



Instructor: [Ashvin Goel](#)

Course Number: ECE344

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# Operating Systems

ECE344, FALL 2016  
UNIVERSITY OF TORONTO

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## COURSE DESCRIPTION

Welcome to ECE344! The goal of this course is to have students understand the design and implementation of operating systems software. Topics include: Introduction to operating systems concepts, process management, memory management and file systems. Time permitting, we will discuss additional topics. The laboratory exercises will require implementing software that helps understand core operating system concepts.

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## COURSE INFORMATION

This site provides course handouts, lecture notes, code samples, lab handouts, and all other lab-related information.

Course announcements and course discussion will be on the [Piazza web site](#). You will need to register with Piazza if you don't have an account. You should post any questions about the course on Piazza before sending individual mails to the TAs or the instructor. Please visit the Piazza site regularly for up-to-date information.

In addition, course grades and past exam information will be available at the [UoT portal site](#).

### Email

You are required to have a valid UTORmail email address. You are responsible for ensuring that your UofT email address (mail.utoronto.ca) is properly entered in the ROSI system. Forwarding your UofT email to a Gmail, Hotmail, Yahoo or other type of email account is not advisable. In some cases, messages from UofT email addresses sent to these accounts are filtered as junk mail.

### Textbook

The suggested text book for this course is: [Modern Operating Systems \(4th Edition\)](#) by Andrew Tanenbaum.

The instructor recommends the following book highly: [Operating Systems: Three Easy Pieces](#) by Remzi H. Arpaci-Dusseau and Andrea C. Arpaci-Dusseau. You can access freely available chapters of the book from the book website or support the authors by buying it.

### Timetable

The lecture and lab times are shown below. You may attend the lectures for Section 1 or Section 2, but please do not switch lectures

because the two sections may not be synchronized. You are expected to attend one three-hour lab session each week.

There are no tutorials in this course.

#### Section 1:

Lecture Times: Thu 3-4pm (RS208), Mon 11-12pm (GB303), Wed 3-4pm (GB303)

Lab Times: Thu 9-12pm (GB243 and GB251)

#### Section 2:

Lecture Times: Thu 4-5pm (RS208), Mon 10-11am (GB303), Wed 4-5pm (GB303)

Lab Times: Thur 12-3pm (GB243 and GB251)

The instructor will be available for office hours weekly as follows:

Office Hours: Mon 12-2pm (SF2001B)

The mid term schedule:

Mid Term: Oct 26, Wed 6:30-7:45pm (EX100)

The tentative final exam schedule:

Final Exam: Dec 15, Thu 6:30-9:00pm

### Course Feedback

You can provide course feedback by posting private notes on Piazza. These notes are only visible to instructors. Note that we do not allow posting anonymous notes.

### Marking and Evaluation

There will be several labs during the term. There will also be one mid-term test during the course. A final exam will be given during the final exam period. The details of the mid-term test and final exam time will be provided in class and on the course web site. The composition of the final mark is as follows:

- Assignments: 25%
- Mid-term test: 25%
- Final exam: 50%

A repository of past exams is available on the lab machines in the /cad2/ece344f/exams directory. The exam questions are contained in separate files, with each file containing a specific course topic. These files are in the PDF file format. You can view the files on the lab machines using a PDF reader, or you can copy these files to your home machine and view them there.

We do not provide or mark problem sets in the course. The repository of past exams is your best resource for preparing for exams. Answers for most questions have been provided. Feel free to get additional clarifications about the questions or their answers on the Piazza website.

### Topic Outline

The following is a list of the topics, and the corresponding reference in the book. Please keep in mind that this list of topics is tentative and is intended to serve as only a general guide.

Topic	Reference
Introduction to OS Concepts	Textbook Chapter 1
Process Management	Textbook Chapter 2
Memory Management	Textbook Chapter 3
I/O and File Systems	Textbook Chapters 4, 5
Atomicity and Consistency	Instructor's notes
Virtualization	Instructor's notes
Introduction to Cloud Computing	Instructor's notes

## LAB INFORMATION

The labs consist of a number of programming exercises. **All the labs are to be done individually.**

A handout describing each lab assignment will be available from the course web site (no hard copies are provided). The lab assignments, their release dates, due dates and the time allotted for the assignment are shown in the [table below](#). Assignments will generally be released on Friday mornings. Assignments are due on Monday afternoons at **5 pm**. Assignments will be marked by the TAs after they are submitted (they are not marked in the labs). The TAs will send you an email with your lab marks.

