# Course Schedule

**Important:** ALL TIMES EASTERN - Please see the <u>University Policies</u> section of your Syllabus for details.

There are six weeks to progress through five modules. This allows students to spend most of the first two weeks on the first module and related activities. Alternatively, it is reasonable to begin quickly giving extra flexibility later in the term.

There are three firm deadlines in the course. These deadlines are generous but inflexible. Therefore, students are strongly encouraged to complete the lectures and quizzes at a pace that approximates the recommended schedule in the table below.

| Module                                    | Quiz<br>(2% each) | Recommended Schedule       | Assignment<br>(26% each) | Fi             |
|---|-------------------|----------------------------|--------------------------|----------------|
| Module 1: Introduction and<br>Isomorphism | <u>Quiz 1.1</u>   | Tuesday, November 3, 2020  | Assignment 1             | Wedı<br>at 4:0 |
|   | <u>Quiz 1.2</u>   | Friday, November 6, 2020   |                          |                |
|   | <u>Quiz 1.3</u>   | Tuesday, November 10, 2020 |                          |                |
| Module 2: Longest Paths                   | Quiz 2.1          | Friday, November 13, 2020  | - <u>Assignment 2</u>    | Wedi<br>4:00   |
|   | <u>Quiz 2.2</u>   | Tuesday, November 17, 2020 |                          |                |
| Module 3: Degree and<br>Diameter          | Quiz 3.1          | Friday, November 20, 2020  |                          |                |
|   | <u>Quiz 3.2</u>   | Tuesday, November 24, 2020 |                          |                |
| Module 4: Crossings                       | Quiz 4.1          | Friday, November 27, 2020  | - Assignment 3           | Wed1<br>4:00   |
|   | <u>Quiz 4.2</u>   | Tuesday, December 1, 2020  |                          |                |
| Module 5: Reconstruction                  | Quiz 5.1          | Friday, December 4, 2020   |                          |                |
|   | Quiz 5.2          | Tuesday, December 8, 2020  |                          |                |

You must achieve a final grade of at least 70% to pass this course.

### Final Examination Arrangement and Schedule

There is no final examination for this course.

## Official Grades and Course Access

Official Grades and Academic Standings are available through Quest.

Your access to this course will continue for the duration of the current term. You will not have access to this course once the next term begins.

# **Contact Information**

#### Announcements

Your instructor uses the **Announcements** widget on the **Course Home** page during the term to communicate new or changing information regarding due dates, instructor absence, etc., as needed. You are expected to read the announcements on a regular basis.

To ensure you are viewing the complete list of announcements, you may need to click **Show All Announcements**.

#### Discussions

For general questions relating to the course, you may use the **General Discussion** topic\* to pose questions to your fellow students and instructor. Before posting a question or contacting the instructor directly, check this topic to see if your question has already been answered.

If you have questions pertaining to a specific assignment, please post in the respective discussion topic listed under **Assignment Discussions**\*.

As you are going through the course, if you have specific questions about course content and/or the module quizzes, these can be posted in the corresponding **Lecture Content and Quizzes** discussion topic\*.

Your instructor drops into the discussion topics regularly.

#### Fall 2020

## Contact Us

| Who and Why   | Contact Details  |  |  |
|---|--|--|--|
| <ul> <li>Instructor</li> <li>Course-related questions<br/>(e.g., course content,<br/>deadlines, assignments,<br/>etc.)</li> <li>Questions of a personal<br/>nature</li> <li>Questions about LaTeX,<br/>Crowdmark</li> </ul> | Post your course-related questions to the Ask the Instructor discussion topic*. This allows other students to benefit from your question as well. Questions of a personal nature can be directed to your instructor. Instructor: J.P. Pretti jpretti@uwaterloo.ca Your instructor checks email and the Ask the Instructor discussion topic* frequently and will make every effort to reply to your questions within 24–48 hours, Monday to Friday. Before contacting your instructor, please check the MATH 600 resources to see if there is an answer to your question. |  |  |
| <ul> <li>Technical Support,<br/>Centre for Extended Learning</li> <li>Technical problems with<br/>Waterloo LEARN</li> </ul>   | learnhelp@uwaterloo.caInclude your full name, WatIAM user ID, student number, and course name<br>and number.Technical support is available during regular business hours, Monday to<br>Friday, 8:30 AM to 4:30 PM (Eastern Time).LEARN Help Student Documentation  |  |  |
| <ul> <li>Learner Support Services,</li> <li>Centre for Extended Learning</li> <li>General inquiries</li> <li>WatCards (Student ID Cards)</li> <li>Examination information</li> </ul>  | Student Resources         extendedlearning@uwaterloo.ca         +1 519-888-4002         Include your full name, WatIAM user ID, student number, and course name and number.  |  |  |

\*Discussion topics can be accessed by clicking **Connect** and then **Discussions** on the course navigation bar above.

