

Formal Analysis: Hilary Term 2017

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This course aims to provide some of the basic formal tools used to study social interactions and apply them to the study of politics. We will encounter models of many of the basic concepts at work in politics: collective action problems, coordination and norms, fairness, distributive justice, principal-agent problems, and a whole variety of strategic behaviours. These concepts emerge time and again across whole swathes of the study of politics: from electoral institutions, to international security, to ethnic conflict, to economic development. The course will teach students not only the basic assumptions of rational choice theory but what happens when those assumptions fail to hold and how culture, emotion, time inconsistency, herding and other 'non-rational' forms of behaviour can be analysed in a formal manner. At the end of the course you should be capable of reading political science literature employing game theory and be able to solve simple game theoretic models, and to think about how such models might be extended to encompass a wide variety of social behaviours. Although the course makes some use of (simple) mathematics there are no formal prerequisites for the course and the instructor will go over many of the core mathematical concepts in the introductory classes.

The core theoretical texts we will follow throughout are *Game Theory for Political Scientists* by James Morrow (1994), *An Introduction to Game Theory* by Martin Osborne (2004), and *political Economy for Public Policy* by Ethan Bueno de Mesquita (2016, henceforth EBdM). These are all good beginner texts, each from a slightly different angle (they are intros written for political scientists, economists and public policy specialists respectively). If possible, I recommend purchase of these books.

Our main examples will come from Andrew Kydd's *International Relations Theory: The Game-Theoretic Approach* (2015) and Scott Gehlbach's *Formal Models of Domestic Politics* (2013).

We will supplement these books with my own lecture notes where appropriate, which I will forward to you. If you haven't taken mathematics for a long time you should also consider purchasing / reading *A Mathematics Course for Political and Social Research* by Will Moore and David Siegel (2013) (on reference in SocSci library). I will use this book and some of my own lecture notes in Week One when we go over the maths needed for the course.

The course will meet twice a week for two hours a time - that is there will be no crucial substantive difference between lectures and classes, both of which I will lead. I will spend time lecturing on both days as well as helping students through problem sets and examples. Please at least skim the readings before class and if possible go over them again after class. Like Hegel, formal theory often makes full sense only on the third go through. The course will be assessed through a final examination.

The class has three problem sets - one on basic models of choice, one on static games, and one on dynamic games. All participants in the class should try and complete all three problem sets since one can only really learn this material by doing (or at least trying to do!). These problem sets will not count as part of your official grade. People taking the class for credit will take an exam in 0th week of Trinity Term. All participants whether for credit or not are expected to attend lectures and do the reading to their best of their ability.

Week One: Introduction to Formal Thinking and Maths Refresher

- (a) Formal Theory and Maths Refresher: Jan 16

Morrow C1; Osborne C1; Moore and Siegel C1-5

- (b) Calculus, Probability, and Optimization: Jan 17

Ansell ‘Making Optimal Political Choices’; Moore and Siegel C6-C9 C15-17.

Week Two: From Utility Functions to Choice

- (a) Utility, social choice and normative theory: Jan 23

Morrow C2; EBdM C1, C3; Ansell ‘Utility and Welfare’

- (a) Arrow’s Theorem and Social Choice: Jan 24

Morrow C2, EBdM C2

Week Three: Strategic Interaction: Public Goods and Nash Equilibria (1)

- (a) Models of markets and market failure: Jan 30

Ansell ‘Microeconomic Approaches’; EBdM C4

- (b) Nash Equilibria: Jan 31

Morrow C3; Osborne C2; EBdM Appendix A

- Problem Set 1: Due Feb 7

Week Four: Nash Equilibria (2)

- (a) Nash Equilibrium Examples: Feb 6

Morrow C4; Osborne C3; Kydd C3; Gehlbach C1;

- (b) Mixed Strategies and Catchup: Feb 7

Osborne C4

Week Five: Dynamic Games

(a) Theory: Feb 13

Osborne C5, Morrow C5 (121-135), EBdM Appendix B

(b) Examples: Feb 14

Gehlbach C4, EBdM C6-C8

- Problem Set 2: Due Feb 21

Week Six: Imperfect Information

(a) Static Games: Feb 20

Osborne C9, Morrow C6, EBdM C5

(b) Dynamic Games: Feb 21

Osborne C10.1-10.4, Morrow C7, EBdM C9

Week Seven: Signaling and Bargaining (1)

(a) Signaling: Feb 27

Osborne C10.5-10.9, Morrow C8, Kydd C9, Gehlbach C7

(b) Bargaining Theory: Feb 28

Osborne C16; Morrow C5 (135-161)

- Problem Set 3: Due Mar 7

Week Eight: Bargaining (2) and Repeated Games

(a) Bargaining Examples: Mar 6

Kydd C4-7; Gehlbach C6

(b) Repeated Games: Mar 7

Morrow C9; Osborne C14; Kydd C8