

Variables, Expressions, & Statements

Chapter 2

Housekeeping

- Github names and Python versions in Moodle?
 - Do it now!
 - Remember your pass words for accessing Github and Google during class (I suggest a pwd. mgr.)
- Written work looks pretty good – will submit comments this week.
- Posted reading assignments this week: Chp. 2-3.



Research Assistant – Empirical Analysis of Education, Gender, and Health

Center for Global Development • Washington, D.C., DC, US

Posted 2 months ago • 83 applicants



1 connection works here

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The Center for Global Development, an independent, non-partisan research organization in Washington, DC seeks a Research Assistant specializing in empirical analysis of development. The successful candidate will have experience with research in economics, public policy, political science, or a related field. The RA must demonstrate strong quantitative, analytical, and communications skills.

Duties

The research assistant will perform a range of project research, policy analysis and other duties including, but not limited to, the following

- Conduct data analysis using Stata, R, ArcGIS, Excel, and other software tools, and prepare tables and graphs to convey research results.
- Communicate data insights with clear write-ups, summaries, and blog posts.
- Conduct literature and data searches for ongoing research projects. Potential areas of focus include education, gender, and health.
- Collaborate with senior staff and members of the CGD communications team to draft blog posts, policy briefs, notes, and reports.

Seniority Level

Entry level

Industry

Non-profit Organization
Management,
Higher Education, Research

Employment Type

Full-time

Job Functions

Research, Analyst,
Information Technology

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- Collaborate with senior staff and members of the CGD communications team to draft blog posts, policy briefs, notes, and reports.
- Provide other research, writing and editing support for various reports and documents.
- Organize and attend meetings/conferences related to research priorities.
- Perform other duties as necessary in support of senior staff.

The successful candidate will have the following qualifications and skills:

- Bachelor's degree in a related field.
- Experience with Stata for data analysis is essential. Familiarity with R, Python, ArcGIS, or MATLAB is a plus but not required. Please specify relevant software skills in your application.
- Some training in econometrics and/or statistics is required. Again, please specify relevant experience.
- Ability to write clearly about the results of economic analysis.
- One to two years of experience in international development or related areas of research or policy analysis is preferred but not required.

This is a full-time position beginning in the spring or summer of 2019. CGD offers a competitive salary commensurate with experience and an outstanding benefits package.

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Today's Outline

- Understand what variables and values are.
- Get familiar with different data types in Python (in version 2.7)
- Talk about the importance of choosing good naming conventions and syntax.
- Write some code and put it in a Github repository

Values & Variables

- What is a value?
 - basic thing a program works with... letters, numbers, 'hello world'. Values have different types. Integers (numbers), "floats" (decimals), and strings.
- What is a variable?
 - A name that refers to a value. In $n = 17$, "n" is the variable.
- What is an operator?
 - symbols that represent computation like + or *.

Values & Variables

- What is an expression?
 - A combination of values, variables, and operators.
- What is a statement?
 - A unit of code that a Python interpreter can execute. E.g. in `print 'Hello World!'` “print” is the Statement and in `my_salary = 25000` it is “my_salary.”
- What is the “order of operations?”
 - PEDMAS.

