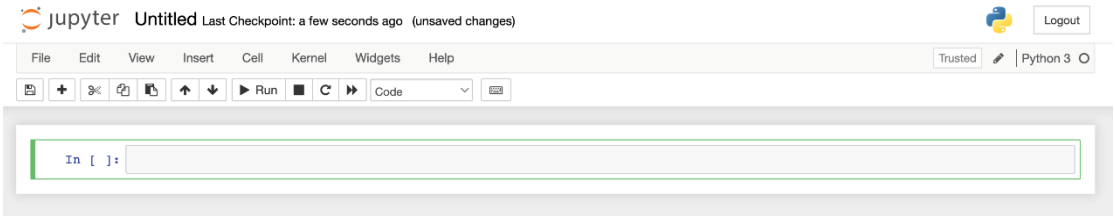
Chapter 1: Python Fundamentals – Math, Strings, Conditionals, and Loops



Operation	Symbol
Addition	+
Subtraction	-
Multiplication	*
Division	/
Integer Division	//
Exponentiation	**
Modulo/Remainder	%

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

```
  File "<ipython-input-2-ac9b8cc41192>", line 1
    1st_number=1
     ^
SyntaxError: invalid syntax
```

```
  File "<ipython-input-3-e3c03546ed83>", line 1
    my_$ = 1000.00
       ^
SyntaxError: invalid syntax
```

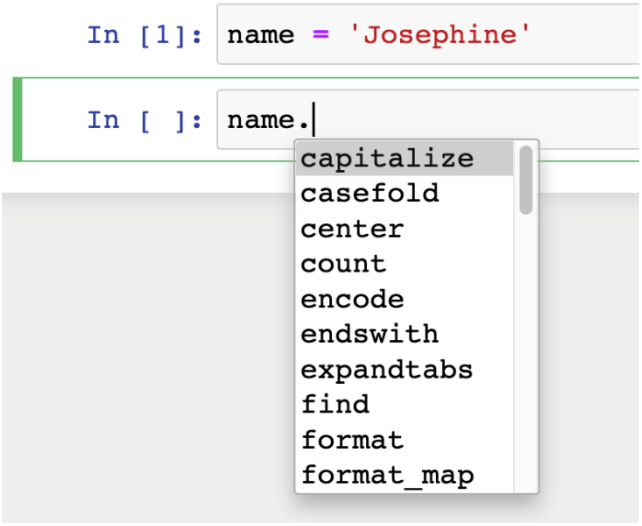
```
In [1]: # This is a comment
```

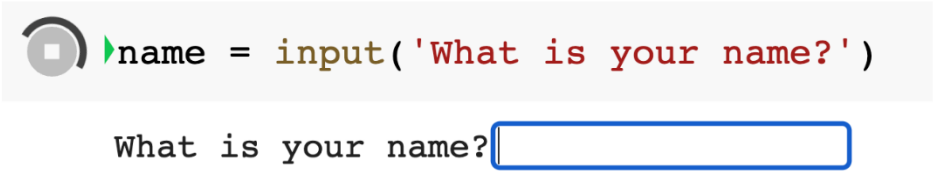
```
In [2]: # Set the variable pi equal to 3.14
        pi = 3.14
```

```
In [3]: pi = 3.14    # Set the variable pi equal to 3.14
```

```
  File "<ipython-input-2-9c3a3fab8dfa>", line 1
    bookstore = 'City Lights"
                             ^
SyntaxError: EOL while scanning string literal
  File "<ipython-input-4-0ef68cccb92b>", line 1
    bookstore = 'Moe's'
                       ^
SyntaxError: invalid syntax
```

Escape Sequence	Meaning
\newline	Ignored
\\	Backslash (\)
\'	Single quote (')
\"	Double quote (")
\a	ASCII Bell (BEL)
\b	ASCII Backspace (BS)
\f	ASCII Formfeed (FF)
\n	ASCII Linefeed (LF)
\r	ASCII Carriage Return (CR)
\t	ASCII Horizontal Tab (TAB)
\v	ASCII Vertical Tab (VT)
\ooo	ASCII character with octal value ooo
\xhh...	ASCII character with hex value hh...





```
[1] name = input('What is your name?')

What is your name?Alenna
```

String	S	a	n		F	r	a	n	c	i	s	c	o
Index	0	1	2	3	4	5	6	7	8	9	10	11	12

Character value	s	c	o
Index Count	-3	-2	-1

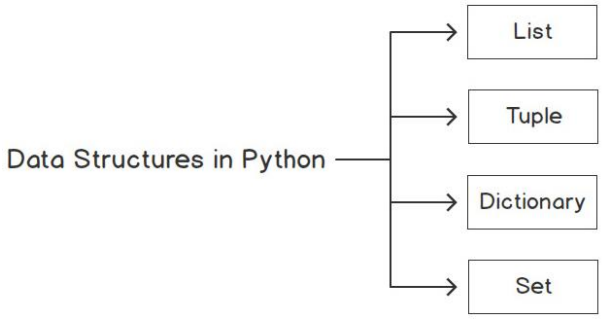
Logical Operators

	not	and	or
A = True	not A = False	A and A = True	A or A = True
B = False	not B = True	A and B = False	A or B = True
		B and B = False	B or B = False

Symbol	Meaning
<	Greater than
<=	Greater than or equal to
>	Less than
>=	Less than or equal to
==	Equivalant to
!=	Not equivalent to

```
A one bedroom in the Bay Area is listed at $599,000
Enter your first offer on the house.
600000
Enter your best offer on the house.
690000
How much more do you want to offer each time?
10000
We're sorry, you're offer of 600000 has not been accepted.
We're sorry, you're offer of 610000 has not been accepted.
We're sorry, you're offer of 620000 has not been accepted.
We're sorry, you're offer of 630000 has not been accepted.
We're sorry, you're offer of 640000 has not been accepted.
Your offer of 650000 has been accepted!
How intelligent are you? 0 is no intelligence. And 10 is a genius
8
Are you human by chance? Wait. Don't answer that.
How human are you? 0 is not at all and 10 is human all the way.
8
I think this courtship is over.
```

Chapter 2: Python Data Structures



Apple	Banana	Orange
5	8	9
7	6	2

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$$

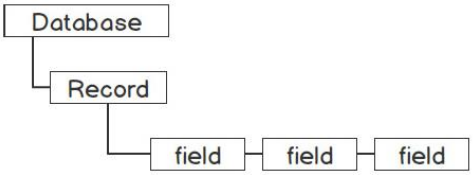
Name	Age	Department
John Mckee	38	Sales
Lisa Crawford	29	Marketing
Sujan Patel	33	HR

```
['Lisa Crawford', 29, 'Marketing']
Name: Lisa Crawford
Age: 29
Department: Marketing
--------------------
```

$$X = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix} \quad Y = \begin{bmatrix} 10 & 11 & 12 \\ 13 & 14 & 15 \\ 16 & 17 & 18 \end{bmatrix} \quad X = \begin{bmatrix} 1 & 2 \\ 4 & 5 \\ 7 & 8 \end{bmatrix} \quad Y = \begin{bmatrix} 11 & 12 & 13 & 14 \\ 15 & 16 & 17 & 18 \end{bmatrix}$$

```
[11, 14, 17, 20]
[29, 38, 47, 56]
[33, 42, 51, 60]
```

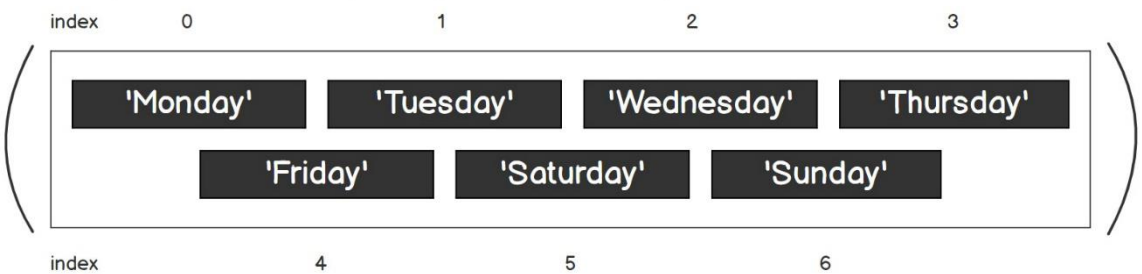
Key	Value
name	Jack Nelson
age	32
department	sales




```
{'title': 'The Godfather', 'director': 'Francis Ford Coppola', 'year': 1972, 'rating': 9.2,
'actors': ['Marlon Brando', 'Al Pacino', 'James Caan'], 'other_details': {'runtime': 175, 'la
nguage': 'English'}}
```

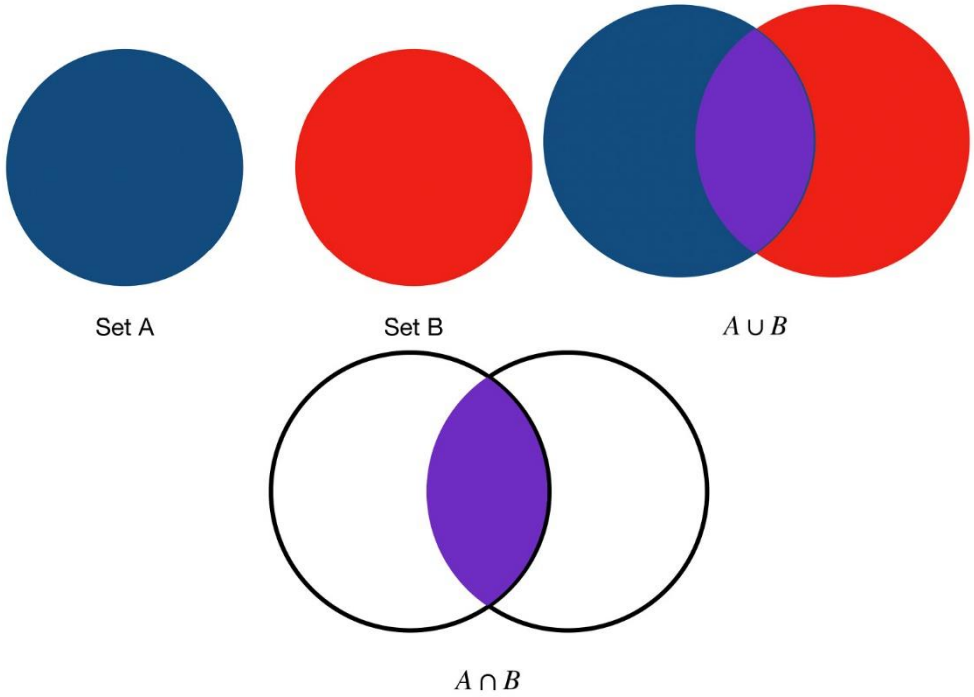
Name	Age	Department
John Mckee	38	Sales
Lisa Crawford	29	Marketing
Sujan Patel	33	HR

```
Name: Sujan Patel
Age: 33
Department: HR
--------------------
```



```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
<ipython-input-2-44651e94c673> in <module>
----> 1 t[2] = 'jazz'

TypeError: 'tuple' object does not support item assignment
```



