

# CS-190T: Beginning Coding for Science

## COURSE INFORMATION

### Instructor(s):

**Lee Spector**

[lasCCS@hampshire.edu](mailto:lasCCS@hampshire.edu)

Office Extension: x5352

Office Hours:

Regular office hours: Tuesdays 10:30-11:30, Thursdays 10:30-11:30 and 2:00-3:30. I am available at many other times as well; feel free to contact me in person or via [email](#) to arrange other meeting times. Sign up for regular office hours and advising day meetings [here](#).

### TA(s):

**Nirman Dave**

[npd15@hampshire.edu](mailto:npd15@hampshire.edu)

Office Hours:

Tuesdays 12:00PM (noon) to 2:00PM at Airport Lounge (APL), Harold F Johnson Library.

These are drop in hours, so no need to pre-book the times. I am available at many other times as well; feel free to contact me in person or via [email](#) to arrange other meeting times.

**Kai Mashima**

[kom14@hampshire.edu](mailto:kom14@hampshire.edu)

Office Hours:

### Term:

2017F

### Meeting Info:

**Tuesday** 09:00 AM - 10:20 AM Adele Simmons Hall (ASH) 126

**Thursday** 09:00 AM - 10:20 AM Adele Simmons Hall (ASH) 126

### Description:

This course is an inquiry-based introduction to computer programming, designed for students with little or no prior experience with programming or computer science, but with interests in some area of science. Students will learn to write programs for data manipulation and scientific modeling in a general purpose programming language. Several of the core concepts of computer science that underlie computational work in the sciences (including the natural, cognitive, and social sciences) will be introduced.

**Course Objectives:**

- To learn to write programs in a general purpose programming language.
- To learn how programming and computational thinking can contribute to scientific inquiry.
- To conduct independent programming-based project work.
- To engage in collaborative learning processes.
- To develop project presentation skills.

**Evaluation Criteria:**

You will be evaluated on the basis of attendance, participation, programming assignments, and in-class “demo” presentations on assignment due dates. You should demonstrate through your participation, your code, and your text that you have read and thought about the course readings. Your portfolio should demonstrate facility with the code environment used in the class and engagement with several of the class topics at the implementation level.

Any missed, late, or inadequate assignments or demos will be noted in your evaluation. If you fail to submit 2 or more assignments, or to present 2 or more of the demos, then you should not expect to receive an evaluation.

**Additional Info:**

**DIVISION I DISTRIBUTION CREDIT**

Successful completion of this course satisfies the Division I distribution requirement in Mind, Brain, and Information. This course provides opportunities for satisfaction of Division I cumulative skills requirements in Quantitative Skills and Independent Work.

**TEXTS**

There is no textbook for this course. All readings will be available for free online.

**SOFTWARE**

We will be using Python 3, in the Jupyter environment, which runs in web browsers.

**FACILITIES**

You may use your own computer and/or the Macs in ASH 126, which will be available at various posted hours. Note that the Macs in ASH 126 may be erased without notice at any time. You may find it convenient to use a thumb drive or some form of cloud storage to transport files to and from class.

### **DIFFICULTY/LEVEL**

This course is primarily intended to serve students without prior programming experience, but those with prior experience can take on more challenging projects and benefit from the course as well.

### **DEMONIC CODING**

Many class sessions will be dedicated in part or entirely to "demonic coding." You must have access to your current work files every day -- on a laptop computer, or a thumb drive, or a cloud service, etc. -- and always be ready to participate as a coder in a demonic coding session.

### **POLICIES IN REGARDS TO ILLNESS, EPIDEMIC, OR PANDEMIC**

If you have a fever, please stay home, take good care of yourself, and contact me by email or phone. If your illness makes it impossible for you to meet the course deadlines then contact me and we will negotiate an accommodation.

### **ADAPTATIONS AND ACCOMMODATIONS**

If you need course adaptations or accommodations because of a disability, or if you have a medical condition that may impact your performance or participation in this course, then please let me know.

If you have approved accommodations then please go to Accessibility Services in CASA to pick up Letters of Accommodation to facilitate a proactive discussion about reasonable accommodations for this course. If you have documented disabilities but have not already already contacted Accessibility Services, then I encourage you to do so. Accessibility Services can be contacted via email: [Accessibility@hampshire.edu](mailto:Accessibility@hampshire.edu), via phone: 413-559-5498, or in person at CASA.

