Python

Bootcamp 2021

Outline for today

- Setup Anaconda
- Running Python
- Variables and Assignment
- Data Type
- Built-in functions
- Conditionals
- Loops

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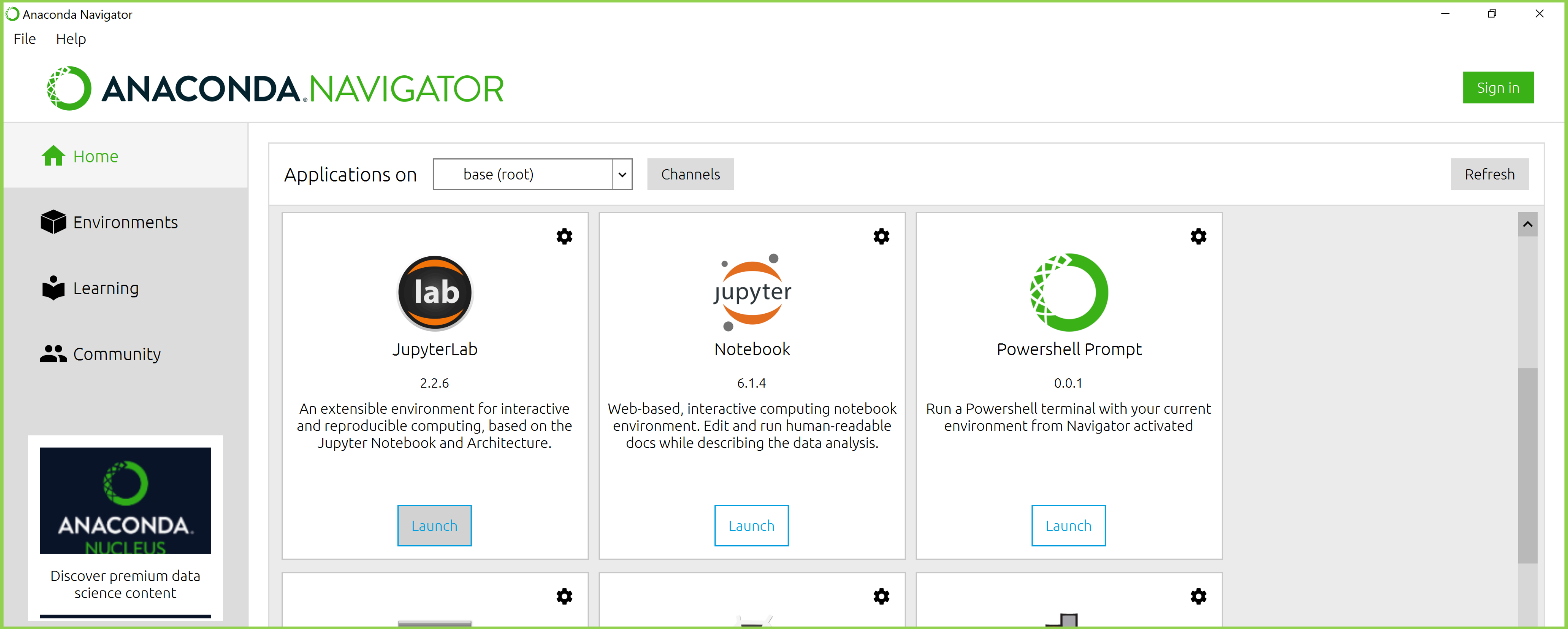
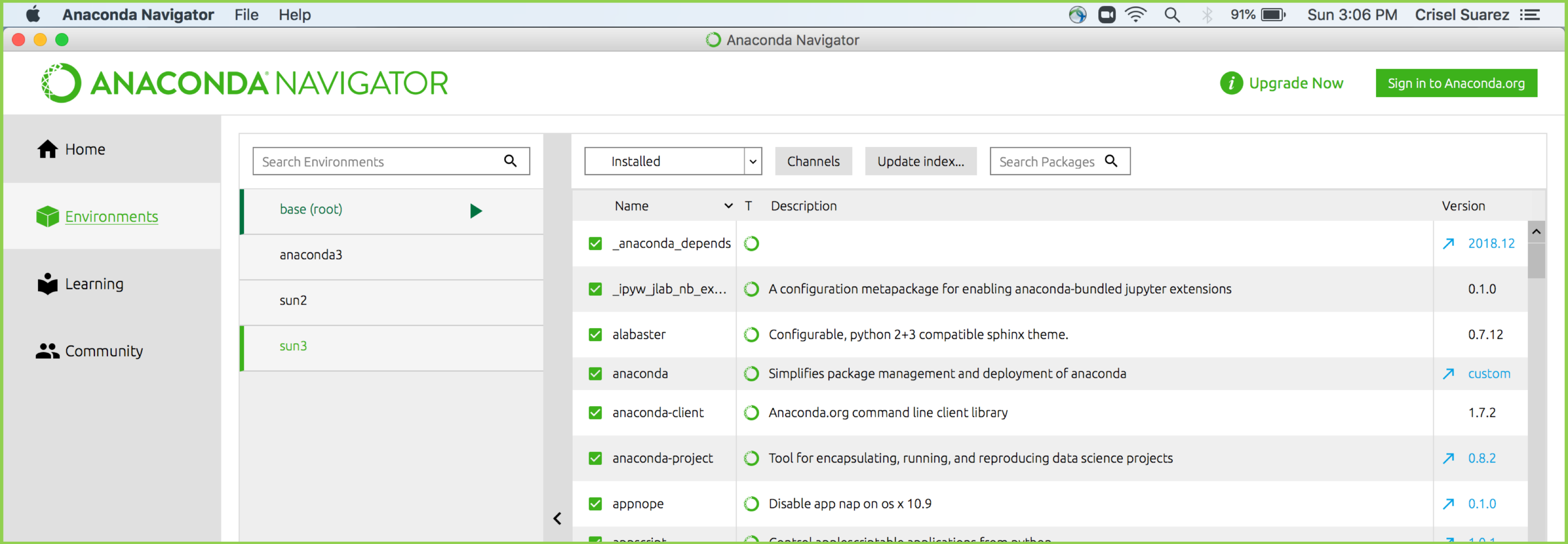
Setup Anaconda



Anaconda Navigator
File
Help
ANACONDA.NAVIGATOR
Sign in
Home
Environments
Learning
Community
ANACONDA. NUCLEUS
Discover premium data science content
Applications on
base (root)
Channels
Refresh
lab
JupyterLab
2.2.6
An extensible environment for interactive and reproducible computing, based on the Jupyter Notebook and Architecture.
Launch
jupyter
Notebook
6.1.4
Web-based, interactive computing notebook environment. Edit and run human-readable docs while describing the data analysis.
Launch
Powershell Prompt
0.0.1
Run a Powershell terminal with your current environment from Navigator activated
Launch

