Purdue University
Modern mathematics in science and society
Fall 2018
MA 279 Syllabus

Instructor: Uli Walther
Office: 746 MATH
Phone: 49-41959
E-mail: walther@math.purdue.edu

1 General Information

1.1 Purdue Pledge

As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together—we are Purdue.

1.2 Class time / location:

TTh 9-10:15, UNIV 117

Students are expected to come to lecture (and recitation, if applicable). Students bear the responsibility of informing the instructor of missed class time in a timely fashion. Aside from sudden illness, this means "ahead of time".

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1.3 Office Hours:

Tue 10:30-11:30, Th 2:00-3:00

1.4 Reading material:

1. Excursions in Modern Mathematics
   Peter Tannenbaum
   9th Edition, Pearson 2018.
2. Handout on linear programming

1.5 Webpages:

Our class page is under `http://www.math.purdue.edu/~walther/teach`. It includes syllabus, some other info concerning the class, and a link to our *Project Rhea* (see below).

1.6 Statement for Students with Disabilities

For details, please see the webpage

`http://www.math.purdue.edu/~walther/teach`

In this mathematics course accommodations are managed between the instructor, student and DRC Testing Center.

Students should see instructors outside class hours before or after class or during office hours to share your Accommodation Memorandum for the current semester and discuss your accommodations as soon as possible, preferably at the fist meeting between student and instructor.

2 Course Structure

2.1 Grading

If you disagree with the grading in any category, you need to resubmit the item in question **with a written explanation** stating *why* (and not just *that*) you deserve more credit.

2.2 Homework:

HW is collected Thursdays in class, or in my office no later than 3:00pm. **No late assignments will be accepted.** Neither will homework deposited anywhere else.

The homework due in any given week is the homework corresponding to the material of the previous week. Homework must be readable and **must be stapled**. Illegible scribblings will receive no credit from the grader.

You are encouraged to attempt all the questions and discuss with your classmates. However, the write-up must be of your own.

2.3 Project Rhea

On *Rhea* you will produce, in groups of about five, a study on a topic related to our course. The possible topics are listed on *Rhea*. Calendar for this:

- You can request being in a group with your friends until Thursday 8-23.
- Groups will be announced via email by Tuesday 8-28.
- Groups must choose a topic by Thursday 8-30. I will assign topics that day.
- Projects are due **midnight Sunday, 12-2, before dead week**.
- You will research and write, and be graded, as a team. Necessary components: title, author list, table of contents, introduction, references, at least 6 pages total.
- You will be graded on style and content. If you cut and paste text from other sources, you must acknowledge the other source in the references. Failure to do so will be viewed as academic dishonesty. At least 90% of the writeup must be your own words.

2.4 Exams:

There will be one midterm, in week 8, on **Thursday, October 11** . Makeup tests may be given in extraordinary instances, but only with *documented* reasons.

The Final Exam and the midterm will be 75 minutes long.

2.5 Course Grade:

Your course grade will be determined using the following distributions:

Rhea	10%
HW	30%
Midterms	30%
Final	30%

2.6 Calculators

Calculators are not allowed on any test.

2.7 Prerequisites

Mastery of material presented in college algebra, precalculus, and some linear algebra (solving linear systems).

2.8 Course learning outcomes

The students will gain knowledge, overview, and understanding in several fundamental mathematical disciplines which fall into four basic categories: voting and apportionment; growth; optimization; data analysis. Some of these theories had their beginnings in the middle ages, but most have been developed in the 20th century and touch the frontier of current research—particularly in the interactions with high capacity computing. Students will assimilate these mathematical ideas while applying them to practical everyday questions, and in turn gain an understanding how real life problems gave rise to the development of mathematical theories. Historical backgrounds and examples as well as current developments in society will document a framework of living mathematical sciences.

The goals of the course are manifold: via appropriate cases, the students will become acquainted with abstract reasoning as it leads to theorems; the course will document the historical impact of society on the development of mathematics, and in turn explain how mathematical endeavors shape and enable numerous aspects of our lives today; the students will get a broad introduction to mathematical ideas that are highly integrated into the human sciences and management and which reflect intellectual responses of society to its needs; the students will carry out independent study and technical writing in the context of the interplay of mathematics and society.

3 Being a member of the university community

3.1 Classroom Safety

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Here are ways to get information about such events.

- Course and class web pages (see item 1.5)
- In particular, review the instructions on `http://www.math.purdue.edu/~walther/teach/emergency.pdf`.

Purdue wants you to know:

Emergency preparedness is your personal responsibility. Purdue University is actively preparing for natural disasters or human-caused incidents with the ultimate goal of maintaining a safe and secure campus.

