CSC165H1S 20241 (All Sections): Mathematical Expression and Reasoning for Computer Science

[Jump to Today](#) | ✎ Edit

↓ **Contents** ↓

Overview

Here is a **one-page term schedule (https://q.utoronto.ca/courses/337013/files/29838608?wrap=1)** ⤓ **(https://q.utoronto.ca/courses/337013/files/29838608/download?download_frd=1)** that gives a visual overview of the entire term.

Feeling Ill? Missed some work?

The **Term Tests and Final Exam** section explains how we handle tests missed for unexpected reasons outside your control.
The **Special Consideration** section explains what you must do to receive *any* form of special consideration. *Please read these carefully and follow the instructions*.

Got a Question or Concern?

See below how to **contact us**. Do **NOT** use Quercus messaging! Do **NOT** send email directly to your instructor or TA!

Week-by-week overview of course activities

Dates & Topics	Materials & Activities	Assessments
Jan 08 – Jan 14 Intro, Preliminaries	**Week 1 Readings and Prep Quiz (https://q.utoronto.ca/courses /337013/quizzes/366860)** **Worksheet 1** Slides: • Jan 8: **LEC01 (https://q.utoronto.ca/courses/337013/files /29757102?wrap=1)** ⤓ **(https://q.utoronto.ca/courses/337013/files /29757102/download?download_frd=1)** ; **LEC02+LEC51 (https://q.utoronto.ca/courses/337013/files/29764850?wrap=1)** ⤓ **(https://q.utoronto.ca/courses/337013/files/29764850 /download?download_frd=1)** ; **LEC03 (https://q.utoronto.ca /courses/337013/files/29764999?wrap=1)** ⤓ **(https://q.utoronto.ca /courses/337013/files/29764999/download?download_frd=1)** • Jan 10: **LEC01 (https://q.utoronto.ca/courses/337013/files**	

Dates & Topics	Materials & Activities	Assessments
	/29802141?wrap=1) ↓ (https://q.utoronto.ca/courses/337013/files /29802141/download?download_frd=1) ; **LEC02+LEC51 (https://q.utoronto.ca/courses/337013/files/29836668?wrap=1)** ↓ **(https://q.utoronto.ca/courses/337013/files/29836668 /download?download_frd=1)** ; **LEC03 (https://q.utoronto.ca /courses/337013/files/29807419?wrap=1)** ↓ **(https://q.utoronto.ca /courses/337013/files/29807419/download?download_frd=1)**	
Jan 15 – Jan 21 Propositional & Predicate Logic *(**Jan 21:** last day to enrol)*	**Week 2 Readings and Prep Quiz (https://q.utoronto.ca/courses /337013/quizzes/366865)** **Worksheet 2; Worksheet 3** Slides: - Jan 15: **LEC01 (https://q.utoronto.ca/courses/337013/files /29864242?wrap=1)** ↓ **(https://q.utoronto.ca/courses/337013/files /29864242/download?download_frd=1)** ; **LEC03 (https://q.utoronto.ca/courses/337013/files/29869381?wrap=1)** ↓ **(https://q.utoronto.ca/courses/337013/files/29869381 /download?download_frd=1)** - Jan 17:	**Problem Set 1** *(**0%**[*] / Jan 23)*
Jan 22 – Jan 28 Direct & Indirect Proofs	Week 3 Readings and Prep Quiz *(TBA)* **Worksheet 4; Worksheet 5** Slides: *(TBA)*	
Jan 29 – Feb 4 Proof by Cases	Week 4 Readings and Prep Quiz *(TBA)* **Worksheet 6** Slides: *(TBA)*	**Term Test 1** *(**12.5%**[†] / Jan 29)*
Feb 5 – Feb 11 Number Theory; Simple Induction	Week 5 Readings and Prep Quiz *(TBA)* **Worksheet 7; Worksheet 8** Slides: *(TBA)*	**Problem Set 2** *(**0%**[*] / Feb 8)*
Feb 12 – Feb 18 Simple Induction	Week 6 Readings and Prep Quiz *(TBA)* **Worksheet 9** Slides: *(TBA)*	**Term Test 2** *(**12.5%**[†] / Feb 14)*
Feb 19 – Feb 25 *(**Feb 19:** U of T closed)*	**Reading Week:** No lectures; an announcement will be made about instructor office hours.	
Feb 26 – Mar 3 Number Representations	Week 7 Readings and Prep Quiz *(TBA)* **Worksheet 10; Worksheet 11** Slides: *(TBA)*	**Problem Set 3** *(**0%**[*] / Mar 5)*
Mar 4 – Mar 10 Asymptotic Notation	Week 8 Readings and Prep Quiz *(TBA)* **Worksheet 12; Worksheet 13** Slides: *(TBA)*	

Dates & Topics	Materials & Activities	Assessments
Mar 11 – Mar 17 Runtime Analysis (**Mar 11:** last day to drop)	Week 9 Readings and Prep Quiz *(TBA)* **Worksheet 14** Slides: *(TBA)*	**Term Test 3** (***12.5%**[†] / Mar 11)*
Mar 18 – Mar 24 Runtime Analysis	Week 10 Readings and Prep Quiz *(TBA)* **Worksheet 15; Worksheet 16** Slides: *(TBA)*	**Problem Set 4** (***0%**[*] / Mar 21)*
Mar 25 – Mar 31 Runtime Analysis (**Mar 29:** U of T closed)	Week 11 Readings and Prep Quiz *(TBA)* **Worksheet 17** Slides: *(TBA)*	**Term Test 4** (***12.5%**[†] / Mar 27)*
Apr 1 – Apr 7 Runtime Analysis	Week 12 Readings and Prep Quiz *(TBA)* **Worksheet 18** Slides: *(TBA)*	**Problem Set 5** (***0%**[*] / Apr 8)*
Apr 10 – Apr 30	(**Final Exam schedule (https://www.artsci.utoronto.ca/current /faculty-registrar/final-exams)** , from Arts & Science)	**Final Exam (50%)**[‡]

[*] **Problem Sets** are worth **no** direct credit.