Setup Anaconda



	Name	T	Description	Version
☑	_anaconda_depends	○		↗ 2018.12
☑	_ipyw_jlab_nb_ex...	○	A configuration metapackage for enabling anaconda-bundled jupyter extensions	0.1.0
☑	alabaster	○	Configurable, python 2+3 compatible sphinx theme.	0.7.12
☑	anaconda	○	Simplifies package management and deployment of anaconda	↗ custom
☑	anaconda-client	○	Anaconda.org command line client library	1.7.2
☑	anaconda-project	○	Tool for encapsulating, running, and reproducing data science projects	↗ 0.8.2
☑	appnope	○	Disable app nap on os x 10.9	↗ 0.1.0
☑	appscript	○	Control applescriptable applications from python	↗ 1.0.1

Setup Anaconda

- >On your bash shell

- $ conda create --name bootcamp2021
- proceed ([y]/n)?
- Y
- $ conda info --envs
- $ conda env list
- $ conda activate bootcamp2021
- $ conda list -n bootcamp2021
- $ conda install package-name
- $ conda install package-name=2.3.4

- https://conda.io/projects/conda/en/latest/user-guide/tasks/manage-environments.html

- https://docs.anaconda.com/anaconda/user-guide/tasks/install-packages/

- $conda create –name bootcamp2021 –clone base

Scripts /Spyder/Jupyter Notebook/JupyterLab

- All have pros/cons
- Choose what works best for you
- It is okay to switch between platforms

Python Scripts

- Run scripts on your bash shell
  - $python

    >>>

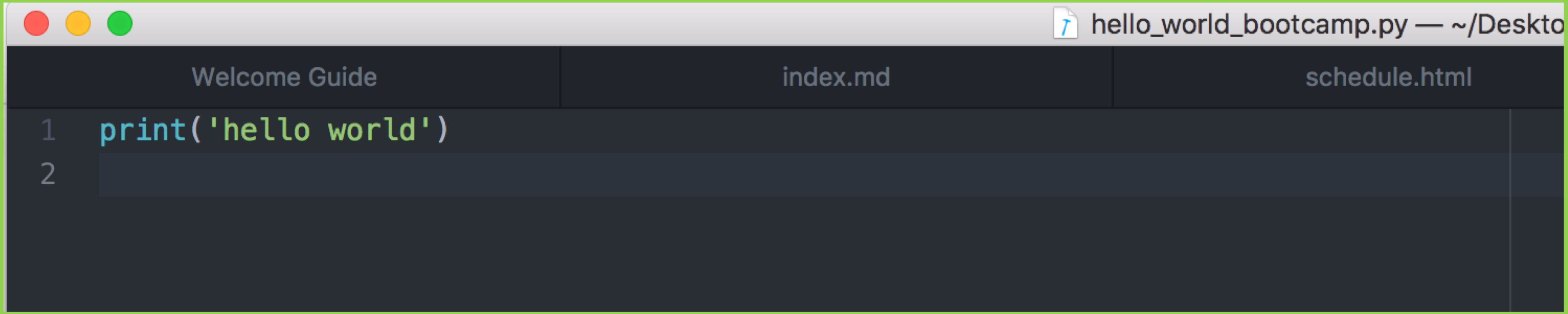
    >>>print(‘hello world’)

    >>>exit() #Go back to your bash shell ($)

