CIS 1100

Types, Variables & Sequences! (Lecture)

Python

Fall 2024

University of Pennsylvania

Correction: Printing `{` and `}` in f-strings

If you want to print `{` in an f-string, you don't escape it with a `\`, instead you "double it" within a `{{}}` pair

example:

```
print(f"{1}}}") # prints "1}"
```

Note: You are not expected to know this, and we will not test on this specific part of f-strings.

Review: Boolean Type

Another type that exists is `bool` which can represent two values `True` or `False`

```
x = True
y = False
print(x)
```

can use the operators `and`, `or` and `not` on booleans

What does `c` evaluate to? **(S7)**

e.g. if we ran this code then printed `c`, what would it print?

```
a = False
b = True
c = (not a or b) and not (a and True)
```

Review: Comparing

A common way to get boolean values is through comparison.

- `==` checks if two things are equal
- `!=` checks if two things are NOT equal

`"Hello" == "hello"` evaluates to False

`5 != 3` evaluates to True

`"hi" == "hi"` evaluates to True

Review: Ordering

There also exist oeprators to check for:

- `<=`: less than or equal to
- `>=`: greater than or equal to
- `<`: less than
- `>`: greater than

Review: Numerical Types

Python can store numbers, but it makes a distinction between two types of numbers:

- `int` These are Integers, meaning any positive or negative value (or zero).
  - e.g. `0`, `-3200`, `10`
- `float` These can store rational numbers and some special values
  - e.g. `3.14`, `2.0`, `infinity`

Review: Other Arithmetic Operators

- `**` used for exponents.
  - e.g. 5 squared is `5 ** 2`
- `//` used for "integer division, rounds the result towards 0
  - `int // int` evaluates to an `int`
  - `3 // 2` evaluates to `1`
- `%` called "modulo" used to get the remainder of a division.
  - `5 % 2` evaluates to `1`
  - `9 % 3` evaluates to `0`

Write some code to determine if the variable x contains an even integer **(L11)**

```
x = <some_number>
is_even = ________________
```

Operator Precedence

When we start combining operators together, it can get pretty complex to figure out the order things are evaluated.

Basic order of operations: (First evaluated to last evaluated)

- Parentheses `()`
- exponents `**`
- multiplication/division/mod `*` `/` `//` `%`
- addition / subtaction `+` `-`
- comparisons and membership `in` `not in` `<` `>=` `==` etc.
- `not`, `and`, `or`

You do not need to memorize these. When in doubt: Use Parenthesis

Type Conversion

Allows you to convert from one type to another

```
x = int("1300")   # converted str to int
z = str(x)        # Z has str conversion of x "1300"
a = bool("True")  # a has bool value True
f = float("3.14") # f has float value 3.14
```

Complex Reassignment

What does `z` evaluate to after this code is run? (S8)

```
x = 3
y = "luv sic"
z = str(x > 0 and x <= 6) + " " + y + str(x)
```

Compressed Order of Operations

- PEMDAS
- comparison
- boolean operations (and/or/not)

TypeError

Some operands cannot be used between some types

Consider:

```
x = 3 + "Howdy"
y = "bleh" > True
```

Most of the time you can resolve this by just adding a type conversion

Invalid Casts

Not all types can always be converted from one to another.

Consider:

```
x = int("Howdy") # invalid literal for int() with base 10: 'howdy'
```

