



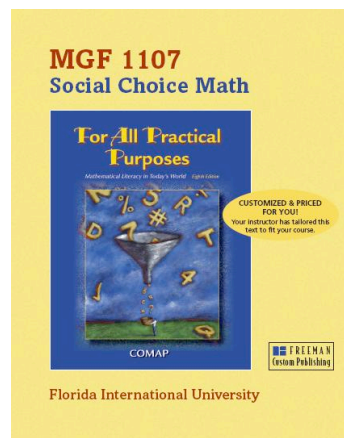
MGF 1107
THE MATHEMATICS OF SOCIAL CHOICE AND DECISION MAKING
DEPARTMENTAL SYLLABUS
Revised Summer 2009 by Mike Rosenthal

This course satisfies FIU's core curriculum and general education math requirements and can be used towards an exemption from the CLAST. It is intended to be of interest to students majoring in Political Science, International Relations, History, Social Studies Education, and Public Administration, although any student may take it.

Topics include voting methods, weighted voting systems, methods of fair division, methods of apportionment, and game theory. Combinatorics and expected value will also be briefly covered.

Text: For All Practical Purposes, custom edition, by COMAP
Students may instead use the 8th edition of For All Practical Purposes. Our custom text includes just chapters 9-15 of the full text at a cost savings to students.

A suggested pacing for 23 lectures follows. This will allow for 4-5 days of testing and review. This pacing assumes no homework is being reviewed in class. Those faculty members taking homework questions in class will cover less material or have to cover the material faster. Optional topics not in the text are *italicized*.



1. CHAPTER 9: Plurality, plurality with runoff, the Hare system, the Borda count, sequential pairwise voting. Condorcet's method is in the text, but is optional.
2. CHAPTER 9: Condorcet's voting paradox, the Pareto condition, the Condorcet winner criterion, monotonicity, *the majority criterion*, independence of irrelevant alternatives, and Arrow's Impossibility Theorem.
3. CHAPTER 9: More on the previous topics, plus approval voting
4. (Not in text, see web page at end of syllabus for problems) *The Fundamental Principle of Counting*, factorials, permutations, the total number of subsets of a set.
5. (Not in text, see web page at end of syllabus for problems) Combinations
6. CHAPTER 11: Introduction to weighted voting systems: quota, weight, winning, losing, and blocking coalitions, dictators, dummies, veto power, critical voters.

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7. CHAPTER 11: Banzhaf power index, *paradox of new members*
8. CHAPTER 11: Equivalent voting systems, minimal winning coalitions.
9. CHAPTER 11: The Shapley-Shubik power index and the Shapley-Shubik power index for systems with large numbers of voters. The Banzhaf power index for large systems is optional.
10. CHAPTER 13: The divide-and-choose method, *the moving knife method*, the lone divider method, proportionality, envy-freeness, and the Selfridge-Conway procedure.
11. CHAPTER 13: The adjusted winner procedure, equitable divisions, Pareto-optimal divisions.
12. CHAPTERS 13-14: The Knaster Inheritance Procedure, more on the desirable properties of a fair division, and the Hamilton method of apportionment.
13. CHAPTER 14: Jefferson' method and Webster's method. The divisor methods of apportionment may be taught using trial-and-error rather than the critical divisor method shown in the text.
14. CHAPTER 14: *Adams' method, the election of 1876*, geometric means and the Hill-Huntington method, the population paradox, *Balinski & Young's impossibility theorem*.
15. CHAPTER 14: *Apportioning the U.S. House of Representatives using real census data and Microsoft Excel*
16. CHAPTER 14: Representative shares, district populations, absolute and relative differences, *bias percentage*
17. (Not in text, see web page at end of syllabus for problems) *Introduction to probability and expected value*
18. CHAPTER 15: Payoff matrices, saddlepoints, value of the game, pure strategies, minimax, maximin,
19. CHAPTER 15: Mixed strategies and larger games with saddlepoints.
20. CHAPTER 15: Dominant and dominated strategies
21. CHAPTER 15: *Solving 2 x n and n x 2 games*.
22. CHAPTER 15: Non-zero sum games, Nash equilibrium, Prisoner's Dilemma, Chicken, *4-way stop, and battle of the sexes*.
23. CHAPTER 15: Sophisticated voting, *the paradox of the chair's position, tacit & revealed deceptions*.

The instructor has some flexibility in choosing topics for this course. Rather than supplementing the text with the italicized topics above, the instructor can include topics from chapters 10 and 12, or chapter 16 from the fourth edition, which covers the Theory of Moves. This chapter is available online at:

http://www.whfreeman.com/comap/con_index.htm?99oed

Instructors teaching the course for the first time can request detailed lecture notes from course coordinator Mike Rosenthal

Supplemental homework problems covering the optional material can be found online at: <http://www.fiu.edu/~rosentha/MGF1107.htm>