Course Syllabus   MTH109: Mathematics and Politics   Fall2012
Instructor: Dr. Glenn Faubert

Goals of the course

The aim of this course is to provide a survey of some mathematical ideas and methods found in political settings and to generally broaden your idea of just what mathematics is and how it can be applied. We will explore various methods of social choice (voting methods) and learn their strengths and weaknesses. We will study the fairness criteria used to evaluate social choice methods and discover how some methods can be manipulated through insincere voting. Some voting systems are specifically designed to model a desired inequality among voters. These are called weighted voting systems. We will learn a way to measures a voter's power in such a system. We will learn to apply the methods of apportionment that have been used to determine the composition of the House of Representatives in the United States over its history, learning their strengths and weaknesses. We will explore the subjective idea of "fairness" and perhaps be surprised to find out just how far mathematics can and cannot go to make this notion objective. We will introduce an important area of mathematics called game theory and learn what mathematics can tell us about how to behave in situations which require both competition and cooperation. We will study two very famous partial conflict games one called "the prisoners' dilemma" and one called "chicken" and explore how they have been used in some important political situations. We will finish with a bit about auctions including the rather famous "dollar auction" and Vickrey auctions. MTH109 satisfies the quantitative general education requirement.

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 by the first class meeting. There will be a quiz on class #2 on the first reading assignment.

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 done on 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 for every class starting in November. Calculator use is allowed 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 tests, written assignments (WA), announced quizzes, unannounced open-book quizzes, and unannounced attendance checks. Minimum points for letter grades are also shown.

Grade	Minimum %		Component	Value
A	93		Test 1	15%
A-	90		Test 2	20%
B+	87		Test 3	20%
B	82		WA	35%
B-	79		Quizzes/Attend	10%
C+	76		Total	100%
C	71			
C-	68			
D+	65			
D	60			
F	0			

Tests

Three tests will be given on the dates shown below. Tests are always closed-book. No questions will be taken during tests. You may have a calculator but never a cell phone on your desk during tests. Cell phones must always be off and out of sight during tests. Cell-phone interruptions 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. 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. Written assignment grades are based 20% on format and 80% on content. Each must be typed and submitted via SAKAI (no email) before class starts on the due date. Late written assignments are accepted with a 50% penalty and at most two calendar days late. SAKAI will enforce this rigidly. 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 several days prior the due date. (for official URI functions, and illness with a doctor's note, for example.) 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 night before they are due. These assignments will require a good deal of thinking. The specifics of some assignments will be provided to you via SAKAI. Students handing in 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.) See also the section on the Honor Code below.

A perfect format grade for written assignments requires:
1. one or two problems per page (no crowding)
2. a typed-out problem statement for each problem so the assignment is self contained
3. tidy, typed exposition (a standard document file or export to pdf is best, avoid jpg)
4. the assignment is submitted in one file with pages in order

A perfect content grade for written assignments requires:
1. the correct answer
2. the correct work and justification
3. clear and precise explanation, naked numerical answers are worthless

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 encourage attendance. If a quiz is given 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 students provide such prior notice via SAKAI, they will be exempt from penalty for unannounced quizzes and random attendance checks. Note: This exemption does NOT apply to WAs or tests. (See above.)

Honor code

If you are caught breaking the URI honor code, you could be given an F for the assignment or the entire class. As a student of higher standards, you pledge to embody the principles of academic integrity. 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. 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. This schedule is subject to possible minor editing in the case of typos, unforeseen scheduling changes, weather anomalies, etc.