- For any emergency call 911.
- There are nearly 300 Emergency Telephone Systems throughout campus that connect directly to the Purdue Police Department (PUPD). If you feel threatened or need help, push the button and you will be connected to the PUPD.
- Fire alarm: immediately evacuate the building; do not use the elevator.
- Shelter in Place requirement for a tornado warning (siren): shelter in the lowest level of this building away from windows and doors.
- Shelter in Place requirement for a hazardous materials release: stay in our classroom shutting any open doors and windows.
- Shelter in Place requirement for an active threat such as a shooting (siren): stay in our classroom and try to lock it.

3.2 Academic Honesty:

• Incidents of academic misconduct in this course will be addressed by the course instructor and referred to the Office of Student Rights and Responsibilities (OSRR) for review at the university level. Any violation of course policies as it relates to academic integrity will result minimally in a failing or zero grade for that particular assignment, and at the instructors discretion may result in a failing grade for the course. In addition, all incidents of academic misconduct will be forwarded to OSRR, where university penalties, including removal from the university, may be considered.

• In order to prevent cheating, we ask that you keep your eyes on your sheet at all times during exams. Looking around is forbidden.

• All electronic devices are forbidden during exams. This includes calculators, cell phones, PDAs, music players, and smart phones and ANYTHING ELSE of electronic nature.

• Working on an exam either before or after the official time is considered cheating. The exam of any student who is caught writing after time is up or before the exam begins may receive a grade of zero on the entire test, and may also be reported to the Dean of Students. The office of the Dean of Students may choose to apply further punishment.

• Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breaches of this value by either emailing integrity@purdue.edu or by calling 765-494-8778. While information may be submitted anonymously, the more information that is submitted provides the greatest opportunity for the university to investigate the concern.

3.3 Classroom Rules:

• Unless other arrangements have been made with the instructor, cell phones and other communication devices must be turned off and stowed away during class.

• Please respect your instructor, your TA, and your fellow classmates. Students who act in a disruptive or disrespecful manner (e.g., arriving late, texting, sending email, surfing the web, talking, etc.) may be asked to leave the classroom.

• All course material is copyrighted. Reproduction or storage in a retrieval system (e.g. the Internet) is prohibited without an explicit agreement with the author of the work. This includes course notes (including your own), homework questions, and exams.

• Taking pictures or making audio/video recording of the lectures is prohibited without the instructor's prior approval. The instructor can forbid all recording.

• Ultimately students are responsible for all required coursework and bear full responsibility for any academic consequences that may result due to absence. `http://www.purdue.edu/studentregulations/regulations_procedures/classes.html`

3.4 CAPS Information

Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at (765)494-6995 and http://www.purdue.edu/caps/ during and after hours, on weekends and holidays, or through its counselors physically located in the Purdue University Student Health Center (PUSH) during business hours.

4 Material covered

	Book Chapters	Key concepts
Week 1	Ch1:The paradoxa of democracy	Plurality method, Borda Count, run-off voting, ranking
Week 2	Ch2:Weighted voting	Banzhaf power index, weighted voting
Week 3	Ch3:Fair division	two player games, divider/chooser/diminisher methods, sealed bids
Week 4	Ch4 (+13):Apportionment	methods of Hamilton, Jefferson and Adams, Alabama paradox, sampling errors of the past
Week 5a	Ch5:Euler paths	graphs, Euler circuits, Fleury's method
Week 5b,6a	Ch6:Traveling Salesmen	Hamilton paths, traveling salesman problems, brute force/nearest neighbor/cheapest link algorithms
Week 6b,7a	Ch7:The mathematics of networks	(counting)(spanning) (weighted) trees, Kruskal's method, connecting three points
Week 7b,8b	review/midterm	
Week 9	*Linear programs	Intro, simplex, dictionaries
Week 10	*Linear programs	Complications, 2-phase and Big-M, duality
Week 11	*Transportation problems	feasibility, NW corner rule, falling/rising index, Vogel–Korda, potential method
Week 12	Ch9:Exponential growth	Fibonacci numbers, golden ratio, gnomons, linear recursions of finite order
Week 13	Ch11:Symmetry	reflection/rotation/translation, Euclidean group, patterns, tilings
Week 14a	Ch12:Fractals	Koch snowflake, chaos game, game of life, Mandelbrot set, Cantor sets
Week 15	*Ch15, 16:Probability	sample spaces, permutations, (uniform) probability spaces, Bernoulli trials, expected value, Markov chain, normal distribution, de Moivre theorem
Week 16	review	

* means: handout.