- $ vim hello_world.py
- print(‘hello world’)
- $python hello_world.py

- vim
- Insert mode (i)
- Type your script/notes
- esc
- :wq

Python Scripts-Atom/Text Editor

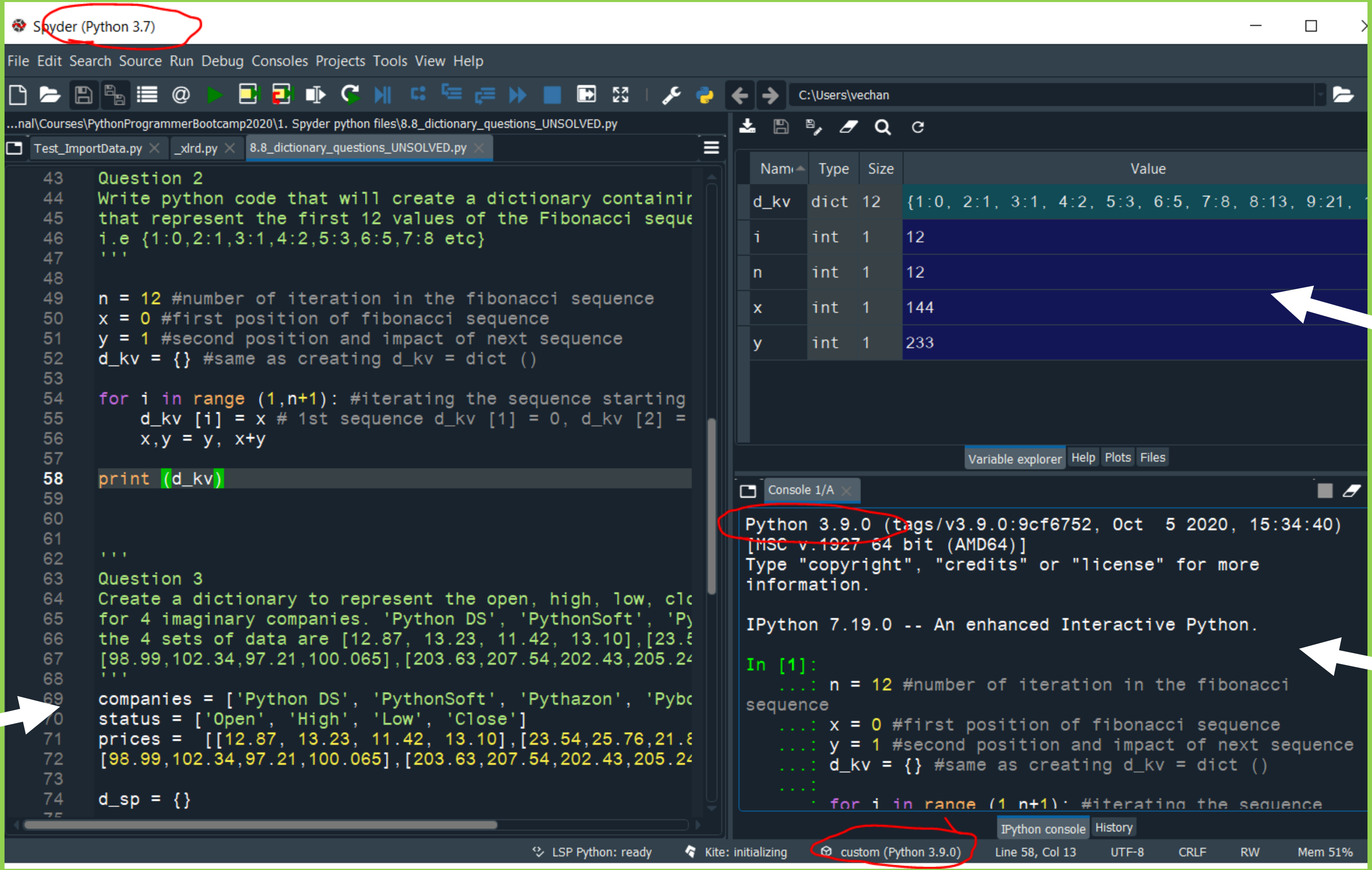


```python
print('hello world')
```

On your bash shell

```
$python hello_world_bootcamp.py
hello world
```

Spyder



Spyder (Python 3.7)
File Edit Search Source Run Debug Consoles Projects Tools View Help
C:\Users\vechan
...nal\Courses\PythonProgrammerBootcamp2020\1. Spyder python files\8.8_dictionary_questions_UNSOLVED.py
Test_ImportData.py
_xlrd.py
8.8_dictionary_questions_UNSOLVED.py

```
Question 2
Write python code that will create a dictionary containir
that represent the first 12 values of the Fibonacci seque
i.e {1:0,2:1,3:1,4:2,5:3,6:5,7:8 etc}
'''

n = 12 #number of iteration in the fibonacci sequence
x = 0 #first position of fibonacci sequence
y = 1 #second position and impact of next sequence
d_kv = {} #same as creating d_kv = dict ()

for i in range (1,n+1): #iterating the sequence starting
    d_kv [i] = x # 1st sequence d_kv [1] = 0, d_kv [2] =
    x,y = y, x+y

print (d_kv)



'''
Question 3
Create a dictionary to represent the open, high, low, clc
for 4 imaginary companies. 'Python DS', 'PythonSoft', 'Py
the 4 sets of data are [12.87, 13.23, 11.42, 13.10],[23.5
[98.99,102.34,97.21,100.065],[203.63,207.54,202.43,205.24
'''
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d_sp = {}
```