# Course Overview

## Description

Graphs are mathematical objects representing connections. These connections can involve real-world entities or abstract ideas.

This course examines the beauty and complexity of this underlying structure. It is a proof-oriented introduction to

graph theory. Select foundational topics including isomorphism, connectivity, and planarity are covered. However, instead of a conventional approach, the joy of graph theory is brought to life through the study of four deep but easy to understand problems. In fact, no solutions<sup>†</sup> to the problems are known!

#### Organization

The course is divided into five modules. The first module is an introduction to graph theory. Each of the remaining four modules begins with motivating real-world applications and ends with an associated open problem<sup> $\dagger$ </sup>.

#### Objectives

Upon successful completion of this course, students should be able to

- read the definition of a property of graphs and determine if a small sample graph has this property,
- read and write short proofs of graph-theoretic facts,
- determine the truth of statements about graphs where this is possible by examining examples and using previous knowledge, and
- appreciate the complexity of graphs and their application to real-world problems.

### Acknowledgements

Many people had a hand in the creation of this course. Cam Connor helped immensely with image creation. Thanks also go to Steven Furino and Ian VanderBurgh for their reviews of the material. All this is in addition to the important roles played by the Centre for Extended Learning and ITMS - Instructional Technologies and Multimedia Services.

### Tips for Success

Graph theory is no easier or more difficult than most other areas of mathematics. However, it might be more abstract than some students are accustomed to. The following suggestions can help make an introduction to graph theory more comfortable and rewarding.

- 1. Draw lots of pictures.
  - There are many in the modules; sketch your own on rough paper as you progress through the lectures.
- 2. Pause often and think about specific examples and counterexamples.
  - The online format makes it easy to replay and rewind the introduction of new concepts.
- 3. Put new terminology and notation to memory before absorbing its use in a proof or application.
  - Quizzes are strategically placed to emphasize the importance of learning the language of graph theory.

Additionally, all of the <u>definitions</u> and <u>results</u> have been extracted into clean, separate documents. They can be printed or be available on the screen for consultation while watching the lectures and working through exercises.

This online course was developed by J.P. Pretti, with instructional design and multimedia development support provided by the Centre for Extended Learning. Further media production was provided by Instructional Technologies and Multimedia Services.

<sup>†</sup>At the time the course was designed, each of the problems was frequently and recently cited as unsolved despite rich histories of research by accomplished and respected graph theorists.

# About the Course Author and Instructor

#### Course Author and Instructor — J.P. Pretti

I earned Bachelor and Master of Mathematics degrees from the University of Waterloo. Following graduate studies with an emphasis on cryptography, I remained at the University of Waterloo as a lecturer. I teach both mathematics and computer science and my love for graph theory comes in part because of how nicely it fits at the intersection of both disciplines.

Outside the university classroom, I work on the many outreach activities of the Centre for Education in Mathematics and Computing. This is an equally enjoyable aspect of my job. Problemsolving during student workshops, teacher conferences and the creation of contests keeps me challenged and in touch with many friends and colleagues in high schools and elementary schools. It is wonderful to have the opportunity to do this both inside Canada and also in other countries around the world.



As of September 2019, I have been the Director of the MMT. It is an honour to be leading this successful and important program which has a meaningful impact on teachers and their students.

In my non-professional life, I am busy happily spending lots of time with my family. During the fall and winter, whenever I can, after my young children fall asleep at night, I sit back and cheer for the Toronto Maple Leafs.

# Materials and Resources

#### Textbook

There is no textbook for the course. All required course work can be tackled using first principles and the lecture modules. Students are strongly encouraged to post to the course discussion board or email the instructor for clarification of any lecture content. Students are discouraged from looking for extra material to supplement the lecture material while enrolled in the course.

