Formal Analysis
Department of Political Science and International Relations
Hilary Term 2022
Course Convenor: Ray Duch
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This course draws heavily on the syllabus developed by Andy Eggers

Course Objectives

Social scientists offer theories (predictions, explanations) of social phenomena. Good theories have clear assumptions and consistent logic. Formal analysis, the subject of this course, is an important tool for generating, refining, and expressing good theories because it places a heavy emphasis on clarity of assumptions and consistency of logic. Students will learn formal analysis mostly through a recently published textbook by a political scientist, focusing mostly on applications in international relations. Course meetings will not convey the basic material in the textbooks. Instead, we will assume that students have grappled with that material, so that class time can is used for invited guest lecturers. These are applied political theorists who use formal models and present their research.

By the end of the course, students should

- be able to read most formal models of political phenomena that appear in published work
- be able to write simple formal models of political phenomena
- be able to recognize and use canonical concepts in game theory such as coordination, collective action, signaling, private information
- better understand why and when simple formal models are useful.

Course Prerequisites

This course uses math a lot, but mostly it is simple algebra. Students will benefit from some facility with algebra (e.g. being able to simplify expressions and isolate variables) and the ability to think abstractly and spatially. We will use some differentiation for optimization problems. We will review techniques that cause students trouble in the first session. However, the math refresher session in week 1 is not a substitute for preparation with the material

in chapters 1, 2, 3, 5, 6, and 8 of Moore Siegel's *A Mathematics Course for Political Social Research* (2013). Students concerned about their background are strongly encouraged to review the relevant material in this book. Required textbook for the course: Andrew H. Kydd *International Relations Theory: The Game-Theoretic Approach* (2015)

Course Logistics

Course meetings take place once a week Tuesdays for 2 hours 14:00–16:00 UTC on Zoom with url provided. Students are expected to have worked extensively through the relevant chapter of Kydd 2015 for each meeting. The class meetings will focus on applications and extensions, delivered via guest lecturers who are all applied political theorists using formal analysis.

Course Assignments

Assessed students will submit two sets of exercises from the Kydd 2015 textbook, and a final discussion paper (1,500 words) that presents and critically discusses a published formal model not in the assigned textbook but that you find interesting. Special focus should be on critically examining assumptions and implications of the chosen formal model. What are the findings and why do they hold? What is interesting about the model? How does it relate to anything else we studied in the course? Can you think of an extension that would show something interesting? The final discussion paper should be submitted in LATEX. The deadlines for submission are as follows:

- Discussion paper: 80% (due 15 April 14:00 UTC)
- 2 Problem sets: 20%:
  - Kydd ex. 3.1 and 3.2 (due Wednesday 10 Feb 14:00 UTC)
  - Kydd ex. 6.1 (due Wednesday 9 Mar 14:00 UTC)

Course Schedule

Lectures take place online on each Tuesday of Hilary Term at 14:00-16:00.

Date	Time	Topic	Reading	
18 January	14:00 - 16:00	Math refresher and introduction	Ray Duch	2
25 January	14:00 - 16:00	Strategic settings	Patrick Le Bihan (Science Po)	3
1 February	14:00 - 16:00	Bargaining	Barton Lee (Magdalen College)	4
8 February	14:00 - 16:00	Power and bargaining	Scott Tyson (Rochester)	5
15 February	14:00 - 16:00	Uncertainty and PBE	Thomas Braeuninger (Mannheim)	6
22 February May	14:00 - 16:00	Cooperation Theory	Patrick Le Bihan (Science Po)	8
1 March	14:00 - 16:00	Cooperation and Cheap Talk	Dominik Duell (Innsbruck)	8, 9.1-9.3
8 March	14:00 - 16:00	Signaling	Indridi Indridison (UC Riverside)	9.4