Course Syllabus MTH109: Mathematics and Politics Fall2019

Instructor: Dr. Glenn Faubert

Goal of the course

To provide students with a general, elementary introduction to applications of mathematics found in political settings that fully satisfies both **B3** and **A2** general education course outcomes. (Mathematical, Statistical, or Computational Strategies **and** Social & Behavioral Sciences) This course is intended as a general educational math class for students who do NOT have calculus or precalculus in their program of study and who have an interest in the social and behavioral sciences.

Learning Outcomes

Upon successfully completion of this course a student will be able to:

1 – Evaluate several methods of social choice (voting methods) through an understanding of their strengths and weaknesses.
2 – Explore the subjective idea of "fairness" and use careful definitions to craft notions of fairness that are objective.
3 – Apply commonly used fairness criteria to evaluate the fairness of social choice methods.
4 – Recognize the manipulability in social choice methods through the use of insincere (strategic) voting.
5 – Appreciate the profound consequence of Arrow's Theorem on all methods of social choice.
6 – Understand why there are voting systems (called weighted voting systems) specifically designed to enforce inequality among voters.
7 – Calculate the relative power of voters in a weighted voting system. It is not proportional to weight!
8 – Apply methods of apportionment used historically to determine the composition of the House of Representatives in the United States and evaluate the strengths and weakness of these apportionment methods.
9 – Understand and apply the model of a two-player, two-strategy game. Find the Nash equilibria in such games and use them in predicting the behavior of people in situations involving both competition and cooperation.
10 – Appreciate the ubiquity two very famous partial-conflict, two-player games called "the prisoners' dilemma" and "chicken." Explain how and why such games are useful in the understanding of some general social/political situations.
11 – Explore the basics of Congressional District determination and Gerrymandering.
12 – Organize their thoughts, articulate their logical reasoning in written assignments and begin to appreciate the uniqueness of mathematics and its use of crystal clear definitions, precise communication, organized steps, and rigorously justified assertions.

Text

The text for the class is Mathematics and Politics, second edition, by Alan Taylor and Allison Pacelli, Springer 2008.
The text's ISBN is 978-0-387-77643-9 and the e-ISBN is 978-0-387-77645-3. It is assumed that will you have access to the text at the beginning of the semester. No special consideration will be given to any student that does not have access to a text. We will follow it closely and nearly all assignments will come directly from the the text.

Sakai

SAKAI will be used in this class for all student/teacher electronic correspondence. Important class announcements, a grade book, submission of homework, and student/teacher messaging will all be implemented using SAKAI. If this is your first semester at URI, get comfortable with SAKAI right away! Go to the URI main page and click on SAKAI and start poking around.

Calculators

A basic calculator will be required in class for every class starting with #29. Calculator use is permitted on all tests, quizzes, and homework assignments. **Cell phone use is prohibited on all tests and all closed-book quizzes.** Do not expect to use your cell phone (or tablet computer) as a calculator.

Grading

Your grade will be based on three in-class exams, written assignments (WA), announced quizzes, unannounced open-book quizzes, and unannounced attendance checks. Minimum points for letter grades are also shown.

Grade	Minimum %
A	92
A-	90
B+	87
B	82
B-	80
C+	77
C	72
C-	70
D+	67
D	60
F	0

Component	Value
Exam 1	25%
Exam 2	25%
Exam 3	20%
WA	20%
Quizzes	10%
Total	100%

Exams

Three semester exams will be given on the dates shown below. Exams are always closed-book. **No questions will be taken during exams.** You may have a calculator **but never a cell phone on your desk during exams.** Cell phones must always be off and out of sight during exams. Cell-phone interruptions (ringing) during a test will be penalized 1 point per second of interruption. Any visible electronic device, except a calculator, is a 5-point score deduction. Cell-phone or computer use during a test will be penalized 50 points. A missed test requires prior notification and written documentation satisfying the instructor before any make-up is allowed. Time will be allocated for a sanctioned make-up exam during the three hour final exam period scheduled by the university. If a sanctioned make-up is not taken then the grade for the test will be zero.