Lab	Topic	Release Date	Due Date	Time Allotted	Lab Marks
1	Review of C, data structures	Sep 9	Sep 26	2 weeks	3
2	Cooperating Threads	Sep 23	Oct 10	2 weeks	5
3	Preemptive Threads	Oct 7	Oct 24	2 weeks	5
4	Concurrent Web Server	Oct 21	Nov 7	2 weeks	4
5	Caching Web Server	Nov 4	Nov 21	2 weeks	3
6	File Systems	Nov 18	Dec 5	2 weeks	5

**Please be aware that this course will require significant time for lab work.** However, the assignments have been designed so that there is enough time to completely finish each assignment. Many of these assignments require **significant** preparation that involves reading the lab documentation and the code provided for the assignment. Each assignment specifies the code that needs to

be read and understood. Please read the handouts carefully before starting with the labs. This preparation **must** be done before the lab or else there will not be enough time to complete the lab. Hence, it is very important to **start as early as possible on your assignments** and avoid procrastination. For most labs, **it will be best to write most of the code beforehand** and then use the lab to test and submit your code and, if needed, get help from the teaching assistants (TAs).

**It is your responsibility to correctly identify and meet the deadline for each assignment.** Assignments will not be accepted after their due dates, without prior arrangement with the course instructor. In general, no deadline extensions will be granted to individuals except in severe circumstances.

### Labs and Lab Access

Labs will be held in the ECE workstation labs at the times shown [above](#). This time is scheduled for ECE344 students. TAs will be available to answer any questions and offer help during these periods. Lab access and use are possible any other time the labs are not occupied or used by another course, but no TAs will be available. Note that all marking will be performed by the TAs after the due date outside the lab hours, and hence it is not essential to attend the labs.

Your assignment code is expected to run on the lab machines. You may also use your home computer to work on assignments. You may do so by remotely accessing the lab machines from home by using a secure shell (ssh on Linux and putty on Windows). More instructions for remote access are available on the course web site.

You may also work on your assignment on your home computer. In that case, it will be best if you have a Linux installation. However, it is important that you get your code to work correctly on the lab machines, no matter where you develop it. **A program that does not work correctly on the lab machines, even if it works correctly on your home machine, will be marked as incorrect.** Plan ahead, and give yourself the time to test what you developed at home on the lab machines before the deadline.

All source code must be compiled and submitted on the lab computers. These computers are Linux machines with names that matches `ug*.eecg.utoronto.ca`, e.g., `ug149.eecg.utoronto.ca`. You can tell which machine you are using from the command prompt. For example, if you are using `ug149.eecg.utoronto.ca`, the command prompt will show `ug149`. The range of machines that are accessible is roughly `ug51-ug100`, `ug132-ug180` and `ug201-250`. The [lab assignments](#) provide more information about the lab machines and how to access them remotely.

### Getting Help

In general, the TAs will be on duty only during the scheduled lab session. To get help at other times, you should use the forum on the Piazza website. The TAs and the instructor will regularly check the forum and answer your questions. These answers become available to all students. Thus, please check the forum before posting a question to make sure that the question has not been posted and

answered earlier. The forum provides functionality for you to receive emails as any messages or their answers are posted. Please enable this functionality if you want to know when your questions have been answered.

You are encouraged to use the forum, and to engage in discussions about the lab assignments with fellow students. Please do not post code on the forum. Doing so will be treated as an academic offense (see below). You can also post messages on Piazza that are only visible to TAs and the instructor.

### Testing Code

The handout for each programming assignment will specify the required functionality of the assignment. It is up to you to make sure that your solution delivers this functionality. The assignments have several unit tests that can be performed to test your program. Please use these tests.

### Submitting Your Lab Work

We will provide instructions for submitting your lab work as part of the lab assignment instructions.

### Marking

Marking will be performed by the TAs after the lab due dates shown in the [table](#) above. Marking will generally be performed using automated test scripts that check the output of your code to ensure that the implementation works correctly. Labs are worth 25% of the total course mark. The breakup of the marks for each lab is shown in the last column of the [table](#) above. **The submitted code is tested to ensure that it is not similar to others. Also, any hard-coding of outputs in your program in an attempt to fool the automated tester is considered a serious offense.** For more details, please see below.

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## INDEPENDENT WORK

Students are encouraged to discuss with one another issues and problems that arise in the course of solving the laboratory assignments. However, **work submitted for credit must be the individual's own work.** It is one thing to discuss and compare approaches to a problem, but quite another to rely on some other person's work to obtain credit for an assignment. **It is also an offense to knowingly allow a copy of your work to be submitted by another person for credit. It is also an offense not to put in place protections to prevent your code from being copied without your knowledge!**

A reasonable rule of thumb to follow during a discussion is that nobody should leave the discussion with written notes of what was said. It is unlikely that two individuals that have discussed various approaches to a problem will write highly similar programs unless one or both have a written record of what was said.

All programs submitted for credit in this course will be compared pair wise to attempt to identify cases of collusion, copying, and

similar offenses. The comparison is performed by a sophisticated program that is capable of detecting similar programs even if considerable effort has been taken to conceal their similarity.

**Any work submitted for credit that is not the work of the person(s) submitting it will be treated as an offense under the Code of Academic Discipline of the University. The Code of Academic Discipline will be rigidly enforced in this course.**

Penalties can range from grade penalties in the course to suspension from the university. The Dean, as advised by the instructor and the Departmental Chair, determines the penalty for each case.

For more details, please refer to the [Academic Integrity](#) policies at the university.