#### Resources

A <u>glossary</u> and <u>summary of results</u> are handy references to be used while progressing through the course. <u>Real-world examples</u> and <u>explorations for use in the classroom</u> are handy resources for future use.

#### Resources

Library services for Co-op students on work term and Extended Learning students

# Grade Breakdown

The following table represents the grade breakdown of this course.

| Assessments            | Weight |
|------------------------|--------|
| Quizzes (2% each)      | 22%    |
| Assignments (26% each) | 78%    |

Quiz questions will be weighted equally. Similarly, the assignments will each consist of ten equally-weighted questions.

You must achieve a final grade of at least 70% to pass this course.

# **Course and Program Policies**

Course Assignment Policies

Your assignments and quizzes must be uploaded by **4:00 PM** on the **Wednesday** of the appropriate week (outlined in the <u>Course Schedule</u>). These days and times are those of the Eastern Time Zone. We cannot accept late submissions.

The assignments and quizzes are both individual exercises. They must not be completed in pairs or groups.

All questions can be answered using the graph theory content from the lecture modules. The only other resources that you may use to solve the problems are the instructor (who is very happy to receive and answer questions!) and the course discussion board. Looking anywhere else for extra background material related to an assignment question or way to approach it is not permitted.

### Course Intellectual Property Policy

Students should be aware that this course contains the intellectual property of their instructor, TA, and/or the University of Waterloo. Intellectual property includes items such as:

- Lecture content, spoken and written (and any audio/video recording thereof);
- Lecture handouts, presentations, and other materials prepared for the course (e.g., PowerPoint slides);
- Questions or solution sets from various types of assessments (e.g., assignments, quizzes, tests, final exams); and
- Work protected by copyright (e.g., any work authored by the instructor or TA or used by the instructor or TA with permission of the copyright owner).

Course materials and the intellectual property contained therein, are used to enhance a student's educational experience. However, sharing this intellectual property without the intellectual property owner's permission is a violation of intellectual property rights. For this reason, it is necessary to ask the instructor, TA and/or the University of Waterloo for permission before uploading and sharing the intellectual property of others online (e.g., to an online repository).

Permission from an instructor, TA or the University is also necessary before sharing the intellectual property of others from completed courses with students taking the same/similar courses in subsequent terms/years. In many cases, instructors might be happy to allow distribution of certain materials. However, doing so without expressed permission is considered a violation of intellectual property rights.

Please alert the instructor if you become aware of intellectual property belonging to others (past or present) circulating, either through the student body or online. The intellectual property rights owner deserves to know (and may have already given their consent).

#### **Program Policies**

Students must maintain an overall average of 75% in the program, with individual course marks of at least 70%.

# University Policies

#### Submission Times

Please be aware that the University of Waterloo is located in the **Eastern Time Zone** (GMT or UTC-5 during standard time and UTC-4 during daylight saving time) and, as such, the time that your activities and/or assignments are due is based on this zone. If you are outside the Eastern Time Zone and require assistance with converting your time, please try the <u>Ontario, Canada Time Converter</u>.

#### Accommodation Due to Illness

If your instructor has provided specific procedures for you to follow if you miss assignment due dates, term tests, or a final examination, adhere to those instructions. Otherwise:

#### Missed Assignments/Tests/Quizzes

Contact the instructor as soon as you realize there will be a problem, and preferably within 48 hours, but no more than 72 hours, have a medical practitioner complete a <u>Verification of Illness Form</u>.

**Email** a scanned copy of the Verification of Illness Form to your instructor. In your email to the instructor, provide your name, student ID number, and exactly what course activity you missed.

Further information regarding Management of Requests for Accommodation Due to Illness can be found on the Accommodation due to illness page.

### Academic Integrity

In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect, and responsibility. **If you have not already completed the online tutorial regarding academic integrity you should do so as soon as possible.** Undergraduate students should see the <u>Academic Integrity Tutorial</u> and graduate students should see the <u>Graduate Students and Academic Integrity</u> website.

Proper citations are part of academic integrity. Citations in CEL course materials usually follow CEL style, which is based on APA style. Your course may follow a different style. If you are uncertain which style to use for an assignment, please confirm with your instructor or TA.