### **PLAGIARISM POLICY**

Official policy text:

All Hampshire College students and faculty, whether at Hampshire or at other institutions, are bound by the ethics of academic integrity. The entire description and college policy can be found in Non Satis Non Scire at [handbook.hampshire.edu](http://handbook.hampshire.edu) under Academic Policies/Ethics of Scholarship. Plagiarism is the representation of someone else's work as one's own. Both deliberate and inadvertent misrepresentations of another's work as your own are considered plagiarism and are serious breaches of academic honesty and integrity. All sources used or consulted in the process of writing papers, examinations, preparing oral presentations, course assignments, artistic productions, and so on, must be cited. Sources include material from books, journals or any other printed source, the work of other students, faculty, or staff, information from the Internet, software programs and other electronic material, designs and ideas. ... All cases of suspected plagiarism or academic dishonesty will be referred to the Dean of Advising who will review documentation and meet with student and faculty member. Individual faculty, in consultation with the Dean of Advising, will decide the most appropriate consequence in the context of the class. This can range from revising and resubmitting an assignment to failing the course. Beyond the consequence in the course, CASA considers first offenses as opportunities for education and official warning. Multiple or egregious offenses will have more serious consequences. Suspected instances of other breaches of the ethics of academic integrity, such as the falsification of data, will be treated with the same seriousness as plagiarism and will follow the same process.

In this course we will often be sharing and borrowing code. This is an important aspect of the course and an important aspect of modern programming practice. This does not mean, however, that it is acceptable to submit code that is not your own without acknowledging sources. Sources should be clearly and explicitly provided in everything that you produce.

## **SCHEDULE**

Because this course is a first-year tutorial, we will use some of our class time to discuss Hampshire College's curriculum and policies, strategies for making the most of your experience at Hampshire, and other issues of concern to first-year students.

In part because of this, the schedule below is approximate and subject to change. Adjustments will be announced in class.

Assigned readings should be read prior to the indicated classes.



News forum

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## Thursday, 7 September (09:00AM - 10:20AM)

In class:

- Syllabus/Overview
- Discussion

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## Tuesday, 12 September (09:00AM - 10:20AM)

### *Installfest*

Before class:

- Read: [The Python Tutorial: Chapter 1](#) and [Chapter 3](#).
- If you will be doing class work on a laptop computer, then bring it to class. You can use the computers in ASH 126 otherwise.

In class:

- [Install Anaconda](#) (which gives you Python 3 and Jupyter Notebook).
- `jupyter notebook` or `jupyter notebook --browser=Chrome`, kill with control-c



Intro Python notebook for class

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## Thursday, 14 September (09:00AM - 10:20AM)

### *Introduction to Python*

Before class:

- Read: [The Python Tutorial: Chapter 4](#).

In class:

- Python fundamentals
  - Demonic coding
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## Tuesday, 19 September (09:00AM - 10:20AM)

### ***Demos***

Before class:

- **Due:** Assignment #1: Submit a Jupyter notebook containing original Python code for any purpose.
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In class:

- Demos



Assignment #1

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## Thursday, 21 September (09:00AM - 10:20AM)

### ***Rosh Hashana***

In class:

- Attendance is optional
  - Demonic coding with TA
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## Tuesday, 26 September (09:00AM - 10:20AM)

### ***Finding Data***

Before class:

- Read the Wikipedia page on Data Science.
  - Check out the website of the Center for Data Science at UMass.
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In class:

- **Note:** Meet on the main floor inside the library.
- Tour the Hampshire College Knowledge Commons with Heather McCann, Associate Librarian for Science and Assessment.

