THE UNIVERSITY OF CHICAGO

MASTERS IN COMPUTATIONAL SOCIAL SCIENCE
THE UNIVERSITY OF CHICAGO

MACS 30111

Principles of Computing 1: Computational Thinking for Social Scientists

Lecture: T/Th 9:30-10:50 am

Agenda

- Background / course info
- Diving in to content!
  - Writing programs
  - Variables
  - Expressions and operators

About me + our TAs

Jean Clipperton

- Jean or Prof. Clipperton

Research:

- Ph.D. in Political Science
- Agent Based Modeling
- Data Visualization

Current research interests:

- Housing Policy
- Text analysis of Taylor Swift + Eras tour

- Ruoyi Wu
- Hantao Xiao

Today’s class

- Course management
- Course Structure and Syllabus
- Difference between 30111 and 30121
- Grading
- Policies
- Challenges
- Course topics

Course Management

- Canvas
  - Course landing page
- Ed discussion
  - Announcements
  - Asking questions (anonymous for private issue)
- GitHub classroom
  - Distribute assignments
  - Accept first assignment (very simple to complete!)
- Gradescope
  - Submit assignments and get feedback
- Course website
  - https://classes.ssd.uchicago.edu/macss/macs30121/
  - **On-campus**
  - **VPN for outside campus**
- Textbook
  - Online
  - pdf

Course Structure and Syllabus

- T/Th lectures + F labs
- 6 modules (9 weeks)

- **Assignments**:
  - Team tutorial
  - Short exercise
  - Programming assignment

- **Exams**
  - Timed-assessments: contact Student Disabilities Services if you need accommodations for this
  - Final (paper-and-pencil)

Grading

- Assignments:
  - Team tutorial (not graded)
  - Short exercise (auto-grading)
  - Programming assignment (auto + manual grading)
    - Style + correctness + completeness + efficiency

- Exams
  - Timed-assessments
  - Final (paper-and-pencil)

- Goal
  - Help you understand how much you truly understand

Grading: different from what you may be used to

Grade / Assignment	Short Exercise (SE)	Programming Assignment (PA)	Exams (average score)	Engagement
A-	5	3	90	regular timely attendance / reflection
B	4	3	80	frequent timely attendance / reflection
C	3	2	70	-
D	3	2	60	-

Plusses and minues (+ and -) on grades come from strong performance on PA assignments and engagement

Grading: Expectations

- Do your best work
- Complete the assignments
- Should be able to expect a B in the course. From there, it depends on effort and how much you are able to challenge yourself with the material
- Goal is that this is a supportive learning environment: you can make mistakes and learn.

Policies

- Submit your own work: you are **encouraged** to work with others, especially on the team tutorial. However, **everything you submit should be the product of your own intellectual contribution. If in doubt, over-document!**
- **This is a learning environment.** We need to make mistakes so that we can grow. I challenge you to try to ask questions that you feel maybe others already know, to check in when you are feeling confused, and to ask for help if you made a mistake.
- Finally, be here on time, do the work, and be committed to a growth mindset.

30121 VS 30111

	30121	30111
Lectures	M1~M7	missing M6: recursion
Team tutorial	✅	✅
Short exercise	✅	✅ + additional
Programming assignment	7	3
Exams	✅	✅
Goal	computational thinking in various social science applications, which are both helpful for social scientists and potential computer scientist (or CS courses or a tech job (SDE, DS))	computational thinking ability and application in basic social science applications, preparation for a career in social science

A **pass** in 30121 can take advanced CS courses.

A pass in 30111 **doesn't count**, need to take CS placement exam for advanced CS courses.

On to the fun stuff!

Digging in and getting started

What is a computer program?

A collection of instructions for the computer to perform.

Ask the computer to

```
print("Hello, world!")
```

```
8+6
```

```
def calculate_salary(hourly_pay, working_hours):
    salary = 0
    for h in working_hours:
        salary = salary + hourly_pay * h

    print("Bob earned $%d in last week" % salary)
    return salary
```

```
salary = calculate_salary(hourly_pay=15, working_hours=[8,6])
```

```
Bob earned $210 in last week
```

Human language: English, Chinese, French, Spanish, Germany, etc.

Computers, **programming language**: Python, Java, C, C++, R, etc.Syntax/semantics

Python 3

- Widely-used modern programming language
- Simple for beginners to get started
- Strong support from large community
- Python as a tool
- The concepts and skills you learn with Python will carry over to many other languages.

Think computationally

Topics:

- Writing and running your first program
- Variables and Types
- Expressions and Operators

Topics:

- **Writing and running your first program**
- Variables and Types
- Expressions and Operators

Your first program

```
print("Hello, world!")
```

How do we run a Python program?

