

Conrad Grebel University College
University of Waterloo
PACS 302 Special Topics: Math for Good and Evil
Winter 2020

Class Time: Tuesday, 6 – 8:50 pm

Location: Room 2201, Paetkau Seminar Room, Conrad Grebel University College

<p>Co-Instructor: Judith Koeller Office Hours: Monday, 4 – 5:00 pm Office Location: MC 6244 Phone: 519-888-4567 x 35128 Email: judith.koeller@uwaterloo.ca Pronouns: they/them, she/her</p>	<p>Co-Instructor: Lowell Ewert Office Hours: Tuesday, 3 – 4:00 pm Office Location: Conrad Grebel Room 4207 Kindred Centre for Peace Advancement Phone: 519-885-0220 x24380 Email: Lowell.ewert@uwaterloo.ca Pronouns: he/him</p>
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Acknowledgment:

We are on the traditional territory of the Attiwandaron (Neutral), Aniashinaabe, Haudenosaunee peoples. The University of Waterloo is situated on the Haldimand Tract, the land promised to the Six Nations that includes ten kilometers on each side of the Grand River.

Course Description:

This course is built on the conviction that the kinds of problems mathematicians and computer scientists seek to address, and the ways they seek to address them, should matter for anyone interested in advancing peace in the world. The peace implications of math and computer science are explored in connection to topics such as wealth, democracy, policing, oppression, war, environment, and health. Students engage with the material through reading, writing and discussion and are not asked to do any computation. This course is designed for students from all faculties and levels of comfort (or discomfort) with mathematics.

Math and computer science are tools of enormous and increasing power that impact our daily lives in thousands of ways that we seldom recognize. Many of the ways that these disciplines have affected us are very beneficial and have transformed the lives of millions of people for the better. Increasingly, however, mathematics and computer science are used in ways that may cause harm.

The purpose of this class is to explore how peace and math intersect. Without peace studies understanding how math can be appropriately harnessed for good, peace theory will be inadequate to prepare students for the twenty-first century. Therefore, peace studies needs to better understand why math matters. Conversely, without peace principles being considered when math is used to accomplish technological objectives, math can instead contribute towards causing harm. Therefore, those studying and utilizing math principles need to also understand and apply peace theory.

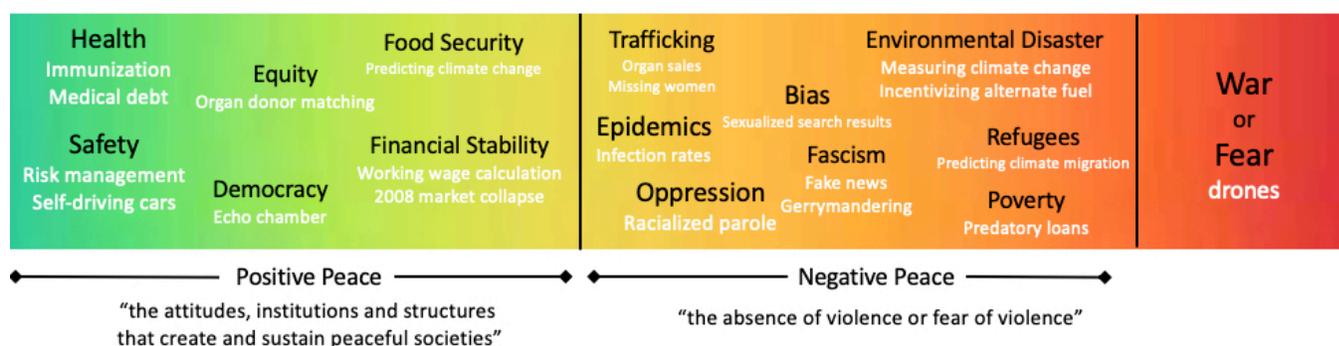
This course will examine topics that lie at the intersection of math and computer science, and sharpen an analysis of how both math and peace studies contribute to creating a stable and peaceful society.