Name	Type	Size	Value
d_kv	dict	12	{1:0, 2:1, 3:1, 4:2, 5:3, 6:5, 7:8, 8:13, 9:21,
i	int	1	12
n	int	1	12
x	int	1	144
y	int	1	233

```
Python 3.9.0 (tags/v3.9.0:9cf6752, Oct  5 2020, 15:34:40)
[MSC v.1927 64 bit (AMD64)]
Type "copyright", "credits" or "license" for more
information.

IPython 7.19.0 -- An enhanced Interactive Python.

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```

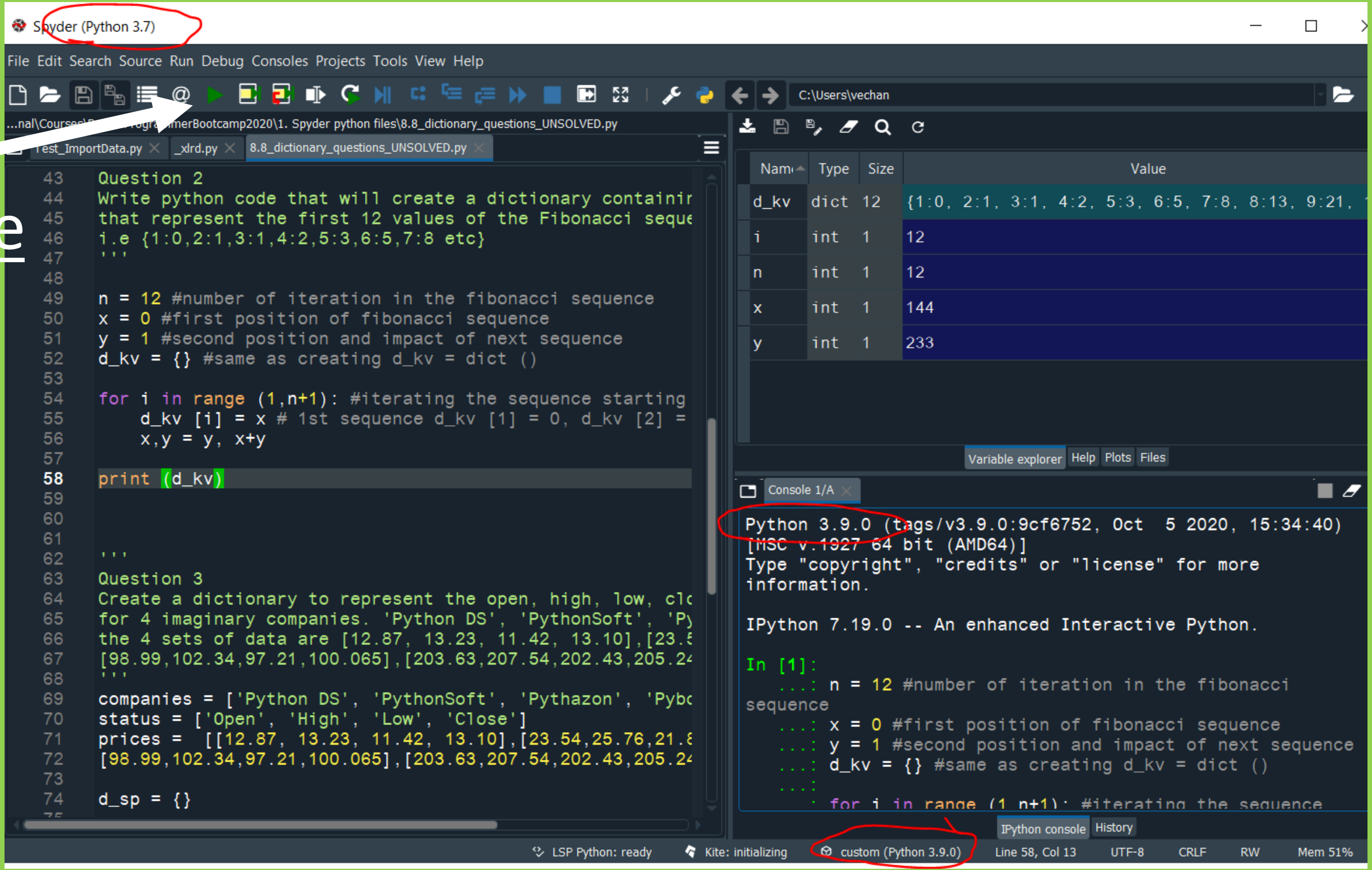
Declared Variables

Script Code goes here

Output

Spyder

Run your code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C:\Users\vechan
...nal\Courses\P...ogra...merBootcamp2020\1. Spyder python files\8.8_dictionary_questions_UNSOLVED.py
Test_ImportData.py
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8.8_dictionary_questions_UNSOLVED.py
Variable explorer
Help
Plots
Files
Console 1/A
IPython console
History

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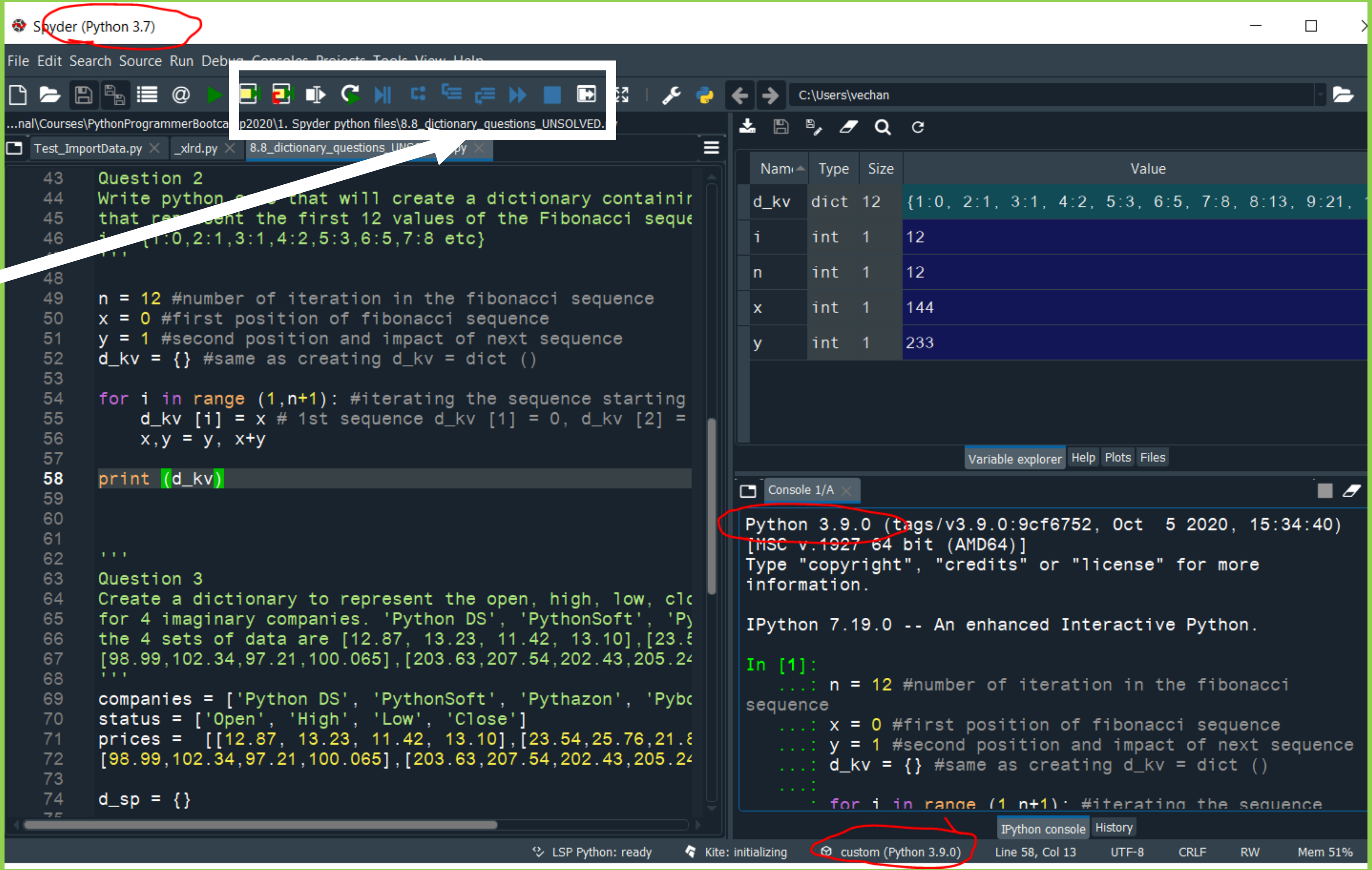
LSP Python: ready   Kite: initializing   custom (Python 3.9.0)   Line 58, Col 13   UTF-8   CRLF   RW   Mem 51%

Spyder

Debug your code



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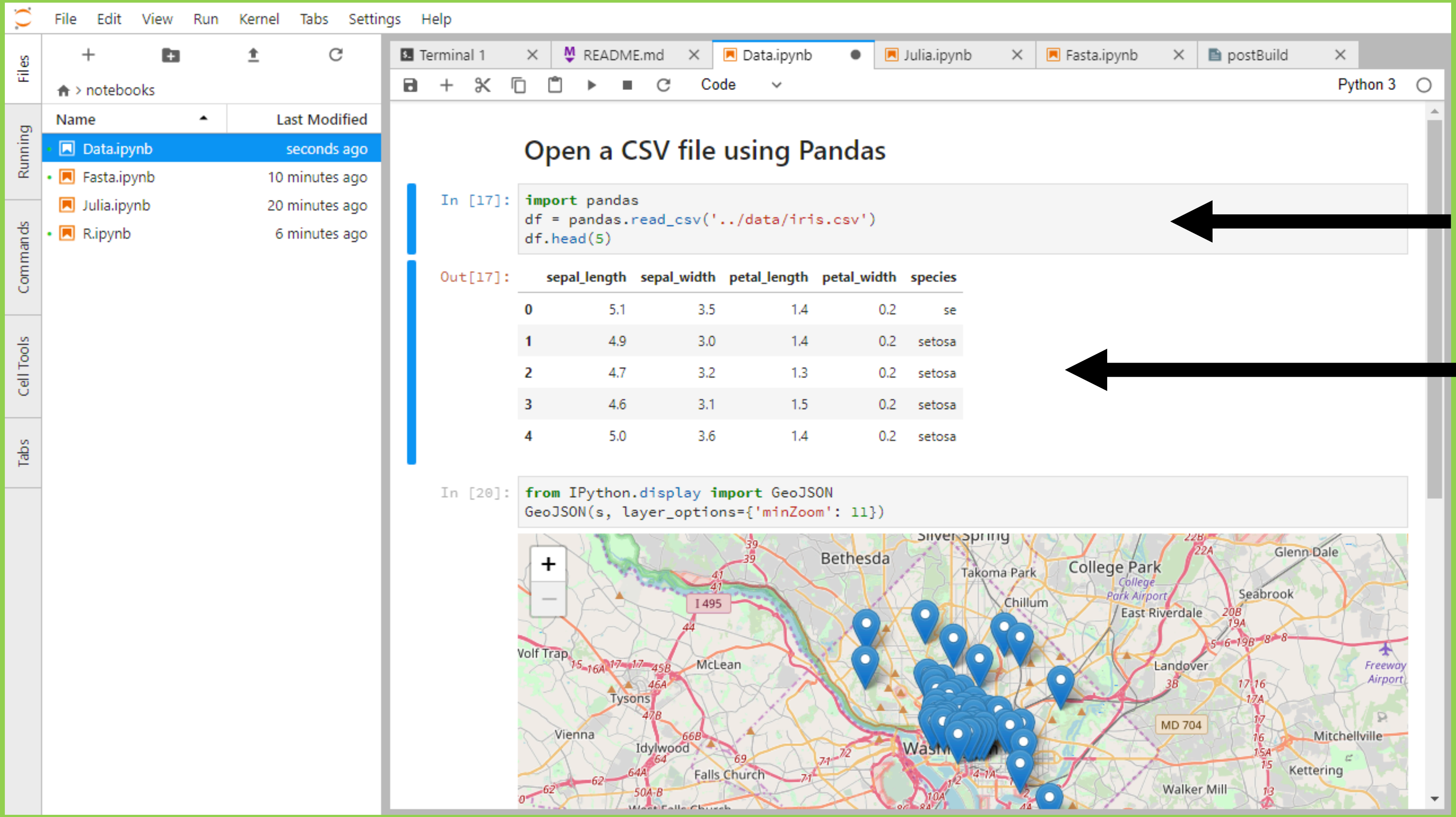
   ...:
   ...: for i in range (1,n+1): #iterating the sequence
```

