

**Instructor:** Linda Garant      **Office** BP 213      ext: 73802      **email:** linda.garant@tufts.edu

**Office Hours:** Mon and Wed 12 - 1 pm (and by appointment).

**Class meetings:** E+ block (Mon and Wed 10:30 - 11:45). Note this course is not coordinated with other sections of Math 19, so you cannot attend other time blocks.

**Text:** Mathematics of Social Choice by Christoph Borgers. The text is on reserve in Tisch Library. We will cover many chapters in the text, and also some small topics not in the text.

**Course Website:** Solutions and other resources can be found on [courses.math.tufts.edu/math19/garant](http://courses.math.tufts.edu/math19/garant).

**Homework** ...is assigned for each class meeting, and should be done before the next class. It may be collected. Answers to many problems are in Appendix D of the text and on the course website. You can ask questions about the homework during office hours and via email.

**Quizzes:** ...will typically happen at the beginning of every class, so you need to get to class on time. Homework problems can appear on quizzes. The quizzes are not sufficient preparation for exams.

**Class Attendance** ...is extremely important! You are responsible for all announcements and content during class meetings. Your grade for any quizzes during a class you miss will be a zero (there are no makeups). If you do miss a class, you should get the notes from one or two classmates, read the pertinent section of the text, and do the homework before seeing me for questions, and before the next class meeting.

**Technology Use:** For all of our benefit, I require that you **turn off any cell phones** or alarms during class. Laptops can also be distracting to others, so please speak with me before using one in class.

**Exams:** You must be present for the exams on **Wednesday Oct 18** and **Thursday Dec 14**. The Math Department Exam policies can be found at <http://math.tufts.edu/courses>, under the headings *Exam Policy* and *Grading Schemes*.

**Honesty:** I have no tolerance regarding cheating on exams or quizzes. I consider cheating to be an egregious violation of the trust of all your classmates as well as myself. Your signature is required on exams to indicate that you have neither given nor received assistance on the exam. Anyone found violating this pledge will receive an F in the course, and will be reported to the Dean of Students.

**Calculators** ...will not be allowed for quizzes nor for exams.

**Grading:** Your three lowest quiz grades will be dropped, and the remaining averaged. Your quiz and two exam scores are weighted equally to create your course average. Your course average is converted to a letter grade as follows: A+ (98 and above), A (93 and above), A- (90-92), B+ (87-89), B (83-86), B- (80-82), C+ (77-79), C (73-76), C- (70-72), D+ (67-69), D (63-66), D- (60-62), F (below 60).

**Learning Objectives** include 1a,c,d,e, and 2a,b from the list of Mathematics undergraduate learning objectives, viewable at <http://ase.tufts.edu/faculty/committees/objectives/math.htm>

**Student Accessibility Services:** To request accommodation due to a documented disability, register with Student Accessibility Services at the beginning of the semester. Call the Student Services Desk (617-627-2000) to arrange an appointment.

|                  |              |                                    |              |                               |
|------------------|--------------|------------------------------------|--------------|-------------------------------|
| <b>Important</b> | <b>9/19</b>  | Last day to add a course           | <b>11/22</b> | no class (Thanksgiving break) |
| <b>Dates</b>     | <b>10/9</b>  | No class (Indigenous People's Day) | <b>12/11</b> | Last day of class             |
|                  | <b>10/10</b> | Last day to drop (without a W)     | <b>12/11</b> | Last day to drop (with a W)   |

**Schedule of Topics, Reading, and Homework:** on next page (changes may be announced in class)

## Compensation and Fair Division (Text Parts II and III)

| Date  | Lecture Topic                                 | Reading (for after class)                     | Problems (for after class)  |
|-------|---|---|---|
| 9/6   | Fair, Envy-Free Compensation                  | Ch. 13 (p.95 - p.100), and Logic Video        | p.103/ 1, 2, 5, 6 (inequalities on p. 100)  |
| 9/11  | Equitable, Pareto-optimal Compensation        | Ch. 13 (p.100 - p.103), Ch 14 (p.105 - p.109) | p. 111/ 2, 4, 5; Compensation Applet Worksheet  |
| 9/13  | More Pareto-optimal, Equitable Compensation   | Ch. 14 (p.110 - p.111)                        | p. 111/1, 3, note: for both 1 and 3, show both methods of computing payouts produce the same result (so compute $\frac{w}{S}(a)$ , and $(\frac{w}{m} \cdot \frac{a}{n})$ for A, and then do similar computations for each of the other players); Compensation Handout 1-6 |
| 9/18  | I Cut You Choose                              | Ch. 16  | p. 126/2; Fair Division Handout 1, 2  |
| 9/20  | Equal Div; Pareto-optimal & Equitable is fair | Ch. 16  | p. 126/ 1, 3, 4, 6  |
| 9/25  | Steinhaus Method                              | Ch. 17  | p. 131/ 1 (typo: B's value of 1 <sup>st</sup> piece should be .2, not .3), 2, 3, 4, 5; p. 141/ 1 - 3; Fair Division Handout 3, 4, 5   |
| 9/27  | Selfridge/Conway                              | Ch. 20  | p. 145/ 1 (typo: B trims to make it as valuable as the <b>left</b> piece), 2, 3, 4; Fair Division Handout 6, 7  |
| 10/2  | Adjusted Winner setup                         | Ch. 21 (p. 149 - 151)                         | p. 145/ 5; p. 154/ 1, 2; Prove Steinhaus is fair, then do the handout   |
| 10/4  | Adjusted Winner method                        | Ch. 22, Ch 23                                 | p. 161/ 1, 2ab; Fair Division Handout 8; Start Non-comprehensive review problems  |
| 10/11 | Apportionment                                 | Website: Apportionment                        | Apportionment Handout; Finish Non-comprehensive review problems; optional: apportionment problems from reading on website p. 146/ 19, 20, 21  |
| 10/16 | Review  |   |   |
| 10/18 | <b>Exam 1</b>                                 | 10:30 - 11:45                                 | in our classroom  |