[†] All **Term Tests** take place **during your regular lecture time** (and in your regular lecture room). The two lowest term test marks will be worth 10% each; the two highest will be worth 15% each. The **Course Summary** below has more details.

[‡] The Final Exam will be scheduled by the Faculty of Arts & Science. In order to pass the course, you must earn at least 25% on the final exam. In other words, if your final exam mark is strictly less than 25%, your final mark in the course will be reduced (if necessary) to no more than 45.

Contents

This page contains LOTS of information, all in one place (to make it easier to search)! The following links may help you find what you are looking for a little faster, but **we strongly recommend that you read this entire syllabus at least once** (during the first week of term would be ideal), to make yourself familiar with the course organization and expectations.

- **Overview** (above)
- Contents — you are here!
- **Logistics**
  - **Office Hours**
  - **Course Staff**
  - **Lecture Schedule**
  - **Contact Us**

Logistics

- **This is an in-person course**, meaning that you must be available for in-person activities (lectures and office hours) and assessments (term tests and final exam).
- All lectures and office hours begin *ten minutes past the hour*. **Lectures and office hours all begin on the FIRST week of classes.**
- You are welcome to attend office hours held by any instructor or TA.
- See the **technical advice** further below, for additional information about connecting to online office hours.
- TA office hours will NOT follow a regular schedule. The details will be posted here, usually the week before the office hours take place.
- Recordings will be generated automatically for some (but not all) of the lecture sections, and can be accessed through the OCCS Student App. *Remember that course videos and materials belong to your instructor and the University, and are protected by copyright.* You are permitted to download videos and materials for your own personal academic use, but *you may not copy, share, or otherwise distribute them* without explicit permission from the instructor.

TA Office Hours

Day and Time   TA   Room or Zoom

Day and Time	TA	Room or Zoom
TBA	*TBA*	*TBA*

Course Staff & Office Hours (Jan 8 – Apr 5)

Who? (Role)	Where?	When?
François Pitt (Coordinator)	**Zoom Link** ⇱ **(https://utoronto.zoom.us/j/81108381671)** Meeting ID: 811 0838 1671 Passcode: 165165	Fri 09:30–11:30
	BA 3289	Tue 13:30–15:00 Thu 13:30–15:00
Gary Baumgartner (Instructor)	BA 3289	Wed 15:30–17:00 Thr 17:00–18:30
Amin Gillani (Support Staff)	*N/A*	*N/A*
Aida Ebrahimi (Lead TA)	*N/A*	*N/A*

Lecture Schedule

What? (Section)	Who? (Instructor)	Where? (Room)	When? (Day & Time)
LEC 0101	François Pitt	PB B250	Mon 11:00–13:00
		MP 203	Wed 11:00–13:00
LEC 0201	Gary Baumgartner	FE 114	Mon 13:00–15:00
		MP 102	Wed 13:00–15:00
LEC 0301	François Pitt	AH 400	Mon 15:00–17:00
			Wed 15:00–17:00
LEC 5101	Gary Baumgartner	MP 202	Mon 18:00–20:00
			Wed 18:00–20:00

Contact Us

Please do **NOT** use Quercus messaging! Please do **NOT** send email directly to your instructor or TA!

1. **Before you ask your question**, please *take a few minutes to see if it might already be answered* on this page (or pages linked from it). You will get an answer faster (no need to wait), and it will make the course better for everyone by leaving us more time to answer other questions.
2. In particular, all course announcements will be posted here, on Quercus. *You are responsible for reading all announcements made by the course team (instructors / TAs / staff), and for being familiar with the entire content of this Syllabus.*
3. If your question is NOT already answered on the course website or discussion board, then either:
   - Start a new topic on Ed (the course discussion board), for all questions of *general interest* (whose answer could be useful to other students).

   or:
   - Send email **from your U of T email address, to the course email address** (csc165-2024-01@cs.toronto.edu **(mailto:csc165-2024-01@cs.toronto.edu)**), for all questions that are *personal* (whose answer is useful only to you). **Please include your full name and UTORid in the body of your message.**
4. In particular, please ask ALL questions about course content and problem sets directly on Ed. This also applies to questions about course administration / logistics, *except* for very personal questions that are relevant only to your unique situation, where you should use email. For content-related questions, you can use the Spoilers feature to help other students avoid discovering solution elements (click on the little lightning bolt icon in the top-left corner of the message editor), or post *private* messages that will be seen only by course instructors and TAs. **Do NOT post any message that reveals the questions or answers on one of our Term Tests, until at least TWO FULL DAYS (48 hours) AFTER the test has been written by every student** (including the evening section).
5. We aim to respond to all email and Ed postings within 48 business hours (not counting weekends and holidays). However, it may take longer, especially near due dates or before the start of classes. If you do not hear back after four days, please do not hesitate to send a follow-up email, or come in person during office hours.