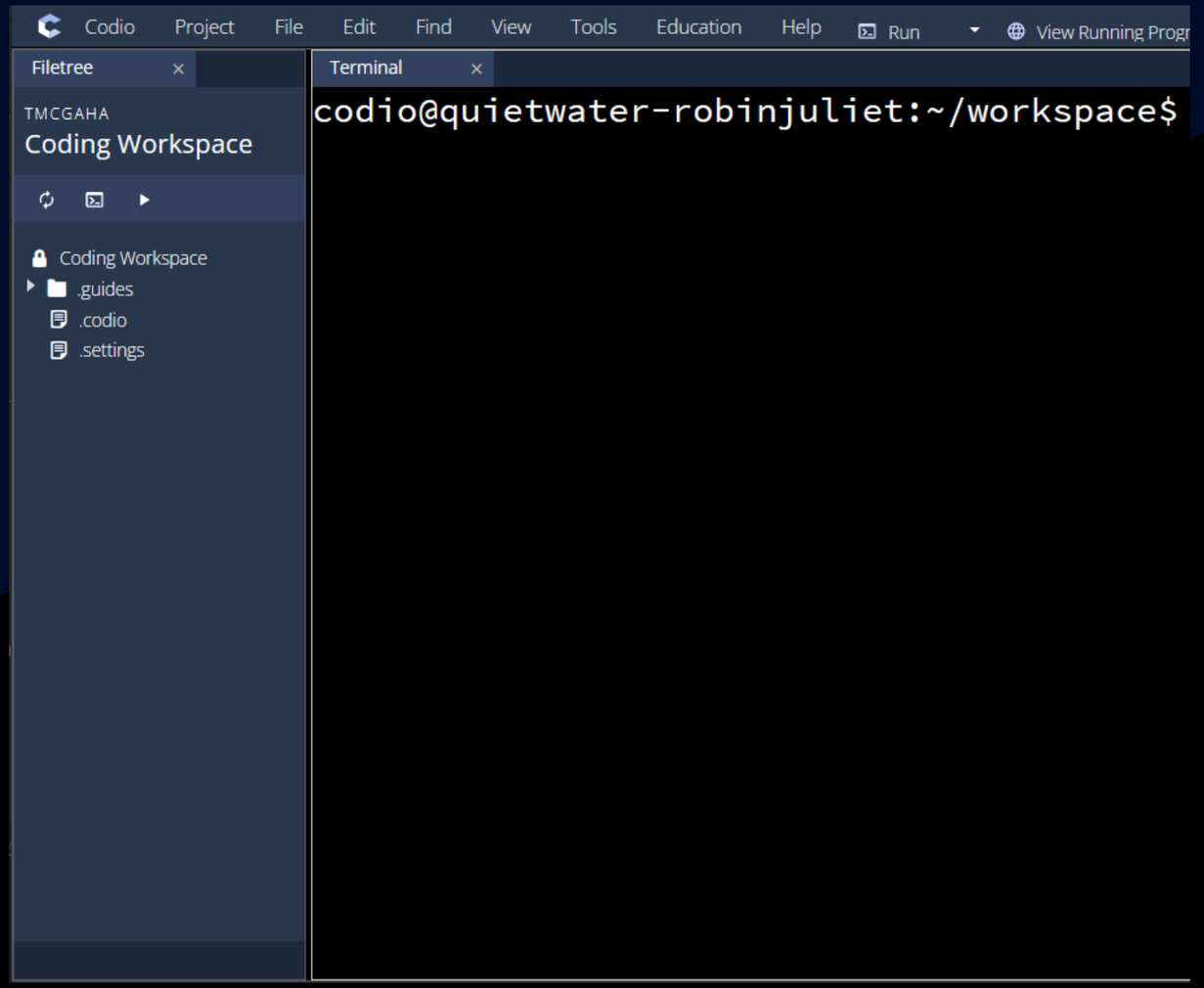
Python REPL

Python has a REPL that you can use to run python code without storing it in a file.
REPL = **R**ead **E**valuate **P**rint **L**oop

Useful if you want to just check something real quick

May be useful to write a regular python file for more longer or complex code.

To run, you can go to the "Run" or "terminal" tab in codio and type the command `python`



Python REPL

To run, you can go to the "Run" or "terminal" tab in codio and type the command `python`

Remember to end any running program first before you try to run the REPL

Once you have it open, you should be able to see it prompt you in the terminal:

```
codio@quietwater-robinjuliet:~/workspace$ python
Python 3.11.2 (main, Apr  3 2023, 13:27:49) [GCC 11.2.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>> 
```

Python REPL

Once you have it open, you should be able to see it prompt you in the terminal:

I underlined the prompt in red

you can then type in lines of python and it will run those lines and remember variables.

if you don't assign a value into a variable, it will print that value.

Use `CTRL + D` or type `exit()` when done.

```
codio@quietwater-robinjuliet:~/workspac
Python 3.11.2 (main, Apr  3 2023, 13:27
Type "help", "copyright", "credits" or
>>> x = int("13")
>>> x
13
>>> print(x)
13
>>>
```

Sequence Types: String

An important aspect of the string type, is that it is a sequence type. A string contains a *sequence* of characters.

Sequences have a length and indices for individual members of the sequences.

For strings, it is a sequence of characters. Emphasis on sequences because: **The order matters**

```
s1 = "hi"
s2 = "ih"
print(s1 == s2) # False
```

Sequence Types: String

Ordering is an important aspect to string, and we use **indices** as a way to specify positions in the string.

Consider the string

index	0	1	2	3	4	5
characters	H	e	l	l	o	!

index `0` is the first position (first character)

`len(string) - 1` is the index of the last character

Sequence Types: Basic Functionality

For any sequence, you can use

- `len(seq)` to find the length of the sequence `seq`
- `seq[i]` to access the `i`th index of the sequence `seq`

```
x = "Travis"
print(x[0])           # 'T'
print(x[3])           # 'v'
print(x[len(x) - 1]) # 's'
```

Practice:

What is the index of the letter `E` and `Y` from the following string (S9)

```
x = "GY! BE"
```

Get the last character of a string. Your code should work for any value of string that has len >= 1. Do not just say `last_char = "e"`. (S10)

```
string = "example"
last_char = ________
```

Practice:

Get the middle character of a string withouth knowing the string's value. Assume length is odd and >= 1. (C12)

```
string = "example"
middle_char = "
```

Hint: `//`

Get the age from this string an int. Do not just say `age = 26`, actually extract it from the string. (Also C12)

```
string = "Age: 26"
age = ____________________
```

Hint: assume age is two characters. Think about what operators are useful here.

Other String Sequence Function

- `string.find(target)`: finds the first index that has the target string, or -1 if not found.

example:

```
"Hello".find("l")  # 2
"Phl".find("U")    # -1
"Attack".find("ta") # 2
```

Reminder:

- There is another check-in due before next lecture as always.
  - Friday's check-in will have an "exit-ticket" for you to submit questions and metrics about the course.
- Office Hours and Recitation start this week!
  - Recitation counts attendance, show up to your assigned recitaiton!
- HW00 is out and due Wednesday (1/29) at midnight
- HW01 will be released on Thursday and due the following Wednesday (normal HW cadence from now on)