Syllabus for MA 637-OV

Graph Theory and Combinatorics -- Summer 2023

Instructor: Dr. Shannon Starr

Class Times: Tuesdays, Thursdays 10:20am – 12:20pm

Class Room: Heritage Hall Building, Room 221

**Combinatorics** is the name mathematicians give to the topic for counting objects from a finite set. A classical example is the number of permutations, or rearrangements, of a deck of cards if you have ***n*** cards in the deck, which is ***n!*** using the factorial function.

**Graph theory** is the name that mathematicians give to the study of graphs: vertices connected by edges. One interesting family of graphs is the set of all trees: connected graphs without any cycles as subgraphs. We will also spend much time on graphs which can be embedded into the plane (planar graphs) and their planar embeddings.

**Course Objectives:** Upon successful completion of this course, you will be able to:

**1.** Perform basic combinatorics calculations, such as those useful in applications, such as probability.

**2.** Perform basic computations related to algorithms like sorting algorithms that arise in combinatorics, and graph theory algorithms like Hierholzer’s algorithm for calculating Eulerian trails in graph theory.

**3.** Understand basic graph theory arguments, including those used for applications such as Sperner’s lemma and its corollary Brouwer’s fixed point theorem.

**4.** Prove that there are only 5 Platonic solids, using duality for planar graphs.

**5.** Prove and apply the matrix-tree theorem of Kirchoff, including proving the Cauchy-Binet theorem for rectangular arrays (such as the multiplicativity of the determinant).

**Instructor email:** slstarr@uab.edu

Typical responses are 24 hours later on weekdays.

**Office hours:** Tuesdays, Thursdays 9-10 and by appointment. My office is in University Hall 4008.

You may also attend via Zoom, on the Zoom link that I will put on the UAB canvas page, if you prefer that. (You do not need to have your camera turned on if you do not want to.) During my office hours, I will have Zoom turned on. Priority will frequently be given to in-person students. But you make an appointment (for in-person or Zoom meeting) to insure a time.

**Required textbook:** The free online pdf file written by Dr. Peter O’Neal, Professor Emeritus, which is available on Canvas.

**Grades:**

HW(50%) + Project(25%) + Final(25%) = 100%

**Homework:** Regular homeworks assigned on Canvas. You turn in your solutions as files on Canvas. I grade the submissions in a preliminary round, marking what is right and wrong. Then you have 1 week to correct any errors or missing portions, before I make a final grade based on the 2nd round.

**Projects:** There will be one project due which involves a report and a video. Topics and directions will be distributed at the halfway point of the summer session term. You can work solo, or in groups of 2 or 3.

**Take-home final**: This will be 25% of the grade.

A = 88–100*,* B = 75–87*,* C = 62–74*,* D = 50–61*.*

*There will be a group project or activity in this course. Please make sure to check the group project instructions page to locate your group and your group space in Canvas. In this group project activity, you will collaborate with other students to submit a report/video/ presentation. As a team, you will work together to break the project up into separate tasks and decide on the tasks or sub-tasks each member is responsible for. Be sure to leave enough time to put all the pieces together before the group assignment is due and to make sure nothing has been forgotten. At the end of the project, you will be required to fill out a group self-evaluation form to evaluate other team members contributions to the project. This peer evaluation score is worth 15% of your group project grade.*

Homework problems will be posted on Canvas

<http://www.uab.edu/online/canvas>

All other materials, such as class announcements, codes, grades, etc., will be posted in Canvas. (Students should log in to Canvas every day.) Homework assignments, projects and the take-home final will only be collected on Canvas.

By working steadily and regularly, you will increase your chances to succeed in this course!

**UAB Policies and Resources**

**Misconduct**

The University of Alabama at Birmingham expects all members of its academic community to function according to the highest ethical and professional standards. Students, faculty, and the administration of the institution must be involved to ensure this quality of academic conduct. Review the Academic Integrity Code linked below.

Academic misconduct undermines the purpose of education. Such behavior is a serious violation of the trust that must exist among faculty and students for a university to nurture intellectual growth and development. Academic dishonesty and misconduct includes, but is not limited to, acts of abetting, cheating, plagiarism, fabrication, and misrepresentation. Candidates are expected to honor the UAB Academic Honor Code as detailed in the most current UAB Student Catalog. Please consult this resource for additional information regarding the specific procedures to be undertaken when a student violates the UAB Academic Honor Code.

<https://www.uab.edu/one-stop/policies/academic-integrity-code>

**DSS Accessibility Statement**

Accessible Learning: UAB is committed to providing an accessible learning experience for all students. If you are a student with a disability that qualifies under Americans with isabilities Act (ADA) and Section 504 of the Rehabilitation Act, and you require accommodations, please contact Disability Support Services for information on accommodations, registration and procedures. Requests for reasonable accommodations involve an interactive process and consist of a collaborative effort among the student, DSS, faculty and staff. If you are registered with Disability Support Services, please contact DSS to discuss accommodations that may be necessary in this course. If you have a disability but have not contacted Disability Support Services, please call

(205) 934-4205 (voice) (205) 934-4205 (TDD) (205) 934-8170 (Fax)

or consult their webpage

<https://www.uab.edu/students/disability/>

or visit their office located in Hill Student Center Suite 409, 1400 University Blvd., Birmingham, AL.

**Non-harassment, Hostile Work/Class Environment**

The UAB College of Arts and Sciences expects students to treat fellow students, their Course Instructors, other UAB faculty members and staff as adults and with respect. No form of hostile environment or harassment will be tolerated by any student or employee.

**Course Netiquette**

There are course expectations concerning etiquette on how we should treat each other online. It is very important that we consider the following values during online discussions and email: **respect**, **confidentiality**, **format** and **relevance**. Every person’s opinion is valued. During online discussions, be sure to state opposing views diplomattically. Do not insult people or their ideas, nor use negative, inappropriate language. When discussing topics, be sure to be discreet about how you discuss children, teachers and colleages. Do not use names of people or facilities. When posting online messages use proper grammar, spelling and complete sentences. Avoid using all capitals (which signifies yelling). Avoid shortcuts and abbreviations such as “cu l8r.” Instead say, “ See you later.” Think before you type. Keep posts relevant to the online discussion topic.