

Course Guide

Independent
Study | in Idaho

Self-paced study. Anytime. Anywhere!

Math 123
Math in Modern Society
University of Idaho
3 Semester-Hour Credits

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Course Objectives

Math 123 Learning Outcomes

- Acquire tools in logic, number theory, geometry, probability, and combinatorics.
- Gain skills in critical thinking and problem analysis.
- Gain experience using critical thinking and problem analysis skills as applied to problems drawn from social studies, demographics, history, and modern issues.
- To cover selected material from chapters 1 through 8 and 11.

Assignments

There are 10 graded assignments for this course. These can be found by looking at the course [site](#). Put your name and section from the book – such as Chapter 5 on the top of each paper handed in. Homework will be graded partially on completion. Certain problems will be selected and graded for correct work and solutions.

Study Hints:

- Keep a copy of every assignment submitted.
- Complete all reading assignments.
- Set a schedule allowing for course completion one month prior to your personal deadline. An *Assignment Submission Log* is provided for this purpose.
- Web pages and URL links in the World Wide Web are continuously changing. Contact your instructor if you find a broken Web page or URL.
- Add your own recommendations here.
- Introduce and explain any terms that are essential to understanding the course.

Refer to the **Getting Started** in [the book](#) for further details on assignment requirements and submission.

Exams

- x You must wait for grades and comments on assignments prior to taking subsequent exams.
- x For your instructor's exam guidelines, refer to the **Course Rules** in [the book](#).
- x There are 4 chapter exams for this course; there is also a final exam. The final exam is cumulative.
- x For the 4 chapter exams you can have an 8.5 by 11 sheet of paper with notes on one side.
- x For the final exam you can have an 8.5 by 11 sheet of paper with notes on both sides.
- x These should be handed in with the test.
- x You will be able to use a calculator.
- x You will not be able to use a laptop, cell phone, or any other internet type of device.

Proctor Selection/Scheduling Exams

All exams require a proctor. At least 2 weeks prior to taking your first exam, submit the completed *Proctor/Exam Request Form* (available at uidaho.edu/isi, under *Forms*) to the ISI office. ISI mails all exams directly to the proctor after receiving the *Proctor/Exam Request Form*. You must schedule the examination time with your proctor prior to each exam. The proctor administers the exam and returns it to the ISI office.

Grading

The course grade will be based upon the following considerations:

Grades will be based on:		Grading Scale:
4 Chapter Exams	60%	A 90-100%
Homework	15%	B 80-89%
Final Exam	25%	C 70-79%
		D 60-69%
		F anything below

The final course grade will be issued after all assignments and exams have been graded.

Acts of academic dishonesty, including cheating or plagiarism are considered a very serious transgression and may result in a grade of F for the course.

About the Course Developer

Cynthia Piez is a Senior Instructor in the Department of Mathematics at the University of Idaho. She has a MS in Mathematics and is ABD in Mathematics Education.

Contacting Your Instructor

Instructor contact information is posted in the **Course Rules** document on your Canvas site

Assignment Submission Log

Send the completed *Proctor Information Form* to the ISI office at least two weeks prior to taking your first exam.

Lesson	Projected Date for Completion	Date Submitted	Grade Received	Cumulative Point Totals
1				
2				
It is time to make arrangements with your proctor to take Exam 1.				
Exam 1				
3				
4				
It is time to make arrangements with your proctor to take Exam 2.				
Exam 2				
5				
6				
7				
It is time to make arrangements with your proctor to take Exam 3.				
Exam 3				
8				
9				
It is time to make arrangements with your proctor to take Exam 4.				
Exam 4				
10				
It is time to make arrangements with your proctor to take the comprehensive Final Exam.				
Final Exam				

Lesson 1

The Mathematics of Elections

Lesson Objectives

- Know what a preference ballot is.
- Be able to determine the winner of an election using: Plurality Method, Borda Count, Plurality with Elimination, the method of Pairwise comparisons.
- Be able to determine which of the fairness criteria have been violated.

Reading Assignment

Read all of chapter 1. This is one place where working the problem along with what is in the book is helpful.

Important Terms

- Players, preference ballot, preference schedule, ranking, voting method.
- Plurality voting method, Borda count voting method, Plurality with Elimination voting method, Pairwise Comparisons voting method, Condorcet candidate.
- Fairness criteria: Majority, Condorcet, Monotonicity, and IIA (Independence of irrelevant alternatives)

Introductory Lecture

Objectives:

- Use each of the voting methods to determine the winning candidate from a preference schedule.
- Understand how to find the number of different pairs from a set.
- Be able to determine when a voting method has the potential to violate one of the four Fairness criteria.
- Read carefully about Arrow's Impossibility Theorem and think about any impact it could have on your life.

During class, I usually ask students to work on a few problems either before or after introducing a topic. You can try them either way.

There are short recorded lectures that then work through these examples. You can also find these activities at the Canvas Math123 site.

Try these after reading chapter 1:

1. I had some extra money and decided to treat a class of 66 students to pizza. I only wanted to order one type of pizza and gave the students 3 choices. On their preference ballot, they had to rank the pizzas by 1st, 2nd or 3rd choice. The pizzas were: A – cheese with snails, B – just cheese, and C – pepperoni. I took the ballots and summarized the voting data into a table like this:

choice	23 students	22 students	21 students
1st	A	B	C
2nd	C	C	B
3rd	B	A	A

- Based on these results, which pizza should I order? Justify your answer.
- It is possible that some students will think that your answer is not satisfactory? Why not?
- Think of another way you could use the voting results above to determine which pizza to order that might prove more satisfactory to the students. What would I do and what pizza would I order?

2. Ordering pizza. Students in a club voted for the type of topping they would get on pizza being ordered. They could choose from anchovies, sausage, pepperoni, or mushroom. Here is the preference schedule for the voting: Find the winners with each of these voting methods: Plurality, Plurality with Elimination, Pair-wise comparisons (Hare), Borda.

	7	5	4	2
1 st	A	S	P	P
2 nd	S	P	S	M
3 rd	M	M	M	S
4 th	P	A	A	A

3. a) Who would win this election if you used a Pair-wise comparison to determine the winner. If there is a winner, that candidate is called a Condorcet candidate.

	29	21	18	10	1
1 st	D	A	B	C	C
2 nd	C	C	A	B	B
3 rd	A	B	C	A	D
4 th	B	D	D	D	A

- Next, use Plurality with elimination to determine the winner.
- Plurality with Elimination has the potential to violate which criterion?

Written Assignment

Chapter 1 (pg. 28):

- 3, 7, 8, 11, 12, 15, 17, 21, 22, 23, 24, 27, 28,
- 31, 32, 33, 34, 37, 38,
- 41, 42, 43, 44, 47, 48,
- 51, 52, 53, 54, 55