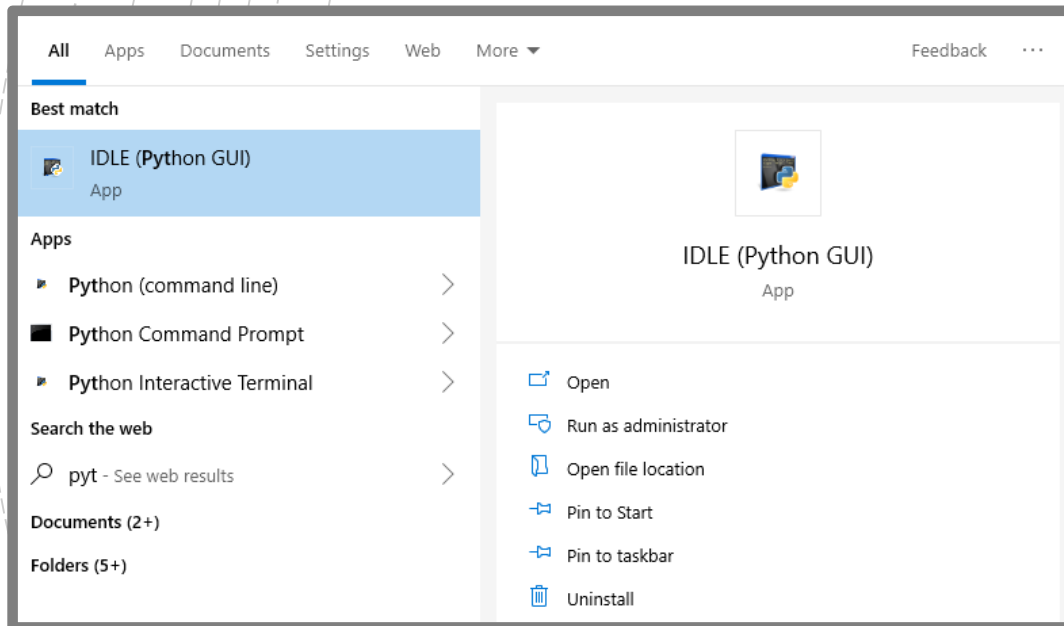


Exercise

- Assign variables with values
- Check the values of variables
- Check the data type of variables
- We're going to do this in the Interpreter (Python shell), which will run your script but not save it anywhere.

Open Up Python Interpreter (**IDLE / GUI**)

- or <https://colab.research.google.com> !





Exercise

- Assign variables with values

```
>>> # This is some sample code.  
>>> message = "Python version: 3.x"  
>>> n = 17  
>>> pi = 3.14159
```

- Run this. What happens?

- Nothing. We need the `print` statement to display it on screen!



Exercise

- Assign variables with values & print them.

```
>>> message = "Python version: 3.x"
>>> n = 17
>>> pi = 3.14159
>>> print (message)
>>> print (n)
>>> print (pi)
```



Exercise

- Now, check the data types of the variables one at a time.
 - >>> type (message)
 - >>> type (n)
 - >>> type (pi)
- What's the output?

Good Variable Syntax

- Make it meaningful! Document what the variable is used for.
- Must be “legal”: cannot use reserved words.
- Follow Python best practices for identifiers:
 - *CaSE SenSiTiVe!* starts with a letter A to Z (upper or lower case), an underscore (_) followed by zero or more letters, then underscores and digits (0 to 9)
 - `Ru87ChUppaChups90543 = 3.14`
 - `area_plowed_hectares = 17.5`
 - `distance_traveled_miles = 4`

Don't use keywords!

<code>and</code>	<code>del</code>	<code>from</code>	<code>not</code>	<code>while</code>
<code>as</code>	<code>elif</code>	<code>global</code>	<code>or</code>	<code>with</code>
<code>assert</code>	<code>else</code>	<code>if</code>	<code>pass</code>	<code>yield</code>
<code>break</code>	<code>except</code>	<code>import</code>	<code>print</code>	
<code>class</code>	<code>exec</code>	<code>in</code>	<code>raise</code>	
<code>continue</code>	<code>finally</code>	<code>is</code>	<code>return</code>	
<code>def</code>	<code>for</code>	<code>lambda</code>	<code>try</code>	

Why is “automatic syntax checking” helpful?

More danger words!

Data
close
range

Float
float
type

Int
int
write

Numeric
input
zeros

array
open

These conflict with commonly used functions.

More danger words!

`acos`

`asin`

`atan`

`cos`

`e`

`exp`

`fabs`

`floor`

`log`

`log10`

`pi`

`sin`

`sqrt`

- Libraries sometimes have their own keywords: e.g. Math
- A “library” is a collection of functions and methods that allows you to perform many actions without writing your code.

Operators & Operands

- What are operators?
 - special symbols that represent computations like: +, -, *, /, %
- How about operands?
 - Operands: The values an operator uses
- Example:

Operators

+

Name

Addition

Example

4 + 5

Output

9

Operators + Strings

- How does the + operator work with strings?
 - It “concatenates”



- Example

```
>>> folder = "d:/data/ma/"
>>> file_1 = "roads.shp"
>>> road_layer = folder + file_1
>>> print(road_layer)
```

Operators + Strings

- How does the * operator work with strings?
 - It means “repeat”



- Example

```
>>> my_string = "pointdata"  
>>> print(my_string*3)
```

Order of Operations



- Parentheses have the highest precedence.

