Course Syllabus MTH109: Mathematics and Politics Fall2014

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 learn various methods of social choice (voting methods) and learn their strengths and weaknesses. We will learn the commonly applied fairness criteria which are used to evaluate social choice methods as well as discover how some methods can be manipulated through insincere (strategic) voting. You may be surprised to learn what Arrow's Theorem has to say about the limits of all methods of social choice. There are voting systems that are specifically designed to enforce inequality among voters! These are called weighted voting systems. They are a special type of a very common voting system in which all voters must vote either yes or no (or abstain) We will learn a way to measures a voter's power in a weighted voting 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, noting 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 use more precise definitions of fairness to determine how to divide goods between competing parties. We will introduce an important area of mathematics called game theory and learn what mathematics can tell us about how to behave and predict behavior in situations which require both competition and cooperation. Along the way, we will study two very famous partial conflict games called "the prisoners' dilemma" and "chicken" and explore how they have been used in some important political situations. We will finish by learning in a bit more depth the ubiquitous "yes-no" voting systems from earlier in the year, and learn a remarkable theorem that extends simple weighted voting systems to cover all "yes-no" voting systems. 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 %
A	92
A-	90
B+	87
B	82
B-	80
C+	77
C	72
C-	70
D+	67
D	60
F	0

Component	Value
Test 1	25%
Test 2	25%
Test 3	15%
WA	25%
Quizzes/Attend	10%
Total	100%

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. 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 11pm on the due date. Late assignments (except WA#7) are accepted with a 50% penalty and only if submitted to SAKAI before the start of the next class. 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. (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.) Please read the section on the Honor Code below.

A perfect format grade 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 in one file with pages in order

A perfect content 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, grammatical, precise explanations

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 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 to WAs, announced quizzes, or tests.

Honor code

If you are caught breaking the URI honor code, you could be given an F for the assignment or the entire class, 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. 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. 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 2014

Class	Date	Section of Text/Topics	Suggested problems	Events: Test, WA, Quiz
1	W 9/3	Introduction, 1.1 Social choice functions, preference	Read preface, syllabus	Sign on to SAKAI
2	F 9/5	1.1 (continued), 1.2 May's theorem, Majority Rule	Example P1-2	Quiz: syllabus & preface
3	M 9/8	1.3 Voting Methods: Plurality, Dictatorship, Borda	P36: #5bc,#6bc	
4	W 9/10	1.3 (continued): Condorcet, Sequential-Pairwise	P36: #5a,#6a, P39: #12	First SAKAI message due
5	F 9/12	1.3 (continued): Hare, 1.4 Fairness criteria	P36: #5d, #6d	
6	M 9/15	1.4 (continued)	P38:#8, P39:#11	Quiz: Social choice methods
7	**W 9/17**	1.5 Analysis of fairness – positive results		**WA#1 due p36#3,4,5f,6f**
8	F 9/19	Discussion of WA#1		
9	M 9/22	1.5 (continued)	P40:#13,#16	
10	W 9/24	1.6 Analysis of unfairness – negative results	P41:#21,#22	Quiz: Fairness proofs p14-19
11	**F 9/26**	1.6 (continued), 1.7 Arrow's theorem	P41:#23, P36:#5e,6e	**WA#2 due p38,#8,13,22,36**
12	M 9/29	Discussion of WA#2		Quiz: 1.8 Approval voting
13	**W 10/1**	**TEST #1 (covers chapter 1)**		**TEST #1**
14	F 10/3	2.1, 2.2 Introduction, Yes-No systems	P65: #1,2	
15	M 10/6	2.3 Weighted voting systems	P65: #3,4,18	
16	W 10/8	2.4 Swap-Robustness	P64: #7,9,16	
17	F 10/10	2.5 Swap-Robustness (cont) omit Trade-Robustness	P70: #24,27a	Quiz: 2.1-2.4
18	**W 10/15**	3.1, 3.2 Political power, Shapely-Shubik power index	P105: #2,3,4	**WA#3 due p65: #3,4,18,24**
19	F 10/17	Discussion of WA#3		
20	M 10/20	3.2 Shapely-Shubik power index (continued)	P106:#9,10,11,15	
21	W 10/22	3.3 Applications of the SSPI: (the EEC)	P108: #24b,30	Quiz: SSPI
22	**F 10/24**	4.1, 4.2 Conflict, Two-player two-strategy games	P137: #1,3	**WA#4due p105#3,10,15,24b**
23	M 10/27	Discussion of WA #4		
24	W 10/29	4.3 Dominant strategies, Nash equilibria	P138: #5,6	
25	F 10/31	4.4 "The prisoner's dilemma" and the arms race	P144: #10,11	Quiz: Dom. strat. & Nash eq.
26	**M 11/3**	4.5 "Chicken" and the Cuban missile crisis	P144: #17,18,19	**WA#5 due p140 #7,10,17,19**
27	W 11/5	Discussion of WA#5		
28	**F 11/7**	**TEST #2 covers (chapters 2, 3, 4)**		**TEST#2**
29	M 11/10	5.1, 5.2 Apportionment, Fairness criteria	P154: learn 3 properties	Classwork: Apportionment
30	F 11/14	5.2 Hamilton's method, Alabama paradox	P174:#3,4	
31	M 11/17	5.3 Jefferson's method	P174:#3,4 w/ Jeff. meth.	
32	W 11/19	5.3 Webster's method	P174:#3,4 w/ Web. meth.	Quiz: Jefferson's method
33	F 11/21	5.3 Hill-Huntington method, 5.4 Balinski-Young result	P174:#3,4 w/ H.H. meth.	Quiz: H-H method
34	**M 11/24**	5.5 Dispute resolution: proportional, envy-free, equitable	P175: #5,6,7,8	**WA#6 (See SAKAI)**
35	W 11/26	Discussion of WA#6		
36	M 12/1	5.7 The adjusted winner procedure	P166-169 example	
37	**W 12/3**	**TEST#3 (chapters 5.1-5.5)**		**Test #3**
38	**F 12/5**	5.7 (continued), 5.8 Israel-Palestine example	P177:#14,15	**WA#7 due p175 #10,14,15**
39	M 12/8	Discussion of WA#7		Quiz: Adjusted winner proc.
F	**Th 12/18**	**Final Exam (**11:30am in class)		