Lecture 3
Introduction to Data:
Types, Values, Function Calls, Variables
Happenings

· CS Resume Workshop 5-6pm on Wednesday, October 2\textsuperscript{nd} CF 115
  Presented by Filip Jagodzinski, students questions about writing resumes and cover letters will be answered while enjoying… PIZZA!

· **Tech Talk: Google** on Monday, October 7\textsuperscript{th} 5-6pm in CF 115
  Googlers share a day-in-the-life as a software engineer
  Resume review with Google on Monday, 10/7 during the day—[sign up here](#)

· **Accenture** on Tuesday October 8\textsuperscript{th} 4-6pm CF 110
  Resume prep, with interviews to follow October 30\textsuperscript{th}-November 1\textsuperscript{st}

· **Tech Talk: Microsoft** on Wednesday, October 9\textsuperscript{th} 5-6:30pm in CF 115
  Powershell: From Windows to the Cross-Platform Cloud
Announcements
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  • Reminder: You can download Thonny from thonny.org.
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  • Reminder: You can download Thonny from thonny.org.

• Please keep track of the hours you spend
Please log in at the beginning of class so you're ready when poll questions come up.

Reminder:

- socrative.com (or get the app)
- Room: 9AM141
- Student ID: Your WWU username.
QOTD

• You are given 3 "slip days" that allow you to submit something 24 hours late without penalty.

T/F: These can be used for labs, assignments, or QOTDs.
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X False.

Slip days are only usable on programming assignments.
QOTD

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   T/F: These can be used for labs, assignments, or QOTDs.

   False.

   Slip days are only usable on programming assignments.

   Special circumstances for missing lab or submitting late? Email me.
QOTD

• T/F: All programming assignments are expected to take approximately the same amount of time to complete.
QOTD

• **T/F:** All programming assignments are expected to take approximately the same amount of time to complete.

  False.
Where are lecture slides posted after lecture?

A. Socrative

B. Gradescope

C. Canvas

D. The course webpage
QOTD

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✅ D. The course webpage
According to the academic honesty policy, which of the following are permitted?

A. Talking about your code with your classmates.
B. Looking at a classmate's code, then immediately sitting down and typing out a very similar program, but with different variable names.
C. Submitting someone else's program as your own.
D. Copying a few lines of someone else's code into your solution, if you understand those lines in detail.
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   ✗

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   ✗
Goals

• Understand that data of different types is represented on a computer in different ways, and know the meaning of the following types:
  • str, int, float

• Know how to use the type conversion functions int, float, str

• Understand the syntax for calling functions with arguments, and know how to use the following functions:
  • print (with multiple arguments) input (with a prompt argument)

• type

• Know how to name and store values using variables and the assignment operator
Last time...
Last time...

- An *algorithm* is a step by step procedure to solve a problem.
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- An **algorithm** is a step by step procedure to solve a problem.

- We sometimes use **pseudocode** - a description of the steps of an algorithm that is not in any particular programming language.
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• Functions and function calls...
Last time: Function Calls
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• We’ve seen two functions so far:
Last time: Function Calls

• We’ve seen two functions so far:
  • print and input
Last time: Function Calls

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• Functions can take inputs, called arguments
Last time: Function Calls

• We’ve seen two functions so far:
  • `print` and `input`

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  `print("some text")`
Last time: Function Calls

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```python
print("some text")
```

"some text" is an argument to the `print` function call
Last time: Function Calls

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  - `print` and `input`

- Functions can take inputs, called `arguments`
  
  ```python
  print("some text")
  
  "some text" is an argument to the print function call
  
  or not:
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• We’ve seen two functions so far:
  • print and input

• Functions can take inputs, called arguments

  `print("some text")`

  "some text" is an argument to the print function call

• or not:

  `input()`
Last time: Function Calls

• We’ve seen two functions so far:
  • print and input

• Functions can take inputs, called arguments

    print("some text")

    "some text" is an argument to the print function call

• or not:

    input()

    input is called with no arguments here
Function Calls

- Syntax for a function call:
  ```python
  print("I am", 31, "years old")
  ```
Function Calls

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\[
\text{print("I am", 31, "years old")}
\]
Function Calls

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Function Calls

- Syntax for a function call:

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- Function name
- Comma-separated list of arguments
- Open paren
Function Calls

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  \texttt{print("I am", 31, "years old")}

  - Function name
  - Comma-separated list of arguments
  - Open paren
  - Close paren
Poll: Print 1

What does the following code print?

```python
print("CSCI", 99 + 42, "at WWU")
```

