Dr. Charles Rocca
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HON 498: Math, Literature, and Movies
Time: Monday 5:30pm - 8:00pm, HI 103
Credits: 3 Credits, Grading: A-F Grading
General Education: QR

Office Hours:

Office hours are on ground for the Fall 2021 Semester. If you need to meet virtually we can make an appointment to do so via my WebEx Virtual Office:
Higgins 101-DV (https://wcsu.webex.com/meet/roccac)

- Monday: 1pm - 2pm, 3:30pm - 4:30pm
- Tuesday: 2:30pm - 4:30pm
- Thursday: 1pm - 2pm
- or by appointment

Course Materials:

- *Sophie's Diary* by Dora Musielak (Novel)
- *Logicomix: An Epic Search for Truth* by Doxiadis, Papadimitriou, Papadatos, and Donna (Graphic Novel)
- *Breaking the Code* by Hugh Whitemore (Play)
- There are also some miscellaneous short stories and biographies, but all of these are available on line or through university databases.

Course Description:

In this course we explore the ways in which mathematics has been represented in literature and in the movies. This includes looking at the mathematics and at its use (and possible abuse) by the creative artists. Ultimately students will develop their own work of mathematical fiction.

Course Outcomes:

Quantitative Reasoning Competency:

Quantitative reasoning is the ability to recognize, interpret, and use quantitative information in a variety of situations in order to understand and create arguments supported by quantitative evidence. Students possessing quantitative reasoning skills will be able to apply quantitative principles, theories, and methods to solve problems, draw conclusions, and make informed decisions based on quantitative information. Further, they will be able to communicate their ideas or conclusions in a variety of appropriate formats (i.e. using words, tables, graphs, equations, etc.).
In this course we will satisfy the **QR competency** in the following ways:

- **Represent:** Represent quantitative information in clear and appropriate forms;

  Justification: Students will explore different ways to represent numbers and physical systems through their study of number theory, geometry/topology, and logic.

- **Apply:** Apply appropriate computational procedures to solve problems;

  Justification: Students will learn some basic symbolic logic and learn how we can apply this knowledge to electrical circuits. They will also explore how number systems have evolved over time and how types of numbers evolve from one another. They will also look at how numbers of combinations quickly grow as the complexity of a system increases.

- **Analyze:** Analyze quantitative information to make judgements and draw conclusions, while recognizing the limitations of such analysis;

  Justification: Students will solve problems problems using different types of reasoning (deductive, inductive, and abductive) while learning the limits of each. They will also learn how analyzing patterns and data can help draw conclusions from seemingly impenetrable ciphers.

- **Interpret:** Interpret quantitative information presented in textual, visual, or notational forms with reference to quantitative principles and theories;

  Justification: Students will learn to interpret data and systems in a mathematical way to better understand and solve problems.

Modes of Inquiry: This class will satisfy all four modes of inquiry.

- **Critical Interpretation and Analysis:** This course is centered on the reading and analysis of "texts" in multiple formats including films, short videos, novels, graphic novels, plays and short stories. Particular emphasis is placed on understanding how the creators of these works use mathematics as a part of the narrative, either moving it along or helping to add depth to the characters.

- **Scientific and Mathematical Analysis:** Throughout the course we will look at both how mathematics has been used in the stories we examine and how it impacts and is impacted by society. We will look at applications of mathematics to understanding ciphers, circuits, space, and time.

- **Historical, Social, and Cultural Analysis:** The readings chosen for this class are organized by time period starting with the French Revolution and ending at World War II. This allows us to examine how the time period influenced the mathematician or vise versa. We will also examine the impact of societal norms on the lives of the mathematicians, i.e. Sophie Germain fighting to learn mathematics as a young girl in the nineteenth century or Alan Turing suffering persecution for his sexual orientation after the war was over. Finally, we will discuss how mathematics is viewed by society and the anxiety that it seems to induce.

- **Artistic Creation and Analysis:** While examining texts students will be asked to consider the creative choices made by the creators, how have they deviated from actual historical persons and events and why. Also, the capstone for the class requires students to work in groups to create a work of mathematical fiction.

Course Content:

Mathematical Topic	Text	"Movie"
Number Theory	*Sophie's Diary*	***TBA***
Logic and Reasoning	*Logicomix*	*The Man who Knew Infinity*
Cryptology	*Breaking the Code*	*Codebreaker*
Topology	*A. Botts, No-Sided Professor, Crooked House*	*Wind and Mr. Ug* and *Flatland*

Grading:

Automathography	10%	Due at the third class meeting
Reading Journal	10%	Checked 4 times throughout the semester
Group Work Write Ups	60%	Handed in at each subsequent class
Biography	10%	Due at the last class before Thanksgiving break
Final Project	10%	Presented in the last two classes/final exam time
Extra Credit	5%	

Automathography: You will need to start your semester by writing a summary of your own experiences with mathematics. What math have you taken over the course of your life time? What did you like? What didn't you like?

Reading Journal: As you read through the stories of mathematics and mathematicians you need to write down your thoughts on what you have read. What surprised you? Did the reading stir up any memories or feelings from your own life? Was there anything in the story that struck you as particularly significant?