Schedule for MTH109 Fall 2012

Class	Date	Text/Topics	Suggested Exercises	Event
1	W 9/5	Introduction	Read preface, syllabus	Sign on to SAKAI
2	F 9/7	1.1 Social choice functions, preference	Example P1-2	Quiz: syllabus & text preface
3	M 9/10	1.2 Two alternatives, May's theorem	Learn May's Theorem	SAKAI message
4	W 9/12	1.3 Methods: Condorcet, Plurality, Borda	P36: #5abc,#6abc	
5	F 9/14	1.3 Methods: Hare, Seq. Pairwise, Dictatorship	P36 :#3,#4	
6	M 9/17	1.4 Fairness criteria	P38:#8	Quiz: social choice methods
7	W 9/19	1.5 Analysis of fairness	P39:#11,#12	WA#1 due p36 #3,#4
8	F 9/21	1.5 Analysis of fairness (continued)	P40:#13,#16	
9	M 9/24	1.6 Analysis of unfairness	P41:#21,#22	Quiz: proofs p14-19
10	W 9/26	1.6 Analysis of unfairness (continued)	P41:#23	
11	F 9/28	1.7 Arrow's theorem	Independent Reading 1.8	WA#2 p38,#8,13,22,36
12	M 10/1	2.1, 2.2 Introduction, Yes-No systems	P65: #1,2	Quiz: Indep. study sec. 1.8
13	W 10/3	2.3 Weighted voting systems	P65: #3,4,18	
14	F 10/5	**TEST #1 (covers chapter 1)**		**TEST #1**
15	W 10/10	2.4 Swap-Robustness	P64: #7,9,16	
16	F 10/12	2.5 Trade-Robustness	P70: #27,29	
17	M 10/15	2.6, 2.7 Characterization of weighted systems	Prop p61, Theorem p63	Quiz: 2.4, 2.5
18	W 10/17	3.1, 3.2 Political power, Shapely-Shubik power index	P105: #2,3,4	WA#3 p65: #2,4,7,27
19	F 10/19	3.2 Shapely-Shubik power index (continued)	P106:#9,10,11,15	
20	M 10/22	3.3 Applications of the SSPI	P108: #24b,30	Quiz: SSPI
21	W 10/24	3.7, 3.8 The Chair's paradox	P111: #40,41	
22	F 10/26	4.1, 4.2 Conflict, Two-player two-strategy games	P137: #1,3	WA#4 p105 #3,10,15,24b
23	M 10/29	4.3, 4.4 Dominant strategies, Nash equilibria	P138: #5,6	
24	W 10/31	4.4, 4.5 The prisoner's dilemma, The arms race	P144: #10,11	Quiz: 4.3
25	F 11/2	4.5, 4.6 Chicken, Cuban Missile Crisis, Yom Kippur War	P144: #17,18,19	
26	M 11/5	5.1, 5.2 Apportionment, Fairness criteria	P154: learn 3 properties	WA#5 p140 #6,10,18,19
27	F 11/9	5.2 Hamilton's method, Alabama paradox	P174:#3,4	
28	M 11/12	**TEST #2 covers (chapters 2, 3 and 4)**		**TEST #2**
29	W 11/14	5.3 Jefferson's method	P174:#3,4 w/ Jeff. meth.	
30	F 11/16	5.3 Webster's method, Hill-Huntington method	P174:#3 w/ Web. & H.H.	
31	M 11/19	5.4 The Balinski-Young result	P174: #1,2	Quiz: H-H method
32	W 11/21	5.5 Dispute resolution: proportional, envy-free, equitable	P175: #5,6,7,8	WA#6 (See SAKAI)
33	M 11/26	5.7 The adjusted winner procedure	P166-169 example	
34	W 11/28	5.7 (continued), 5.8 Israel-Palestine example	P177:#14,15	Quiz: 5.7
35	F 11/30	6.2, 6.3 Escalation, The Dollar Auction, Game trees		Independent study 5.9, 6.1
36	M 12/3	6.3 Tree analysis; punishing vs. conservative convention	P200 #1,3	WA#7 p175 #5,8,10,14
37	W 12/5	6.5 O'Neill's theorem (conservative convention only)	P200 #17,18	
38	F 12/7	6.6 Sealed bids, Vickrey auctions, eBay auctions	P204 #26,30	Independent study 6.7
39	M 12/10	Review		Quiz: O'Neill's Theorem
Final		**TEST #3 (covers chapters 5 and 6)**	Study for Final	WA#8 p200 #1,3,17,18,30