Instructor:	Ira Winder, Room 9-547
Web:	ira.mit.edu
Email:	jiw@mit.edu
Office Hours:	dusp.mit.edu/officehours
Teaching Assistant:	Nina Lutz, Room E15-488a
Web:	nlutz.me
Email:	nlutz@mit.edu
Office Hours:	(arrange via email)

Credits:	9 units (3-0-6)
Prerequisite(s):	6.0001 & 2, or equivalent skill in Python or Java with permission of instructor
Class Meetings:	February 7th – May 16th; Thursdays 2-5pm
Room:	9-451
GitHub:	https://github.com/irawinder/cusw-SPR19

Subject Overview

Computation permeates nearly every course at MIT. Urban Scientists must uniquely learn to responsibly and playfully wield the tools of computation to solve complex problems at the convergence of society and the built environment. Your algorithm may be efficient, but is it Ethical? Is it Just? Are you even asking the -right- questions?

In this project-based course, students learn how to formulate and develop interactive simulations of complex urban systems representing a diversity of stakeholders. Students are introduced to novel interactive engagement tools for the study and design of cities, blending software with playful mediums such as Lego bricks. Lectures include case studies of real-world interactive simulations developed for research and practice. Seasoned professionals offer project-based tutorials in Processing, a flexible sketchbook for coding in the context of visual arts.

Learning Objectives

- *Computation* - Apply computer science skills toward solving problems in Urban Science.
- *Mens et Manus* - Gain the confidence and capability to build computational artifacts for use in practice and advanced research. Deploy exhibitions and interactive models that communicate and teach novel ideas and relationships.
- *Mindful Coding* - Learn to frame meaningful problems lest you become committed to mindless coding.
- *Systems Design* - Understand problems as emergent elements within systems of technology, living-beings (stakeholders), and the environment within which you are trying to intervene.
- *Collaboration* – Learn how to collaborate and share code with GitHub

Project-based Learning

Above all else, this is a project-based course, and we hope you will use the time and space to develop ideas and skills beyond the scope of our tutorials. Project-based learning means that you don't have to be content with spoon-fed techniques. As instructors, we're not going to tell you to "solve such-and-such problem with machine learning." Instead, we're going to ask, "Do you *need* machine learning for the problem you are trying to solve? Yeah? Okay, then let's do this."

Student Deliverables:

- *Class Participation* – Please plan to attend every class unless you receive permission in advance from the instructors for specific dates.
- *Homework Assignments* – Short visual programming exercises in Processing, mostly in the first half of the semester.
- *Mid-term (Due March 21st, 2019)* – A small independent project that incorporates some or all of lessons learned up to now.
- *Final Design Project (Finals)* - complete as individuals or pairs. Teams larger than two people need permission of the instructor.

Readings

Lessons and readings from the following texts will be covered throughout the course. Though you are not required to procure these books, we think they are great placed to start if you would like to have an in-depth familiarity with the field.

- Keeney, Ralph L. and Howard Raiffa. Decisions with Multiple Objectives: Preferences and Value Tradeoffs. Cambridge University Press, 1993.
- Schon, Donald A. and Martin Rein. Frame Reflection: Toward the Resolution of Intractable Policy Controversies. Basic Books 1994.
- Lazar, Jonathan, Jinjuan Heidi Feng, and Harry Hochheiser. Research Methods in Human-Computer Interaction. Morgan Kaufmann, Second Edition, 2017.
- Tutorials and resources from https://processing.org/

Course Collaborators

Throughout the course we will invite a number of professionals and institutions to participate as guest lecturers and case study collaborators. Tentative guests include:

- Carl Christensen & Karoline Skatteboe (SpacemakerAI)
- Eric Plosky (USDOT)
- Jeremy Burke & Ramon Gras (Aretian Urban Analytics)
- Bryan Moser (MIT Systems Design & Management)
- New York Hall of Science (NYSCI)
- Olivier de Weck (MIT Strategic Engineering Research Group)

Meeting (Week – Date)			Subject Matter	Assignment Given
Wk 1	Thu	Feb 7	Lecture: Urban Science Demo: Processing	
Wk 2	Thu	Feb 14	Lecture: Multi-objective Decisions Tutorial: Interactive Computation	Due: Download Processing
Wk 3	Thu	Feb 21	Lecture: Working with Urban Data Tutorial: Importing Geospatial Data	Due: Interactive Visualization
Wk 4	Thu	Feb 28	Lecture: Working with Urban Data Tutorial: Importing Population Data	Due: Mapping Exercise
Wk 5	Thu	Mar 7	Lecture: Agent-based Modeling Tutorial: Modeling & Simulation	Due: Population Data Exercise
Wk 6	Thu	Mar 14	Guest Speaker: Eric Plosky (USDOT); Working Session	
Wk 7	Thu	Mar 21	**Mid-term Presentation**	Due: Mid-term Projects
	Thu	Mar 28	SPRING BREAK	
Wk 8	Thu	Apr 4	Visual Communication and Graphical User Interfaces	
Wk 9	Thu	Apr 11	Tangible Interaction and Other Alternative Mediums	Due: Final Project Outline
Wk 10	Thu	Apr 18	Working Session	Due: Final Project Proposal
Wk 11	Thu	Apr 25	Working Session	
Wk 12	Thu	May 2	Working Session	
Wk 13	Thu	May 9	Working Session	
Wk 14	Thu	May 16	**Final Presentation**	Due: Final Projects

"I have a secret goal, which is to encourage you
to use mathematical play in a computational
setting ... to make things that make people think
and interact with ideas. In other words, to make art."

- Brandon Martin-Anderson