↑ [Contents](#) ↑

Textbooks

- **Required: [Course Notes](https://q.utoronto.ca/courses/337013/files/29603075?wrap=1) (https://q.utoronto.ca/courses/337013/files/29603075?wrap=1)** ↓ **(https://q.utoronto.ca/courses/337013/files/29603075/download?download_frd=1)** .
- **Optional:** Susanna Epp, *Discrete Mathematics with Applications*. Fifth Edition, Cengage Learning, 2020. (Contains many examples and additional practice problems about each topic in the course, and beyond.)
  - **[Discrete Mathematics on the U of T Libraries](https://librarysearch.library.utoronto.ca/permalink/01UTORONTO_INST/14bjeso/alma991107278006806196) (https://librarysearch.library.utoronto.ca/permalink /01UTORONTO_INST/14bjeso/alma991107278006806196)** .
  - **[Discrete Mathematics on the U of T Bookstore](https://www.campusebookstore.com/integration/AccessCodes/default.aspx?permalinkId=abe4a724-af2f-4e1b-a3bd-0ed5044b9828&frame=YES&) (https://www.campusebookstore.com/integration /AccessCodes/default.aspx?permalinkId=abe4a724-af2f-4e1b-a3bd-0ed5044b9828&frame=YES&**

t=permalink) . You can also get print copies at the bookstore.

- ○ **Discrete Mathematics on Cengage.ca** ▷ **(https://www.cengage.ca/c/discrete-mathematics-with-applications-5e-epp/9781337694193)** — use coupon code CengageW22592 for 10% off when you order directly from Cengage (the code is entered on the shipping and payment details page when you complete your order).
- **Optional:** Daniel Velleman, *How to Prove It: A Structured Approach*. Third Edition, Cambridge University Press, 2019. (Excellent, more in-depth presentation of each proof technique, the logic behing it, and intuition on how to use it.)
  - ○ **How to Prove It on the U of T Libraries (https://librarysearch.library.utoronto.ca/permalink /01UTORONTO_INST/14bjeso/alma991106616167606196)** .
  - ○ **How to Prove It on the U of T Bookstore** ▷ **(https://www.uoftbookstore.com/product/38318)** .
  - ○ **How to Prove It on Cambridge Press** ▷ **(https://www.cambridge.org/highereducation/books/how-to-prove-it/6D2965D625C6836CD4A785A2C843B3DA)** .

<div align="right">

↑ **Contents** ↑

</div>

Marking Scheme and Course Activities

- Weekly **prep quizzes** (**worth 0%**).
- Weekly **worksheets** (**worth 0%**).
- Five **Problem Sets** (**worth 0%**).
- Four **Term Tests** (**worth 50% in total**: 10% each for the two lowest marks; 15% each for the two highest marks).
- One **Final Exam** (**worth 50%**). *You must earn a minimum of 25% on the exam in order to pass the course.*

See the **Overview** table for the exact dates of term work (including the tests).

<div align="right">

↑ **Contents** ↑

</div>

Weekly Prep Quizzes and Worksheets

1. **WS 1 Handout (https://q.utoronto.ca/courses/337013/files/29757106?wrap=1)** ↓ **(https://q.utoronto.ca /courses/337013/files/29757106/download?download_frd=1)** / **WS 1 Solutions (https://q.utoronto.ca /courses/337013/files/29757107?wrap=1)** ↓ **(https://q.utoronto.ca/courses/337013/files/29757107 /download?download_frd=1)**
2. **WS 2 Handout (https://q.utoronto.ca/courses/337013/files/29851029?wrap=1)** ↓ **(https://q.utoronto.ca /courses/337013/files/29851029/download?download_frd=1)** / WS 2 Solutions
3. WS 3 Handout / WS 3 Solutions
4. WS 4 Handout / WS 4 Solutions
5. WS 5 Handout / WS 5 Solutions
6. WS 6 Handout / WS 6 Solutions
7. WS 7 Handout / WS 7 Solutions
8. WS 8 Handout / WS 8 Solutions
9. WS 9 Handout / WS 9 Solutions

10. WS 10 Handout / WS 10 Solutions
11. WS 11 Handout / WS 11 Solutions
12. WS 12 Handout / WS 12 Solutions
13. WS 13 Handout / WS 13 Solutions
14. WS 14 Handout / WS 14 Solutions
15. WS 15 Handout / WS 15 Solutions
16. WS 16 Handout / WS 16 Solutions
17. WS 17 Handout / WS 17 Solutions
18. WS 18 Handout / WS 18 Solutions

This course is partially *flipped*: instead of using precious lecture time to present easy material that you can read about on your own, we ask you to do some readings and prep work, so that we can use lecture time to tackle more difficult examples and answer your questions. The best way to prepare for each week is to complete the weekly readings and prep quiz on Quercus (you can access these directly through the course navigation) **before** Monday's lectures.

In addition, each 2-hour lecture block will consist of a mix of traditional lectures and worksheets (except for the very first lecture and the very last, and the days when we hold a Term Test). The worksheets allow you to put in practice the course material, so that if you encounter any difficulties or questions, you have an opportunity to ask your instructor or a TA — in other words, this is dedicated time we have set aside to allow you to get help.

Links to worksheet handouts will be added here as the term progresses (usually one or two weeks before they are taken up in lecture). Sample solutions will usually be added the following week.

Problem Sets

1. **PS 1 Handout (https://q.utoronto.ca/courses/337013/files/29840611?wrap=1)** ↓ **(https://q.utoronto.ca /courses/337013/files/29840611/download?download_frd=1)** / PS 1 Solutions
2. PS 2 Handout / PS 2 Solutions
3. PS 3 Handout / PS 3 Solutions
4. PS 4 Handout / PS 4 Solutions
5. PS 5 Handout / PS 5 Solutions

Links to each problem set handout will be added here as the term progresses (usually two weeks before they are "due"). Sample solutions will usually be added one week later.

