Intro to Python
(Part 1)

Workshop Lead: Benjamin Z. Rudski

Date: July 16, 2024

MiCM McGill initiative in Computational Medicine

Mission statement: deliver quality workshops designed to help biomedical researchers develop the skills they need to succeed.

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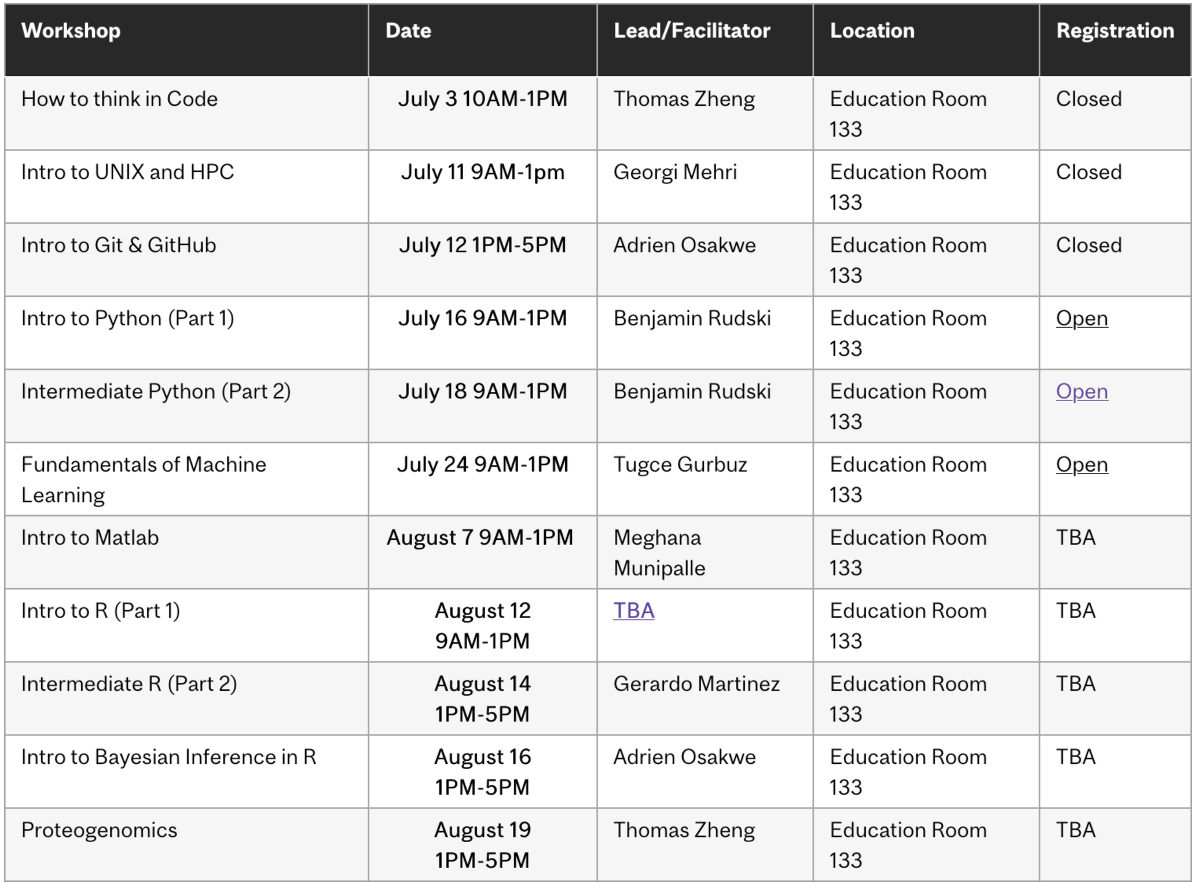
Summer 2024 Workshop Series



Workshop	Date	Lead/Facilitator	Location	Registration
How to think in Code	July 3 10AM-1PM	Thomas Zheng	Education Room 133	Closed
Intro to UNIX and HPC	July 11 9AM-1pm	Georgi Mehri	Education Room 133	Closed
Intro to Git & GitHub	July 12 1PM-5PM	Adrien Osakwe	Education Room 133	Closed
Intro to Python (Part 1)	July 16 9AM-1PM	Benjamin Rudski	Education Room 133	Open
Intermediate Python (Part 2)	July 18 9AM-1PM	Benjamin Rudski	Education Room 133	Open
Fundamentals of Machine Learning	July 24 9AM-1PM	Tugce Gurbuz	Education Room 133	Open
Intro to Matlab	August 7 9AM-1PM	Meghana Munipalle	Education Room 133	TBA
Intro to R (Part 1)	August 12 9AM-1PM	TBA	Education Room 133	TBA
Intermediate R (Part 2)	August 14 1PM-5PM	Gerardo Martinez	Education Room 133	TBA
Intro to Bayesian Inference in R	August 16 1PM-5PM	Adrien Osakwe	Education Room 133	TBA
Proteogenomics	August 19 1PM-5PM	Thomas Zheng	Education Room 133	TBA

https://www.mcgill.ca/micm/training/workshops-series

About me

- BSc from McGill in Hon. CS/Bio, Minor Math
- Third-year PhD candidate in Quantitative Life Sciences (QLS)
- Research on trabecular bone structure in the Reznikov Lab, McGill Bioengineering
  - 3D image processing and analysis
  - Programming is an almost-daily task in my life!