Group Work Write Ups: Most days will, after a hopefully brief introduction, be spent working in groups to understand some aspect of mathematics either from or related to what you are reading. The group work may be based directly on the readings for the class, or will be based on supplementary materials and follow after some instruction. After each class it is the responsibility of each group to write a reflection on what they did that day. Each student needs to take at least one turn writing a reflection. The reflection must include examples of the mathematics you discussed and the groups thoughts. You are expected to write up the mathematics with as much precision and clarity as you would employ in any other piece of writing.

Biography: Many of our readings, even some of the fictional ones, involve real mathematicians. Pick a mathematician to research and to write about. You can not pick any of the mathematicians who were central characters in the readings or movies, but you can certainly pick an ancillary character. You might also want to look toward your final project, researching the life and works of a mathematician who could be involved in your story is a good way to add depth and realism to your work.

Final Project: For your culminating experience in this class you need work as part of a group to create a work of mathematical fiction and present it to the class. You can write a short illustrated story (comic), or a one or two scene play or movie. Whatever you create needs to be thoroughly researched and include real, though perhaps not deep, mathematics. You will be evaluated on how well you tell your story, the humanity of your characters, and how accurately you portray your mathematics. The project should be accompanied by a reflection on the choices you made and why you made them.

Course Calendar:

Monday	
8/30 **Setting Foundations for Thought:** A look at the role of definitions and axioms. In particular we look at modular arithmetic and division.	**1**
9/6 Labor Day - No Classes	
9/13 **The Fundamental Theorem of Arithmetic** We look at one of the many theorems which deserve the title "Fundamental" and the important role of prime numbers.	**2**
9/20 **Other Number Systems:** We look at number systems from different cultures and how we can get new types of numbers from old. **Automathography Due**	**3**
9/27 ***Movie TBA***, **Journal Check #1 Due**	**4**
10/4 **And, Or, Yes, and No: Basics of Symbolic Logic:** Look at the basics of symbolic logic with emphasis on how the basic operators interact and play around with universal and existential quantifiers in the context of *Tarski's World*.	**5**
10/11 **Deductive, Abductive, Inductive Reasoning:** Compare the logic of Euclid versus the conclusions of Sherlock Holmes. Also, we look at the dangers of drawing conclusions from data and how mathematicians approach induction.	**6**
10/18 **Gödel and Incompleteness:** We will look at some paradoxes and try to understand why sometimes the answer is that there is no answer.	**7**
10/25 ***The Man Who Knew Infinity***, **Journal Check #2 Due**	**8**
11/1 **The Enigma Machine:** Look at all the different ways the Enigma machine could be configured and make sure we know how it works. Then examine the strategies for breaking the Enigma Code and why the Lorenz Cipher needed something more revolutionary.	**9**

Monday	
11/8 ***Read Scenes from Breaking the Code*** **and watch Codebreaker: The Story of Alan Turing**, **Journal Check #3 Due**	**10**
11/15 ***The Story of Wind and Mr. Ugand and Some Arts and Crafts Topology:*** We look at the Moebius Strip and other bizarre topological structures.	**11**
11/22 ***Flatland: A Romance of Many Dimensions:*** We introduce the idea of Flatland, a two dimensional world. We will then look at how it can better understand our own world. **Biography Due**	**12**
11/29 **Final Project Presentations**	**13**
12/6 **Final Project Presentations**, **Journal Check #4 Due**	**14**
12/13 **Final Project Presentations**	**15**

You and Your Grades:

- "A" (Exceptional) range 90% to 100%:
  The student has demonstrated significant mastery of the appropriate knowledge and skills relevant to the course. The student is able to solve standard formulaic exercises and most nonstandard problems which require deeper insight.
  - "A" $\iff 92.5\% \leq Grade \leq 100\%$
  - "A-" $\iff 90\% \leq Grade < 92.5\%$
- "B" (Good) range 80% to 90%:
  The student has demonstrated mastery of the appropriate knowledge and skills relevant to the course. The student is able to solve standard formulaic exercises and some nonstandard problems which require deeper insight.
  - "B+"$\iff 87.5\% \leq Grade < 90\%$
  - "B" $\iff 82.5\% \leq Grade < 87.5\%$
  - "B-"$\iff 80\% \leq Grade < 82.5\%$
- "C" (Adequate) range 70% to 80%:
  The student has demonstrated adequate mastery of the appropriate knowledge and skills relevant to the course. The student is able to solve most standard formulaic exercises but struggles with nonstandard problems which require deeper insight.
  - "C+"$\iff 77.5\% \leq Grade < 80\%$
  - "C"$\iff 72.5\% \leq Grade < 77.5\%$
  - "C-"$\iff 70\% \leq Grade < 72.5\%$
- "D" (Inadequate) range 60% to 70%:
  The student has demonstrated inadequate or incomplete mastery of the appropriate knowledge and skills relevant to the course. The student is able to solve some standard formulaic exercises but few if any nonstandard problems which require deeper insight.
  - "D+"$\iff 67.5\% \leq Grade < 70\%$
  - "D" $\iff 62.5\% \leq Grade < 67.5\%$
  - "D-" $\iff 60\% \leq Grade < 62.5\%$
- "F" (Unacceptable) below 60%:
  The student has demonstrated essentially no mastery of the appropriate knowledge and skills relevant to the course. The student is unable to solve most standard formulaic exercises and essentially no nonstandard problems which require deeper insight.