The purpose of the problem sets is to clarify what you should know at various points during the course, by reviewing what we covered in lectures and consolidating your understanding. They are an opportunity to practice what you have learned and apply your knowledge and skills to new and more complex problems. **Treat every problem set like a "practice term test"**: a chance to try out your understanding in a context where you cannot lose marks for making mistakes; an opportunity to find out what you don't know and correct it *before* the following term test. They are typically the most challenging part of this course. *Start problem sets early!* At any point in time, you should be able to read any problem set handout to figure out

what you're supposed to do, even if you have no clue *how* to do it (yet).

Even though Problem Sets are **not worth marks directly**, you will have an opportunity to submit your answers on MarkUs *to obtain brief feedback on the quality of your answers*.

Submission instructions

- Problem sets may be submitted online through MarkUs. You may submit work at any time, but **only work submitted before 23:59:00 on the due date is guaranteed to receive feedback**. If you haven't used MarkUs before, give yourself plenty of time to figure it out, and ask for help if you need it! The following **Documentation for Students** ⤷ **(https://github.com/MarkUsProject/Markus/wiki/Student-Guide)** may also be useful if you have never used MarkUs before.

- The link to connect to MarkUs is included directly in the navigation menu for the course. When you click on it, you will be taken to a login page where you should use your UTOR username and password. Once you have logged in, you will see a page with one tile for each course from this term that is using MarkUs — just click on the tile for csc165.

- If you work in a group *(which you are encouraged to do)*, **please create a group on MarkUs and make a SINGLE submission for your entire group**. This allows us to give feedback only once for each submission, which saves time that we can use to give *better* feedback to everyone.

- Please submit your answers in a separate document for each problem, and **give each document a name that starts with "Qn"**, where *n* is the question number. You may type your answers or hand-write them *legibly*, on paper or using a tablet and stylus, in a separate document or directly on the question paper (if there is space). We encourage you to use **LATEX** if you have the time (it's a good opportunity to learn about this standard format for typesetting technical work), but *this is NOT required*.

- Each document must be in PDF or a photo (JPEG / JPG / GIF / PNG / HEIC / HEIF). **Other formats** (e.g., Word documents, LaTeX source files, ZIP files) **are NOT accepted** — you must **export**, **compile**, **convert** and/or **combine** documents into **ONE** document in a supported format, for each individual problem. **Careful: just changing the name of a document does NOT change its content to be in the corresponding format!**

- Each document you submit must be no larger than 19MB. This may happen if you combine multiple photos into one document without any sort of compression, or when exporting longer documents from OneNote; if it does, you should use a compression tool to make your documents smaller, although please make sure that your document is still legible before submitting it. (There are good, free tools you can use for this, like **PDFSAM** ⤷ **(https://pdfsam.org/)** or **PDF24** ⤷ **(https://pdf24.org/)** .)

- **The safest way to know that your submission is okay is to try to view it afterwards**: if MarkUs can display your submission **in your browser** *(NOT by downloading it and opening it on your device)*, then everything worked fine; if you are unable to view your submission **directly on MarkUs**, then there was a problem that you must fix.

- You can submit your work more than once; the most recent version submitted within the deadline is the one that will receive feedback. However, your final submission should always contain *exactly one document **per question***. In general, you can (**and should**) simply overwrite your last submission with the next one — in other words, submit any new version of a document under the same name as the previous version. MarkUs will replace your old document with the new one, *but keep a record of the*

previous versions so that we can roll back to them if necessary. You can never lose information this way.

- Note that there will usually be multiple problem sets to which you can submit documents. *Double-check before you submit to make sure you are submitting your work to the correct problem set!*

Term Tests and Final Exam

Test & Exam Information
*(see the **Overview** for dates, times, and location)*

Test	Coverage	Practice	Papers & Solutions
TT1	*TBA*; PS1	*TBA*	*TBA*
TT2	*TBA*; PS2	*TBA*	*TBA*
TT3	*TBA*; PS3	*TBA*	*TBA*
TT4	*TBA*; PS4	*TBA*	*TBA*
Exam	Comprehensive: you are expected to be familiar with **all** the material covered in the course.	**Old Exams Collection (https://myaccess.library.utoronto.ca /login?url=https://exams.library.utoronto.ca)**	*Cover Page and Reference Sheet will be posted*

To help stop the spread of respiratory viruses, including **Influenza (flu)** ⤷ **(https://www.ontario.ca/page/flu-facts)** and **COVID-19** ⤷ **(https://www.ontario.ca /page/protection-covid-19-and-other-respiratory-illnesses)** , **anyone who feels sick should stay home** and complete the **self-assessment** ⤷ **(https://www.ontario.ca/self-assessment/)** tool to learn more about what to do next. The number 1 precaution when you are sick is to wear a **well-fitted mask** ⤷ **(https://www.ontario.ca/page/protection-covid-19-and-other-respiratory-illnesses#section-3)** in all public settings. [From the U of T Environmental Health & Safety's **Procedures for Respiratory Illnesses (https://ehs.utoronto.ca/symptomatic-or-confirmed/)** .]

Keep in mind that **course instructors cannot grant Special Consideration for Final Examinations**! If you are unable to write the final exam, please contact your **College Registrar (https://future.utoronto.ca/current-students/registrars/)** for the next steps — the process is explained in more detail on the **Sidney Smith Commons (https://sidneysmithcommons.artsci.utoronto.ca/i-cant-make-a-test-or-exam-what-do-i-do/)** .

