The Edward S. Rogers Sr. Department of Electrical & Computer Engineering
UNIVERSITY OF TORONTO

APS 105S: Computer Fundamentals

Winter 2023

Welcome! Computer software has become one of the most important engineering tools ever created. Even in the last few years, software has become essential in almost every human endeavour, whether it is music, design, health care, business or entertainment. The goal of this course to introduce you to the basics of computer software, and show you how to use it to solve problems. The course is also meant to be your first taste of what engineering design really is all about.

APS105 will provide you with the foundation for studying software systems in greater depth in later courses. You will learn how to make high-quality software through participating in lectures, but most importantly by the work you do for the laboratory exercises. The main topics to be covered are: the representation of information, programming techniques, programming style, basic loop structures, functions, arrays, strings, pointers, linked lists, binary search trees, and searching and sorting algorithms. The laboratories in this course reinforce the lecture topics and develop essential programming skills, using the C programming language. Though we will focus on the C programming language, the fundamental concepts taught in this course apply to most modern programming languages, such as C++, Python, and Javascript.

Learning Outcomes

- Learn how to write and debug practical computer programs using the C programming language
- Learn about basic data structures, such as linked lists and binary search trees

- Learn about how basic algorithms, such as searching and sorting algorithms, can be designed and implemented

Instructors, Lecture Times and Office Information

Course coordinator: Bruno Korst (LEC 0103) (Office: PT374D, Office hour TBA, Zoom meeting room: https://utoronto.zoom.us/j/88508937446 -- Passcode: aps105) - Lectures: M2-3pm (MS2170), W2-3pm (SF1101), R2-3pm (SF1101).

Kia Shakiba (LEC101) (Office: PT392, Office hour TBA, Zoom meeting room: https://utoronto.zoom.us/j/4760321227) - Lectures: T12-1pm (MC254), R12-1pm (MC252), F2-3pm (MC254)

Salma Emara (LEC102) (Office: SF1021B, Office hour: Thursdays 12 pm to 1 pm, Zoom meeting room : https://utoronto.zoom.us/j/81994733653) – Lectures: M12-1pm (BA1170), W12-1pm (BA1170), F2-3pm (BA1170)

Philip Anderson (LEC104) (Office: EA316, Office hour TBA, Zoom meeting room: https://utoronto.zoom.us/j/4920918611 (passcode f7KugZ) – Lectures: M9-10am (BA1170), W2-3pm (SF1101), R2-3pm (SF1101)

Further details on lecture times and location can be found via the Timetable Builder (ttb.utoronto.ca), under APS105H1 S Computer Fundamentals.

Grading

The grades in the course will be based on 9 laboratories, the midterm examination, and the final examination. The midterm examination will cover all the material up to the week before the Reading Week, and will take place on **Tuesday Feb 28, 2023, 13:10 — 14:50**, for a **duration of 100 minutes**, at Examination Centre **Room EX 100 and EX 200**. The final examination will be

comprehensive, covering all the material in this course, with emphasis on material covered after the midterm examination.

The composition of the final grade is as follows: Labs 30%, Midterm Examination 30%, Final Examination 40%. Labs 1, 2, 3 are 2% each, Labs 4, 5 and 6 are 3% each, Lab 7, 8, 9 are 5% each.

Course Website

The website for this course (https://q.utoronto.ca/courses/288235) can be found on Quercus, accessible from the University of Toronto Portal (https://q.utoronto.ca). Look for the course titled Computer Fundamentals. All four sections are in the same online course website — you can ignore the part of the course title labeled LEC0101. The course syllabus (this document), course schedule, in-class announcements, and all handouts for the labs will be accessible there.

Course Schedule

Lectures and tutorials begin at 10 minutes past the hour, and end at the hour. Refer to a separate spreadsheet that you can download from the course website for a detailed schedule for this course.

Lab Assignments

The crucial part of this course is to learn programming by actually doing it. We provide strong TA support in the labs to both help you, and to make sure you're learning the key skills and concepts. You will be expected to do work on your labs on your own time. You may use your own computer and also use the Engineering Computing Facility (ECF) computers in room SF 1012 and 1013.

There are 10 lab exercises in this course (including lab 0), and the lab schedule is provided to you in the course schedule spreadsheet, which you can download separately from the course

website. Every lab (except Lab 0) has grades associated with it. It is essential to learn all of the earlier material as the later content will be based on it.