More on this later

Jupyter Lab (.ipynb)

$ jupyter lab



Open a CSV file using Pandas

```
In [17]: import pandas
         df = pandas.read_csv('../data/iris.csv')
         df.head(5)
```

Out[17]:

	sepal_length	sepal_width	petal_length	petal_width	species
0	5.1	3.5	1.4	0.2	se
1	4.9	3.0	1.4	0.2	setosa
2	4.7	3.2	1.3	0.2	setosa
3	4.6	3.1	1.5	0.2	setosa
4	5.0	3.6	1.4	0.2	setosa

```
In [20]: from IPython.display import GeoJSON
         GeoJSON(s, layer_options={'minZoom': 11})
```

Cell – Code

Output

To run a cell:
shift + enter

https://jupyterlab.readthedocs.io/en/stable/user/notebook.html

$ jupyter notebook

Jupyter notebook (.ipynb)

- When in Command mode (esc/gray),
  - The b key will make a new cell below the currently selected cell.
  - The a key will make one above.
  - The x key will delete the current cell.
  - The z key will undo your last cell operation (which could be a deletion, creation, etc).

https://jupyter-notebook.readthedocs.io/en/latest/notebook.html

Jupyter notebook (.ipynb)

- Markdown great for commenting/adding notes to your code!

- A simple plain-text format for writing lists, links, and other things that might go into a web page.

Turn the current cell into a **Markdown cell** by entering the Command mode (**Esc**) and press the **M** key.

In [ ]: will disappear to show it is no longer a code cell and you will be able to write in Markdown.

Turn the current cell into a **Code** cell by entering the Command mode (**Esc**) and press the **y** key

Markdown – html

* Use asterisks
* to create
* bullet lists.

Lists

# A Level-1 Heading

## A Level-2 Heading (etc.)

Headings

[Create links](http://software-carpentry.org) with `[...](...)`.

Or use [named links][data_carpentry]. [data_carpentry]: http://datacarpentry.org

urls + links

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- Setup Anaconda
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- Variables and Assignment ←
- Data Type
- Built-in functions
- Packages
- Conditionals
- Loops

Variables and Assignments

- In Python the **=** symbol assigns the value on the right to the name on the left
- age = 42
- my_name = ‘Crisel Suarez’
- Grade1 = ‘A’

- Variable names
  - can **only** contain letters, digits, and underscore _
  - cannot start with a digit
  - are **case sensitive** (age, Age and AGE are three different variables)

Variables and Assignments

- first_name = ‘Kathy ’
- age = 10
- **print**(first_name, 'is', age, 'years old’)

- Variables can be used in calculations:
    - new_age = age +10

- Indexing
- print(first_name[0]

*** Python indexing starts at 0 ***

Outline Wednesday

- Jupyter Magic Commands ←
- Indexing and Slices
- Lists
- Built-in Functions
- Conditionals
- Loops
- Functions

Key Points

- Use variables to store values.
- Use print() to display values.
- Variables persist between cells.
- Variables must be created before they are used.
- Variables can be used in calculations.

Jupyter Magic Commands

- %run hello.py
- %%time
- % who
- %who str | % who int
- %pinfo <variable>
- %env
- %matplotlib inline
- %load hello.py
- %lsmagic

https://www.tutorialspoint.com/jupyter/ipython_magic_commands.htm

Jupyter Magic Commands

- Can run Unix commands straight from your Jupyter Notebooks
- !
- !head –n 5 haiku.txt
- !pip install astropy

- Almost all the things we learned in Unix we can use in Jupyter Notebooks

Data Types

- str() – String
  - Concatenation +
  - Repetition *
- int()- integer
- Float() - decimals
- Type() > What kind of data type

Math

- Add +
- Subtract -
- Multiply *
- Divide /
- Power **
- Reminder %
- Absolute value abs()

Operators

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

Operators

- and
- or
- in (Membership)
- not in (Membership)
- True
- False

Outline Wednesday

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Indexing and Slices

- [start:stop]
- atom_name = 'sodium’
- print(atom_name[0:3])
  - > sod

- len(atom_name)
- 6

Outline Wednesday

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Lists

- Storing multiple variables

- pressures = [0.273, 0.275, 0.277, 0.275, 0.276]

- **print**('pressures:', pressures)
- **print**('length:', len(pressures))
- **print**('zeroth item of pressures:', pressures[0])

- pressures[0] = 0.265

-

Lists – Appending

- list_name.append()
- primes = [2, 3, 5]
- **print**('primes is initially:', primes)
- primes.append(7)
- **print**('primes has become:', primes)

Lists – Deleting

- del list_name[index] to remove an element from a list

- primes = [2, 3, 5, 7, 9]
- **print**('primes before removing last item:', primes)
- **del** primes[4]
- **print**('primes after removing last item:', primes)

List- Empty []

- Empty_list = []

- Helpful as a starting point for collecting values

Practice:

- **print**('string to list:', list('tin’))
- **print**('list to string:', ''.join(['g', 'o', 'l', 'd’]))

What does list do?

What does .join do?