Written Assignments (WA)

Each written assignment (WA) should be thought of as a small writing project. Each written assignment grade is based 20% on format and 80% on content (see below). Each assignment must be typed and submitted via the SAKAI assignment tool (not email, not in a message) before 10pm on the due date. Late assignments are accepted with a 50% penalty but only if submitted to SAKAI before the start of the next class. SAKAI will timestamp all submission. To be excused from a missing/tardy homework assignment you must provide written documentation that is acceptable to the instructor. This written documentation must account for the two days prior the due date as well. Start on the written assignments early! Some students score significantly lower on the written assignments than on the tests. Often this is for failing to follow the format or for starting written assignments the day before they are due. These assignments will require a good deal of thinking and review of your notes and the text. Students submitting identical or near-identical writing assignments will split the homework grade. (If two students hand in near-identical work their grades will be halved, for example.) Please read the section on academic honesty below.

A perfect format grade (20%) for written assignments requires:
1. your name date and assignment number on top
2. each problem numbered with a typed-out problem statement for each problem followed by your answer
3. tidy, typed exposition (a standard document file or export to pdf is best, please avoid bulky jpg files)
4. the assignment is submitted to SAKAI in one file with pages in order

A perfect content (80%) grade for written assignments requires:
1. the correct answers
2. the correct work and justification (unjustified, one word or one number answers –even if correct– are worth zero.)
3. clear, grammatically precise explanations

The writing assignments are time consuming to grade and so generally take a week to be returned, however, all the writing assignments will be discussed in class during the period following the due date.

Classwork/Quizzes

Classwork will consist of announced and unannounced in-class assignments on recent material. Their purpose is to give you a head start on homework and to encourage regular attendance. Classwork need not follow the homework format. There are never make-ups for missed classwork; this would defeat its purpose. Valid written excuses are required to be exempt from classwork.

Attendance

Unannounced quizzes and random attendance checks will be used to enforce attendance. If a quiz is unannounced it will be “open book” and “open notes.” Students who occasionally need to miss a class should notify their instructor BEFORE THE START OF CLASS on the day that they will miss. If a student provides such prior notice via SAKAI, he/she will be exempt from penalty for unannounced quizzes and random attendance checks. Note: This exemption does NOT apply announced quizzes, WAs, or tests.

Academic Honesty

Students are expected to be honest in all academic work. A student's name on any written work, quiz or exam shall be regarded as assurance that the work is the result of the student's own independent thought and study. Work should be stated in the student's own words, properly attributed to its source. Students have an obligation to know how to quote, paraphrase, summarize, cite and reference the work of others with integrity. The following are examples of academic dishonesty.

- Using material, directly or paraphrasing, from published sources (print or electronic) without appropriate citation
- Claiming disproportionate credit for work not done independently
- Unauthorized possession or access to exams
- Unauthorized communication during exams
- Unauthorized use of another's work or preparing work for another student
- Taking an exam for another student
- Altering or attempting to alter grades
- The use of notes or electronic devices to gain an unauthorized advantage during exams
- Fabricating or falsifying facts, data or references
- Facilitating or aiding another's academic dishonesty
- Submitting the same paper for more than one course without prior approval from the instructors.

If you are caught perpetrating an academically dishonest act, you could be given an F for the assignment or the entire class, and/or reported to the university for disciplinary action or dismissal. As a student of higher standards, you pledge to embody the principles of academic integrity.

In MTH109 you may work with other students on your homework assignments as follows: You may discuss concepts, principles and methods with each other, however, **you must prepare your own final submission separately**. You are not to copy another student's homework nor cooperate while composing the wording of your answers. Collaboration among students is not permitted during examinations.

Special accommodations

Students with special requirements and proper documentation through Disability Services should inform their instructor as early as possible. University regulations require that documentation be provided at least one week before special consideration is given.

Course outline

On the next page is a comprehensive course outline; use it to keep up with the reading, plan your studying, find your homework assignments, know when your tests are, etc. We will follow the schedule quite closely, but of course it is subject to possible minor editing in the case of typos, unforeseen events, weather anomalies, etc.

