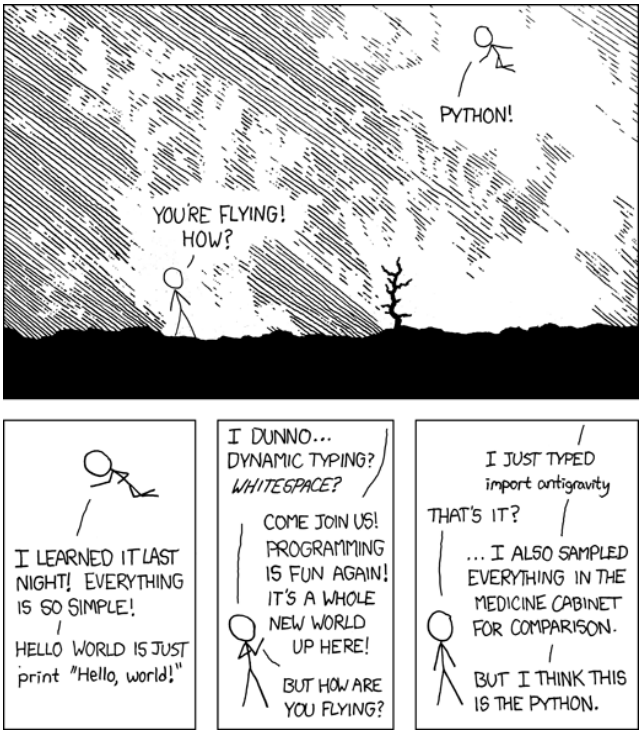
BILD 62 | Introduction to Python for Biologists

WINTER 2023



Instructor Ashley Juavinett

Instructional Assistants
Zaida Rodriguez
Rohini Gadde

Office hours
Fridays at 4 pm on Zoom
(link on Canvas)

Class Schedule
Lectures: T/Th, 9:30 -10:50 am in TATA 3201

Discussion Sections (Mondays, HSS 2321)
8-8:50 am | 9-9:50 am | 12-12:50 pm

Course GitHub: https://github.com/BILD62/BILD62_WI23

Course Description: Introductory class for biology students interested in using Python for data analysis and visualization. Course covers the basics of programming in Python and introduces students to various implementations of Python analyses for biological data such as time series and images.

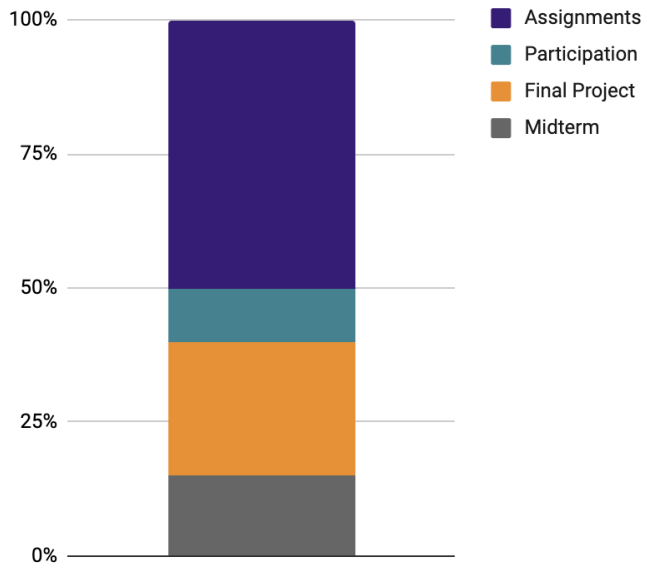
By the end of this course, you will be able to:

- Read and run basic Python programs, recognizing the structures used (i.e. variables, conditionals, loops, functions) and explaining how they work
- Manipulate and create objects in Python, including data structures and classes
- Write, edit, and execute Python code in Jupyter Notebooks as well as the command line
- Visualize and run hypothesis-testing on simple datasets in Python
- Implement common algorithms for analyzing biological data (e.g., time series, images) and determine when such computations are appropriate

Grading

- **In-class work & participation (10%)**:
  - Attendance (5%): If you attend >75% of discussion sections (6 out of 8), you'll receive all 50 points.
  - In-class work (5%): We will complete several activities in class for credit. If you miss these, you'll need to contact the IAs and make them up before Friday at 5 pm.

- **Assignments (50%)**: Weekly take-home coding assignments will support your progression through the course topics. Assignments will be submitted through the DataHub (http://datahub.ucsd.edu) and graded automatically using a tool called NBGrader.
  - All assignments are released by Wednesday at 5 pm, due the following **Tuesdays at 5 pm**, and are worth 2.5-10% each.
  - These assignments should be completed individually and should take you about 1-2 hours.
  - At the end of the quarter, **I will drop your lowest assignment grade.**



- **Final Projects (25%)** Includes the project proposal, code, and deliverables. During finals week, we'll have a final project roundtable where you'll share your project with classmates and visitors.

- **Midterm Exam (15%)** About two thirds through our course, we will have an open note, open Python exam in which you will be asked to practice some of the fundamentals of Python and apply your knowledge of how to work with biological datasets.