A handout describing each assignment will be available on the course website roughly two weeks prior to the week in which it is due. Each lab will consist of several questions, and each question will include several public test cases for you to test your code with. You will be using https://examify.ca to test and submit your solutions for each of the questions. After the submission deadline (which is specified in the lab handout and also visible in examify.ca), your solutions will be automatically marked using a number of test cases used for marking. Though the test cases for marking are not made public, some of them will be identical to the public test cases. The output produced by your solutions will be checked against the output generated by the correct solutions. Late submissions will not be accepted and you will receive a mark of zero.

These lab assignments will likely take a substantial amount of your time; it is important to start as early as possible on your assignments. You are free to discuss your approach with your fellow students; however you may not copy all or part of someone else's assignment solution. All lab assignments you submit should be your own work. Furthermore, under the University of Toronto code of conduct, a person who supplies an assignment to be copied will be penalized in the same way. We will use software to detect copying that is quite sophisticated and so is difficult to defeat. Those found will be prosecuted as academic offences. (Please refer to the following link for more: https://www.academicintegrity.utoronto.ca/wp-content/uploads/sites/135/2014/06/ProcessChartAI.pdf)

In your timetable, you have been assigned a two-hour period for working on your lab assignments. Each lab subsection will be permanently assigned to one Teaching Assistant (TA). That TA will be responsible for helping you with your labs throughout this term, so it is essential to prepare your questions and discuss them with your lab TA during your two-hour lab period. Labs will be held in room SF1012 and SF1013 in the Sandford Fleming Building according to the schedule posted in the timetable.

Please refer to the Timetable Builder found at https://ttb.utoronto.ca/

Section		Day	Time	Location
PRA	0101	Wednesdays	11:00-13:00	SF 1013
PRA	0102	Thursdays	15:00-17:00	SF 1013
PRA	0103	Mondays	13:00-15:00	SF 1013
PRA	0104	Thursdays	12:00-14:00	SF 1013
PRA	0105	Thursdays	09:00-11:00	SF1013
PRA	0106	Mondays	09:00-11:00	SF 1013
PRA	0107	Thursday	12:00-14:00	SF 1012
PRA	0108	Fridays	13:00-15:00	SF1013

The total amount of marks for the labs contribute 30% to your final grade, with earlier labs counting for less. However, you should not skip any labs, as the later more complex labs rely on the basic knowledge learned in the earlier ones.

Lab 0 will begin in the first week of classes, but will not be marked. Starting from Lab 1, check your individual schedule for the time of your lab section. You must attend your assigned lab subsection with your assigned TA.

Using Lab Software at Home — Visual Studio Code

You will be using a software tool that makes it easier to develop software itself — it makes sense that software developers have created many software tools to help in this process. We will be using the Visual Studio Code, which allows you to create and edit your software, compile it (you will learn what that means) and then execute it. Visual Studio Code is available on the computers in the ECF labs, and can be easily downloaded and installed on your own computer running either Windows or macOS, by visiting its website https://code.visualstudio.com/.

After downloading and installing Visual Studio Code, you will also need to install the C compiler and debugger. On macOS, you can install them by running the following command in your Terminal in Visual Studio Code:

```
xcode-select --install
```

On Windows, you will need to install minGW-w64 using MSYS2 in order to install your C compiler and debugger.

You will also need to install two extensions in Visual Studio Code, called C/C++ (by Microsoft) and C/C++ Runner (by franneck94). Two tutorial videos — for macOS and Windows respectively — have been provided to you in the course website to walk you through all the steps you will need for installing and using Visual Studio Code to compile, run and debug C programs. Detailed step-by-step instructions are also included in Lab 0.

Tutorials

There are 8 tutorial sections in this course, with one hour per week on different schedules (included in the preceding table). Tutorials will begin in the week of January 17, 2022, there will be no tutorials scheduled in the first week (the week of January 10, 2022) of this course.

Tutorials are conducted by a Teaching Assistant (TA) who will be prepared to discuss the material from the previous week's lectures but who will also be open to questions from the class. It is likely that the first 30 minutes or so will be used to introduce and discuss a few programming examples that you have not yet seen in class, and the next 20 minutes or so may be open for questions. The tutorials will be far more useful if you interact with the TA and ask him/her to explain material you do not understand, either from the labs or lectures.