*We will come back to list with Numpy’s version …arrays

Key Points

- Use an index to get a single character from a string.
- Use a slice to get a substring.
- Use the built-in function len() to find the length of a string.
- Python is case-sensitive.
- Use meaningful variable names

Dictionaries {} or dict()

- Mutable key-value pairs

- zoo = {‘cats’ : 4 , ‘dogs’: 5, ‘goats’: 3, ‘camels’ : 2 }
- person = dict(name = "John", age = 36, country = "Norway")

- zoo[‘cats’]
  - > 4

- zoo.keys()
- zoo.values()
- zoo.items()

Dictionaries

- food = {‘breakfast’ : 2 , ‘lunch’: ‘salad’,
  ‘dinner’: {‘first_course’ : ‘soup’,
  ‘second_course’: ‘chicken’ }
  desert = [‘flan’, ’coockies’, ‘NY_cheesecakes’]}

- food['dinner']['first_course’]
- food['dessert'][0]

Tuple – ()

- Tuples are used to store multiple items in a single variable.
- A tuple is a collection which is ordered and **unchangeable**.
- Tuples are written with parentheses ()
- Allows duplicated items

```
thistuple = ("apple", "banana", "cherry")

thistuple = ("apple", "banana", "cherry", "apple", "cherry")
```

Sets – {}

- Unordered
- Unchangeable
- No duplicate values.

```
thistuple = {"apple", "banana", "cherry”}

thistuple = {"apple", "banana", "cherry", "apple", "cherry”}
```

Python Collections

- **List** is a collection which is ordered and changeable. Allows duplicate members.
- **Tuple** is a collection which is ordered and unchangeable. Allows duplicate members.
- **Set** is a collection which is unordered and unindexed. No duplicate members.
- **Dictionary** is a collection which is ordered* and changeable. No duplicate members.

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Built-in functions

- Think math function
- f(x) = x + 5
- x -> input
- f(x) -> output

- Functions can take 0 or many arguments
- print()
- f(x1, x2, x3,…) = x1+ x2+x3 +…..

Built-in functions

- max(1,2,3)
- min(5,6,7)
- round(3.712, 1) #rounds to 1 decimal place

- help(round)

Functions attached to objects are called methods

- Methods have parentheses like functions, but come after the variable.

```
my_string = 'Hello world!' # creation of a string object

print(my_string.swapcase())
# calling the swapcase method on the my_string object
```

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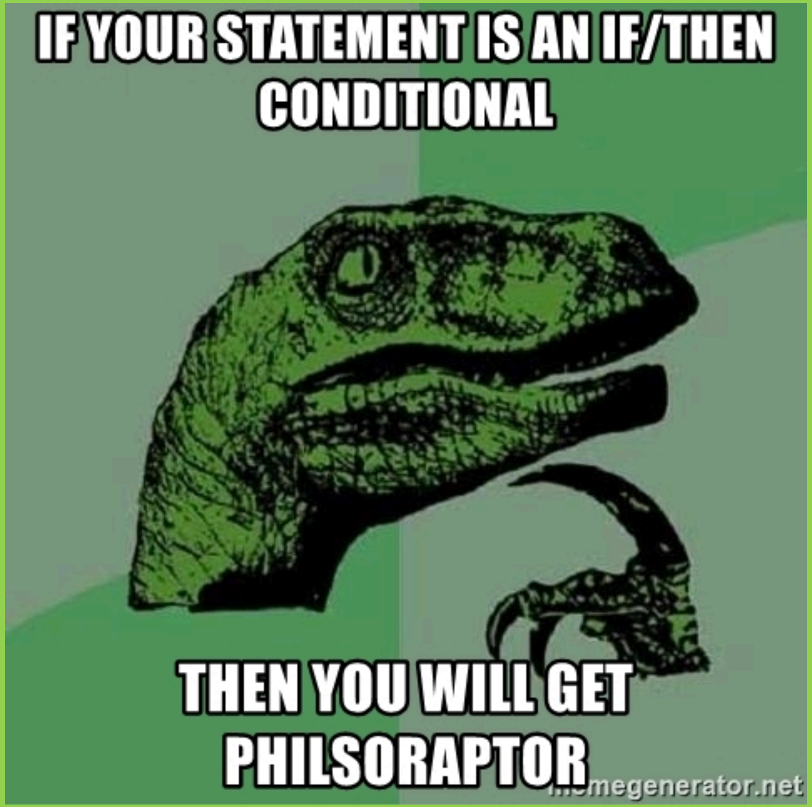
Conditionals

- if (condition is True):
  then do something

- if (condition is True):
  then do something
- else:
  - Do something else

- if (condition is True):
  then do something
- elif (this condition is true):
  - then do this
- else:
  - Do this


IF YOUR STATEMENT IS AN IF/THEN CONDITIONAL
THEN YOU WILL GET PHILSORAPTOR
memegenerator.net

Conditionals – Try it out

- mass = 3.4
- If mass > 3.0:
  - print('Mass is ' , mass)

- if mass > 3:
  - print('Mass is less than 3')
- else:
  - print('Mass is more than 3')

- if mass < 3.7:

  print('mass less than 3.7')
- elif (if mass > 3.2):
  - print('mass greater than 3.2')
- else:
  - print(mass greater than 3.7 or less than 3.2)

Conditionals – Try it out

- mass = 3.4
- If ((mass < 3.7) and (mass >3.2)):
  - print(mass less than 3.7 or greater than 3.2)

- mass = 3.4
- If ((mass < 3.7) or (mass >3.2)):
  - print(mass less than 3.7 or greater than 3.2

- mass = 3.8
- If ((mass < 3.7) and (mass >3.2)):
  - print(mass less than 3.7 or greater than 3.2