A. CSCI141atWWU
B. "CSCI 141 at WWU"
C. CSCI 141 at WWU
D. CSCI 99 + 42 at WWU
Poll: Print 2

How many **arguments** are there to the following call to the print function?

```
print("CSCI", 99 + 42, "at WWU")
```
Today: Data

What is data, anyway?
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What is data, anyway?

data

/ˈdeɪtə, ˈdeɪʃə/

noun

facts and statistics collected together for reference or analysis.
synonyms: facts, figures, statistics, details, particulars, specifics, features;  More

- the quantities, characters, or symbols on which operations are performed by a computer, being stored and transmitted in the form of electrical signals and recorded on magnetic, optical, or mechanical recording media.
- PHILOSOPHY
  things known or assumed as facts, making the basis of reasoning or calculation.
Data Types
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• Different kinds of data are stored differently.
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• All pieces of data have a type (sometimes also called class)
Data Types

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• All pieces of data have a **type** (sometimes also called **class**)

• We’ve seen 2 already:
  
  • “Hello world!”
  
  • 3 (as in 3 * 4 + 2)
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• We’ve seen 2 already:
  • “Hello world!” **String** *(type str)*
  • 3 (as in $3 \times 4 + 2$)
Data Types

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• We’ve seen 2 already:
  
  • “Hello world!”  String (type `str`)
  
  • 3 (as in 3 * 4 + 2)  Integer (type `int`)


Data Types

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• We’ve seen 2 already:
  • “Hello world!” **String (type str)***
  • 3 (as in 3 * 4 + 2) **Integer (type int)***

• Here’s another:
  • 3.14
Data Types

• Different kinds of data are stored differently.

• All pieces of data have a type (sometimes also called class)

• We’ve seen 2 already:
  • “Hello world!”  String (type str)
  • 3 (as in 3 * 4 + 2)  Integer (type int)

• Here’s another:
  • 3.14  Floating-point number (type float): a number with a decimal point
Data Types: Why?
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- All pieces of data have a type (sometimes also called class)
Data Types: Why?

- All pieces of data have a **type** (sometimes also called **class**)

- Practical reasons:
Data Types: Why?

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- Practical reasons:
  - Need to know how to store it in memory
    (how to encode it as 1’s and 0’s)
Data Types: Why?

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  • Need to know what you can do with it
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    • can you compute \( 10 + "\text{Scott}" \)?
Data Types: Why?

- All pieces of data have a **type** (sometimes also called **class**)

- Practical reasons:
  - Need to know how to store it in memory (how to encode it as 1’s and 0’s)
  - Need to know what you can *do* with it
    - can you compute `10 + "Scott"`?
    - what about `1.1 + 2`?
Data Types

• How do you find out what type a piece of data is?
  • Just ask!
  • Python has a function called `type` which tells you the type, or class, of any value.
The **type** Function

- The type function takes one piece of data (a **value**) and gives back the type of the value.

- **Examples:**

<table>
<thead>
<tr>
<th>Function call</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>type(16)</code></td>
<td><code>&lt;class 'int'&gt;</code></td>
</tr>
<tr>
<td><code>type(&quot;CSCI 141&quot;)</code></td>
<td><code>&lt;class 'str'&gt;</code></td>
</tr>
<tr>
<td><code>type(16.0)</code></td>
<td><code>&lt;class 'float'&gt;</code></td>
</tr>
</tbody>
</table>

16.0 is (mathematically) an integer, but the decimal point causes it to be interpreted as a float.
Got that?

What will be the result of calling:

```python
type(1.2)
```

A. `<class 'str'>`

B. `<class 'float'>`

C. `<class 'int'>`

D. `<class 'String'>`
Got that?

What will be the result of calling:

type("1.2")

A. `<class 'str'>`
B. `<class 'float'>`
C. `<class 'int'>`
D. `<class 'String'>`
Data Type Conversions

• What if you have “1.4” (class str) but you want 1.4 (class float)?

• Here are three more functions:

   int()

   float()

   str()

• Each tries to convert its argument to the given type, and throws an error if it’s not possible.
type and type conversions: demo
Types and type conversions: demo

• int to int
• int to string
• float to int
• string to int
• string to float
### print and input

- **print** can take any number of arguments, of any type.
  - Non-string arguments will be converted into strings
  - Arguments are printed in sequence, separated by a space

- **input** can take zero or one arguments
  - If given one argument, the argument is printed as a prompt before waiting for input.
Advanced Print and Input: Demo
Advanced Print and Input: Demo

• Print with multiple arguments, including non-strings
• Print with no arguments
• Input with a prompt
Variables
Variables

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- They simply allow you to store (or remember) values.
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Variables

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- They simply allow you to store (or remember) values.
- Computers are pretty dumb, but they're really good at a few things, for example:
  - arithmetic
  - remembering things
Variables: Definition

• A variable is a name in your program that refers to a piece of data (or a value).
Variables: Usage
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- A variable is a name in your program that refers to a piece of data (or a value).
- How do you use them?
Variables: Usage

• A **variable** is a name in your program that refers to a piece of data (or a value).