For further information on academic integrity, please visit the Office of Academic Integrity.

#### Turnitin

#### Fall 2020

MATH 674 Topic 5 Online

**Turnitin.com**: Text matching software (Turnitin®) may be used to screen assignments in this course. Turnitin® is used to verify that all materials and sources in assignments are documented. Students' submissions are stored on a U.S. server, therefore students must be given an alternative (e.g., scaffolded assignment or annotated bibliography), if they are concerned about their privacy and/or security. Students will be given due notice, in the first week of the term and/or at the time assignment details are provided, about arrangements and alternatives for the use of Turnitin® in this course.

It is the responsibility of the student to notify the instructor if they, in the first week of term or at the time assignment details are provided, wish to submit the alternate assignment.

#### Turnitin® at Waterloo

## Discipline

A student is expected to know what constitutes <u>academic integrity</u> to avoid committing an academic offence, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about "rules" for group work/collaboration, should seek guidance from the course instructor, academic advisor, or the undergraduate Associate Dean. For information on categories of offences and types of penalties, students should refer to <u>Policy</u> <u>71 - Student Discipline</u>. For typical penalties, check <u>Guidelines for the Assessment of Penalties</u>.

### Appeals

A decision made or penalty imposed under <u>Policy 70 - Student Petitions and Grievances</u>, (other than a petition) or <u>Policy 71 - Student Discipline</u>, may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to <u>Policy 72 - Student Appeals</u>.

### Grievance

A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read <u>Policy 70 - Student Petitions and Grievances</u>, Section 4. When in doubt please be certain to contact the department's administrative assistant who will provide further assistance.

### Final Grades

In accordance with <u>Policy 46 - Information Management</u>, Appendix A - Access to and Release of Student Information, the Centre for Extended Learning does not release final examination grades or final course grades to students. Students must go to <u>Quest</u> to see all final grades. Any grades posted in Waterloo LEARN are unofficial.

## AccessAbility Services

AccessAbility Services, located in Needles Hall, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodation to lessen the impact of your disability, please register with AccessAbility Services at the beginning of each academic term and for each course.

#### Accessibility Statement

The Centre for Extended Learning strives to meet the needs of all our online learners. Our ongoing efforts to become aligned with the <u>Accessibility for Ontarians with Disabilities Act (AODA)</u> are guided by University of Waterloo accessibility <u>Legislation</u> and policy and the <u>World Wide Web Consortium's (W3C) Web Content</u> <u>Accessibility Guidelines (WCAG) 2.0</u>. The majority of our online courses are currently delivered via the Desire2Learn Learning Environment. Learn more about <u>Desire2Learn's Accessibility Standards Compliance</u>.

### Use of Computing and Network Resources

Please see the Guidelines on Use of Waterloo Computing and Network Resources.

## Copyright Information

#### **UWaterloo's Web Pages**

All rights, including copyright, images, slides, audio, and video components, of the content of this course are owned by the course author and the University of Waterloo, unless otherwise stated. By accessing this course, you agree that you may only download the content for your own personal, non-commercial use. You are not permitted to copy, broadcast, download, store (in any medium), transmit, show or play in public, adapt, or change in any way the content of these web pages for any other purpose whatsoever without the prior written permission of the course author and the University of Waterloo, Centre for Extended Learning.

#### **Other Sources**

Respect the copyright of others and abide by all copyright notices and regulations when using the computing facilities provided for your course of study by the University of Waterloo. No material on the Internet or World Wide Web may be reproduced or distributed in any material form or in any medium, without permission from copyright holders or their assignees. To support your course of study, the University of Waterloo has provided hypertext links to relevant websites, resources, and services on the web. These resources must be used in accordance with any registration requirements or conditions which may be specified. You must be aware that in providing such hypertext links, the University of Waterloo has not authorized any acts (including reproduction or distribution) which, if undertaken without permission of copyright owners or their assignees, may be infringement of copyright. Permission for such acts can only be granted by copyright owners or their assignees.

If there are any questions about this notice, please contact the University of Waterloo, Centre for Extended Learning, Waterloo, Ontario, Canada, N2L 3G1 or <u>extendedlearning@uwaterloo.ca</u>.