*If you miss a test for unexpected reasons outside your control, please follow the instructions in the **Special Consideration** section.* **If you miss one test *for approved reasons*,** we will calculate a mark for the test you missed, based on your performance on the other tests *and on the final exam*, taking into account the class averages on every test and exam. This ensures that you are not unfairly penalized if the test you missed was easier, but also that you do not gain an unfair advantage if you missed a harder test. **If you**

miss more than one test, we will require you to make an appointment with your **College Registrar (https://future.utoronto.ca/current-students/registrars/)** to put in place a concrete plan for the rest of the term, *before* we approve any exception. This ensures that you are realistic about your ability to succeed in the course and that you have thought about how you will manage the risk: after all, missing more than one tests would put you in a situation where you would be taking the final exam with NO feedback on your performance for half the material of the course (or more). To ensure you do not engage in "magical thinking" (that everything will work out fine, but without a concrete plan), *we will require confirmation from your College Registrar* that you have met with them and that your approach to the rest of the term is realistic. Once we receive this, we can easily put in place appropriate accommodations for all your missed work.

You are expected to write *every* test. In addition to providing us with a component of your final course mark, each test will provide *you* with valuable feedback on your understanding of a significant portion of the course material. If you are truly unable to write a test, we can make up for the missing marks easily enough, but it is more difficult (and requires more work on your part) to make up for the lost learning opportunity. This places you at a disadvantage for the final exam. The policy described in the previous paragraph does NOT mean that you can simply *choose* to "skip a test". Rather, it is meant for *emergencies:* situations where you are truly **unable** to write the test with everyone else (not just when it is inconvenient). You have to judge whether your situation is only an inconvenience (something that prevents you from performing at the top of your abilities but whose real impact on your performance is relatively small), or a major disadvantage (something that makes your performance *significantly* worse than normal). We understand that sometimes, it can be difficult to make a clear distinction between these two types of situations. For your own sake, we ask that you be realistic about your expectations and that you only request Special Consideration when it is truly necessary.

What to expect (in general terms)

Term Tests will generally contain 3–4 questions, at least one of which is meant to be easy (a more-or-less direct application of course material), and at least one of which is meant to be somewhat challenging (require some creativity in applying the course material).

We know tests are time-limited; we won't ask questions that require a lot of time to figure things out! For example, we are not likely to ask you to solve a completely new "Challenge"-level problem, because that might require you to spend too long thinking about various possibilities to find one that works. But we *could* give you a problem *similar* to a Challenge-level question from a problem set, one where the key insight from the problem set can be applied fairly directly. This would then be considered a reasonably easy question, because you wouldn't need to come up with any new ideas to solve it, just show that you can apply something you have already learned (assuming that you did learn it from working on the problem set, of course).

How to Prepare

First review the materials listed above. Start with the **Problem Sets**, the worksheets, and the weekly preps. Make sure you understand how to solve each of them, and use this to decide what to review next — focus on the topics and problems that you have more difficulty with. Don't forget to compare your answers against sample solutions (when these are available).

Next, you can try questions from previous years' term tests — see above for some links, but **please read the rest of this paragraph first**! Keep in mind that questions on our test are more likely to be related to problems you have *already* worked on this term than to questions from previous tests. At the same time, these past test problems are a good way to practice your understanding. *For maximum benefit, we strongly suggest the following approach:* try these questions only **after** you have finished reviewing the rest of the materials from this term; **time yourself** to get the benefit of a real "test experience", as a way to verify not only your understanding, but also your ability to answer questions quickly (this will matter for the actual tests); and finally, *don't look at the solutions* until you have finished working on the questions as if it were a real test.

Make good use of the **[Sidney Smith Commons' Exam Toolkit (https://sidneysmithcommons.artsci.utoronto.ca/exam-toolkit/)](https://sidneysmithcommons.artsci.utoronto.ca/exam-toolkit/)** . This contains many general resources to help you prepare for term tests and the final exams, including sections on "what to expect", "how to study", and "strategies".

How to write tests (and the exam)

Read the questions! If you answer the wrong question, even if it's because you were nervous and you misread it, there is nothing that we can do. If something is unclear, *please ask*.

Manage your time! Be disciplined, to leave most of your time free for solving problems. In particular, it's fine to give point-form answers with the key elements, instead of spending time writing long, complete sentences.

Show what you know! Your strategy during the test should be:

- to identify the questions that you know how to answer (this means that you must read EVERY question **before** you start answering any of them);
- to answer those questions right away;
- to go back to the questions you're not sure about, and work on them;
- if you get stuck on a question, to move on to the next one and come back later (don't waste your time) — you can figure out ahead of time how much time to devote to each question (based on how much it's worth), and stick to that estimate as much as possible.

If you have an idea how to solve a question but no time to do it in detail, then of course you should write down your idea. You will get part marks for any question where you have the correct structure (i.e., clearly showing that you know what you are supposed to do), even if you cannot fill in the details. So it always pays off to take a minute to write down a correct outline for your answer — it's worth marks, even if you are unable to do more.

Explain what you're doing! When you give an answer, make sure that you give at least a short statement of what you're doing before giving us the answer: if your answer is incorrect, this can make the difference between getting NO mark (because we can't tell if you understand what you're doing) or getting part marks (if we see that you have the right idea but simply made a small error, or that you have the wrong idea but wrote it up correctly).

Don't ramble! Write concise, to-the-point answers. If you ramble, or if you write an answer for a related (but different) problem with no adjustment or explanation, the feeling it gives us is that you don't know the correct answer. Also, be aware that if you give us a correct answer followed by explanations that are clearly wrong or irrelevant, you will lose marks! So only write down what you know is correct: if you're not sure, either say so explicitly or don't say anything.

On the other hand, if you start writing down an answer and you realize that it's wrong, SAY SO! You'll get more part marks for showing that you understand your mistake, even if you're not sure how to fix it, than if you simply leave it like that (which gives the impression that you don't even realize that what you did was wrong).

On a related note, don't feel like you must fill all the available space: it is quite possible that a correct answer will require only part of the space for some questions.