Learning Objectives:

Students who complete this course will be able to:

- (Math objectives):
 - Articulate a multiplicity of ways that math can be used to benefit society or cause harm.
 - Evaluate the peace implications of specific mathematical work.
 - Articulate strategies for ethical dilemmas related to work in math or computer science.
- (Peace objectives):
 - Describe the complexity of peace beyond the simple absence of violence.
 - Envision and describe how math and computer science can be leveraged to better serve the interests of society.
 - Articulate the potential of collaborations between peace studies and mathematics to benefit society.

Concept Map:



Text Description: there is a continuum from war or the fear of war, to Negative Peace (the absence of violence or fear of violence), to Positive Peace (the attitudes, institutions and structures that create and sustain peaceful societies). Positive Peace is associated with Health, Safety, Democracy, Food Security and Financial Stability, while Trafficking, Epidemics, Oppression, Bias, Fascism, Environmental Disaster, Refugees and Poverty characterize Negative Peace. For each of these examples, mathematics plays a role in fostering or inhibiting peace.

Course teaching methodology:

A seminar course, PACS 302 will emphasize critical analysis and discussion. It will not assume that there is one "right" answer to questions posed or issues discussed, but rather that there are ways of thinking that will enable students to develop their own personal viewpoints. Students have much to contribute to this topic and will be expected to be engaged in class discussions and come to class well prepared. This course assumes that we all learn best and internalize lessons learned most effectively in a process of dialogue with each other. Students must therefore personally wrestle with concepts discussed in order to benefit from the course. Teaching methodologies that will be used will include:

- Presentation of key topics by course instructors
- Small group discussions
- Videos and guest lecturers
- Discussion of current events relevant to course topics
- Student involvement in research, presentations and reports
- Simulations, case studies and discussion of hypothetical scenarios

Required Reading Materials:

This course will use materials posted on LEARN and on-line resources. There is no required textbook.

Web Page:

This course will use a WATERLOO LEARN website. This site will provide general information for the course, reading assignments, grades for assignments, and other matters that may be posted from time-to-time. Important announcements such as the cancellation of class for some reason will also be posted there, so please check the site before each class, just in case.

Course Evaluation and Assignments:

Baseline Reflection Essay (5% of course mark) – due second week of the term, January 13, 2020, before the start of class. No research is required to complete this essay as this is a reflection paper.

Write a two page essay (500 words) that responds to the following:

- Section 1 – Complete the following sentences and briefly elaborate on each sentence:
 - When I think of math, I think
 - The impact math has on my life is.....
 - The connection my likely vocation has to math is.....
- Section 2 - Complete the following sentences and briefly elaborate on each sentence:
 - When I think of peace studies, I think....
 - The impact peace has on my life is.....
 - The connection my likely vocation has to peace is
- Section 3 - List three key questions regarding the topic of this course that you hope to answer this term, and why the answers to these questions is important to you.
- Section 4 – Reflect on any additional issues related to the course theme and topic that intrigues you that you hope to explore this term.

On-line Quizzes (15% of course mark) – due weeks 2 through 11.

Each week, read the assigned Weekly Readings, all of which can be downloaded from Learn at least one week in advance. Complete a series of ten quizzes on the readings, each composed of randomly assigned questions. The top eight of ten quizzes will count towards the final term grade. Quizzes will be available on Learn for any 60 minute period from the Sunday at 5pm two days before class until Tuesday at 5 pm the day of class. Students may work in groups of two.

In-class Writing Assignments (15% of course mark).

In 10 classes, you will be asked to reflect on some aspect of the class, a reading assignment, or application of the course topic to a contemporary theme. Only the marks of the 8 highest will be counted. Assignments will be graded mostly as pass/fail if they indicate a reasonable amount of interaction with the question given. More detail about expectations for this assignment will be given in class prior to the activity. No make-up assignments will be given.