- $2 * (3 - 1)$
- $(1 + 1) ** (5 - 2)$



- Exponentiation has the next highest precedence.

- $2 ** 1 + 1$
- $3 * 1 ** 3$

- Multiplication and Division have the same precedence (higher than Addition and Subtraction)

- What happens when you have two operators with the same precedence?

Backslash (\)

- \ is to start character sequences which have to be interpreted differently than if the same characters were presented on their own.

- \n Newline
- \t Tab



- Try:

```
n = 42
print(n)
```

- Now Try

```
n = 42
print("First line \n Second line")
```

Backslash (\)

- Double backslash (\\) are used when you want to show slashes!



- Try:

```
>>> file_2='d:\data\Tanzania\new_villages.shp'  
>>> print (file_2)
```

- Now try:

```
>>> file_2='d:\\data\\Tanzania\\new_villages.shp'  
>>> print(file_2)
```

Backslash (\)

- Backslash (\\) is required for quotation marks



- Try:

```
>>> str = "Have you read "Things Fall Apart"?"
```

- Now try:

```
>>> str = 'Have you read \'Things Fall Apart\'?'
>>> print(str)
```

File naming

Good to have a defined standard. We will use:

`Firstname_Lastname_Lab2.py`

`Firstname_Lastname_What-is-Github_Lab1.doc`



Exercise

Create and run a .py program to calculate the area and perimeter of a circle.

1. Type code in a new **Python Script window or Colab**
2. Save to local drive using good naming conventions: the file name extension has to be `.py`
3. Edit it, add comments
4. Check syntax errors
5. Run the program
6. Save the file to Github!



Exercise

```
>>> pi = 3.14
>>> r = 2.0
>>> area = pi * (r**2)
>>> perim = 2.0*pi*r
>>> print "Given r: ", r
>>> print " Area is: ", area
>>> print " Perimeter is: ", perim
# Py3 Syntax is print('Given r:', r)
```

Commenting:

```
"""  
Author: Shadrock the Pugnacious  
Created: 1 April 2019  
Note: this is to show how comments work.  
"""
```

```
pi = 3.14 # 2 digits kept  
r = 2.0
```

```
#This line calculates area  
area = pi *(r**2)
```

```
#This line calculates perimeter  
perim = 2.0*pi*r
```

```
#These lines outputs the results  
print("Given r: ",r)  
print("Area is: ",area)  
print("Perimeter is:", perim)
```



REQUIRED!

Share our script!

- Open up Github.
- Let's create a repo and upload our script.
- Repo name: 302-test-repo
- Change the readme.

Let's Look at Markdown

- Open <https://www.makeareadme.com>
- Initialize a new repo in your public Github
- All repos should have a brief description of the lab and the files in that repo.
- Adding images to repos?
<https://github.com/Shadrock/code-snippets>

Summary & Assignment

- Variables are things that refer to values:
 - **n = 17**
- Different data types are string, float, integer:
 - **“text is a string”, 26.3, 8**
- Good naming (for variables and homework files)!
- Always add comments!
- Don't forget to read Chp. 2 – 3.
- New writing assignment up!

Readings

- Reading assignment discussion: any surprises?
- Did you find anything useful or interesting in video?
- Do any of the concepts around the “open source debate” resonate for the work in your field?

Lab 2

- Lab 2 - Calculating agricultural land and rain runoff in Kenya. Very similar to what we did today!
- Will be posted on Moodle.
- Priyanka will go over it this on Friday.

Use this? From old.

- Identifiers are described by the following lexical definitions:

```
identifier ::= (letter|"_") (letter | digit | "_")
```

```
letter      ::= lowercase | uppercase
```

```
lowercase  ::= "a"..."z"
```

```
uppercase  ::= "A"..."Z"
```

```
digit      ::= "0"..."9"
```

- Identifier examples (such as variable names, function names in a program):

```
i, j, file_name, _inputX, layer1, value1_x,  
value2_x, Calc_area, calc_suitability
```