CRP 6330
Methods of Regional Science and Planning II

COURSE DESCRIPTION
Is the world flat and “distance is dead”? Despite recent claims, geographic proximity in social interactions has never been more important. How do we introduce space into our models for planning analysis? Why are things as they are? How do we evaluate plans/policies when spatial interactions matter? The course addresses these questions drawing on recent advances in spatial modeling and data science.

The methods to be discussed include the framework of agent-based modeling (ABM), inter-regional input-output (IRIO), structural path analysis (SPA), and computable general equilibrium (CGE). The models covered are analytically intractable: results can only be derived using numerical simulations. The analysis therefore requires computer packages, including IMPLAN, Excel, GAMS, and NetLogo. We begin with Jane Jacob’s (The Death and Life of Great American Cities, 1961) notion of cities as a complex spatial system. Neighborhoods, metropolitan areas, and regions are adaptive, self-organizing systems of individuals whose interdependent actions create urban forms and produce spatial patterns. To explore how macro-patterns emerge from micro-behavior, we will discuss the bottom-up framework of agent-based modeling. We then turn our attention to top-down IRIO analyses, which are appropriate for short-term planning while recognizing the salience of inter-regional flows of goods and people. We close by engaging the CGE method in which the supply side interacts with demand to render prices endogenous, enabling planners to plan for the medium term and beyond.

In reading the materials we will engage in this course primarily as consumers of previous studies, with an eye towards the production of new research. I value diversity and encourage you to contribute to class discussions on the basis of your previous experience and academic training to add to our mutual understanding of cities and regions.

LEARNING OBJECTIVES
Upon completion of this course, you should be able to …

- Describe differences between top-down and bottom-up frameworks
- Distinguish between inter-regional and multi-regional models of spatial relations
- Identify the data required for construction of different models
- Implement simple skeleton models in a computer program and validate the algorithm
- Write a report, interpret, and explain simulation results in layman’s terms
- Articulate underlying assumptions and limitations of models
- Apply the regional science methods described above to new planning situations
PREREQUISITES
Though previous knowledge in economics, math and computational methods is useful, strength in one or two of these areas can more than accommodate for little or no background in one or two of the others. The course is designed to be a second course in regional science. The IRIO discussion in particular is more easily accessible if you have completed the methods of regional impact analysis CRP 3270/6270.

LEARNING PROCESS, FORMAT, AND EXPECTATIONS
- Please let the instructor know if you need special accommodations for the lecture, laboratory, presentations, and assignments.
- This class is like a job. You can miss a day’s work here and there with no problem. However, more than four unexcused absences in the semester may result in a zero credit for the class participation portion of the grade.
- You are encouraged to participate actively in all class discussions, presentations, and assignments. Active participation includes raising questions, offering feedback, engaging in critical reflection, sharing ideas and collaborating with other class participants.
- I plan to distribute 6 problem sets this semester. While answers should be submitted individually, I encourage you to work in study groups. You will have at least 1 week to complete an assignment.
- There will be opportunities for reflective practice and active learning through group and individual presentations.
- As the final assignment, students will choose a topic and complete a term paper. The 25-30 page paper ideally includes a literature review, description of data & methodology, interpretation of results, discussion on assumptions & model limitations, and directions for further research. The paper applies one of the tools discussed in class to a new situation, and discusses the planning/policy implications.
- All academic work must meet the standards contained in the “Cornell University Code of Academic Integrity” (http://cuinfo.cornell.edu/Academic/AIC.html). Students are responsible for informing themselves about those standards before completing any academic work. The individual assignments and term paper, in particular, are your own work and responsibility.

COURSE ASSESSMENTS
Your grade will be determined according to the following scheme:
- 10 percent – class attendance and participation
- 40 percent – problem sets
- 10 percent – others, such as presentations, group project, etc. This requirement may vary for different years. Check with Professor Mansury for specifics.
- 40 percent – final project

TEXTBOOKS
REQUIRED

**OPTIONAL**

The required textbooks are available from Campus Store. I have also requested copies to be placed on reserve in the Fine Arts Library.