Chapter 3: Executing Python – Programs, Algorithms, and Functions


```
Help on module my_module:

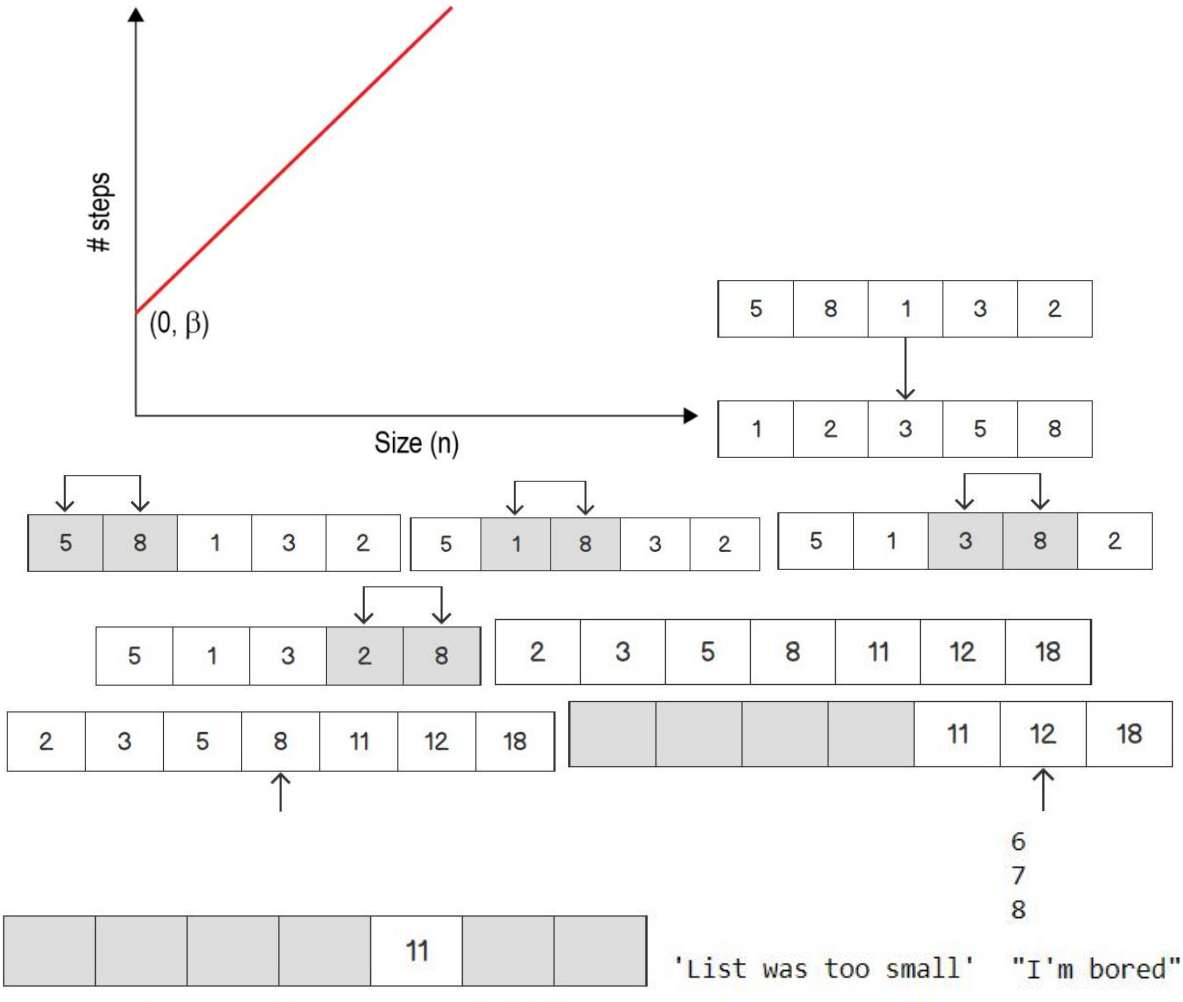
NAME
    my_module - This script computes the sum of the factorial of a list of numbers

FUNCTIONS
    factorial_sum(numbers)

FILE
    /Users/coreyjwade/my_module.py
```

```
' This script computes the sum of the factorial of a list of numbers'
```

```
(base) coreyjwade@Coreys-MacBook-Air-2 ~ % python today.py
2022-08-27
```




```
3       Stopping sum at 5 because we have previously compu
2       ted it
1
liftoff! 21
```

```
                            Stopping sum at 1000000 because we have previously
                            computed it
0.17615495599999775 seconds 3.6922999981925386e-05 seconds

500000500000                500000500000
```

```
2.4620000012021137e-06 seconds elapsed
6.030800000189629e-05 seconds elapsed
8.65640000000667e-05 seconds elapsed
0.00010789800000310379 seconds elapsed
0.00012594900000095777 seconds elapsed
0.0002756930000025193 seconds elapsed
0.00030112900000034415 seconds elapsed
0.00032656500000172173 seconds elapsed
0.0003499490000002936 seconds elapsed
0.00037087300000138157 seconds elapsed
0.0003934370000031606 seconds elapsed

100
```

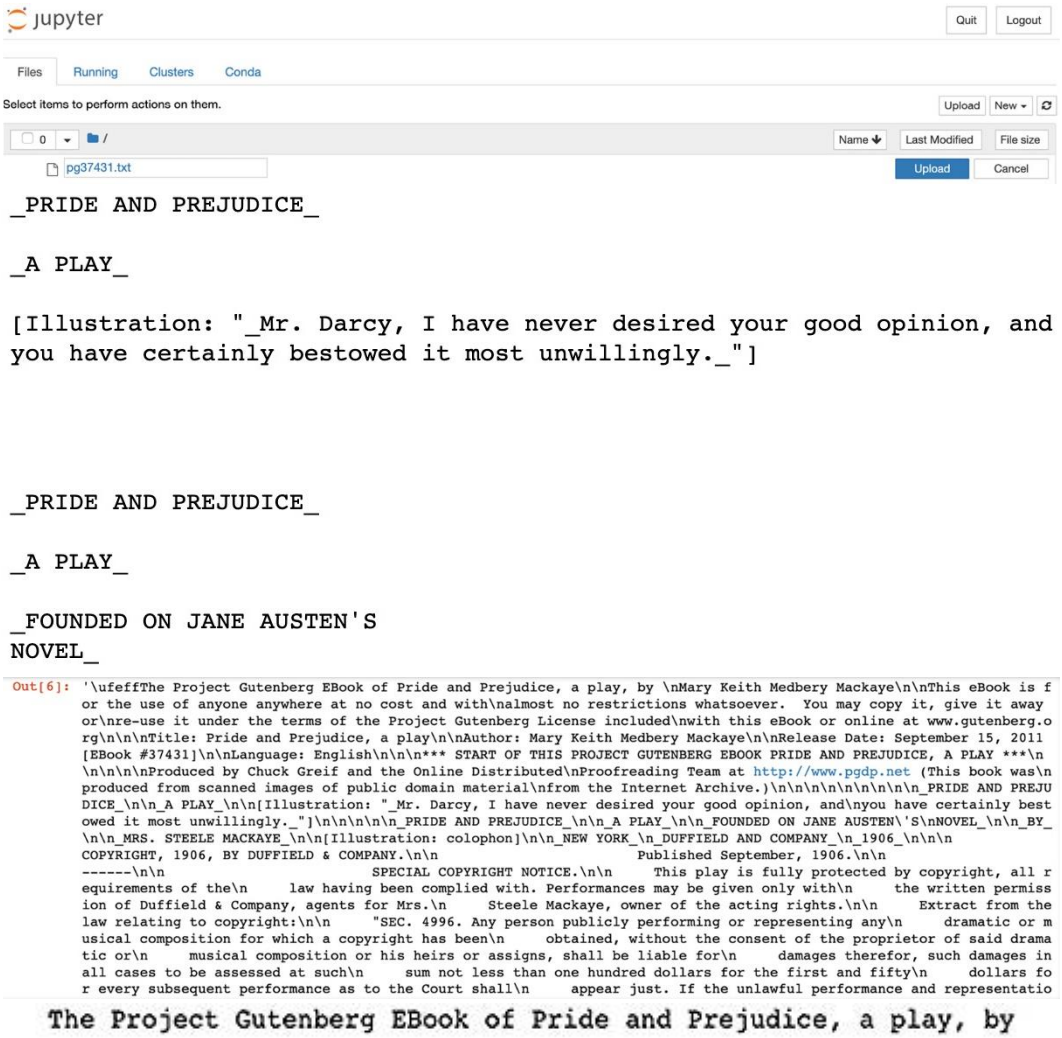
```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
<ipython-input-2-80d732a03aaf> in <module>
      4
      5 my_func()
----> 6 y

NameError: name 'y' is not defined
```