Take care of yourself! You'll function much better if you are well-rested and relaxed than if you are tired or tense. Take some time to exercise (moderately), to burn off some of your body's stress, leaving you better able to manage your stress levels and better able to perform. Eat a nutritious meal (but not too much) so you're not hungry during the test. And get a good night's sleep the night before.

A related tip I learned from a student: trying to "force yourself to be calm" may not work well, or may even backfire, because you're trying to suppress your body's natural response to stress. Instead, trick your brain into thinking that what you're feeling is not stress — it's excitement! The two feelings are similar enough, you can think of it as looking forward to the challenge — the way a trained athlete is primed for a competition, and turning their nervousness into positive stress.

↑ **Contents** ↑

Academic Integrity

All work you submit must be your own. It is an academic offence to copy the work of someone else — even if the other person is not a student — *unless you explicitly and clearly attribute the work to its original source*. This includes words, sentences, entire documents, and even ideas. Whether you copy or let someone else copy, it is an offence. Academic offences are taken very seriously and can have correspondingly serious consequences.

At the same time, we want you to benefit from working with other students. For this course, you must write up your own individual submission to every problem set — you cannot submit the same answers as another student — but you are allowed to discuss how to solve the problems with anyone you wish. The purpose of the problem sets is to ensure that **you** understand how to solve the problems. Even if you did not generate a solution yourself, you can still receive useful feedback on your work. (See the **Problem Sets** section for more details.)

You are also welcome to freely discuss course material and technology (such as LATEX) related to assignments, and we encourage you to do so. For example, you may work through examples that help you understand course material or a new technology, or help each other configure your system to run a

supporting piece of software.

Any collaboration on, or sharing of, term test solutions *or questions* is strictly forbidden!

Please take a few minutes to consult the **Academic Integrity at U of T (https://www.academicintegrity.utoronto.ca/)** website: it contains good information and concrete strategies to help support your learning in ways that follow the principles of academic integrity, in addition to references to formal policies and procedures.

What about ChatGPT?

In this course, you may use generative artificial intelligence (AI) tools (like ChatGPT and GitHub Copilot) as learning aids and to help complete problem sets. *You will NOT be permitted to use generative AI on the term tests or final exam.* While some generative AI tools are currently available for free in Canada, please be warned that these tools have not been vetted by the University of Toronto and might not meet University guidelines or requirements for privacy, intellectual property, security, accessibility, and records retention. Generative AI may produce content which is incorrect or misleading, or inconsistent with the expectations of this course. They may even provide citations to sources that don't exist — and submitting work with false citations is an academic offense. These tools may be subject to service interruptions, software modifications, and pricing changes during the semester.

Generative AI is NOT required to complete any aspect of this course, and we caution you to not rely on these tools to complete your coursework. Instead, we recommend treating generative AI as a supplementary tool only for exploration or drafting content — **always remembering to cite any resource you used to generate your answers**. Ultimately, you (and not any AI tool) are responsible for your own learning in this course, and for all the work you submit for credit. It is your responsibility to critically evaluate the content generated, and to regularly assess your own learning independent of generative AI tools. Overreliance on generative AI may give you a false sense of how much you've actually learned, which can lead to poor performance on the term tests or final exam, in later courses, or in future work or studies after graduation.

Special Consideration

To help stop the spread of respiratory viruses, including **Influenza (flu)** ⤷ **(https://www.ontario.ca/page/flu-facts)** and **COVID-19** ⤷ **(https://www.ontario.ca /page/protection-covid-19-and-other-respiratory-illnesses)** , **anyone who feels sick should stay home** and complete the **self-assessment** ⤷ **(https://www.ontario.ca/self-assessment/)** tool to learn more about what to do next. The number 1 precaution when you are sick is to wear a **well-fitted mask** ⤷ **(https://www.ontario.ca/page/protection-covid-19-and-other-respiratory-illnesses#section-3)** in all public settings. [From the U of T Environmental Health & Safety's **Procedures for Respiratory Illnesses (https://ehs.utoronto.ca/symptomatic-or-confirmed/)** .]

If you are unable to complete course work or if you miss a test due to major illness or other circumstances outside of your control, **please get in touch with us as soon as possible**. Special consideration will be evaluated on a case-by-case basis and is not given automatically — we may be unable to grant you exactly the special consideration you seek, so please ensure we have time to discuss your situation.

In order to receive special consideration, you must fill out a **[Request for Special Consideration Form](https://forms.office.com/r/3WvN9kupwC)** ⤷ **[(https://forms.office.com/r/3WvN9kupwC)](https://forms.office.com/r/3WvN9kupwC)** . Simply complete and submit the form online as soon as you can, **together with supporting documentation**. *Accepted forms of documentation have been updated for this year!* They include Absence Declaration (via ACORN), or the University's Verification of Student Illness or Injury (VOI) form, or letters from your College Registrar or Accessibility Services. But be warned that starting this year, *Absence Declaration can be used at most ONCE PER TERM*, and for a maximum of seven consecutive days (this is a new policy). For more information on each type of documentation, including when and how to use it, please read all the details carefully on the new **[Student Absences](https://www.artsci.utoronto.ca/absence)** **[(https://www.artsci.utoronto.ca/absence)](https://www.artsci.utoronto.ca/absence)** page from the Faculty of Arts & Science.

IMPORTANT: If you know that you will NOT be able to write a term test, just submit the request form as soon as you are able (and have obtained appropriate documentation). It is NOT necessary to send email for "simple" requests due to illness / injury or personal / family emergencies — just the form is sufficient. However, if your situation is particularly unusual or complex, please contact us (by email using csc165-2024-01@cs.toronto.edu **[(mailto:csc165-2024-01@cs.toronto.edu)](mailto:csc165-2024-01@cs.toronto.edu)**) to discuss the details. In that case, **please reach out as soon as you can** (even before you have obtained documentation): it is always easier to resolve situations earlier rather than later.