1. In the Python interpreter
   - Small piece of code
   - Interactive

2. Saving the code to a file and *running* that file (you also got training on opening files in the terminal in the bootcamp)
   - Large piece of code
   - Reusable

Run a Python program in Python Interpreter

```
Last login: Thu Sep 21 13:03:43 on ttys001
(base) jeanclipperton@MAPSS-35004L Examples % python3
Python 3.9.12 (main, Apr  5 2022, 01:53:17)
[Clang 12.0.0 ] :: Anaconda, Inc. on darwin
Type "help", "copyright", "credits" or "license" for more information.
>>> print("Hello World!")
Hello World!
>>>
```

```
Last login: Thu Sep 21 13:03:47 on ttys001
(base) jeanclipperton@MAPSS-35004L Examples % ipython
Python 3.9.12 (main, Apr  5 2022, 01:53:17)
Type 'copyright', 'credits' or 'license' for more information
IPython 8.2.0 -- An enhanced Interactive Python. Type '?' for help.

In [1]: print("Hello World!")
Hello World!

In [2]:
```

~/Library/CloudStorage/Box-Box/Teaching/30111/Examples — python3

Run a Python file

A **.py** file that contains a sequence of Python instructions

```
Last login: Thu Sep 21 13:01:11 on ttys001
(base) jeanclipperton@MAPSS-35004L Examples %  echo "print('Hello world!')" > te
st.py
(base) jeanclipperton@MAPSS-35004L Examples % python3 test.py
Hello world!
(base) jeanclipperton@MAPSS-35004L Examples %
```

Interpreter vs File

1. In the Python interpreter
   - Small piece of code
   - Interactive
   - "REPL" (Read-Evaluate-Print-Loop)

2. Saving the code to a file and *running* that file
   - Large piece of code (e.g., 1000 lines)
   - Re-usable

Workflow:

1. Use interpreter to play around
2. Add code to the *.py* file
3. Test the program
4. Polish and repeat

Coding practice:

- Follow instructions from: course website → resources → running Python
  - Terminal + Python Interpreter
  - Terminal + IPython Interpreter
  - Terminal + Text Editor (*.py* file)

Topics:

- Writing and running your first program
- **Variables and Types**
- Expressions and Operators

Variables

Keep track of certain information while your program is running.

A variable is a symbolic name representing a location (the information stored in this location) in the computer memory.

Variables

Assign a value to a variable:

variable = value

Assignment operator

Assignment statement:

message = "Hello, world!"

Variable Value

Variable Types

- Integers (e.g., quantity = 10)
- Real numbers, or “floats” (e.g., price = 1.99)
- Strings (e.g., name = “banana”)
- Booleans (e.g., is_fail= True/False)

Python is a ***dynamically-typed*** language. It infers the type based on the value being assigned.

the built-in **type()** function

Variable Types: Casting

Infer the type of a variable by the value it is assigned:

- x = 14.5, x = "hello"
- msg = "The value of pi is" + 3.1415
- Is this correct?

Casting: explicitly tell Python to convert a value to a specific type:

- *cast* 3.1415 into a string by using the **str()** function
- msg = "The value of pi is " + str(3.1415)
- similarly, there are **int()** and **float()** functions.

Quiz

Variables allow us to…

- Increase and decrease the size of our memory (because that size is variable)
- Keep track of information in our program
- Specify whether I'm running a Python program or a Java program

Quiz

What operator do I use to assign a value to a variable?

- =
- ==
- <-

Quiz

What are the types we can use in Python?

- Python only provides numerical types
- Integers, floats, strings, booleans, and None
- Real numbers, complex numbers, and text

Topics:

- Writing and running your first program
- Variables and Types
- **Expressions and Operators**

Expressions

```
a = 5
b = 3
x = 1.5
s = "Hello, world!"
```

Expressions: combinations of variables and operators

```
addition = 2 + 2
subtraction_1 = a - 1
subtraction_2 = a - b
```

Arithmetic Operators

- Addition: +
- Subtraction: -
- Multiplication: *
- Division: /
- Integer division: //
- Modulus: % (e.g., 8%3 = 2)

The order of evaluation is governed by ***precedence rules*****,** which we can affect using parentheses.

Comparison Operators

- Less than: <
- Less than or equal: <=
- Greater than: >
- Greater than or equal: >=
- Equal: ==
- Not equal: !=

return Boolean value

Boolean operators

a = 5
b = -10

Logical AND: **and**

- True if both operands are True. Otherwise, False.
- a>0 and b>0

Logical OR: **or**

- True if at least one of the operands are True
- False if both are False
- a>0 or b>0

Logical NOT: **not**

- opposite of the boolean value
- not a>0

Coding practice:

Reference book:

- **1.2.5**
- **1.2.6**
- **1.2.7**

A leap year is a year that…

- Is divisible by 4 but *not* divisible by 100
- Unless the year is divisible by 400

Topics:

- Writing and running your first program
  - Interpreter
  - File
- Variables and Types
  - Types (integer, real number, string, boolean)
  - Casting
- Expressions and Operators
  - Arithmetic
  - Comparison
  - Boolean

Homework and Assignments

1) Read 1.3 and 2.1 before next class
2) TT: Tuesdays
3) SE: Fridays , lab on Fridays
4) Accept SE0 to join GitHub classroom
5) Office hours
    1) Canvas

First week lab schedule (Sep 30th)

- Software and package installation
  - Anaconda

- Tutorials
  - Git
  - Linux

- Course workflow
  - Git/GitHub
  - Canvas
  - GradeScope
  - Resources

Homework

- Enroll in GitHub classroom
  - Accept the first assignment (see Canvas announcement)

- Explore the course website
  - https://classes.ssd.uchicago.edu/macss/macs30121/