



MTH 493

Computational Commutative Algebra

Spring 2020

Course information

Room: RT 403

Time: TR 4:00 - 5:15 pm

Credits: 3.0

Prerequisites: A grade of C or better in MTH 288 and MTH 358, or permission of the instructor.

Description: This course is an introduction to computational commutative algebra and algebraic geometry with a focus on computational methods. The main objects of study will be polynomial rings, ideals, Gröbner bases, and affine varieties. Whenever possible, we will approach these topics from an algorithmic perspective and develop computational methods to study them concretely with the aid of software. Further topics will be explored in student projects.

Learning outcomes: Successful MTH 493 students will:

- become familiar with basic concepts of commutative algebra and their connection to geometry;
- learn computational methods to solve interesting problems in commutative algebra and algebraic geometry;
- become acquainted with computer algebra systems for research in commutative algebra and the implementation of algorithms.

Online resources: Visit Blackboard for up-to-date information about this course.

Instructor

Name: Federico Galetto

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Phone: 216-687-4696

Office: Rhodes Tower 1528

Office hours: Schedule an appointment at <https://math.galetto.org/appt>

Materials

The following textbook is required. A digital copy can be obtained for free from the CSU library website at <https://scholar.csuohio.edu/record=b3026111>.

Required textbook:

- David A. Cox, John Little, Donal O'Shea, *Ideals, Varieties, and Algorithms. An Introduction to Computational Algebraic Geometry and Commutative Algebra*, 4th edition, Springer (Undergraduate Texts in Mathematics), 978-3-319-16720-6 (hardcover), 978-3-319-16721-3 (eBook)

Required software:

- Daniel R. Grayson and Michael E. Stillman, *Macaulay2, a software system for research in algebraic geometry*, Available at <http://www.math.uiuc.edu/Macaulay2/>.

Notes and other materials will be distributed online. All course materials are copyrighted and cannot be distributed without the permission of the authors.

Grading

Grade calculation: All grades will be posted on Blackboard. Your percentage grade will be computed according to the following breakdown and converted to a letter grade as indicated below.

60%	Homework	A	93%-100%	C+	76%-79%
20%	Exam	A-	90%-92%	C	70%-75%
20%	Project	B+	87%-89%	D	60%-69%
100%	Total	B	83%-86%	F	0%-59%
		B-	80%-82%		

Homework:

- Due dates will be announced in class and online.
- All assignments must be submitted on Blackboard by the due date, unless otherwise indicated.
- Your work must be submitted as a single PDF file. If possible, prepare your solutions using typesetting software (e.g. LaTeX, LibreOffice Writer, Microsoft Word, etc.). If you handwrite solutions, scan them using a scanner machine or a dedicated scanning app (e.g. Adobe Scan, Microsoft OneDrive, etc.).
- Certain homework assignments will require students to write computer code for Macaulay2. More details on submitting these assignments will be given in class.
- Clearly indicate your name and student number on all assignments.
- Your solutions must be legible and clearly organized. You are expected to use proper grammar and correct spelling. Failure to comply may result in a request for resubmission or a lower grade.
- You are expected to work independently on all assignments, unless otherwise indicated.

Exams: There will be one exam held in class on the following (tentative) date:

- Thursday, March 26, 2020

Topics will be announced in class. You are required to bring identification.

Project: A final project on a topic of your choice is due on April 28. A selection of projects will be presented in class; other topics will be considered if close enough to the course content. Projects need to include a significant mathematical result, accompanied by relevant examples and computer code. More details about projects and related policies will be communicated in class.

Participation: Active participation is encouraged and can contribute positively to your grade. Such participation includes answering questions in class, asking good questions in class, etc.

Grade appeal: You are responsible for checking corrections on quizzes and tests, and for ensuring grades are reported correctly on Blackboard. Any appeal request must be submitted within one week after the grade is posted.

Policies

Attendance: You are expected to attend all classes. If you are unable to attend a class, it is your responsibility to notify your instructor in advance and to inquire about any topics covered and announcements made during that class.

Electronic devices: The use of electronic devices such as (but not limited to) phones, smartwatches, computers, tablets, and headphones is prohibited during class, unless otherwise indicated. If you wish to use an electronic device for note taking, you need to receive explicit consent from your instructor and you may occasionally be asked to submit a sample of your notes.

Excused absences: You may only be excused from class and class related activities in case of university sanctioned activities (such as conferences, competitions, etc.) or in case of medical conditions. With the exception of unforeseen medical emergencies, you must notify your instructor of your absence and present sufficient documentation in advance. Sufficient documentation includes an invitation to attend an event or a doctor's note indicating you cannot take the test on the scheduled date.

Extra credit and makeups: There is no extra credit in this class. There are no makeups in this class other than for excused absences.

Academic integrity: Cheating and/or plagiarism will not be tolerated. Cheating includes copying or receiving help from another student on quizzes, tests or exams, as well as allowing another student to copy from your work. Receiving help from someone else by using an electronic device such as a mobile phone or a smartwatch constitutes cheating. Copying another student's homework, or allowing someone else to do your homework for you, is also considered cheating. If cheating occurs in a quiz or test, the student will receive a grade of 0 for that component of the course. If a student cheats a second time during the course, the student will receive an F for the course. If cheating occurs on the final exam, the student will receive a grade of F in the course. Any cheating activity may be reported for further action. Information regarding the official CSU Policy on Academic Misconduct can be found at https://www.csuohio.edu/sites/default/files/3344-21-02_0.pdf.

Accommodations: Educational access is the provision of classroom accommodations, auxiliary aids and services to ensure equal educational opportunities for all students regardless of their disability. Students who feel they may need an accommodation based on the impact of a disability should contact the Office of Disability Services at 216-687-2015. The Office is located in BH 147. Accommodations need to be requested in advance and will not be granted retroactively.

Withdrawals: The last day to withdraw is Friday, March 27, 2020. Withdrawing from the course may put a student in violation of the federally mandated standards for academic progress (SAP) that a student must maintain to be eligible for financial aid. Please visit <https://www.csuohio.edu/financial-aid/standards-academic-progress-sap> for more information.

Course modifications: The instructor retains the right to modify the contents of the course, including grading criteria and course policies. Reasonable notice will be given for all time sensitive matters. Course changes will be communicated in class and on Blackboard.