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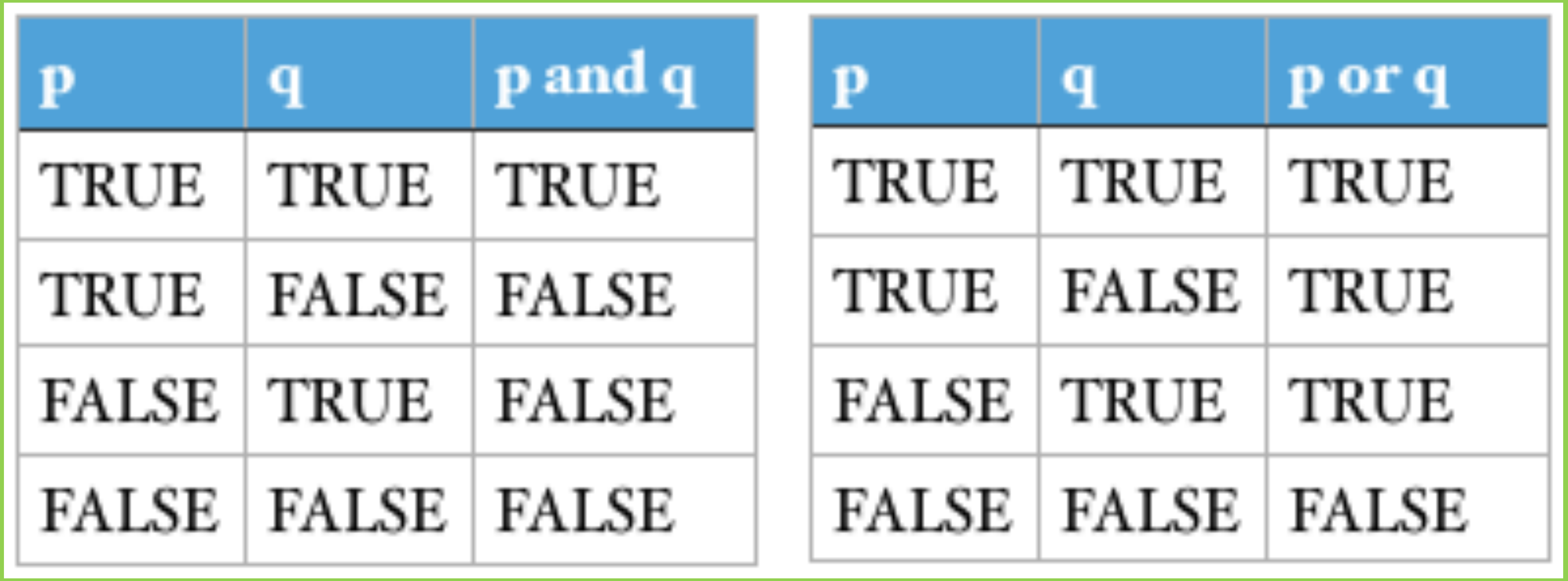
- If ((mass < 3.7) or (mass >3.2)):
  - print(mass less than 3.7 or greater than 3.2

Conditionals



p	q	p and q
TRUE	TRUE	TRUE
TRUE	FALSE	FALSE
FALSE	TRUE	FALSE
FALSE	FALSE	FALSE

p	q	p or q
TRUE	TRUE	TRUE
TRUE	FALSE	TRUE
FALSE	TRUE	TRUE
FALSE	FALSE	FALSE

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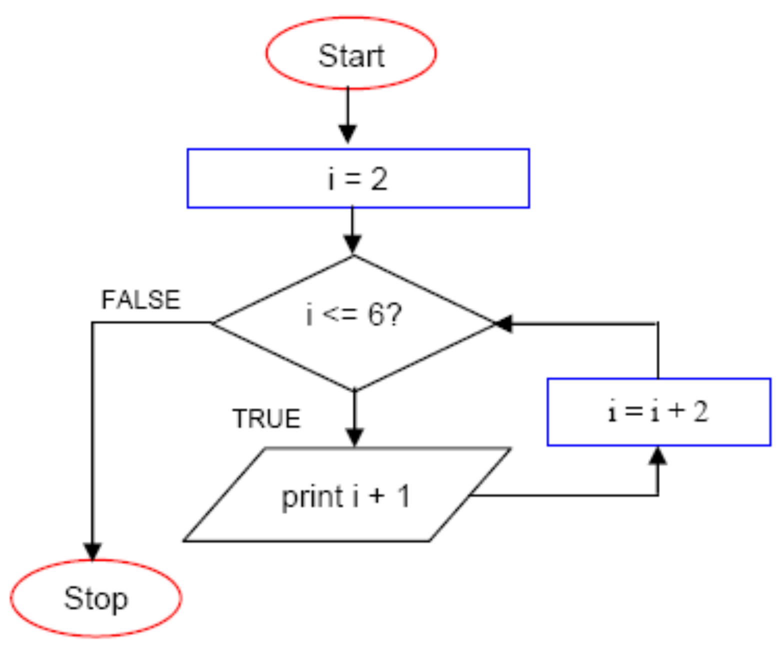
Loops

Loops are a programming construct which allow us to repeat a command or set of commands for each item in a list. As such they are key to productivity improvements through automation



i	i<= 6	Output
2	True	3
4	True	5
6	True	7
8	False	

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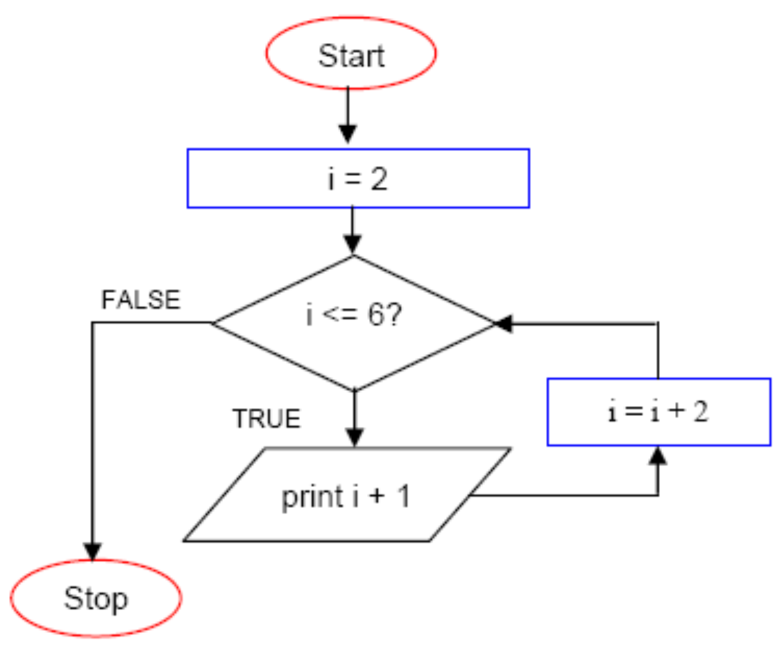