Book Report (15% of course mark) – due Tuesday, February 4, 2020, at the beginning of class. Write a book report approximately 1,200 words on one of the books provided on the Book Report List. Other books may be considered if a student makes a good case that the book that is consistent with course themes. No more than two students may sign up to complete a report on the same book. The signup sheet to select a book is accessible through LEARN. Students may be called on to share key aspects of their book report in class as their book is relevant to themes that will be discussed in class. Guidelines for writing a good book review will be discussed in class.

Final Project Outline and Check-in (10% of course mark) – due in class on Tuesday, March 31, 2020

- Some topic ideas can be in the Book Report List and a Related News Articles folder on Learn.
- By March 31, write a first draft of your Final Project. Bring to class the completed Final Project Outline and Check-In Form (available on Learn) identifying components of your final project, such as the topic, its connections both to peace and to math, 3 main bibliography sources, and stakeholders.
- During the class on March 31, each student can take a few minutes to informally describe their topic and the details in their outline. Others will ask questions and may have ideas. This is a chance to talk about where you might be stuck, how to focus a broad topic, etc.
- At the end of class, each student will write briefly about how the discussion shaped their own project, and in response to a topic presented by another student.

Final Project (25% of course mark) – due Tuesday April 7, 2020 at 9:00 am to the Learn dropbox.

Complete a major project that addresses an issue related to this course that is of particular interest to you. You may work alone or in groups of up to three. Projects may consist of a traditional research paper of 10 – 15 pages (roughly 2,500 – 3,500 words in length, excluding the title page and bibliography). (Groups of 2 should submit 15-22 pages and groups of 3 should submit 20-30 pages.) Research papers should have footnotes, in Chicago style. Students may propose an alternative assignment (digital, etc.) that will roughly equal an equivalent workload. A detailed rubric will be available on Learn.

Papers should include the following sections:

- Title page
- Table of Contents
- Executive summary
- Main body of paper
- Conclusion
- Bibliography

Final Reflection Essay (15% of course mark) – due before the start of class March 24, 2020.

Complete a five-page essay (approximately 1,250 words) that reflects on any changes in attitude you may have experienced towards course topics during the term. This essay should:

- Review and evaluate your baseline essay and explain why you agree or disagree with what was written at the start of the term.
- Reflect on what surprised you most when re-reading your baseline reflection.
- Note significant changes in opinion that you may have had or key areas in which your thinking is still unsettled or unclear.
- Discuss whether you think a course like this should be included in the PACS or Math programs, and give reasons for your comments.
- Reflect on the role of a university – does it have an obligation to teach students how their discipline impacts society both positively and negatively? If so, how should it best do this?
- *If your future vocation is likely to be in Math/CS:* Imagine that your future job duties run counter to peace and the common good. Reflect on how your professional code of ethics and/or personal obligations may influence your response.

OR

If your future vocation is not likely to be in Math/CS: Reflect on how math/computer science might interact with your long-term vocation as a tool with peace implications, or describe other matters related to course themes that you feel pertinent.

- It is expected that this Final Reflection will be footnoted, relying on materials found in at least six sources, some of which, but not more than half, can be sources assigned in class.

Group Work

Note that if students decide to work to collaboratively develop and submit a final project, a [Group Assignment Disclosure](#) required by the Faculty of Arts must be completed and handed in at least one month in advance.

Submission guidelines

The final project and quizzes are submitted on Learn. All other assignments must be submitted in written, hard copy format.

Late assignments

Assignments must be submitted when due; late assignments will be subject to the following deductions:

- An immediate 5% penalty.
- Additional 2% per week day (Monday – Friday) for additional days late

Please be in touch with a course instructor at least 24 hours PRIOR to the assignment due date if there is legitimate need for accommodation. If you are ill, please communicate as quickly as you are able. A medical note may be required for an accommodation.

UWaterloo Policies

Academic Integrity: In order to maintain a culture of academic integrity, members of the University of Waterloo are expected to promote honesty, trust, fairness, respect and responsibility.