Additional notes about grading:

- We will be using Canvas (http://canvas.ucsd.edu) to manage grades and assignments.
- **Late policy**: Assignments and projects will lose -10% for each day they are late.
- **Grading Scheme:** Final scores will be converted to letter grades, where A=100-90%, B=89-80%, C=79-70%, D=69-60%, and F=59-0%. For positive and minus grades, A+ = 97-100, A = 93-96.99, A- = 90-92.99, B+ = 87-89.99, B = 83-86.99, and so on.
- Final scores are as you see them on Canvas, once all of your assignments are graded. There is no rounding up to the closest score.

Course Resources

Computing Resources

You will need access to a computer and an internet connection for our course. It will also significantly help if you have a laptop (or an iPad + keyboard) for both lectures and discussions. We *may* have access to extra laptops in TATA 2501 if you need one — please come to class a few minutes early to arrange. We'll ask for your ID (student or drivers) in exchange for borrowing a laptop for the class period. If you need a laptop for the quarter, you can request a loaner laptop by filling out this form: https://eforms.ucsd.edu/view.php?id=490887.

Textbook

There is no official textbook for this course. However, we'll be relying on several online resources:

- Mansuri & Moshiri, **Intro to Computer Science & Python Stepik Course**
- VanderPlas, **Whirlwind Tour of Python**
- Software Carpentry, **Plotting and Programming in Python**
- Libeskind-Hadas & Bush, **Computing for Biologists** **(note:** only available for purchase, optional).

Course Philosophy

A note on our course's environment
We'll be working together to create an equitable and inclusive environment of mutual respect, in which we all feel comfortable to share our moments of confusion, ask questions, and challenge our understanding. Everyone should be able to succeed in this course. If you do not feel that is the case please let me know.

Course accommodations
If you need accommodations for this course due to a disability, please contact the Office for Students with Disabilities (osd@ucsd.edu) for an Authorization for Accommodation letter. Please speak with me in the first week of class if you intend to apply for accommodations. For more information, visit http://disabilities.ucsd.edu.

This course, and the work it entails, is for *you*
You won't benefit if others do your work. If you're unclear about what constitutes cheating in this course, please ask. Cases of academic dishonesty or cheating will be first handled by me, and then by the Academic Integrity Office. If you become aware of cheating in this class, you can anonymously report it.

We'll be relying a lot on other people's code as we learn. Here are some guidelines as to how you should use other code in the process of writing your own, as well as how you can talk to your classmates about the code we're working with in class:

Do explain the thought process behind your code.
Do share the general steps you took to solve a problem.
Do describe your code to others, either verbally or in writing.
Do use examples on the internet to inform your code.

Do not screenshot someone else's code.
Do not directly share your code with others, either in text or image format.
Do not directly copy 5+ lines of code from examples on the internet.
Do not share the values of variables that are explicitly asked for in the validation of the question.

Syllabus

(subject to change!)

Date	Topic	Before class
Week 1	To set the foundation for this course, we'll introduce the approaches and tools that we'll use throughout, as well as the motivation for learning how to code as a biology student.	
Jan 10	**#1: Welcome to BILD 62!** Introduction to the course, people & tools	Take the entry survey
Jan 12	**#2: Where Python lives, and how to talk to it** *Note*: In-Class Activity, due Monday @ 5 pm	Take the computing attitudes survey
Week 2	Fundamental coding skills in Python	
	Note:** No discussion sections this week **(MLK Day)	
Jan 17	**#3: Data structures:** lists, tuples, and dictionaries	*Due Monday at 5 pm: In-Class Activity* *Due Tuesday at 5 pm*: **a0**
Jan 19	**#4: Functions, booleans & conditionals**	
Week 3	Fundamental coding skills in Python (continued)	
Jan 24	**#5: For Loops**	*Due Tuesday at 5pm*: **a1**

Jan 26	**#6: While Loops**	

Week 4

Jan 31	**#7:** Object-oriented programming	*Due Tuesday at 5pm*: **a2**
Feb 2	**#8** NumPy introduction	

Week 5

Scientific Computing

Feb 7	**#9:** Visualizing data	*Due Tuesday at 5pm*: **a3**
Feb 9	**#10:** Data Analysis	

Week 6

Feb 14	*BILD 62 Bingo [Questions]*	*Due Tuesday at 5pm*: a**4**
Feb 16	**#11:** Pandas *Note*: In-Class Activity, due Monday @ 5 pm	

Week 7

	Note: *No discussion sections this week* ***(Presidents' Day)***	
Feb 21	**#12:** Linear algebra in Python	*Due Tuesday at 5pm*: **a5** (Midterm Review Quiz)
Feb 23	**Review for midterm** Information for final projects	

Week 8

Feb 28	Time series & signal processing Group formation for final projects	Take home midterm due Tuesday at 5pm

Mar 2	**What counts as a cell?** Image processing & cell detection in Python	

Week 9 _____ - *informatics*

Mar 7	**Neuroinformatics: Using Python in literature searches**, featuring guest lecturer Monique Surles-Ziegler	*Due Tuesday at 5pm*: **a6**
Mar 9	**Neuroinformatics: Using Python in literature searches**, part II	*Due Thursday at 5pm*: **Project proposal**

Week 10 Wrapping up

Mar 14	Documentation, version control, and collaborating on code *Note*: In-Class Code Review Activity, due Friday @ 5 pm	*Due Tuesday at 5pm*: **a7**
Mar 16	Next steps in bioinformatics, biological data science & computational approaches to big data (and time to work on final projects)	

Final Project Showcase: Tuesday, March 21, 8-11 am