https://github.com/bzrudski

Outline

1. **Module 1 – Introduction to Programming (30 minutes)**
   a. Basic Concepts and Definitions
   b. Welcome to Python
2. **Module 2 – Python Basics (1 hour, 15 minutes)**
   a. Foundations of Python - A Brief Overview of Types and Variables
   b. Numbers and Comparisons
   c. Intro to Control Flow and Loops (if, while and for)
   d. Exercise
3. **Module 3 – Strings and Collections: An Object Primer (1 hour)**
   a. Introducing the String!
   b. Introduction to Tuples, Lists and Dictionaries
   c. Exercise
4. **Module 4 – Modules and Packages (40 minutes)**
   a. Using Modules
   b. Package Management
   c. Exercise
5. **Module 5 – Where to go from here (10 minutes)**
   a. What to learn next? How?
   b. How to get help and how not to get help?
   c. Other cool programming topics

Module 1

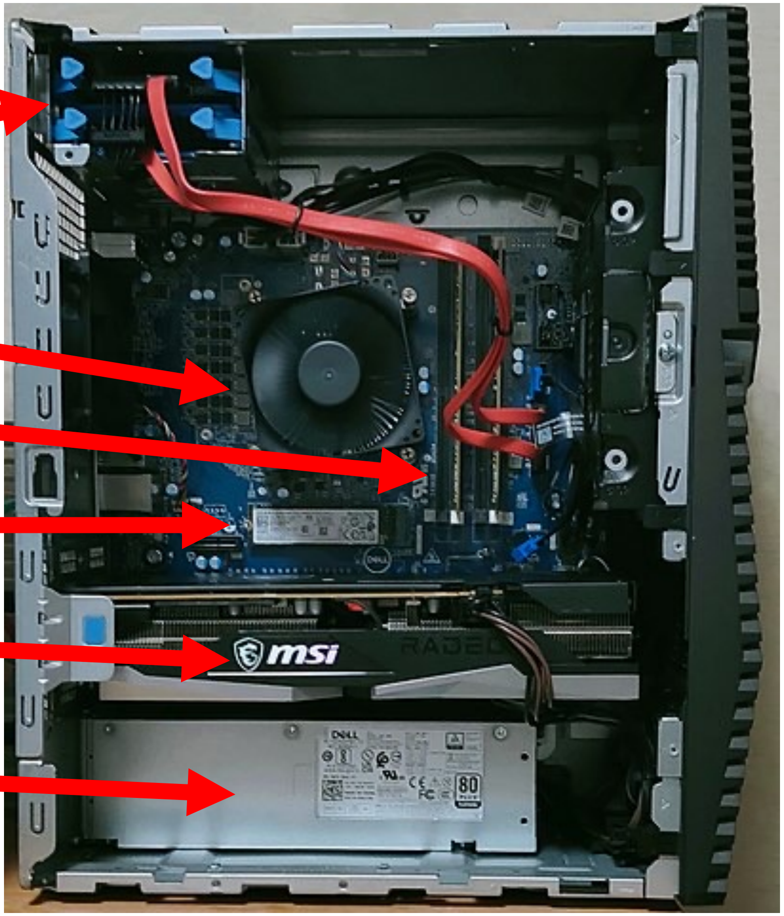
Introduction to Programming

Module Outline

a. Basic Concepts and Definitions
    a. What is a Computer?
    b. What is a Program?
    c. What are Programming Languages?
b. Welcome to Python
    a. What is Python?
    b. How to Install Python
    c. Tools for Using Python

Basic Concepts and Definitions

- What is a computer?



Hard drive

CPU

RAM

Motherboard

Graphics Card

Power Supply

Dell G5 5000 motherboard.jpg, by Project Kei, licensed under the Creative Commons Attribution-Share Alike 4.0 International license.