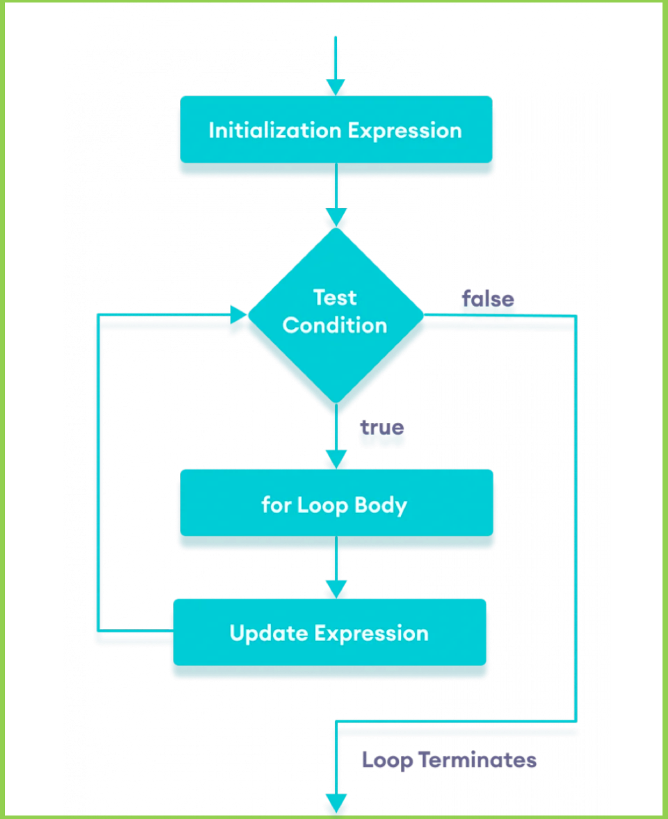

Loops

- **for** number **in** [2, 3, 5]:
    - **print**(number)

- primes = [2, 3, 5]
- **for** p **in** primes:
    - squared = p ** 2
    - cubed = p ** 3
    - **print**(p, squared, cubed)

Loops

- The built-in function range produces a sequence of numbers.
- *Not* a list: the numbers are produced on demand to make looping over large ranges more efficient.

- **print**('a range is not a list: range(0, 3)’)
- **for** number **in** range(0, 3):
  - **print**(number)

Loops – Practice

- *# List of word lengths: ["red", "green", "blue"] => [3, 5, 4]*
- lengths = ____
- **for** word **in** ["red", "green", "blue"]:
  - lengths.____(____)
- **print**(lengths)

Loops – Practice

- *# List of word lengths: ["red", "green", "blue"] => [3, 5, 4]*
- lengths = []
- **for** word **in** ["red", "green", "blue"]:
  - lengths.append(len(word))
- **print**(lengths)

Loops – Practice

- *# Concatenate all words: ["red", "green", "blue"] => "redgreenblue”*
- words = ["red", "green", "blue"]
- result = ____
- **for** ____ **in** ____:
  - ____
- **print**(result)

Loops – Practice

- *# Concatenate all words: ["red", "green", "blue"] => "redgreenblue”*
- words = ["red", "green", "blue"]
- result = ””
- **for** word **in** words:
  - result = result+word
- **print**(result)

Practice

- Write a program that prints the following pattern:

```
*
**
***
****
*****
******
```

Practice

- Write a program that prints the following pattern:

```
*
**
***
****
*****
******
```

```
for star in range(7):
    print('*’ * star)
```

Outline- Friday

- Loops (cont.)
- Functions
- Packages
  - Numpy
  - Pandas
  - Matplotlib
- Mini Project?

Practice

- Write a program that prints the following pattern:

```
*
**
***
****
*****
******
```

Practice

- Write a program that prints the following pattern:

```
*
**
***
****
*****
******
```

```
for star in range(7):
    print('*’ * star)
```

While Loops

- Need to define an indexing variable***

```
i = 1
while i < 6:
        print(i)
        i += 1
```

```
i = 1
while i < 6:
        print(i)
        i += 1
else:
        print("i is no longer less than 6")
```

Loop can run forever

Conditionals + Loops

```
i = 0
while i < 6:
    i += 1
    if i == 3:
        print(”i is 3”)
    print(i)
```

```
masses = [3.54, 2.07, 9.22, 1.86, 1.71]
for m in masses:
    if m > 3.0:
        print(m, 'is large’)
    else:
        print(m, ‘is small’)
```

Loops

- **continue** - stop the current iteration, and continue with the next

```
fruits =
["apple", "banana", "cherry"]
for x in fruits:
  if x == "banana":
    continue
  print(x)
```

```
i = 0
while i < 6:
  i += 1
  if i == 3:
    continue
  print(i)
```

Loops

- **break** - stop the loop even if the while condition is true

```
fruits =
["apple", "banana", "cherry"]
for x in fruits:
  print(x)
  if x == "banana":
    break
```

```
i = 1
while i < 6:
  print(i)
  if i == 3:
    break
  i += 1
```

Loops

- **pass** – ”Empty loop”

```
for x in [0, 1, 2]:
  pass
```

Nested Loops

```
persons = [ "John", "Marissa", "Pete", "Dayton" ]
restaurants = [ "Japanese", "American", "Mexican",
"French" ]

for person in persons:
    for restaurant in restaurants:
        print(person + " eats " + restaurant)
```

Nested Conditionals

```
num = float(input("Enter a number: "))
if num >= 0:
    if num == 0:
        print("Zero")
    else:
        print("Positive number")
 else:
    print("Negative number")
```

Keypoints

- Use if statements to control whether or not a block of code is executed.
- Conditionals are often used inside loops.
- Use else to execute a block of code when an if condition is ***not*** true.
- Use elif to specify additional tests.
- Create a table showing variables' values to trace a program's execution.

Keypoints

- A *for loop* executes commands once for each value in a collection.
- A for loop is made up of a collection, a loop variable, and a body.
- The first line of the for loop must end with a colon, and the body must be indented.
- Indentation is always meaningful in Python.
- Make meaningful loop variables
- The body of a loop can contain many statements.
- Use range to iterate over a sequence of numbers.

Outline Wednesday

- Jupyter Magic Commands
- Indexing and Slices
- Lists
- Built-in Functions
- Conditionals
- Loops
- Functions ←

Functions def()

***Functions return something

```
def print_greeting():
        print('Hello!')

def print_date(year, month, day):
        joined = str(year) + '/' + str(month) + '/’ + str(day)
        print(joined)


def average(values):
if len(values) == 0:
         return None
 return sum(values) / len(values)
```

Practice

- Fill in the blanks to create a function that takes a list of numbers as an argument and returns the first negative value in the list. What does your function do if the list is empty?

```
def first_negative(values):
    for v in _____:
        if _____:
            return _____
```

Practice

- Fill in the blanks to create a function that takes a list of numbers as an argument and returns the first negative value in the list. What does your function do if the list is empty?

```
def first_negative(values):
    for v in values:
        if v<0:
            return v
```

Functions + Variable Scope

- ***Global variable***
  - Defined outside any particular function.
  - Visible everywhere.

- ***Local variable***
  - Defined inside the function.
  - Not visible in the main program.

```
pressure = 103.9
def adjust(t):
    temperature = t * 1.43 / pressure
    return temperature
```

Keypoints

- Break programs down into functions to make them easier to understand.
- Define a function using def with a name, parameters, and a block of code.
- Defining a function does not run it.
- Arguments in call are matched to parameters in definition.