Section	Day	Time	Location
TUT 0101	Thursdays	15:00-16:00	BA2165
TUT 0102	Mondays	14:00-15:00	MY330
TUT 0103	Tuesdays	12:00-13:00	SF3201
TUT 0104	Wednesdays	10:00-11:00	HA403
TUT 0105	Fridays	11:00-12:00	WB130
TUT 0106	Mondays	11:00-12:00	MY380
TUT 0107	Wednesdays	10:00-11:00	UC163
TUT 0108	Fridays	09:00-10:00	SF3202

Participation in the tutorials will be mandatory.

Plenary Lectures

The course will progress at a rather fast pace, and an additional plenary lecture is scheduled **every Tuesday at 5 — 6 p.m.** for all four lecture sections. The room is **MY150**. This plenary lecture is designed to focus on the labs, bonus helpful material that helps you understand the course even better, as well as preparation strategies for the midterm and final examination. The plenary lecture will be taught sometimes by the instructors and sometimes by the tutorial TAs. Though the lecture is optional, it is highly recommended for you to attend, especially if you find it difficult to follow the regular lectures in the course.

The weekly plenary lecture starts on January 17, 2021.

Textbook

This course has no textbook. You are welcome to select a textbook from the many available alternatives that suits your entry programming level and learning style. We found no textbook that would support both a beginner programmer and one that already had some programming knowledge. Use a search engine (like Google) to check out available titles.

Professor Salma Emara has prepared an excellent resource for the APS105 students, which follows the flow of topics presented in the course. Feel free to use it as a reference: https://learningc.org/cover.html

Another good example that is free provided that you subscribe to their free newsletter: https://www.freecodecamp.org/news/the-c-beginners-handbook/. It covers the basics but does not cover the more advanced topics we will cover towards the end of the term.

We invite you to look for high-quality online sources introducing the C programming language, and to share them on the Piazza discussion forum for this course (see the next section).

Course Discussion Forum

If you have any questions that are not specific to you and are likely of interest to your classmates as well:, you are invited to post them on the Piazza discussion forum for this course. You can post anonymously to your classmates (but not to the instructors). Piazza is the fastest way to get answers to your questions, so use it!

To sign up on the Piazza discussion forum, use the following link:

https://piazza.com/utoronto.ca/winter2023/aps105h1s

The Piazza page for the course is found here: https://piazza.com/class/lcgnjpjimjl20x

If you would like clarifications or explanations of laboratory assignments, do not wait until your scheduled lab section. You should first check the Piazza discussion forum — someone else may have asked the same question already. Fellow students may also help you out by replying to your questions. Even if you do not have a question about a lab, it is a good idea to check the Piazza discussion forum from time to time. You may see a question or a response there that will make you realize that there is some feature of the lab that you had never considered. We will be using the Piazza website only as a discussion forum — note that **all course announcements will be made using the Quercus course website only**.

If you are considering posting a question to the discussion forum, you should do two things before doing so. First, try to read the current entries to see if your question has already been asked and answered. Second, you should make sure that your question is as clear as you can make it.

Petitions and Re-marking Requests

If you miss a lab assignment or the midterm examination for a valid reason, you need to submit a petition to the First Year office, which will then be validated and sent to your instructor. The online

petition should be sent to the First Year office within 5 days of the event, and include documentation.

If you believe that your lab assignments or midterm examination were not marked correctly, you need to submit a re-marking request form within two weeks, with detailed reasons in writing. The re-marking request form can be downloaded from the course website.

Academic Integrity Policies

In developing solutions to labs, you may wish to discuss your approach to the solution with your fellow students. This is fine as long as the final solution is yours alone. You should never copy your lab solutions or let another student copy yours, not even a portion of them. You should not post any of your assignment questions in a private or public online discussion forum or website in order to solicit solutions from others. You should not allow any other student to read any portions of your solution, either by sharing a computer screen, or by sharing portions of the code remotely via instant messaging or social networking web sites. Note that, under the University of Toronto code of conduct, a person who supplies an assignment to be copied will be penalized in the same way. We will use modern software to detect copying that is quite sophisticated and difficult to defeat.