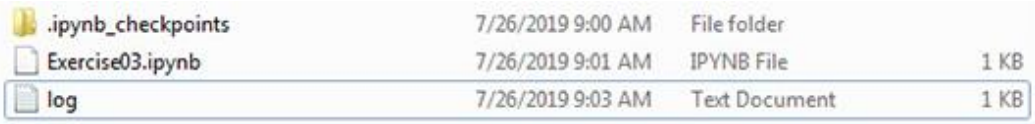
$$f(x) = \frac{1}{1 + e^{-x}}$$

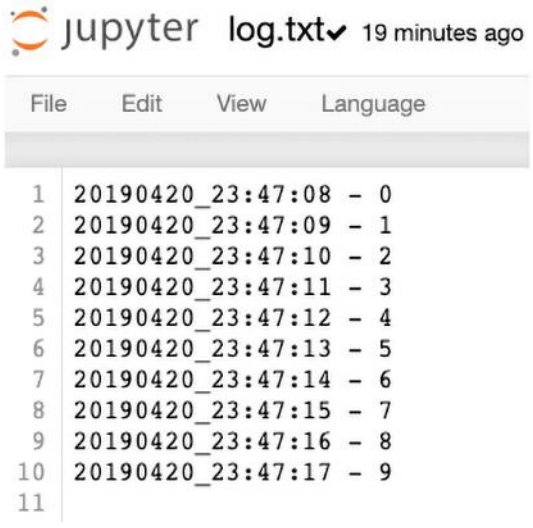
```
[0.04742587317756678,
 0.006692850924284855 4,
 0.7310585786300049,
 0.9820137900379085]    ['Jim', 'Kim']
['Ming', 'Boris', 'Andrew', 'Jennifer']
```

Chapter 4: Extending Python, Files, Errors, and Graphs



```
20220523_03:32:09 -  0
20220523_03:32:10 -  1
20220523_03:32:11 -  2
20220523_03:32:12 -  3
20220523_03:32:13 -  4
20220523_03:32:14 -  5
20220523_03:32:15 -  6
20220523_03:32:16 -  7
20220523_03:32:17 -  8
20220523_03:32:18 -  9
```





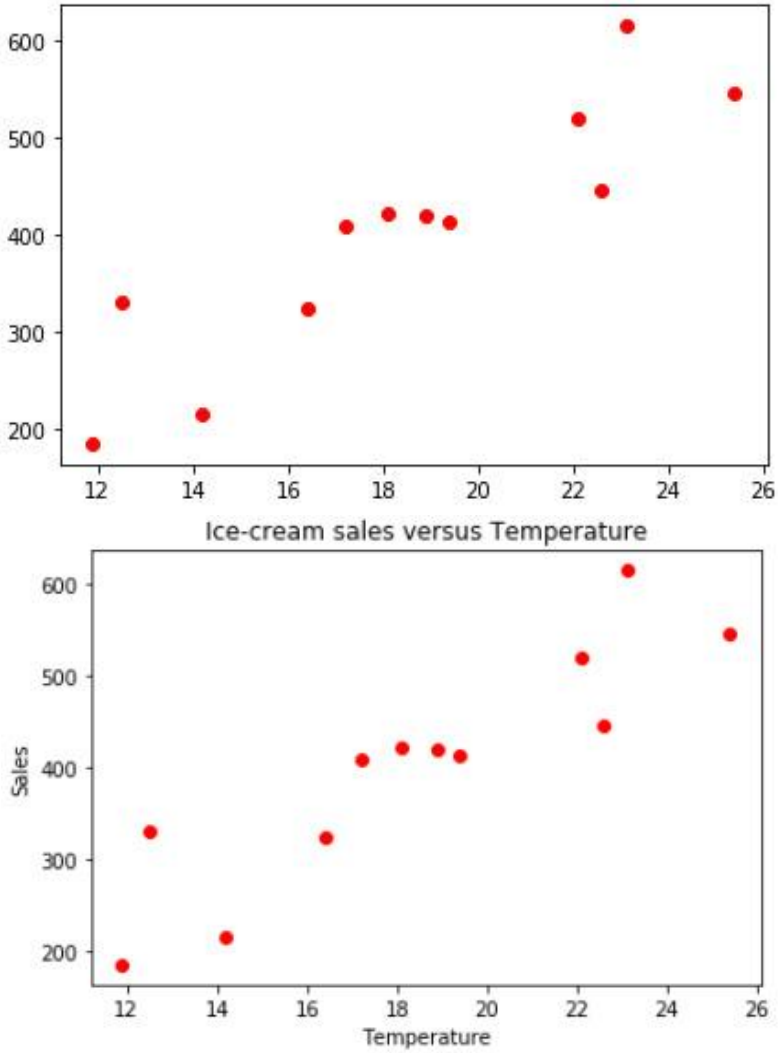

```
---------------------------------------------------------------------------
AssertionError                            Traceback (most recent call last)
<ipython-input-14-3a9a99a5e24a> in <module>
      1 x = 2
----> 2 assert x < 1, "Invalid value"

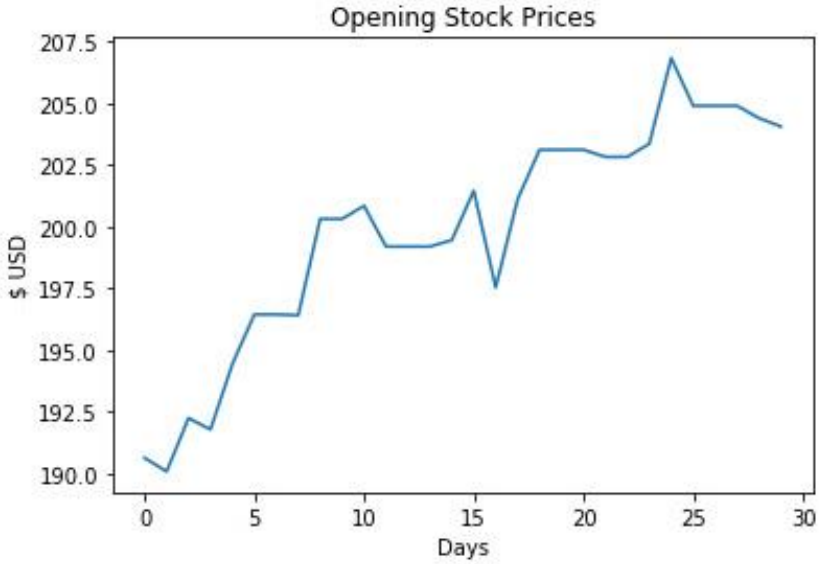
AssertionError: Invalid value
```

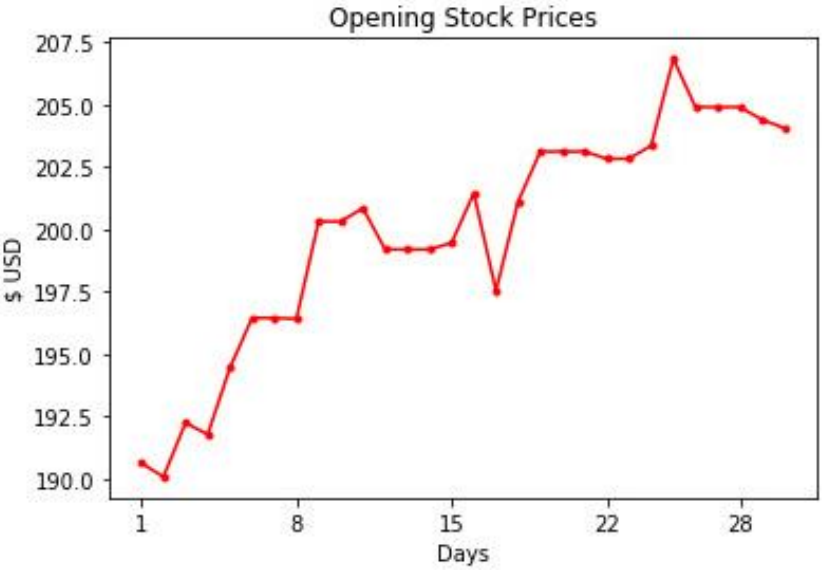
```
---------------------------------------------------------------------------
AssertionError                            Traceback (most recent call last)
<ipython-input-21-cec864bd4977> in <module>
      1 ranks = []
----> 2 print("Average of mark1:",avg(ranks))
      3

<ipython-input-18-5b6c83fe5ee4> in avg(marks)
      1 def avg(marks):
----> 2     assert len(marks) != 0
      3     return round(sum(marks)/len(marks), 2)

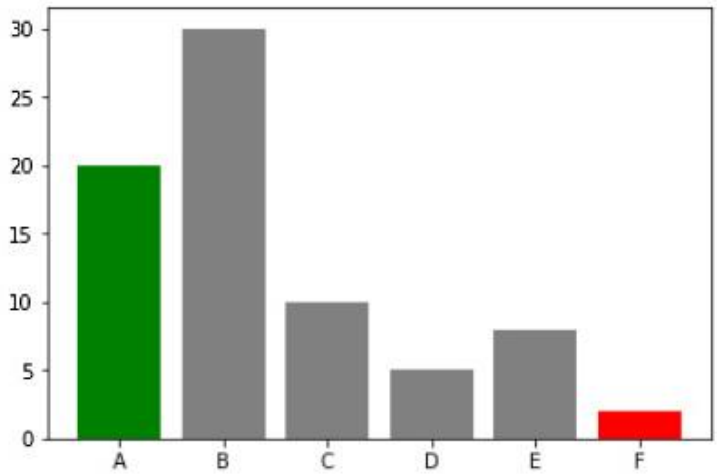
AssertionError:
```