If you face a situation that is particularly disruptive (especially if it is likely to affect more than one course), please also contact your **[College Registrar](https://future.utoronto.ca/current-students/registrars/)** **[(https://future.utoronto.ca/current-students/registrars/)](https://future.utoronto.ca/current-students/registrars/)** — they are best equipped to provide you with general advice and support that goes beyond a single course. They can also help you document your situation and contact each of your course instructors on your behalf, to simplify the process of requesting accommodations.

Remark Requests

If you believe there was an error in the marking of your work — or if you just have questions about how your work was marked — you may request that it be remarked. Please complete and submit a Remark Request **directly on MarkUs** (no separate form or email message is required). You must give a specific reason for the request, referring to possible errors or omissions by the marker, or asking specific questions about the feedback (or lack of feedback) you received.

Remark requests must be received within **two weeks** of when the item was returned.

Please note that when we receive a remark request, we may regrade the entire submission, though we will generally focus on the questions that are the subject of your request. Your mark may go up or down as a result of the remark. *This is not meant to discourage you from submitting remarking requests!* Just to acknowledge the reality that errors can be made in both directions in the initial marking: it's possible that TAs

misunderstand your solution and penalize it more than appropriate, but it's also possible that TAs forget or miss some mistakes in your solution and do not apply appropriate penalties. When we remark, we correct both types of marking errors.

Creating a Positive Learning Environment

We are committed to creating a respectful learning environment in computer science courses for all students and expect that you will adhere to the University of Toronto's **Code of Student Conduct (https://governingcouncil.utoronto.ca/secretariat/policies/code-student-conduct-december-13-2019)** . Please be mindful of how your behaviour influences the atmosphere in our learning community, not just in classes, but also in computer labs, in online forums, and anywhere that you interact with other students and members of the department.

About Masks

If you feel sick (even if you have not tested positive for COVID-19), we kindly ask that you wear a mask during lectures and in-person office hours, as a courtesy to all your classmates (some of whom may live with immunocompromised individuals). Wearing a mask is a simple, non-invasive way to be considerate to your community by reducing the risks of transmission of COVID-19 (and other airborne illnesses), especially in indoor spaces where distancing is not possible.

Accessibility

The University of Toronto is committed to accessibility. If you require accommodations for an ongoing disability or an acute issue such as an injury, you should register with **Accessibility Services (https://studentlife.utoronto.ca/service/accessibility-services-registration-and-documentation-requirements/)** (AS). The process of accommodation is both confidential and private. AS provides the information necessary to implement an accommodation and no more, e.g., what is listed in a Letter of Accommodation. Your instructors and other university staff will not reveal that you are registered with AS.

Students who require accommodations for term tests (or the final exam) must register with **Accommodated Testing Services (https://lsm.utoronto.ca/ats/)** (ATS). We will only be providing test accommodations sent to us through that official channel. This helps to guarantee that accommodations are provided in a fair and consistent manner for everyone.

Calendar Information

Course Description

Introduction to abstraction and rigour. Informal introduction to logical notation and reasoning. Understanding,

using and developing precise expressions of mathematical ideas, including definitions and theorems. Structuring proofs to improve presentation and comprehension. General problem-solving techniques. Representation of floating-point numbers. Running time analysis of iterative programs. Formal definition of Big-O. Diagonalization, the Halting Problem, and some reductions. Unified approaches to programming and theoretical problems.

Corequisites: CSC108H1 / CSC120H1 / (equivalent programming experience). *(If you have not enrolled in or completed CSC108 / CSC120, that's okay — you will still be allowed to take CSC165. However, in this case it is your responsibility to ensure that you have the equivalent programming experience so that you're prepared to succeed in this course.)*

Exclusions: CSC111H1, CSC236H1, CSC240H1, MAT102H5, CSC236H5, CSCA67H3, MATA67H3, CSCB36H3

↑ **Contents** ↑

Learning Outcomes

In this course, you will learn…

- To express statements and problems using precise mathematical language in new and familiar domains.
- To evaluate the correctness and style of mathematical proofs in new and familiar domains.
- To create a mathematical proof or disproof of a given statement in new and familiar domains, choosing from among different proof techniques.

The domains we study in this course include:

- sets and functions
- number theory
- algorithm running time analysis
- graphs and trees

↑ **Contents** ↑

Technical Requirements

Some course activities (office hours) may be offered online, through Zoom.

- To join online office hours, you must be signed in to your U of T Zoom account.
- "*What U of T Zoom account?*" Glad you asked: log into the **U of T Zoom portal** ⧉ **(https://utoronto.zoom.us/)** to claim your *free* Zoom education license.
- You will have a much better experience if you use the most recent version of the desktop client for Zoom, instead of accessing it through a web browser.
- More generally, to fully participate in all course activities, you require reliable access to a **full computer** (*not just a smartphone*) on which you can browse web pages, read lecture slides, and type and submit problem sets.
- To attend online office hours, this computer must have a **microphone**, optionally a webcam, as well as a

reliable, high-speed internet connection.

LATEX help

LATEX is a standard typesetting program used in computer science, and we encourage you to learn how to use LATEX as part of your work — *though this is **not necessary** to submit work in this course*. The important thing is that you submit documents only in one of the approved formats, no matter how you generated them. In this section, we provide some resources to help you get started with LATEX.

There is no general "course template" for LATEX documents. Time permitting, I may try to post samples here if people run into difficulties generating certain types of content (e.g., graph pictures). Also, you can always ask questions on Ed, where I (and others) will be happy to help.