## Voting (Text Part I)

| Date  | Lecture Topic  | Reading (for after class)                                    | Problems (for after class)  |
|-------|--|--|---|
| 10/23 | Basic Methods, Condorcet                                 | Ch. 1, and Borda Video                                       | p. 9/ 1 - 7, start considering extra credit vote option (see handout on p.9 in packet, or website for detailed instructions)  |
| 10/25 | Sequential, Fairness Criteria                            | Ch. 2, Paulos article, and Majority/Condorcet video          | p. 15/ 1, 2, 3, 7, 8, 9, 10. Also, you will hand in the following homework on 11/1: from Paulos article find winner(s) of election with revised numbers (36, 28, 18, 9, 9) using Plurality, Borda, Pairwise, Runoff, Elimination, and Coombs, and draw graph. Do each method completely, writing all steps since quiz on 11/1 will ask for details. |
| 10/30 | Spoilers   | Ch. 3, LePore article, and No Spoiler video                  | p. 21/ 1, 2, 3, 4; Voting Handout 1, 2; Paulos: show Cain and Perry are spoilers using Borda, Romney is a spoiler using Runoff and Elimination, and Cain is a spoiler using Plurality.  |
| 11/1  | Smith Set  | Ch. 4 (p. 23 - 24, and 4.9 on p. 27 to end)                  | p. 30/ 1, 2, 3, 4, 5; Prove Pairwise is unanimity fair, then do the handout   |
| 11/6  | Smith fairness, a posteriori SF (out of order with text) | Ch. 5 (p. 31 - 32)   | p. 30/ 2, 6, 7, 8; p. 35/ 3, 6; Voting Handout 3a-d, 9a,c,e; submit poll question if doing optional extra credit vote   |
| 11/8  | No Weak Spoiler, a priori SF                             | Ch. 5 (p.33 - 35)  | p. 35/ 1, 2, 7, 8, 9; Voting Handout 8, 9b  |
| 11/13 | Schulze's Beatpath                                       | Ch. 6 (omit Prop 6.3 proof on p. 40); and Monotonicity video | p. 41/ 1, 2, 3, 5 (typo: Prop 6.3 should be Prop 6.5), 6; Voting Handout 8, 9f  |
| 11/15 | Monotonicity I   | Ch. 7 (p. 43 - mid p. 45)                                    | p. 52/1, 2 (add parts c: plurality, d: pairwise, e: a priori Smith fair plurality), 3; Voting Handout 7   |
| 11/20 | Monotonicity II  | Ch. 7  | Voting Handout 3e, 4, 5, 6; show runoff violates monotonicity for preference schedule in monotonicity video   |
| 11/27 | IIC , Pareto Efficiency                                  | Ch. 9  | p. 69/ 1, 2, 4 ; Criteria Handout 1-7   |
| 11/29 | Muller-Satterthwaite                                     | Ch. 9  | p. 69/ 5 ; complete extra credit  |
| 12/4  | Ranking, Weighted Voting I                               |  | One shot (not recursive) rankings for p. 81/ 1, 2, 4a, 7; One shot elimination ranking for example 11.2 on p. 77; Voting Handout 10, 11a-11g, 11m-11q, 12-14, Weighted Voting Handout 1,2,3 and corresponding parts of 13   |
| 12/6  | Weighted voting II                                       | Website: Banzhaf   | Weighted Voting Handout 4 - 9, 11b - 11e, 13; Nassau handout  |
| 12/11 | Review   |  |   |
| 12/14 | <b>Final Exam</b>  | 8:30 - 10:30 am  | (room to be determined)   |