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  1. Decide what value you want to store in the variable
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  my_age 31
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  3. In your program, use the assignment operator to assign that variable name to the value:

        my_age = 31
Variables: Usage

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```python
    my_age = 31
```
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```python
my_age = 31
```

The assignment operator.
Variables: Usage

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Variables: Usage

\[ \text{my\_age} = 31 \]

The assignment operator.

- For now, think of `my_age` as a named place where we can store any value.

- You can replace the current value with a different one:
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You can replace the current value with a different one:

my_age = 32
Variables: Usage

my_age = 31

The assignment operator.

• For now, think of my_age as a named place where we can store any value.

• You can replace the current value with a different one:
  
  my_age = 32
  
  Happy Birthday
The Assignment Operator: Not “Equals”

- This is not stating an equality, like in math.
- It is associating a name with a value.

\[
\begin{align*}
\text{my\_age} & = 32 \\
\text{my\_age} & = 31 \\
\text{my\_age} & = 32
\end{align*}
\]

(whiteboard) a simple diagram of what's happening here
Using Variables

- Assigning a value is **not** stating an equality, like in math: it’s storing a value.

  ```python
  my_age = 31
  my_age = 32
  ```

  A variable’s value can be **updated** (overwritten) by a new value using the assignment operator.

  “my_age equals 32”
  “my_age becomes 32”
  “my_age gets 32”
  “the variable my_age takes on the value 32”
Using Variables

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my_age = 31
my_age = 32
```

A variable’s value can be **updated** (overwritten) by a new value using the assignment operator.

- **Wrong:** “my_age equals 32”
- **Correct:** “my_age becomes 32”
- “the variable my_age takes on the value 32”
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- Assigning a value is **not** stating an equality, like in math: it’s storing a value.

  ```
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  ```

A variable’s value can be **updated** (overwritten) by a new value using the assignment operator.

- “my_age equals 32” **✗**
- “my_age becomes 32” **✓**
- “the variable my_age takes on the value 32” **✓**
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  my_age = 32

A variable’s value can be **updated** (overwritten) by a new value using the assignment operator.

- X “my_age equals 32”  
- √ “my_age becomes 32”  
- √ “the variable my_age takes on the value 32”
What can you do with variables?

Use them anywhere you’d use a value!

print(5)  
a = 5

print(a)

These two programs both print 5.
Variable Names
Variable Names

• How do you use variables?
  1. Decide what value you want to store in the variable
  2. **Decide on a sensible name**
  3. In your program, use the assignment operator to store that value in the variable
Variable Names

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• Great power, great responsibility: variables names can be almost anything!
Variable Names

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• **Valid** variable names:
  • start with a letter or an underscore ( `_` )
  • can contain any letters and digits
  • are case-sensitive (name is not the same as Name)
  • are not the same as any Python language **keywords** (words that already mean something else):

    False, None, True, and, as, assert, async, await, break, class, continue, def, del, elif, else, except, finally, for, from, global, if, import, in, is, lambda, nonlocal, not, or, pass, raise, return, try, while, with, yield

    True  2plus2  a_number  firstOfThreeValues
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False  None  True  and  as  assert  async  await  break  class  continue  def  del  elif  else  except  finally  for  from  global  if  import  in  is  lambda  nonlocal  not  or  pass  raise  return  try  while  with  yield

True  2plus2  a_number  firstOfThreeValues
Variable Names

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• A **good** variable name:
  • is descriptive - tell a reader what data they refer to
  • is not too long
  • follows a standard naming convention, e.g.:
    • starts with lower case letter
    • words are separated by underscores

```
current_time          a4            hair_color
midterm_exam_grade_as_a_percent
```
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  • follows a standard naming convention, e.g.:
    • starts with lower case letter
    • words are separated by underscores

• these depend on context!

- current_time ✓
- midterm_exam_grade_as_a_percent ✓
- a4 ✗
- hair_color ✓
Next time

• More variables
• Operators
• Expressions
• Arithmetic