End User Agreement:

General Expectations: As a student in this class you are expected to:

- show up for every class on time, prepared to learn,
- actively participate in class,
- take notes in class,
- review your notes on a regular basis,
- check your university email every day,
- check the class website at least every other day, (http://sites.wcsu.edu/roccac)
- begin studying for exams in a timely fashion,
- ask questions in class,
- attend office hours,
- seek help in the math tutoring clinic, and
- complete assignments and readings on time.

Assignment Guidelines: (These apply to all out of class work.)

- Out of class assignments should always look neat, legible, and professional; they must be written on loose leaf college ruled paper or be typed. Messy unprofessional work will be rejected or will receive a 10% penalty.
- Whenever appropriate, answers on all assignments should be given in complete sentences. I should be able to tell what your answer means without re-reading the problem.
- An assignment is considered late after I have handed it back or gone over it in class. Late assignments are accepted but will receive at most 75% credit. Also, late assignments go to the absolute bottom of the stack of papers to be graded, all on time work is graded first.
- If you work on an assignment as part of a group, then there may be no more than three individuals in the group and you must hand in only one copy of the assignment with all your names on it; if you hand in multiple copies, I will deduct points.

Exam Makeup Policy: To qualify for a makeup exam you must have a valid reason for missing the exam and, if at all possible, let me know ahead of time that you are missing the exam. You will need to show up for class in person in order to arrange a time for the make up exam. If you do not have a valid reason, do not give prior notice when possible, or simply do not show up for an exam, you are not entitled to a makeup and will not be given one. If you fail to show up for your makeup exam, you will not be given a second opportunity.

The 2% Exception: Any assignment, quiz, or other piece of work which is ultimately worth no more then 2% of your final grade can not be made up or turned in late.

Time on Task: For all your classes you should be spending at least 2 hours working outside of the class for every 1 hour in the class. In particular for this class you should be doing 6 hours of work a week not including class time. Note that this is an average, if you are weak in the subject or under prepared you will need to spend more time on the class.

Attendance: There is no specific policy for attendance in this course. However please keep the following in mind:

- if you have three consecutive unexcused absences within the first half of the semester I am required to report to the University that you have stopped attending,
- some assignments may be started, if not completed, in class, and
- while most of the dates and assignments for the course will be posted on the website occasionally small assignments or quizzes may only be announced in class.

Also, if you come in late after I have taken attendance, then *you* are responsible for emailing me to let me know you were in class.

Devices: If you wish to have an electronic device in class to help with learning the material, recording notes, or recording lectures that is fine. Please make an attempt to be polite and professional, do not not use your device for personal reasons during class; that is the sort of behavior that can ruin things for everyone.

Academic Honesty: If on any assignment, quiz, or exam you turn in someone else's work as if it were your own you will receive a zero on that assignment, quiz, or exam. If you are caught doing this three times you will receive an F in the course and the Dean will be informed of your academic dishonesty.
(WCSU Honesty Policy: http://www.wcsu.edu/facultystaff/handbook/forms/honesty-policy.pdf)

Accommodations: If you have need of an accommodation for testing or note taking, please visit AccessAbility Services, located in White Hall 005 (http://www.wcsu.edu/accessability). They will give you an accommodation letter which you must bring to me as soon as possible.

Extra Resources:

[1] E. A. Abbott, *Flatland: the classic speculation on life in four dimensions.* HarperCollins, New York, 1994.

[2] S. Barr, *Experiments in topology.*, Dover, New York, 1989.

[3] A. Crannell, M. Frantz, F. Futamura, *Dürer: disguise, distance, disagreements, and diagonals!* Math horizons, Vol. 22, No. 2 (November 2014), pp. 8-11, 25.

[4] T. Cubitt, D. Pérez-García, M Wolf, *The unsolvable problem.* Scientific American, Vol. 319 Number 4, pp. 28-37, October 2018.

[5] C. Beavan, *Codebreaker: the story of Alan Turing.* Story Center Productions, 2012.

[6] A. Doxiadis, C. Papadimitriou, *Logicomix: an epic searth for truth.* Bloomsbury, Singapore, 2009.

[7] S. S. Epp, *Discrete mathematics with applications, fourth edition.* Brooks/Cole Cengage Learning, Boston 2011.

[8] C. Fadiman, *Fantasia mathematica.* Copernicus, New York, 1997.

[9] A. Kasman, *Mathematical fiction* http://kasmana.people.cofc.edu/MATHFICT/, Accessed February 2021.

[10] D. Musielak, *Sophie's diary.* AuthorHouse, Bloomington, 2008.

[11] B. Polster, M. Ross, *Math goes to the movies.* Johns Hopkins University Press, Baltimore, 2012.

[12] H. Whitemore, *Breaking the code.* Samuel French, New York, 1988.