Arts: [Academic Integrity website](#) University of Waterloo: [Academic Integrity Office](#)

Discipline: A student is expected to know what constitutes academic integrity to avoid committing an academic offence, and to take responsibility for his/her actions. [Check [the Office of Academic Integrity](#) for more information.] 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 [Policy 71, Student Discipline](#). For typical penalties, check [Guidelines for the Assessment of Penalties](#).

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 [Policy 70, Student Petitions and Grievances, Section 4](#) When in doubt, please be certain to contact the department’s administrative assistant who will provide further assistance.

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

Accommodation for students with Disabilities: [AccessAbility Services](#), located in Needles Hall, Room 1401, 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 accommodations to lessen the impact of your disability, please register with [AccessAbility Services](#) at the beginning of each academic term.

Other sources of information for students:

Mental Health Support: All of us need a support system. The faculty and staff in Arts encourage students to seek out mental health support if they are needed.

On Campus

- Counselling Services: counselling.services@uwaterloo.ca / 519-888-4567 ext. 32655
- **MATES:** one-to-one peer support program offered by Federation of Students (FEDS) and Counselling Services
- Health Services Emergency service: located across the creek from Student Life Centre

Off campus, 24/7

- **Good2Talk:** Free confidential help line for post-secondary students. Phone: 1-866-925-5454
- Grand River Hospital: Emergency care for mental health crisis. Phone: 519-749-4300 ext. 6880
- **Here 24/7:** Mental Health and Crisis Service Team. Phone: 1-844-437-3247
- **OK2BME:** set of support services for lesbian, gay, bisexual, transgender or questioning teens in Waterloo. Phone: 519-884-0000 extension 213

Full details can be found online on the Faculty of Arts [website](#)

Download [UWaterloo and regional mental health resources \(PDF\)](#)

Download the [WatSafe app](#) to your phone to quickly access mental health support information.

Accommodation for Illness: A medical certificate presented in support of an official petition for relief from normal academic requirements must provide all of the information requested on the “University of Waterloo Verification of Illness” form or it will not be accepted. More information can be obtained from Health Services and the form is available in pdf:

<https://uwaterloo.ca/health-services/student-medical-clinic/services/verification-illness>

The Writing Centre: Writing Centre staff offer one-on-one support in planning assignments and presentations, using and documenting research, organizing and structuring papers, and revising for clarity and coherence. Make an appointment or drop in at the Library for quick questions or feedback. To book a 50-minute appointment and to see drop-in hours, visit www.uwaterloo.ca/writing-centre

Book Report List

We suggest you read one of the following books that we believe are relevant to the course will help you as you plan your final major project. Most of these books should be available at the Conrad Grebel University College Milton Good Library on reserve. Other books may be considered for this assignment if a student makes a good case for the applicability of another book that is consistent with course themes. Sign up for you book via Learn; no more than two students may sign up for the same book.

