

MONTGOMERY COLLEGE - Germantown Campus**Mathematics & Statistics Department****Course Syllabus****I. Instructor Information**

Professor: Dr. Zhou Dong

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Office Hours: By appointment [Click here to make a virtual appointment](#)

II. General Course Information

Honors Fundamentals of Scientific Research – SCIR297HC

PREREQUISITE:

Completion of at least 12 college credits, a 3.4 grade point average or higher, a grade of A or B in ENGL 101 or ENGL 101A and BIOL 150, CHEM 131, MATH 165, and approval of instructor.

Summer I & II 2022: CRN 47196

Class Times: F 9:00 am – 12:00 pm

Class Room: HS 165

III. Specific Outcomes

Designed for the promising science, engineering, or mathematics (SEM) student who would like to build upon general SEM skills learned from general courses in order to generate competency in scientific critical thinking and research. This course enables SEM students to pursue research topics of their own choosing with the guidance and supervision of an assigned faculty member. Students should have a strong interest in SEM and be committed toward completion of a multi-semester and interdisciplinary-spanning research project. Projects will not duplicate curriculum content but will expand on that content.

IV. Text and Supplies**Required Text:**

- Lessons in Play: An Introduction to Combinatorial Game Theory, Second Edition by Michael H. Albert, Richard J. Nowakowski, David Wolfe
www.lessonsinplay.com

The professor reserves the right to make changes to this syllabus.

Last Updated July 29, 2024

- Combinatorial Game Suite
<http://cgsuite.sourceforge.net/>

Other resources:

- Knop's Courses – Introduction to Combinatorial Game Theory
https://www.youtube.com/watch?v=DbCKHPIMN2c&list=PLxYr6TaF_SDV5r6rml0LDxuO48FPFb6Rk
- Coursera - Games Without Chance: Combinatorial Game Theory
<https://www.coursera.org/learn/combinatorial-game-theory>
- Final Answers – Mathematical Games (2 Players)
<http://www.numericana.com/answer/games.htm>
- Erik Demaine's Combinatorial Game Theory webpage
<https://erikdemaine.org/games/>
- David Eppstein's Combinatorial Game Theory webpage
<https://www.ics.uci.edu/~eppstein/cgt/>
- Jeff Erickson's Combinatorial Game Theory webpage
<http://jeffe.cs.illinois.edu/mathgames.html>
- Unsolved Problems in Combinatorial Games
<http://library.msri.org/books/Book42/files/guy.pdf>

V. Grading

A. Requirements

The student is required to

- Attend and participate in all class meetings and workshops
- Complete readings and homework as assigned
- Complete a research project on a combinatorial game
- Prepare a presentation and present it at the colloquium in Fall 2022

B. Course Grade

Attendance and Participation	20%
Homework	20%
Research Project	40%
Presentation	20%

A = 90% – 100%

B = 80% – 90%

C = 70% - 80%

D = 60% - 70%

F < 60%

VI. Student Code of Conduct and Collegewide Policies and Procedures

<http://cms.montgomerycollege.edu/mcsyllabus/>

VII. Campus Resources

A. Student Health and Wellness

<http://cms.montgomerycollege.edu/student-health-and-wellness/fuel-for-success/>

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VIII. Course Schedule

Date	Reading (to do before class, attempt the Prep Problems and Exercises, bring questions to class)
Week 1 6/10	Appendix A 0 Combinatorial Games 0.1 Basic Terminology
Week 2 6/17	1 Basic Techniques 1.1 Greedy 1.2 Symmetry 1.3 Parity 1.4 Give Them Enough Rope! 1.5 Strategy Stealing 1.6 Change the Game! 1.7 Case Study: Long Chains in Dots & Boxes
Week 3 6/24	2 Outcome Classes 2.1 Outcome Functions 2.2 Game Positions and Options 2.3 Impartial Games: Minding your P's and N's 2.4 Case Study: Roll the Lawn 2.5 Case Study: Timber 2.6 Case Study: Partizan Endnim
Week 4 7/1	3 Motivational Interlude 3.1 Sums 3.2 Comparisons 3.3 Equality and Identity 3.4 Case Study: Domineering
Week 5 7/8	Appendix B Independent Research – decide on a game to research (No class this week)
Week 6 7/15	4 The Algebra of Games 4.1 The Fundamental Definitions 4.2 Games Form a Group with a Partial Order 4.3 Canonical Form 4.4 Case Study: Cricket Pitch 4.5 Incentives
Week 8 7/22	Independent Research – gather preliminary results (No class this week)
Week 9 7/29	5 Values of Games 5.1 Numbers 5.2 Case Study: Shove 5.3 Stops 5.4 A Few All-Smalls: Up, Down, and Stars 5.5 Switches 5.6 Case Study: Elephants & Rhinos 5.7 Tiny and Miny 5.8 Case Study: Toppling Dominoes 5.9 Proofs of Equivalence of Games and Numbers

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Week 10 8/5	6 Structure 6.1 Games Born by Day 2 6.2 Extremal Games Born by Day n 6.3 More about Numbers 6.4 The Distributive Lattice of Games Born by Day n 6.5 Group Structure
Week 11 8/12	Independent Research – finalize results and proofs (No class this week)