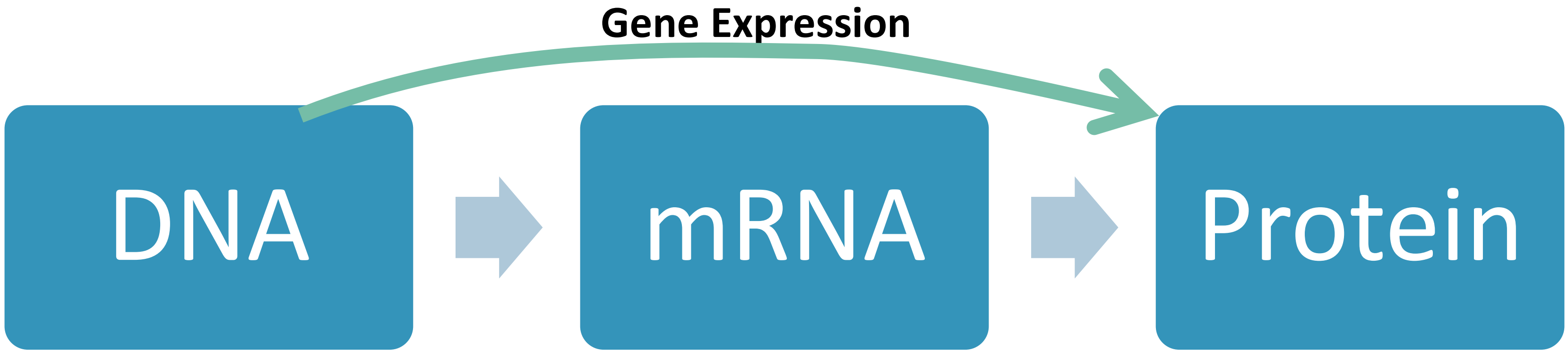
Basic Concepts and Definitions

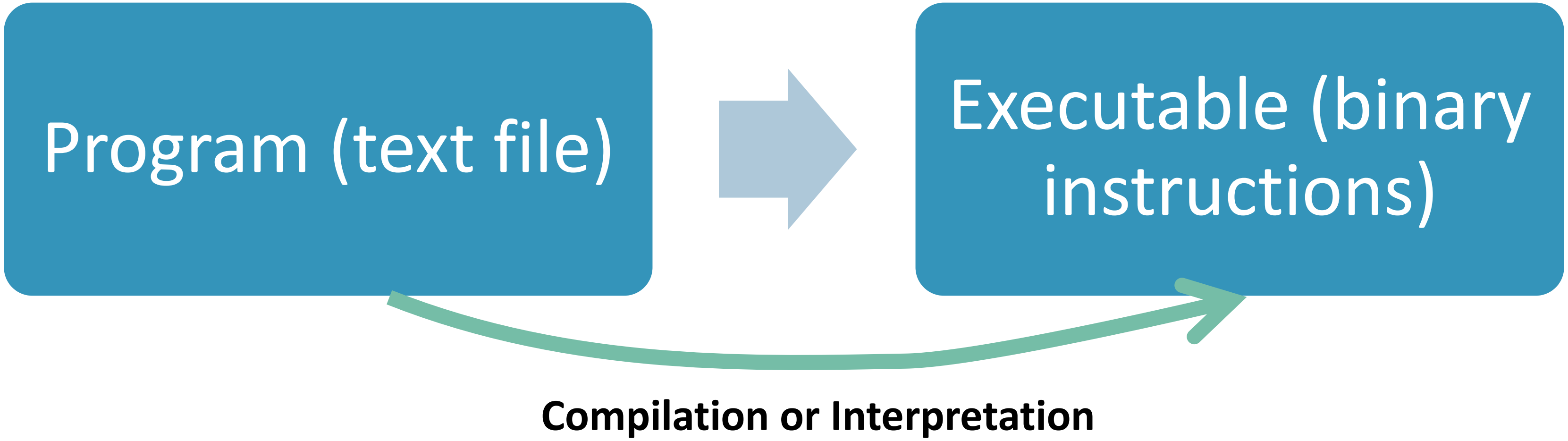
- What is a computer?
  - RAM: memory – store data
  - CPU: processor – perform operations on data
- How do we tell it what operations to do on what data?...
- **Programming!**
- Program is a **text file** that contains instructions:
  - What operations to do
  - On what data

Basic Concepts and Definitions

- What is a program? – Instructions
- How do we write a program?
  - Using a **programming language**
- **Poll:** Who does the programming language help?
  - (a) The computer
  - (b) The programmer
  - (c) Nobody… it's a useless waste of time!
- Let's see why…

Basic Concepts and Definitions




Program (text file)
Executable (binary instructions)
Compilation or Interpretation

Welcome to the Python Programming Language!

- For more history: https://en.wikipedia.org/wiki/History_of_Python
- Introduced in 1991 by Guido van Rossum
- Features:
  - Free and Open Source
  - Interpreted
  - Object-Oriented
- https://python.org

Welcome to the Python Programming Language!

- Free and Open Source
  - Anyone can download, use, **modify and distribute** the Python programming language.
- Interpreted
  - Python scripts are run line-by-line
  - Can easily launch it from the command line and have access to **interactive shell**
- Object-Oriented
  - “Objects” – collections of data and manipulations that make it easier to represent the real world

Interactive Workshop!

- That’s pretty much all that will be in the slides… For the rest, we’ll go to a Jupyter Notebook:

To the repository!

To summarize

- ✓ Computers are machines that store data and perform operations.
- ✓ Data can be represented as numbers, strings or more complicated collections that can be processed using various functions.
- ✓ Packages and modules offer additional functionality not included by default.

Now you are ready to:

- Use variables and collections to represent data in Python code.
- Use control flow and loops to write powerful code.
- Use functions from existing packages and modules.

Acknowledgements

- Thank you to MiCM for giving me this opportunity and for helping me along the way.
- Thank you to the professors from the McGill School of Computer Science for helping me along my programming journey and for inspiring me to share my programming experience with others.
- Thank you to Professor Mathieu Blanchette, whose COMP 204 course helped introduce me to Python (back in Fall 2018).