Schedule for MTH109 Fall 2019

Class	Date	Section of Text/Topics	Suggested problems	Events: Test, WA, Quiz
1	W 9/4	Introduction, 1.1 Social choice functions, preference	Read preface, syllabus	Sign on to SAKAI
2	F 9/6	1.1 (continued), 1.2 May's theorem, Majority Rule	Example P1-2	
3	M 9/9	1.3 Voting Methods: Plurality, Borda, Dictatorship	P36: #5bc,#6bc	
4	W 9/11	1.3 (continued): Condorcet, Sequential-Pairwise	P36: #5a,#6a, P39: #12	Assignment#1: SAKAI mess.
5	F 9/13	1.3 (continued): Hare, 1.4 Fairness criteria	P35: #3, P36: #5d, #6d	Wrksht #2: Choice methods
6	M 9/16	1.4 (continued)	P38:#8, P39:#11	
7	**W 9/18**	1.6 Analysis of fairness – negative results	P41:#21,#22	**WA#1 due p35#3,5f,6f**
8	F 9/20	Discussion of WA#1		
9	M 9/23	1.5 Analysis of fairness – positive results	P40:#13,#16, P46:#36	
10	W 9/25	1.5 (continued) *(last drop day with no W grade)*		
11	**F 9/27**	1.7 Arrow's theorem, 1.8 Approval voting	P41:#23, P36:#5e,6e	**WA#2 due p40 #13,22,25**
12	M 9/30	Discussion of WA#2		Quiz#3: Fairness proofs
13	**W 10/2**	**TEST #1 (covers chapter 1)**		**TEST #1**
14	F 10/4	2.1, 2.2 Introduction, Yes-No systems	P64: #1,2	
15	M 10/7	2.3 Weighted voting systems	P65: #3,4,18	
16	W 10/9	2.4 Swap-Robustness	P65: #7,9	
17	F 10/11	2.5 Intro and 1st proposition only	P70: #24,27a	Wrksht #4: 2.1-2.4
18	**T 10/15**	3.1, 3.2 Political power, Shapely-Shubik power index	P105: #2,3,4	**WA#3 due p65: #3,4,7,8**
19	W 10/16	Discussion of WA#3		
20	F 10/18	3.2 Shapely-Shubik power index (continued)	P106:#9,10,11,15	
21	M 10/21	3.3 Applications of the SSPI: (the EEC)	P108: #24b,30	Quiz #5: SSPI
22	**W 10/23**	4.1, 4.2 Conflict, Two-player two-strategy games	P137: #1,3	**WA#4due p105 #9,10b,21d**
23	F 10/25	Discussion of WA #4		Clsswrk #6: Penny matching
24	M 10/28	4.3 Dominant strategies, Nash equilibria	P138: #5,6,7	
25	W 10/30	4.4 "The prisoner's dilemma" and the arms race	P144: #10,11	Quiz#7: Dom. strat. Nash eq.
26	**F 11/1**	4.5 "Chicken" and the Cuban missile crisis	P144: #17,18,19	**WA#5 due p140 #7,10,13,19**
27	M 11/4	Discussion of WA#5		
28	**W 11/6**	**TEST #2 covers (chapters 2.1-2.4, 3.1-3.3, 4.1-4.5)**		**TEST#2**
29	F 11/8	5.1, 5.2 Apportionment, Fairness criteria	P154: learn 3 properties	Clsswrk#9: Apportionment
30	**W 11/13**	5.2 Hamilton's method, Alabama paradox	P174:#3,4	~~**WA#6**~~ omitted
31	F 11/15	5.3 Jefferson's method	P174:#3,4 w/ Jeff. meth	
32	M 11/18	5.3 Webster's method		Clsswrk#10: Jefferson meth.
33	**W 11/20**	5.3 Webster's method (cont)	P174:#3,4 w/ Web. meth.	**WA#7 due p174 #4 (3** mthd)
34	F 11/22	Discussion of WA#7		Quiz#11: Webster method
35	M 11/25	5.3 Geometric Averaging, Hill-Huntington method	P174:#3,4 w/ H.H. Meth.	
36	M 12/2	5.3 Hill-Hunt (cont), 5.4 Balinski-Young result		Quiz#12: Hill-Huntington
37	**W 12/4**	**TEST#3 (chapters 4.7-5.4)**		**Test #3**
38	F 12/6	Congressional districts and Gerrymandering	Class notes	
39	M 12/9	(continued)		Quiz #13: Gerrymandering
FE		**Final Exam, and make-ups for excused tests**	**Date: TBA**	