronto.edu/~fpitt/documents/plagiarism.html`
`http://www.governingcouncil.utoronto.ca/Assets/Governing+Council+Digital+Assets/Policies/PDF/ppjun011995.pdf`
`http://www.governingcouncil.utoronto.ca/Assets/Governing+Council+Digital+Assets/Policies/PDF/ppjul012002.pdf`
`http://advice.writing.utoronto.ca/using-sources/how-not-to-plagiarize/`

Accessibility Services: The University of Toronto is committed to accessibility. If you require accommodations for a disability, or have any accessibility concerns about the course, the classroom or course materials, please contact Accessibility Services as soon as possible. See `http://www.accessibility.utoronto.ca/`