

MA 764
IBL Chip Firing
Spring 2025, MWF 11-11:50
Funkhauser Building FB-213

Instructor: Dave Jensen

Office: POT 733

Email: dave.h.jensen@gmail.com

Course Website: [www.ms.uky.edu/~dhje223/MA 764 Spring 2025.html](http://www.ms.uky.edu/~dhje223/MA_764_Spring_2025.html)

Course Description: The chip-firing game is a simple game with only one move. Starting with a collection of poker chips on the vertices of a graph, one is allowed to move them around the graph using what is known as the “chip-firing move”. Despite its simplicity, this game has deep connections to dynamics, number theory, and algebraic geometry. This course will serve as an introduction to the chip-firing game, with emphasis on examples and concrete combinatorial constructions.

Topics:

1. The chip-firing game and Picard group of a graph.
2. Canonical representatives of divisors on graphs. Reduced, orientable, and break divisors.
3. Basic invariants of divisors on curves. Degree, rank, and the Riemann-Roch Theorem.
4. Open problems in combinatorial Brill-Noether theory.
5. (If time permits.) Connections to algebraic geometry.

Format: This class will be taught in an inquiry based format. We will follow notes that contain very few proofs, but guide the students through the process of discovery. Students will provide proofs of the stated theorems, propositions, and exercises in class together. Grades will be based on participation.

Materials: Notes for this class are available at the course website.

Grading: Your course score will be based entirely on participation. Students are expected to prepare solutions to assigned problems in advance of class meetings, and present them during class.

Academic Integrity: Per university policy, students shall not plagiarize, cheat, or falsify or misuse academic records. Students are expected to adhere to University policy on cheating and plagiarism in all courses. The minimum penalty for a first offense is a zero on the assignment on which the offense occurred. If the offense is considered severe or the student has other academic offenses on their record, more serious penalties, up to suspension from the university may be imposed.

Plagiarism and cheating are serious breaches of academic conduct. Each student is advised to become familiar with the various forms of academic dishonesty as explained in the Code of Student Rights and Responsibilities. Complete information can be found at the following website: <http://www.uky.edu/Ombud> . A plea of ignorance is not acceptable as a defense against the charge of academic dishonesty. It is important that you review this information as all ideas borrowed from others need to be properly credited.

Part II of Student Rights and Responsibilities (available online

<http://www.uky.edu/StudentAffairs/Code/part2.html>) states that all academic work, written or otherwise, submitted by students to their instructors or other academic supervisors, is expected to be the result of their own thought, research, or self-expression. In cases where students feel unsure about the question of plagiarism involving their own work, they are obliged to consult their instructors on the matter before submission.

When students submit work purporting to be their own, but which in any way borrows ideas, organization, wording or anything else from another source without appropriate acknowledgment of the fact, the students are guilty of plagiarism. Plagiarism includes reproducing someone else's work, whether it be a published article, chapter of a book, a paper from a friend or some file, or something similar to this. Plagiarism also includes the practice of employing or allowing another person to alter or revise the work which a student submits as his/her own, whoever that other person may be.

Students may discuss assignments among themselves or with an instructor or tutor, but when the actual work is done, it must be done by the student, and the student alone. When a student's assignment involves research in outside sources of information, the student must carefully acknowledge exactly what, where and how he/she employed them. If the words of someone else are used, the student must put quotation marks around the passage in question and add an appropriate indication of its origin. Making simple changes while leaving the organization, content and phraseology intact is plagiaristic. However, nothing in these Rules shall apply to those ideas which are so generally and freely circulated as to be a part of the public domain (Section 6.3.1).

Please note: Any assignment you turn in may be submitted to an electronic database to check for plagiarism.

Accommodations Due to Disability: If you have a documented disability that requires academic accommodations, please see me as soon as possible. In order to receive accommodations in this course, you must provide me with a Letter of Accommodation from the Disability Resource Center (Room 2, Alumni Gym, 257-2754, email address: jkarnes@email.uky.edu) for coordination of campus disability services available to students with disabilities.

Suggestions and Other Course Issues: Suggestions for improvement are welcome at any time. Any concern about the course should be brought first to my attention. Further recourse is available through the Mathematics Director of Undergraduate Studies and the Department Chair, both accessible from the Main Office in 715 Patterson Office Tower.