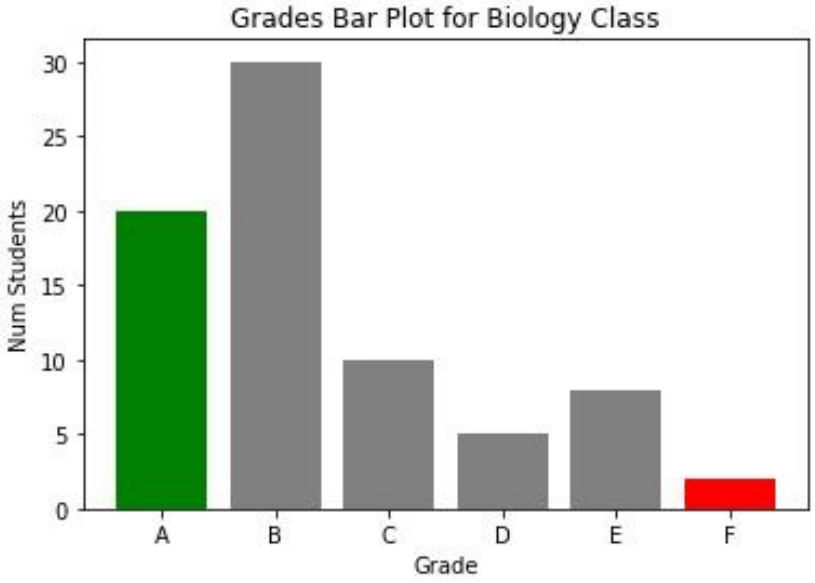


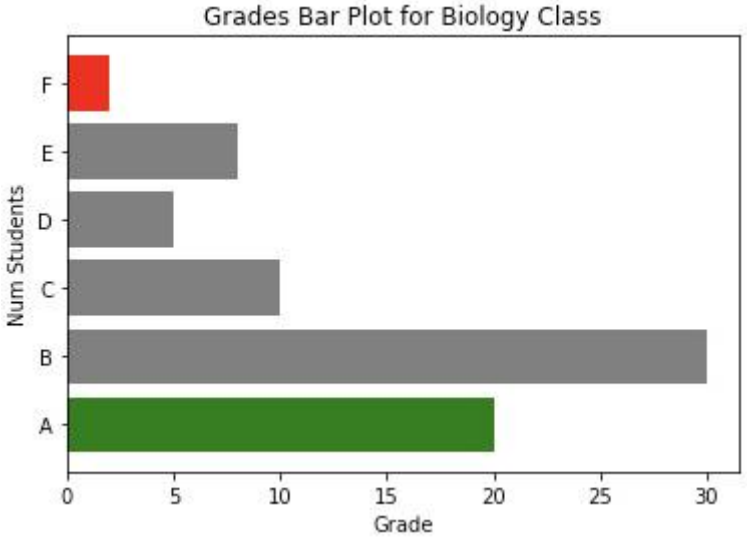


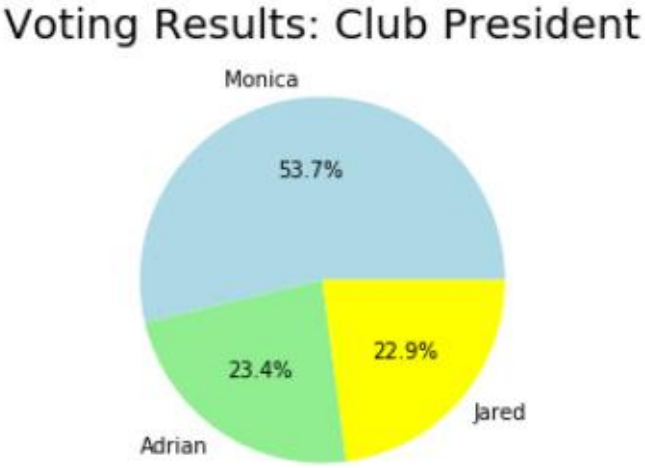


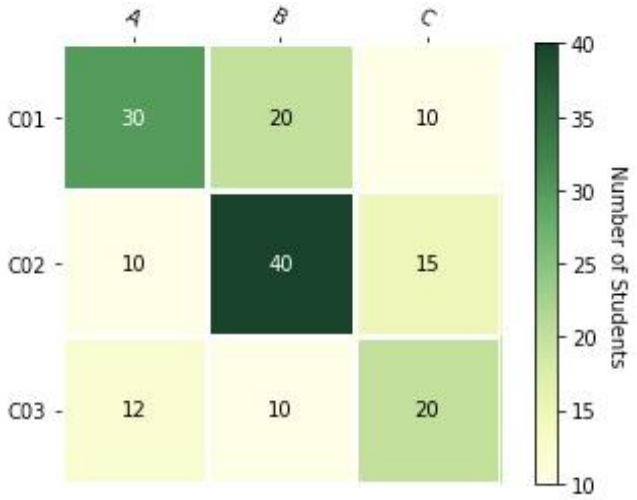

```
Out[5]: <BarContainer object of 6 artists>
```

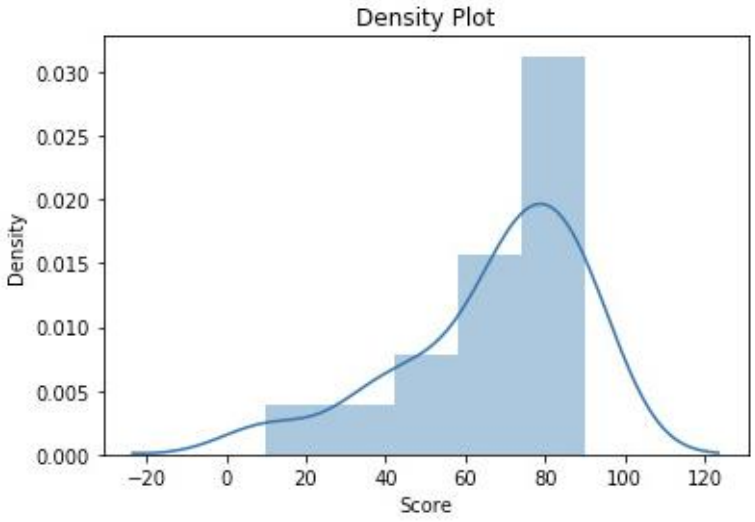


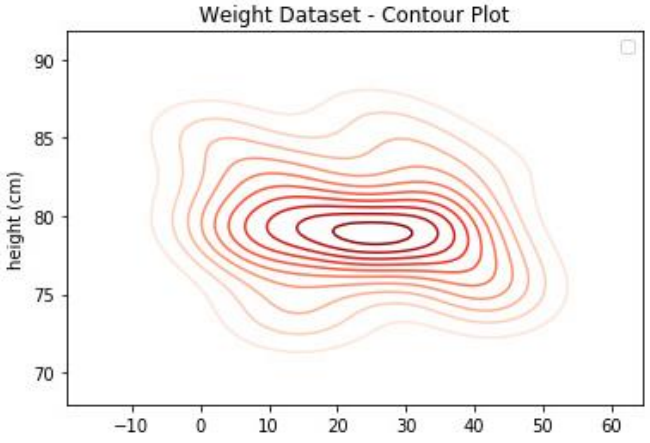

Grades Bar Plot for Biology Class
Num Students
30
25
20
15
10
5
0
A
B
C
D
E
F
Grade

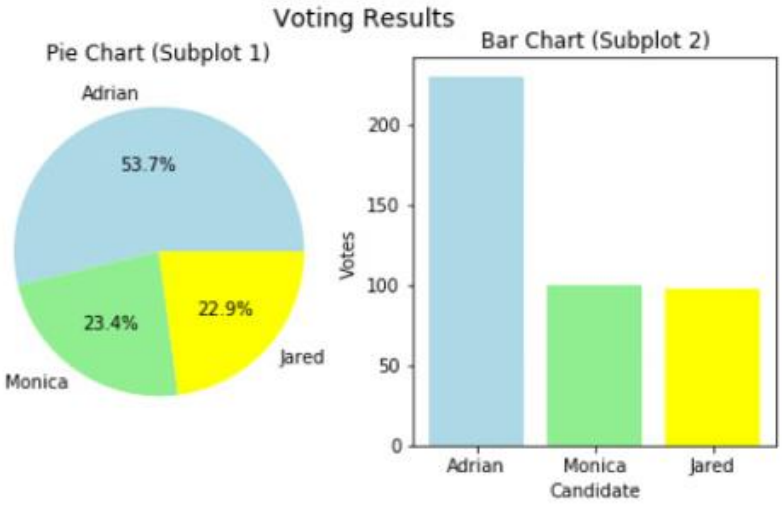

Grades Bar Plot for Biology Class
Num Students
F
E
D
C
B
A
0
5
10
15
20
25
30
Grade


Voting Results: Club President
Monica
53.7%
22.9%
23.4%
Jared
Adrian


A
B
C
C01
C02
C03
30
20
10
10
40
15
12
10
20
40
35
30
25
20
15
10
Number of Students


Density Plot
Density
0.030
0.025
0.020
0.015
0.010
0.005
0.000
−20
0
20
40
60
80
100
120
Score


Weight Dataset - Contour Plot
height (cm)
90
85
80
75
70
−10
0
10
20
30
40
50
60

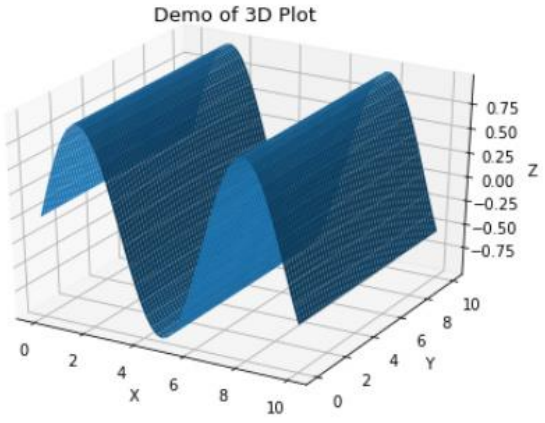


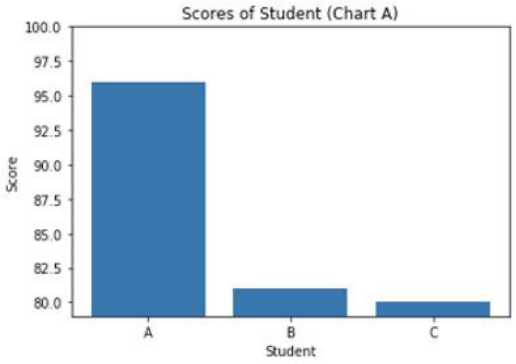
In [10]:
```
from mpl_toolkits.mplot3d import Axes3D
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
X = np.linspace(0, 10, 50)
Y = np.linspace(0, 10, 50)
X, Y = np.meshgrid(X, Y)
Z = (np.sin(X))

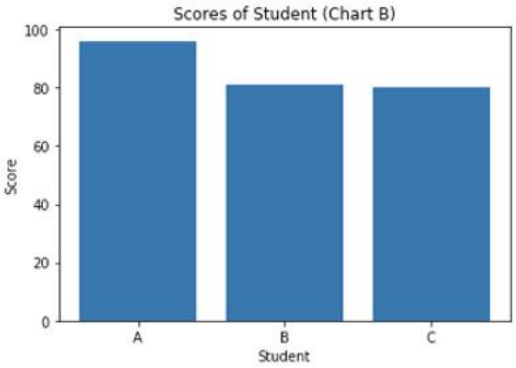
# Setup axis
fig = plt.figure(figsize=(7,5))
ax = fig.add_subplot(111, projection='3d')
ax.plot_surface(X, Y, Z)

# Add title and axes labels
ax.set_title("Demo of 3D Plot", size=13)
ax.set_xlabel('X')
ax.set_ylabel('Y')
ax.set_zlabel('Z')
```