If you use an online source, rather than developing the code yourself, this is also cheating, although it is expected that students will use online sources to check usage and examples of various C language constructs. If you do copy an online source you run the risk that others may also do so, or that the online source is included in the plagiarism detection system. Either way, copying will be detected and processed as in the paragraph above.

For both the midterm and final examination, you must do these yourself and must not supply or obtain answers or share information with other students. We may use methods to detect such exchanges and will send the matters to the academic integrity representatives for the faculty.

For more details, please refer to: https://www.academicintegrity.utoronto.ca/

Code of Behaviour on Academic Matters: https://governingcouncil.utoronto.ca/secretariat/policies/code-behaviour-academic-matters-july-1-2019

Getting Help

Although you may never have needed extra help in school before, you may well find that you need assistance in this course. Even if you have heard that it is hard to find help at university, the truth is that help is readily available in a number of forums.

• Tutorials. Although TA's are given topics for discussion in the tutorials, questions from students are more than welcome. Questions should be of a type that might be of interest to other students in the class.

• Piazza discussion forum. Don't be afraid to post a question on the discussion forum — many others may be experiencing the same difficulty.

• Office hours. As noted earlier, your instructor is available for extra help during regular office hours.

• Lecture recordings. Some lecture recordings will be posted for your reference after the lectures.

Email

Please make sure that you check your University of Toronto mail account on a daily basis. You are required to read your email messages that are sent to you at your University of Toronto email address as it may contain important announcements from the First Year Office, the ECE Undergraduate Office, or from an instructor or coordinator of this course.

Additional Information and Resources

Statement on Inclusivity, Equity and Diversity at the University of Toronto

The University of Toronto commits to all students, faculty and staff that you can learn, work and create in a welcoming, respectful and inclusive environment. In this class, we embrace the broadest range of people and encourage their diverse perspectives. This team environment is how we will innovate and improve our collective academic success. You can read the evidence for this approach.

We expect each of us to take responsibility for the impact that our language, actions and interactions have on others. Engineering denounces discrimination, harassment and unwelcoming behaviour in all its forms. If you experience or witness any form of harassment or discrimination, including but not limited to, acts of racism, sexism, Islamophobia, anti-Semitism, homophobia, transphobia, ableism and ageism, please tell someone so we can intervene. Engineering takes these reports extremely seriously. You can disclose incidents of discrimination or harassment to our Assistant Dean, Diversity, Inclusion and Professionalism. You can also talk to anyone you feel comfortable approaching, including your instructor, your TA, or the First Year Office.

Accessibility Services

The University of Toronto supports accommodations for students with diverse learning needs, which may be associated with mental health conditions, learning disabilities, autism spectrum, ADHD, mobility impairments, functional/fine motor impairments, concussion or head injury, blindness and low vision, chronic health conditions, addictions, deafness and hearing loss, communication disorders and/or temporary disabilities, such as fractures and severe sprains, or recovery from an operation. If you have a learning need requiring an accommodation, please visit https://www.studentlife.utoronto.ca/ as soon as possible.

Mental Health Awareness

As a university student, you may experience a range of health and/or mental health challenges that could result in significant barriers to achieving your personal and academic goals. The University of Toronto and the Faculty of Applied Science & Engineering offer a wide range of free and confidential services that could assist you during these times. We encourage you to seek out these resources early and often.

Student Life Website: https://www.studentlife.utoronto.ca

Health and Wellness Website: https://studentlife.utoronto.ca/hwc

If, at some point during the year, you find yourself feeling distressed and in need of more immediate support, the Feeling Distressed Webpage: https://www.studentlife.utoronto.ca/feeling-distressed, will have more campus resources for you to use.

Immediate help is available 24/7 through Good2Talk, a post-secondary student helpline at 1-866-925-5454.

All students in the Faculty of Applied Science and Engineering have an Academic Advisor who can advise on academic and personal matters. You can find your department's Academic Advisor here:

https://undergrad.engineering.utoronto.ca/advising-support-services/academic-advising/

Land Acknowledgement

We wish to acknowledge this land on which the University of Toronto operates. For thousands of years it has been the traditional land of the Huron-Wendat, the Seneca, and most recently, the Mississaugas of the Credit River. Today, this meeting place is still the home to many Indigenous people from across Turtle Island and we are grateful to have the opportunity to work on this land.