Otherwise, you may find the following links helpful.

- **Overleaf** ⤷ **(https://www.overleaf.com/)** is an online application that allows you to edit and compile LATEX files right in your browser, and even collaborate with others — *always while following Academic Integrity requirements, of course*. It also provides some **tutorials** ⤷ **(https://www.overleaf.com/learn)** on the basics of using LATEX.
- A detailed, yet simple and accessible online LATEX tutorial **(a great place to start):** https://www.latex-tutorial.com/ ⤷ **(https://www.latex-tutorial.com/)** .
- Download LATEX on the official LATEX webpage: https://latex-project.org/ ⤷ **(https://latex-project.org/)** (click on "Get" in the top menubar and select an appropriate distribution to download).
- A relatively comprehensive introduction to LATEX **(highly recommended, but long):** https://ctan.mirror.rafal.ca/info/lshort/english/lshort.pdf ⤷ **(https://ctan.mirror.rafal.ca/info/lshort/english/lshort.pdf)** .
- A LATEX wiki (most Google searches lead here): https://en.wikibooks.org/wiki/LaTeX ⤷ **(https://en.wikibooks.org/wiki/LaTeX)** .
- A fantastic application of machine learning; use it to find LATEX commands based on the symbol: https://detexify.kirelabs.org ⤷ **(https://detexify.kirelabs.org)** .
- A graphical LATEX editor (requires downloading and installing the software): https://www.lyx.org/ ⤷ **(https://www.lyx.org/)** .
- A different graphical editor (also requires downloading and installing software): https://texmacs.org/ ⤷ **(https://texmacs.org/)**
- A forum for asking LATEX-related questions **(highly recommended)**: https://tex.stackexchange.com/ ⤷ **(https://tex.stackexchange.com/)** .

Course Summary:

Date	Details	Due

Date	Details	Due
Tue Jan 23, 2024	📝 **Problem Set 1 (https://q.utoronto.ca/courses/337013 /assignments/1219053)**	due by 11:59pm
Mon Jan 29, 2024	📅 **Term Test 1 (LEC0101) (https://q.utoronto.ca /calendar?event_id=730583& include_contexts=course_337013)**	11:15am to 12:30pm
	📅 **Term Test 1 (LEC0201) (https://q.utoronto.ca /calendar?event_id=730584& include_contexts=course_337013)**	1:15pm to 2:30pm
	📅 **Term Test 1 (LEC0301) (https://q.utoronto.ca /calendar?event_id=730585& include_contexts=course_337013)**	3:15pm to 4:30pm
	📅 **Term Test 1 (LEC5101) (https://q.utoronto.ca /calendar?event_id=730586& include_contexts=course_337013)**	6:15pm to 7:30pm
Thu Feb 8, 2024	📝 **Problem Set 2 (https://q.utoronto.ca/courses/337013 /assignments/1219060)**	due by 11:59pm
Wed Feb 14, 2024	📅 **Term Test 2 (LEC0101) (https://q.utoronto.ca /calendar?event_id=730587& include_contexts=course_337013)**	11:15am to 12:30pm
	📅 **Term Test 2 (LEC0201) (https://q.utoronto.ca /calendar?event_id=730588& include_contexts=course_337013)**	1:15pm to 2:30pm
	📅 **Term Test 2 (LEC0301) (https://q.utoronto.ca /calendar?event_id=730589& include_contexts=course_337013)**	3:15pm to 4:30pm
	📅 **Term Test 2 (LEC5101) (https://q.utoronto.ca /calendar?event_id=730590&**	6:15pm to 7:30pm

Date	Details	Due
	include_contexts=course_337013)	
Tue Mar 5, 2024	📝 **Problem Set 3 (https://q.utoronto.ca/courses/337013 /assignments/1219067)**	due by 11:59pm
	📅 **Term Test 3 (LEC0101) (https://q.utoronto.ca /calendar?event_id=730591& include_contexts=course_337013)**	11:15am to 12:30pm
Mon Mar 11, 2024	📅 **Term Test 3 (LEC0201) (https://q.utoronto.ca /calendar?event_id=730592& include_contexts=course_337013)**	1:15pm to 2:30pm
	📅 **Term Test 3 (LEC0301) (https://q.utoronto.ca /calendar?event_id=730593& include_contexts=course_337013)**	3:15pm to 4:30pm
	📅 **Term Test 3 (LEC5101) (https://q.utoronto.ca /calendar?event_id=730594& include_contexts=course_337013)**	6:15pm to 7:30pm
Thu Mar 21, 2024	📝 **Problem Set 4 (https://q.utoronto.ca/courses/337013 /assignments/1219069)**	due by 11:59pm
	📅 **Term Test 4 (LEC0101) (https://q.utoronto.ca /calendar?event_id=730595& include_contexts=course_337013)**	11:15am to 12:30pm
Wed Mar 27, 2024	📅 **Term Test 4 (LEC0201) (https://q.utoronto.ca /calendar?event_id=730596& include_contexts=course_337013)**	1:15pm to 2:30pm
	📅 **Term Test 4 (LEC0301) (https://q.utoronto.ca /calendar?event_id=730597& include_contexts=course_337013)**	3:15pm to 4:30pm

Date	Details	Due
	🗓 **Term Test 4 (LEC5101) (https://q.utoronto.ca /calendar?event_id=730598& include_contexts=course_337013)**	6:15pm to 7:30pm
Tue Apr 9, 2024	🖉 **Problem Set 5 (https://q.utoronto.ca/courses/337013 /assignments/1219071)**	due by 11:59pm

🗓 **Term Test 4 (LEC5101)**