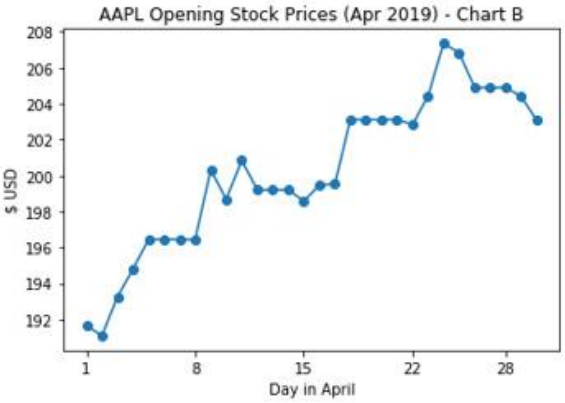
Out[10]:
```
Text(0.5, 0, 'Z')
```

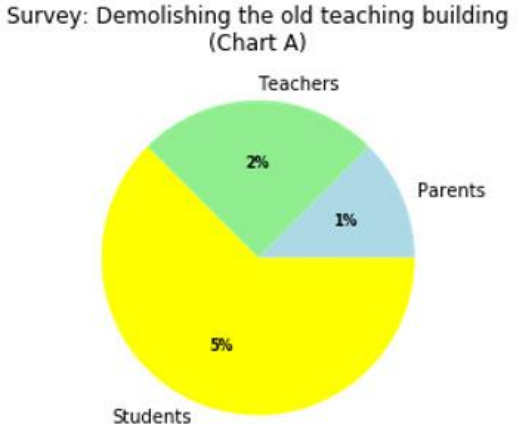


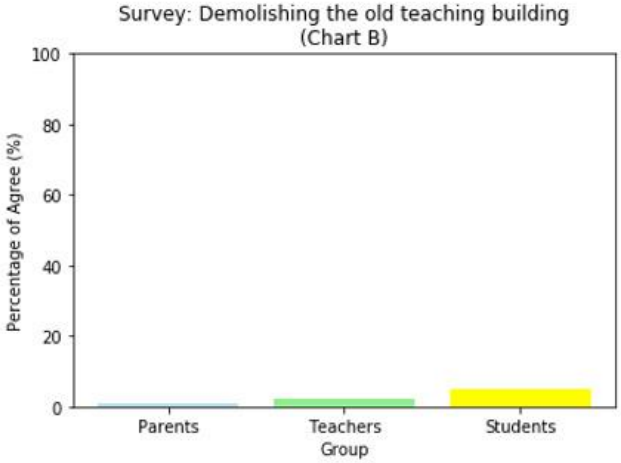

Scores of Student (Chart A)
Score
Student
A
B
C

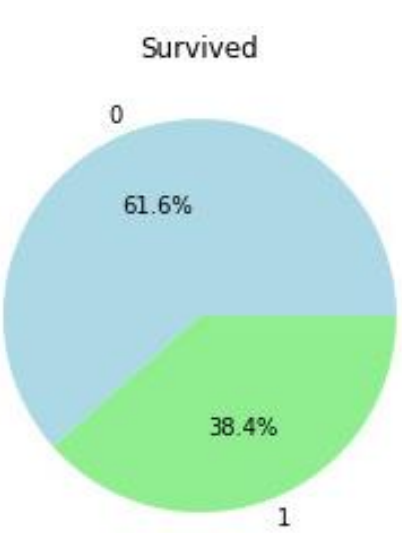

Scores of Student (Chart B)
Score
Student
A
B
C

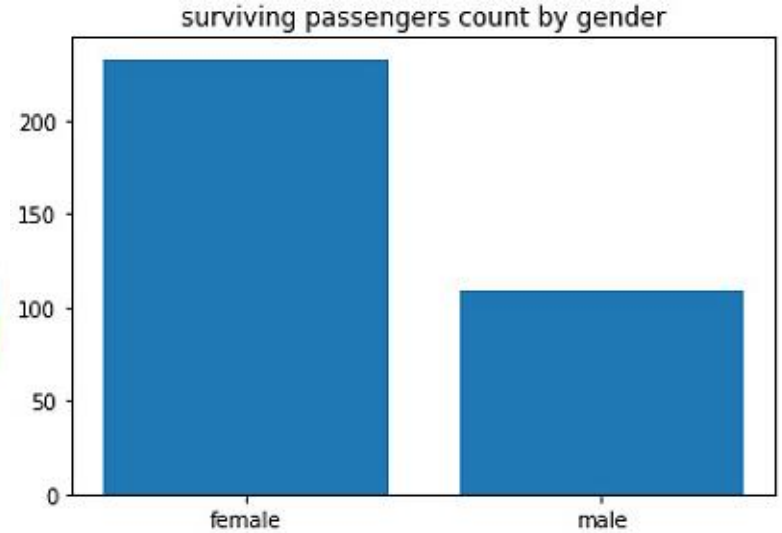

AAPL Opening Stock Prices (April 2019) - Chart A
$ USD
Day in April


AAPL Opening Stock Prices (Apr 2019) - Chart B
$ USD
Day in April


Survey: Demolishing the old teaching building
(Chart A)
Teachers
Parents
Students
2%
1%
5%


Survey: Demolishing the old teaching building
(Chart B)
Percentage of Agree (%)
Parents
Teachers
Students
Group


Survived
0
61.6%
38.4%
1


surviving passengers count by gender
female
male

Chapter 5: Constructing Python – Classes and Methods

```
str(object='') -> str
str(bytes_or_buffer[, encoding[, errors]]) -> str

Create a new string object from the given object. If encoding or
errors is specified, then the object must expose a data buffer
that will be decoded using the given encoding and error handler.
Otherwise, returns the result of object.__str__() (if defined)
or repr(object).
encoding defaults to sys.getdefaultencoding().
errors defaults to 'strict'.
```

```
['__repr__',
 '__hash__',
 '__str__',
 '__getattribute__',
 '__lt__',
 '__le__',
 '__eq__',
 '__ne__',
 '__gt__',
 '__ge__',
 '__iter__',
 '__mod__',
 '__rmod__',
 '__len__',
 '__getitem__',
 '__add__',
 '__mul__',
 '__rmul__',
 '__contains__',
 '__new__',
'encode',
'replace',
'split',
'rsplit',
'join',
'capitalize',
```

```
'Michael Smith'
```

```
A class to capture useful information regarding my pets, just incase
I lose track of them.
```

```
first_circle.color
```

```
'blue'
```

```
second_circle.color
```

```
'red'
```

```
first_circle.is_shape
```

```
True
```

```
{'name': 'United States of America',
 'population': None,
 'size_kmsq': 9800000.0}
```

def function_name (thing, thang = 4)

arg kwarg

$$Area = \pi * r^2$$

```
<__main__.Pet object at 0x0000018E1BBA5630> Rudolf (height: 40 cm)
```

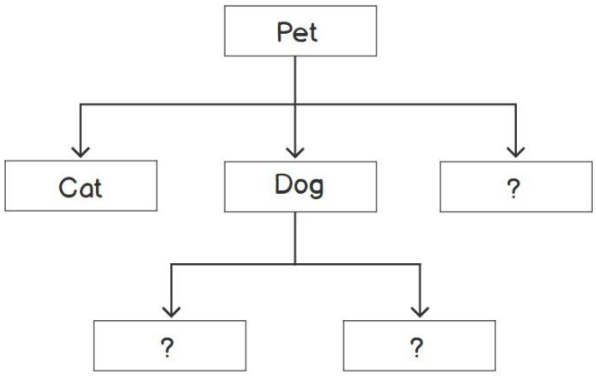
```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
<ipython-input-222-fef40f29f19e> in <module>
----> 1 customer.full_name = 'Mary Schmidt'

AttributeError: can't set attribute
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
<ipython-input-112-a59047203345> in <module>
      1 temp = Temperature(5)
----> 2 temp.fahrenheit = -500

<ipython-input-108-256b69371a35> in fahrenheit(self, value)
     10     def fahrenheit(self, value):
     11         if value < -460:
---> 12             raise ValueError('Temperatures less than -460F are not poss
ible')
     13         self.celcius = (value - 32) * 5 / 9

ValueError: Temperatures less than -460F are not possible
```




```
Blah blah blah            2020-01-10
Hello, my name is Thomas  2021-01-04
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
<ipython-input-146-9604ddbc3006> in <module>
      1 my_person = Person('Mary', 'Smith')
----> 2 my_person.full_name = 'Mary Anne Smith'

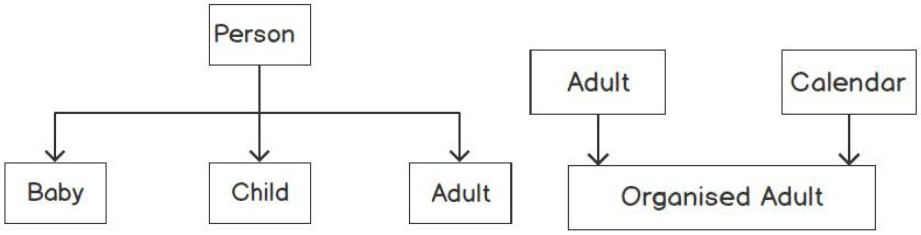
<ipython-input-142-a8f3417079a7> in full_name(self, name)
     10     @full_name.setter
     11     def full_name(self, name):
---> 12         first, last = name.split(' ')
     13         self.first_name = first
     14         self.last_name = last

ValueError: too many values to unpack (expected 2)
```

```
Hello, my name is John
It is a pleasure to meet you!
```

```
Hello, my name is John
It is a pleasure to meet you!
```