- Discuss data sources.
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## **Thursday, 28 September (09:00AM - 10:20AM)**

**Advising Day: No Class**

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## **Tuesday, 3 October (09:00AM - 10:20AM)**

### ***Scraping and Wrangling Data***

Before class:

- Read: The Python Tutorial, [Chapter 5](#) and [Chapter 7](#).
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In class:

- Finding and working with your data
  - [data.gov](#)
  - [Demonic coding](#)
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## **Thursday, 5 October (09:00AM - 10:20AM)**

### ***Data Science***

Before class:

- Read: Data Science and Prediction, by Vasant Dhar.
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In class:

- Demonic coding



Data Science and Prediction

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## **Tuesday, 10 October (09:00AM - 10:20AM)**

**October Break: No Class**

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## **Thursday, 12 October (09:00AM - 10:20AM)**

### ***Demos***

Before class:

- **Due:** Assignment #2: Submit a Jupyter notebook that reads and prints information about your data.
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In class:

- Demos
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## **Tuesday, 17 October (09:00AM - 10:20AM)**

### ***Analyzing and Visualizing Data***

Before class:

- Read: How to make beautiful data visualizations in python with matplotlib, by Randal S. Olson.
  - Optional: Watch [Statistical Data Analysis in Python tutorial videos](#).
  - Optional: Review Variance and variability lecture materials from Harvard's CS109: Data Science.
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In class:

- Analysis and visualization
  - Demonic coding
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## **Thursday, 19 October (09:00AM - 10:20AM)**

### ***Demonic Coding***

In class:

- [Demonic coding](#)
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## **Tuesday, 24 October (09:00AM - 10:20AM)**

**Community Education Day: No Class**

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## **Thursday, 26 October (09:00AM - 10:20AM)**

### ***Demos***

Before class:



- **Due:** Assignment #3: Submit a Jupyter notebook that produces meaningful analysis and/or visualizations of your data.
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In class:

- Demos
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## **Tuesday, 31 October (09:00AM - 10:20AM)**

### ***Simulating Coins, Dice and Cards***

Before class:

- Read: Python Module of the Week: random – Pseudorandom number generators.
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In class:

- Code for simulating coins, dice, and cards
  - Demonic coding
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## **Thursday, 2 November (09:00AM - 10:20AM)**

### ***Simulating Genomes***

Before class:

- Read What, if anything, is a Wolf?, by R. Coppinger, L. Spector, and L. Miller.
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In class:

- Code for simulating genetic mutation.
  - Demonic coding
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## **Tuesday, 7 November (09:00AM - 10:20AM)**

### ***Simulating Populations***

Before class:

- Read: Group size, individual role differentiation and effectiveness of cooperation in a homogeneous group of hunters by R. Escobedo, C. Muro, L. Spector, and R. P. Coppinger.

- Read: Emergence of Collective Behavior in Evolving Populations of Flying Agents, by L. Spector, J. Klein, C. Perry, and M. Feinstein.
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In class:

- Packs and swarms
  - Demonic coding
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### **Thursday, 9 November (09:00AM - 10:20AM)**

#### ***Demonic Coding***

In class:

- Demonic coding
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### **Tuesday, 14 November (09:00AM - 10:20AM)**

#### ***Demos***

Before class:

- **Due:** Assignment #4: Submit a Jupyter notebook that conducts a simulation and analyzes and/or visualizes the data produced by the simulation.
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In class:

- Demos
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### **Thursday, 16 November (09:00AM - 10:20AM)**

#### ***Other Tools and Applications***

Before class:

- Read: Partial and total-order planning: evidence from normal and prefrontally damaged populations, by M.J. Rattermann, L. Spector, J. Grafman, H. Levin, and H. Harward.
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In class:

- The Chores experimental environment
  - Demonic coding
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**Tuesday, 21 November (09:00AM - 10:20AM)**

*Special Topic TBA*

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**Thursday, 23 November (09:00AM - 10:20AM)**

Thanksgiving: No Class

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**Tuesday, 28 November (09:00AM - 10:20AM)**

*Project Discussion*

Before class:

- **Due:** Assignment #5: Submit a 1-page project proposal (details will be discussed in class).
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In class:

- Project discussion
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**Thursday, 30 November (09:00AM - 10:20AM)**

*Demonic Coding*

In class:

- Demonic coding
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**Tuesday, 5 December (09:00AM - 10:20AM)**

*Demonic Coding*

In class:

- Demonic coding
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**Thursday, 7 December (09:00AM - 10:20AM)**

*Demonic Coding*

In class:

- Demonic coding
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## **Tuesday, 12 December (09:00AM - 10:20AM)**

### ***Demos***

Before class:

- **Due:** Assignment #6: Final project + self evaluations.
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In class:

- Demos
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## **Thursday, 14 December (09:00AM - 10:20AM)**

### ***Demos***

In class:

- Demos, continued
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