**SOFTWARE PACKAGES**
• NetLogo is the programming platform for agent-based modeling (ABM) in this course, and downloadable for free from [http://ccl.northwestern.edu/netlogo](http://ccl.northwestern.edu/netlogo)
• IMPLAN is available in the Jones Lab (West Sibley 3rd floor), and can also be accessed through Splashtop from a personal computer (contact the AAP IT Solutions at Sibley Dome 2nd floor)
• GAMS is the industry standard software for computable general equilibrium modeling. The base module is freely downloadable from [http://www.gams.com/](http://www.gams.com/)

**COMPUTER LAB SESSION**
To assist with the computational and other technical aspects of this course, non-compulsory lab sessions are offered on select **Tuesday** evenings 7~8:30pm

**IMPORTANT DATES**
**February Break** 02/13 – 02/16. No Class 02/15

**Spring Break** 03/26 – 04/03. No Class 03/28 and 03/30

**Term Paper**
Due Date and Time: **TBA** (check [https://registrar.cornell.edu/Sched/exams.html](https://registrar.cornell.edu/Sched/exams.html))

**COURSE ACTIVITIES & ASSIGNMENTS**

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Due date (subject to change)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework 1</td>
<td>February 5</td>
</tr>
<tr>
<td>Homework 2</td>
<td>February 19</td>
</tr>
<tr>
<td>Homework 3</td>
<td>March 4</td>
</tr>
<tr>
<td>Homework 4</td>
<td>March 18</td>
</tr>
<tr>
<td>Homework 5</td>
<td>April 15</td>
</tr>
<tr>
<td>Homework 6</td>
<td>May 6</td>
</tr>
</tbody>
</table>
COURSE OUTLINE

Week 1: Overview
Jan 27
Syllabus and class overview
Writing assignment in class: one paragraph description of the (planned) topic for your term paper arguing the need for a spatial model to address your questions

Week 2: Cities as Complex-Systems
Feb 01
What is a complex systems?
Readings and video material:
- SFI video tutorials on complex system

Feb 03
Introduction to agent-based modeling
Reading:
- RAILSBACK. Chapters 1, 2, 3, 4

Week 3: Agent-Based Modeling (ABM)
Feb 08 & 10
Model of neighborhood segregation
Reading:

February Break 02/13 – 02/16. No Class 02/15

Week 4: More ABM
Feb 17
The ODD protocol
- RAILSBACK. Chapter 5

Week 5: ABM Validation
Feb 22
Testing ABM program
Reading:
- RAILSBACK. Chapter 6

Feb 24
Modeling spatial patterns
Reading:
- RAILSBACK. Chapters 8
- GILBERT. Chapter 1

Further readings
- GILBERT. Chapter 2

**Week 6: Spatial Input-Output Models I**
**Feb 29 & Mar 02**
Inter-regional models & IMPLAN data
Readings:
- Miller, R. Chapter 3 in ISARD.
- MILLER. Chapter 3

**Week 7: Spatial Input-Output Models II**
**Mar 07**
Group presentation (ABM)

**Mar 09**
Multi-regional input-output (MRIO) models
Readings:
- Miller, R. Chapter 3 in ISARD.
Application example:
- A 7-region model of Cornell’s collar counties

**Week 8: Structural Path Analysis (SPA)**
**Mar 14 & 16**
Multiplier decomposition
Readings:
- Thorbecke, E. Chapter 7 in ISARD.

**Week 9: GIS & Big Data Integration**
**Mar 21**
Group presentation (IRIO/MRIO)

**Mar 23**
Integrating GIS with IMPLAN/SAM/SPA, Reference USA database
Readings:
- ISARD. Chapter 2, section 2.4

**Spring Break 03/26 – 04/03. No Class 03/28 and 03/30**

**Week 10: Introduction to Computable General Equilibrium (CGE) Models**
**Apr 04**
The theoretical framework of a simple CGE model
Reading:
- HOSOE. Chapter 2

**Apr 06**
Group presentation (GIS/Big Data)

**Week 11: more CGE**
**Apr 11 & 13**
Solving a simple CGE model in Excel.
Reading:

**Week 12: GAMS**
**Apr 18**
Introduction to GAMS
Readings:
- HOSOE. Chapter 3

**Apr 20**
Calibration.
Readings:
- HOSOE. Chapter 5

**Week 13: Standard CGE Models**
**Apr 25 & 27**
A standard CGE model for impact analysis, closure
Reading:
- HOSOE. Chapters 6, 7

**Week 14: Advanced CGE Models**
**May 2 & 4**
Increasing returns, imperfect competition
Week 15: Closing Remarks
May 09
Group presentation (CGE)

May 11
Closing remarks

Week 16: Study Period

Week 17: Final Exam Period
Term paper due.
TBA

LINKS & WEBSITES
NetLogo
http://ccl.northwestern.edu/netlogo/

Railsback & Grimm Online Resources
http://press.princeton.edu/titles/9639.html

Complex Systems
http://www.complexityexplorer.org/

IMPLAN

GAMS
http://www.gams.com/