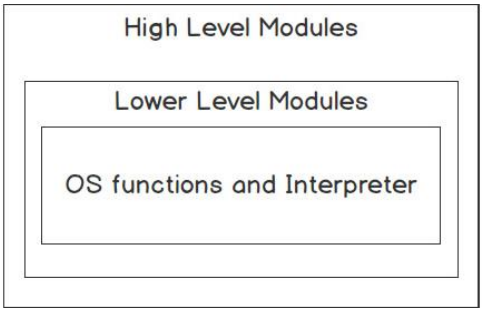
```
01-Jan-2018
03/03/2018
```

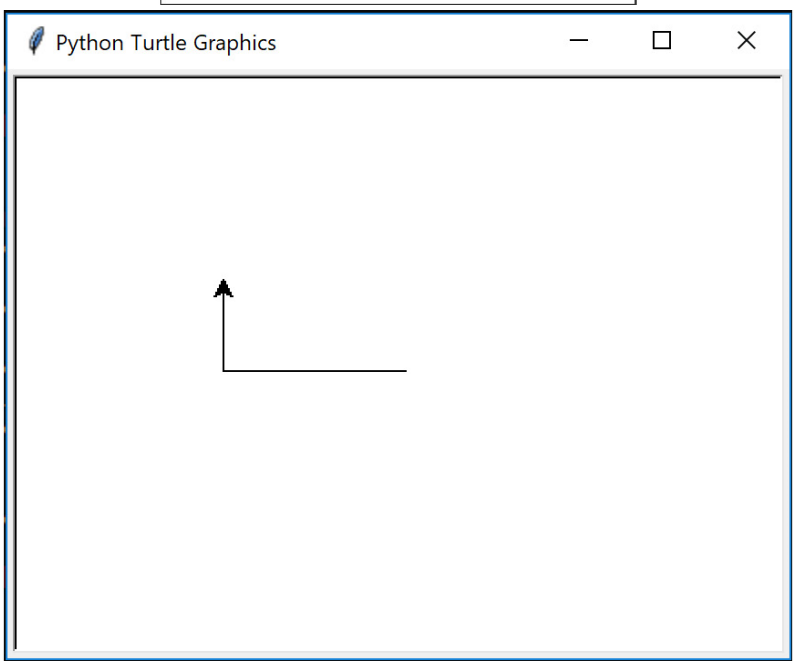



```
Hello, my name is Andres
Blah blah blah
Booking appointment for date 2018-01-01
```

```
Note that you are booking an appointment with a baby.
Booking appointment for date 2018-01-01
```

Chapter 6: The Standard Library






```
mcorcherojim at PF11AY8S in ~
$ python3.7 echo.py --help
usage: echo.py [-h] [-c] message

positional arguments:
  message           Message to be echoed

optional arguments:
  -h, --help        show this help message and exit
  -c, --capitalize
mcorcherojim at PF11AY8S in ~
$ python3.7 echo.py hello --capitalize
Hello
```

```
mariocj89 at DESKTOP-9B6VH3A in ~/workspace
$ python3.7 echo.py -h
usage: echo.py [-h] [-c] [--repeat REPEAT] message [message ...]

Prints out the words passed in, capitalizes them if required and repeat them
in as many lines as requested.

positional arguments:
  message           Messages to be echoed

optional arguments:
  -h, --help        show this help message and exit
  -c, --capitalize
  --repeat REPEAT
```

```
mariocj89 at DESKTOP-9B6VH3A in ~/workspace
$ python3.7 echo.py hello packt reader --repeat=3 -c
Hello Packt Reader
Hello Packt Reader
Hello Packt Reader
```

```
                    True
datetime.date(2019, 4, 20) False datetime.timedelta(days=1, seconds=1800)
  '2019-04-21T12:38:49.117769+00:00' 1970-01-01 00:00:00.000052+00:00

          datetime.date(2019, 1, 28),
          datetime.date(2019, 1, 29),  datetime.date(2019, 2, 1),
          datetime.date(2019, 1, 30),  datetime.date(2019, 2, 2),
          datetime.date(2019, 1, 31),  datetime.date(2019, 2, 3),
          datetime.date(2019, 2, 1),   datetime.date(2019, 2, 4),
          datetime.date(2019, 2, 2),   datetime.date(2019, 2, 5),
                                  Machine network name: PF11AY8S
        Process id: 13244         Python version: 3.7.0
        Parent process id: 8792   System: Windows
```

```
.
|___file_a.txt
|___folder_1
| |___file_b.txt
| |___file_c.py
|___folder_2
| |___folder_3
| | |___file_d.txt
```

```
      USERNAME environment variable: CorcheroMario

        *.txt: [WindowsPath('path-exercise/file_a.txt')]

        **/*.txt: [WindowsPath('path-exercise/file_a.txt'), WindowsP
        ath('path-exercise/folder_1/file_b.txt'), WindowsPath('path-
        exercise/folder_2/folder_3/file_d.txt')]

        */*: [WindowsPath('path-exercise/folder_1/file_b.txt'), Wind
        owsPath('path-exercise/folder_1/file_c.py'), WindowsPath('pa
        th-exercise/folder_2/folder_3')]

       Files in */*: [WindowsPath('path-exercise/folder_1/file_b.tx
       t'), WindowsPath('path-exercise/folder_1/file_c.py')]

    stdout:  b'subprocess-examples.ipynb\n' stdout:
    stderr:  b''                              subprocess-examples.ipynb
```

```
stdout:
 total 4
-rwxrwxrwx 1 mcorcherojim mcorcherojim 1957 Apr 19 17:14 subprocess-examples.ipynb
```

```
---------------------------------------------------------------------------
CalledProcessError                        Traceback (most recent call last)
<ipython-input-31-36d3d0f47957> in <module>()
----> 1 result = subprocess .run(["ls", "non_existing_file"], check=True)
      2 print("rc: ", result.returncode)

/usr/local/lib/python3.7/subprocess.py in run(input, capture_output, timeout, check, *popenargs, **kwargs)
    479         if check and retcode:
    480             raise CalledProcessError(retcode, process.args,
--> 481                                      output=stdout, stderr=stderr)
    482     return CompletedProcess(process.args, retcode, stdout, stderr)
    483

CalledProcessError: Command '['ls', 'non_existing_file']' returned non-zero exit status 2.
```

```
   SHELL_TITLE=PF11AY8S | Started: 2019-04-19T04:44:27 UTC
   TERM=xterm-color
   SHELL=/bin/bash
   HISTSIZE=100000
   SERVER=PF11AY8S
   DOCKER_HOST=localhost:2375                    SERVER=OTHER_SERVER
```

```
SHELL_TITLE=PF11AY8S | Started: 2019-04-19T04:44:27 UTC
TERM=xterm-color
SHELL=/bin/bash
HISTSIZE=100000
SERVER=OTHER_SERVER
DOCKER_HOST=localhost:2375
```

```
Logging at warning
Logging at error
Logging at fatal
```

```
0 errors reported in moon
1 errors reported in moon
2 errors reported in moon
```

```
ERROR:root:Something bad happened
Traceback (most recent call last):
  File "<ipython-input-8-adcdec9cc60b>", line 2, in <module>
    int("nope")
ValueError: invalid literal for int() with base 10: 'nope'
```

```
ERROR:root:Something bad happened
Traceback (most recent call last):
  File "<ipython-input-9-39a74a45c693>", line 2, in <module>
    int("nope")
ValueError: invalid literal for int() with base 10: 'nope'
```

```
ERROR:root:Something bad happened
Traceback (most recent call last):
  File "<ipython-input-18-997c7c2a8b8d>", line 5, in <module>
    d["missing_key"] += 1
KeyError: 'missing_key'
ERROR:root:Something bad happened: 'missing_key'
```

```
LETTER - 114
SMALL - 58
CAPITAL - 56
WITH - 55
SIGN - 21
```

```
QUESTION - 2
CIRCUMFLEX - 11
DIGIT - 10
PYTHON - 0
```

```
HR audit:
- Hired Sam
- Hired Tom

Finance audit:
- Used 1000£
```

```
INFO: Hello logging world
```

```
HR audit:
- Area created
- Hired Sam
- Hired Tom

Finance audit:
- Area created
- Used 1000£
```

```
As appetizers: Hummus.
As main: Pizza.
As dessert: Chocolate cake.
As drink: Water.
```

```
As appetizers: Hummus.
As main: Pizza.
As dessert: Chocolate cake.
As drink: Water.
As side: French fries.
```

```
As appetizers: Hummus.
As main: Pizza.
As dessert: Chocolate cake.
As drink: Red Wine.
```

```
As appetizers: Hummus.
As main: Pasta.
As dessert: Chocolate cake.
As drink: Water.
As side: French fries.
```

```
Heavy operation for 1
Func returned: 10
Heavy operation for 1
Func returned: 10
```

```
Heavy operation for 1
Func returned: 10
Heavy operation for 2
Func returned: 20
Heavy operation for 3
Func returned: 30
Heavy operation for 1
Func returned: 10
```

```
Heavy operation for 1
Func returned: 10
Heavy operation for 2
Func returned: 20
```

```
Heavy operation for 1
Cached func returned: 10
Cached func returned: 10
Heavy operation for 1
Func returned: 10
Heavy operation for 1
Func returned: 10
```

```
x: 1
y: 2
z: 3
```

```
x: 1     x: Wops
y: 2     y: 1
z: Wops  z: 2
```

```
Help on built-in function print in module builtins:

print(...)
    print(value, ..., sep=' ', end='\n', file=sys.stdout, flush=False)

    Prints the values to a stream, or to sys.stdout by default.
    Optional keyword arguments:
    file:  a file-like object (stream); defaults to the current sys.stdout.
    sep:   string inserted between values, default a space.
    end:   string appended after the last value, default a newline.
    flush: whether to forcibly flush the stream.
```

```
Hello stderr Hello stderr
```