- John Carreyrou. *Bad Blood: Secrets and Lies in a Silicon Valley Startup*, New York: Alfred A. Knopf, 2018.
- Brian Christian. *The Most Human Human: What Artificial Intelligence Teaches Us About Being Alive*, Knopf Doubleday Publishing Group, 2012.
- Brian Christian and Andrew Guthrie Ferguson. *The Rise of Big Data Policing: Surveillance, Race, and the Future of Law Enforcement*, New York: New York University Press, 2017.
- Pedro Domingos. *The Master Algorithm: How the Quest for the Ultimate Learning Machine Will Remake Our World*, Basic Books, 2018.
- David Eggers. *The Circle*. Knopf, 2013.
- Virginia Eubanks. *Automating Inequality: How High-Tech Tools Profile, Police, and Punish the Poor*, New York: St. Martin's Press, 2017.
- Virginia Eubanks. *Digital Dead End: Fighting for Social Justice in the Information Age*, Cambridge: MIT Press, 2012.
- Hannah Fry. *Hello World: Being Human in the Age of Algorithms*, New York: W.W. Norton & Company, 2018.
- Tom Griffiths. *Algorithms to Live By: The Computer Science of Human Decisions*, Penguin, 2016.
- Daniel J. Levitin. *Weaponized Lies: How to Think Critically in the Post-Truth Era*, New York: Dutton, 2017.
- Sylvia Nasar. *A Beautiful Mind*. Simon and Shuster, 1998.
- Safiya Umoja Noble. *Algorithms of Oppression: How Search Engines Reinforce Racism*, New York: New York University Press, 2018.
- Cathy O'Neil. *Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy*, New York: Broadway Books, 2017.
- Alex Rosenblat. *Uberland: How Algorithms are Rewriting the Rules of Work*, Oakland: University of California Press, 2018.
- Emmanuel Saez and Gabriel Zucman. *The Triumph of Injustice: How the Rich Dodge Taxes and How to Make Them Pay*. Penguin Random House Books, 2019.
- Paul Scharre. *Army of None: Autonomous Weapons and the Future of War*, New York: W.W. Norton & Company, 2018.
- Tom Slee. *No One Makes You Shop at Wal-Mart: the surprising deceptions of individual choice*, Between the Lines Publishing, 2006.
- David Stocker, *Maththatmatters 2: A Teacher Resource linking math and social justice*, CCPA, 2018.
- David Sumpter. *Outnumbered: From Facebook and Google to fake news and filter-bubbles – the algorithms that control our lives*, New York: Bloomsbury Sigma, 2018.

Books dealing with thoughtful responsibility or justice-related themes:

- Jonathan Haidt. *The Righteous Mind: Why Good People are Divided by Politics and Religion*, Knopf Doubleday Publishing Group, 2013.
- Elizabeth Minnich. *The Evil of Banality: On the Life and Death Importance of Thinking*, New York: Rowman and Littlefield, 2017.
- Scott. E. Page. *The Difference: How the Power of Diversity Creates Better Groups, Firms, Schools, and Societies*, 2008.
- Hans Rosling. *Factfulness: Ten Reasons We're Wrong About the World – and Why Things Are Better Than You Think*, New York: Flatiron Books, 2018.

Weekly Schedule

The following schedule may change from time-to-time. Any changes will be announced in class at least a week in advance, with announcements on LEARN.

January 7: Introduction

January 14: Introduction to the field of Peace Studies – Lowell Ewert

- Assignments:
 - Baseline Reflection Essay is due.
 - Quiz 1 is due on-line before class begins.

January 21: Introduction to the field of Mathematics – Judith Koeller

- Assignment: Quiz 2 is due on-line before class begins.

January 28: Ethical Quandaries and Whistleblowing – Lowell and Judith

- Assignment: Quiz 3 is due on-line before class begins.

February 4: Democracy – guest Byron Weber Becker (Lowell)

- Assignments:
 - Quiz 4 is due on-line before class begins.
 - Book Report is due.

February 11: Environment - Judith

- Assignment: Quiz 5 is due on-line before class begins.

February 18: Reading Week, no class

February 25: Policing - Lowell

- Assignment: Quiz 6 is due on-line before class begins.

March 3: Modelling and Social Change – guest David Eagle (Judith)

- Assignment: Quiz 7 is due on-line before class begins.

March 10: Equity, Bias and Oppression – guests Sheila James and Steph Stewart (Judith)

- Assignment: Quiz 8 is due on-line before class begins.

March 17: Wealth and Poverty – guest Steve Furino (Lowell)

- Assignment: Quiz 9 is due on-line before class begins.

March 24: Health – Judith

- Assignments:
 - Quiz 10 is due on-line before class begins.
 - Final Reflection Essay is due.

March 31: Final project check-in Night - Lowell and Judith

- Assignment: Write a first draft of your final project. Bring to class the completed Final Project Outline and Check-In Form. During class, each student can take a few minutes to informally describe their project. Others will ask questions and may have ideas. This is a chance to talk about where you might be stuck, how to focus a broad topic, etc. At the end of class, you will be asked to write about how the discussion shaped your own project, and in response to a topic presented by another student.