MONTGOMERY COLLEGE - Germantown Campus

Mathematics & Statistics Department

Course Syllabus

I. Instructor Information

Professor: Dr. Zhou Dong
Email: Zhou.Dong@MontgomeryCollege.edu
Phone: (240) 567-7810
Office: HT 134
Mail box: HT 314
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 2023: CRN 40516
Class Times: F 9:00 am – 12:00 pm
Class Room: HT 122

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.

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- Combinatorial Game Suite
  http://cgsuite.org/

Other resources:

- Knop's Courses – Introduction to Combinatorial Game Theory
  https://www.youtube.com/watch?v=DbCKHPlMN2c&list=PLxYr6TaF_SDV5r6rmI0LDxuO48FPFb6Rk
- 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 2023

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 *6/9* *In Person*	Appendix A 0 Combinatorial Games 0.1 Basic Terminology 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 2 *6/16* *In Person*	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 3 *6/23* *In Person*	3 Motivational Interlude 3.1 Sums 3.2 Comparisons 3.3 Equality and Identity 3.4 Case Study: Domineering
Week 4 *6/30* *In Person*	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 Incentives
Week 5 *7/7* *No meeting*	Appendix B Learn to use CGSuite Independent research
Week 6 *7/14* *Online*	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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	5.10
Week 8 *7/21* *Online*	6 Values of Games 6.1 Numbers 6.2 Case Study: Shove 6.3 Stops 6.4 A Few All-Smalls: Up, Down, and Stars 6.5 Switches 6.6 Case Study: Elephants & Rhinos 6.7 Tiny and Miny 6.8 Case Study: Toppling Dominoes 6.9 Proofs of Equivalence of Games and Numbers
Week 9 *7/28* *TBA*	Meet to discuss research, work on presentation
Week 10 *8/4* *No Meeting*	Work on research and presentation
Week 11 *8/11* *In Person*	Finalize and practice presentation