Chapter 7: Becoming Pythonic

```
['spam', 'spamspam', 'spamspamspam', 'eggs', 'eggseggs', 'eggseggseggs', 'chips', 'chipschips', 'chipschipschips']
```

```
['spam', 'eggs', 'chips', 'spamspam', 'eggseggs', 'chipschips', 'spamspamspam', 'eggseggseggs', 'chipschipschips']
```

```
['Magnus Carlsen vs. Fabiano Caruana', 'Magnus Carlsen vs. Yifan Hou', 'Magnus Carlsen vs. Wenjun Ju', 'Fabiano Caruana vs. Magnus Carlsen', 'Fabiano Caruana vs. Yifan Hou', 'Fabiano Caruana vs. Wenjun Ju', 'Yifan Hou vs. Magnus Carlsen', 'Yifan Hou vs. Fabiano Caruana', 'Yifan Hou vs. Wenjun Ju', 'Wenjun Ju vs. Magnus Carlsen', 'Wenjun Ju vs. Fabiano Caruana', 'Wenjun Ju vs. Yifan Hou']
```

```
{'Eric': 4, 'Graham': 6, 'Terry': 5, 'John': 4}
```

```
{'Vivian': 70, 'Racheal': 82, 'Tom': 80, 'Adrian': 79}
```

```
---------------------------------------------------------------------------
KeyError                                  Traceback (most recent call last)
<ipython-input-1-63d140c09c07> in <module>
      1 john = { 'first_name': 'John', 'surname': 'Cleese' }
----> 2 john['middle_name']

KeyError: 'middle_name'
```

```
       What is your name?
       What is your quest?
       What is the average airspeed velocity of an unladen swallow?
```

```
[2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97]
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
<ipython-input-1-c81778c59ded> in <module>
----> 1 primes_under_five = iter(PrimesBelow(5))
      2 next(primes_under_five)
      3 2
      4 next(primes_under_five)
      5 3

NameError: name 'PrimesBelow' is not defined
```

```
---------------------------------------------------------------------------
KeyboardInterrupt                         Traceback (most recent call last)
<ipython-input-23-afd3c871a33d> in <module>()
----> 1 [p for p in Primes() if p < 100]

<ipython-input-23-afd3c871a33d> in <listcomp>(.0)
----> 1 [p for p in Primes() if p < 100]

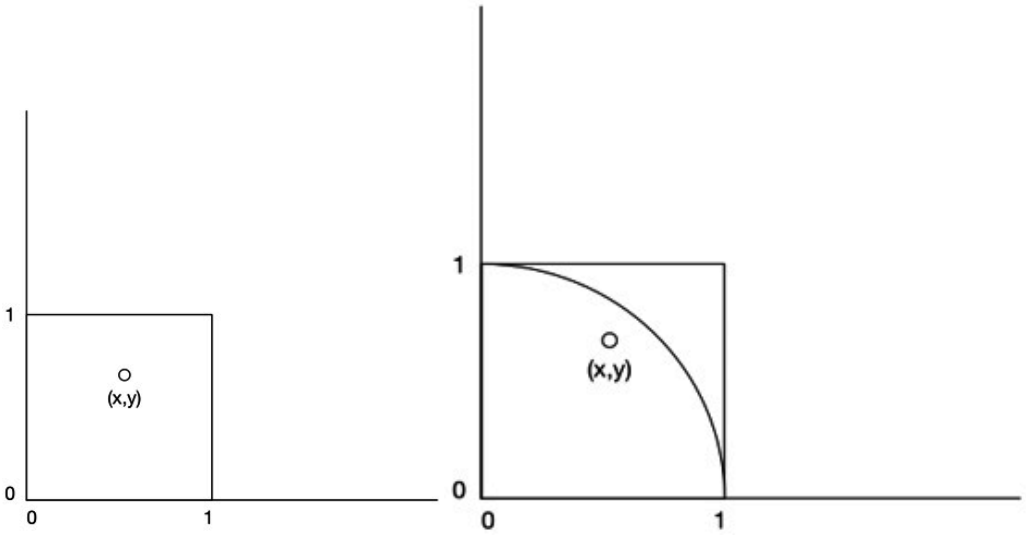
<ipython-input-22-c1ad65bf0095> in __next__(self)
     11             if square_root >= 2:
     12                 for i in range(2, square_root + 1):
---> 13                     if current % i == 0:
     14                         is_prime = False
     15                         break

KeyboardInterrupt:
```

```
[2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97]
```

```
['White', 'Black', 'White', 'Black', 'White', 'Black', 'White', 'Black', 'White', 'Black']
```

```
[2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97]
```




```
[3.236, 3.232, 3.2106666666666666, 3.206, 3.1824, 3.1633333333333336, 3.1582857142857144, 3.1645, 3.1577777777777776]
[0.0944073464102071, 0.09040734641020709, 0.0690740130768734 4, 0.06440734641020684, 0.04080734641020678, 0.021740679743540436, 0.016693060695921247, 0.022907346410206753, 0.016185124187984457]
```

```
<re.Match object; span=(35, 37), match='ff'>
```

```
The Norwegian Blue is a wonderful ex-parrot. This ex-parrot is notable for its exquisite plumage.
```

```
['Xander Harris', 'Amy Alexandrescu', 'Weifung Xu']
```

Chapter 8: Software Development

```
(Pdb) l
  9             # They are making enough already.
 10             return rise - 0.10
 11
 12
 13 B   def calculate_new_salary(salary, promised_pct, is_manager, is_good_year):
 14  ->     rise = promised_pct
 15
 16         # remove 10% if it was a bad year
 17         if not is_good_year:
 18             rise -= 0.01
 19         else:
```

```
(Pdb) args
salary = 1000000
promised_pct = 0.3
is_manager = True
is_good_year = True
```

Health?	Hungry?	Initial Basket	Output
True	False	-	['orange', 'apple', 'strawberry']
False	True	["tea"]	['tea', 'jam', 'sandwich']
True	True	-	['orange', 'apple', 'strawberry', 'strawberry', 'sandwich']

```
In [6]: print("First basket:", create_picnic_basket(True, False))

        First basket: ['orange', 'apple', 'strawberry']

In [7]: print("Second basket:", create_picnic_basket(False, True, ["tea"]))

        Second basket: ['tea', 'jam', 'sandwich']

In [8]: print("Third basket:", create_picnic_basket(True, True))

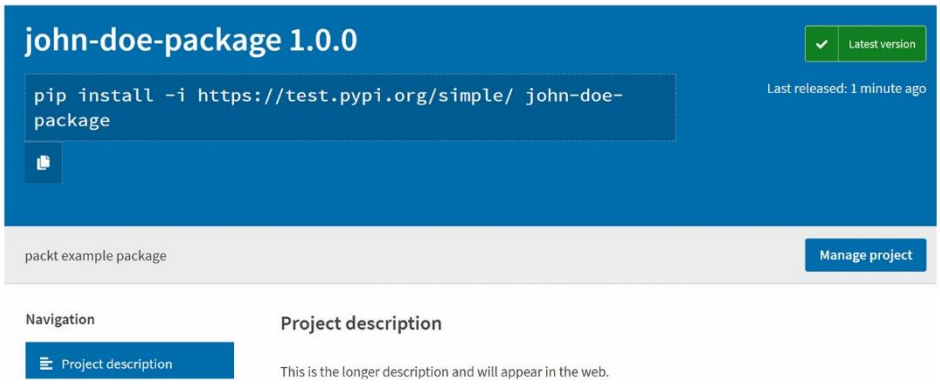
        Third basket: ['orange', 'apple', 'strawberry', 'sandwich']
```

```
test_divisible_numbers (__main__.TestIsDivisible) ... ok
test_not_divisible_numbers (__main__.TestIsDivisible) ... ok

----------------------------------------------------------------------
Ran 2 tests in 0.016s

OK
```

```
$ twine upload --repository-url=https://test.pypi.org/legacy/ dist/*
Uploading distributions to https://test.pypi.org/legacy/
Enter your username: mariocj89
Enter your password:
Uploading john_doe_package-1.0.0.tar.gz
100%|
```

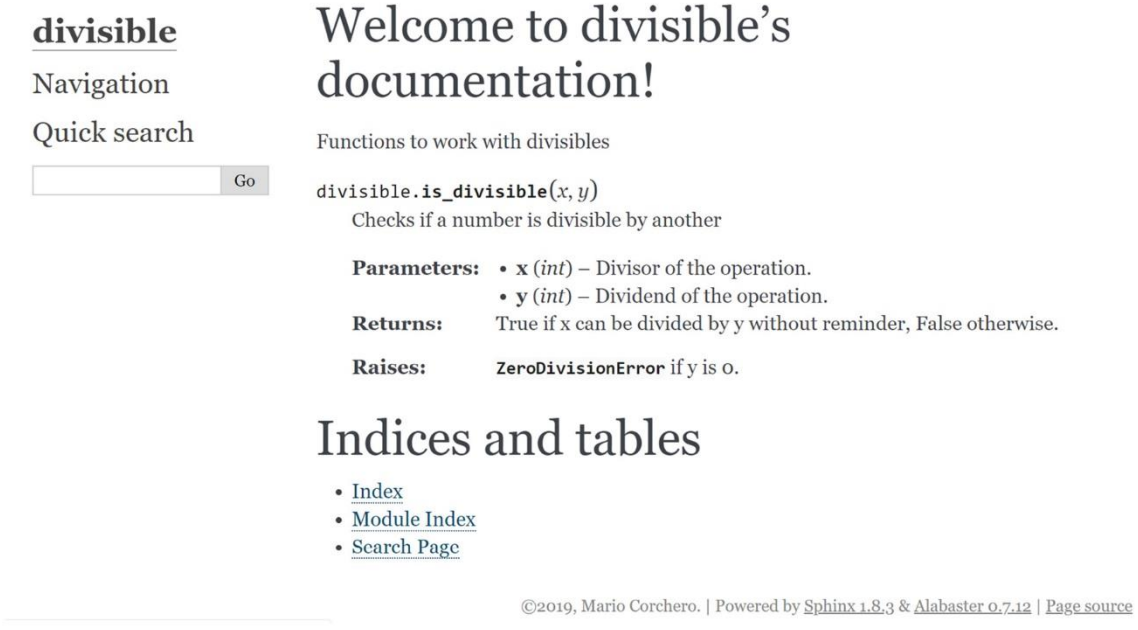


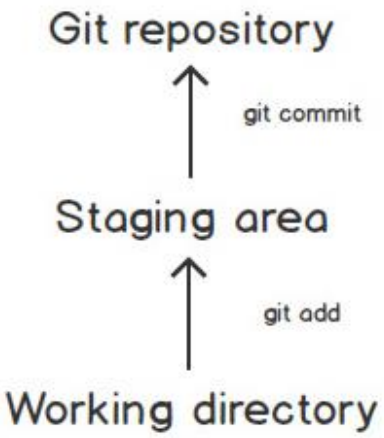

```
print(value, ..., sep=' ', end='\n', file=sys.stdout, flush=False)

Prints the values to a stream, or to sys.stdout by default.
Optional keyword arguments:
file:  a file-like object (stream); defaults to the current sys.stdout.
sep:   string inserted between values, default a space.
end:   string appended after the last value, default a newline.
flush: whether to forcibly flush the stream.
```

```
Help on function example in module __main__:

example()
    Prints the example text
```






```
$ git clone https://github.com/python/cpython.git
Cloning into 'cpython'...
remote: Enumerating objects: 1, done.
remote: Counting objects: 100% (1/1), done.
remote: Total 745673 (delta 0), reused 0 (delta 0), pack-reused 745672
Receiving objects: 100% (745673/745673), 277.17 MiB | 2.38 MiB/s, done.
Resolving deltas: 100% (599013/599013), done.
Checking connectivity... done.
Checking out files: 100% (4134/4134), done.
```

```
$ git status
On branch master
Your branch is up-to-date with 'origin/master'.
Changes not staged for commit:
  (use "git add <file>..." to update what will be committed)
  (use "git checkout -- <file>..." to discard changes in working directory)

        modified:   Misc/ACKS

no changes added to commit (use "git add" and/or "git commit -a")
```

```
$ git diff
diff --git a/Misc/ACKS b/Misc/ACKS
index ec5b017..f38f40b 100644
--- a/Misc/ACKS
+++ b/Misc/ACKS
@@ -326,6 +326,7 @@ David M. Cooke
 Jason R. Coombs
 Garrett Cooper
 Greg Copeland
+Mario Corchero
 Ian Cordasco
 Aldo Cortesi
 Mircea Cosbuc
```

```
Add Mario Corchero to Misc/ACKS file

Adds my name as I am experimenting how to user git.
# Please enter the commit message for your changes. Lines starting
# with '#' will be ignored, and an empty message aborts the commit.
# On branch master
# Your branch is up-to-date with 'origin/master'.
#
# Changes to be committed:
#       modified:   Misc/ACKS
#
```

```
$ git commit
[master 6bdb37c] Add Mario Corchero to Misc/ACKS file
 1 file changed, 1 insertion(+)
```

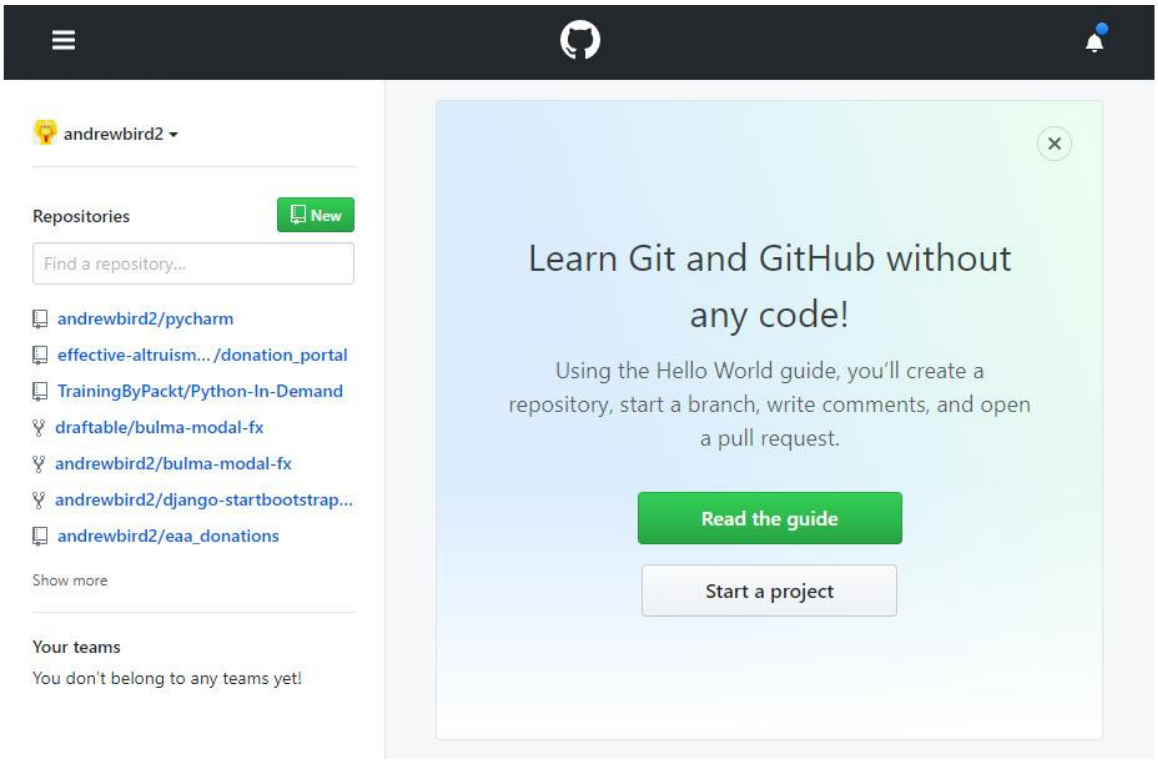
```
$ git show
commit 6bdb37c2ec16bc7a8a3fd518754518e76b8b12d1
Author: Mario Corchero <mariocj89@gmail.com>
Date:   Tue May 14 22:11:40 2019 +0100

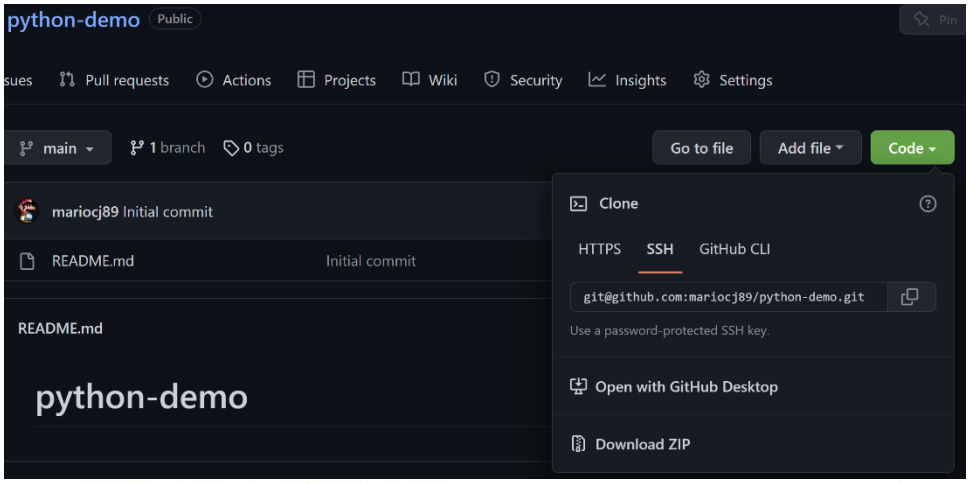
    Add Mario Corchero to Misc/ACKS file

    Adds my name as I am experimenting how to user git.

diff --git a/Misc/ACKS b/Misc/ACKS
index ec5b017..f38f40b 100644
--- a/Misc/ACKS
+++ b/Misc/ACKS
@@ -326,6 +326,7 @@ David M. Cooke
 Jason R. Coombs
 Garrett Cooper
 Greg Copeland
+Mario Corchero
 Ian Cordasco
 Aldo Cortesi
 Mircea Cosbuc
```

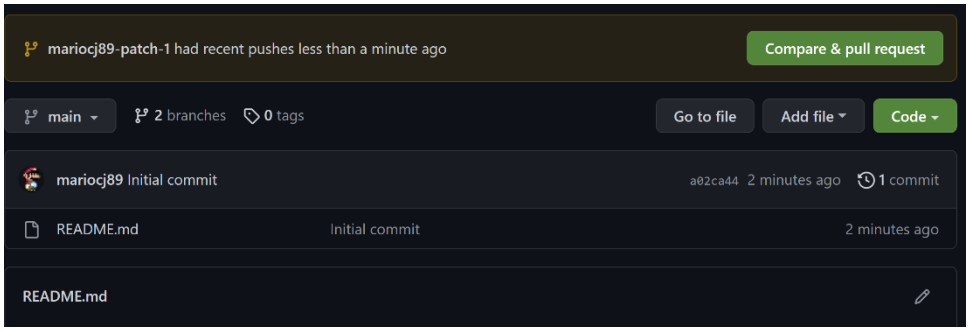
Chapter 9: Practical Python - Advance Topics





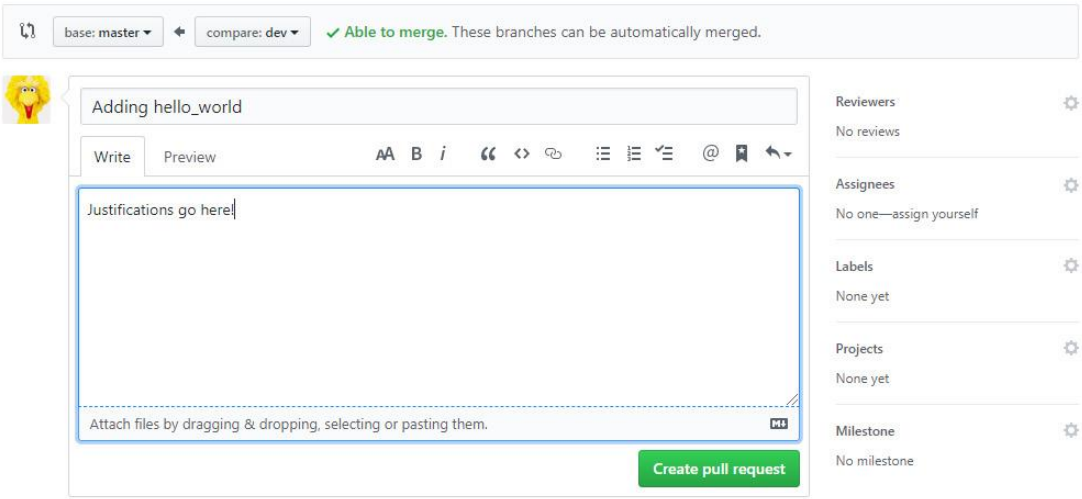

```
Enumerating objects: 3, done.
Counting objects: 100% (3/3), done.
Writing objects: 100% (3/3), 223 bytes | 111.00 KiB/s, done.
Total 3 (delta 0), reused 0 (delta 0)
To github.com:andrewbird2/python-demo.git
 * [new branch]      master -> master
```

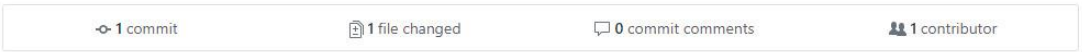
```
(base) C:\Users\andrew.bird\python-demo>git checkout -b dev
Switched to a new branch 'dev'
```

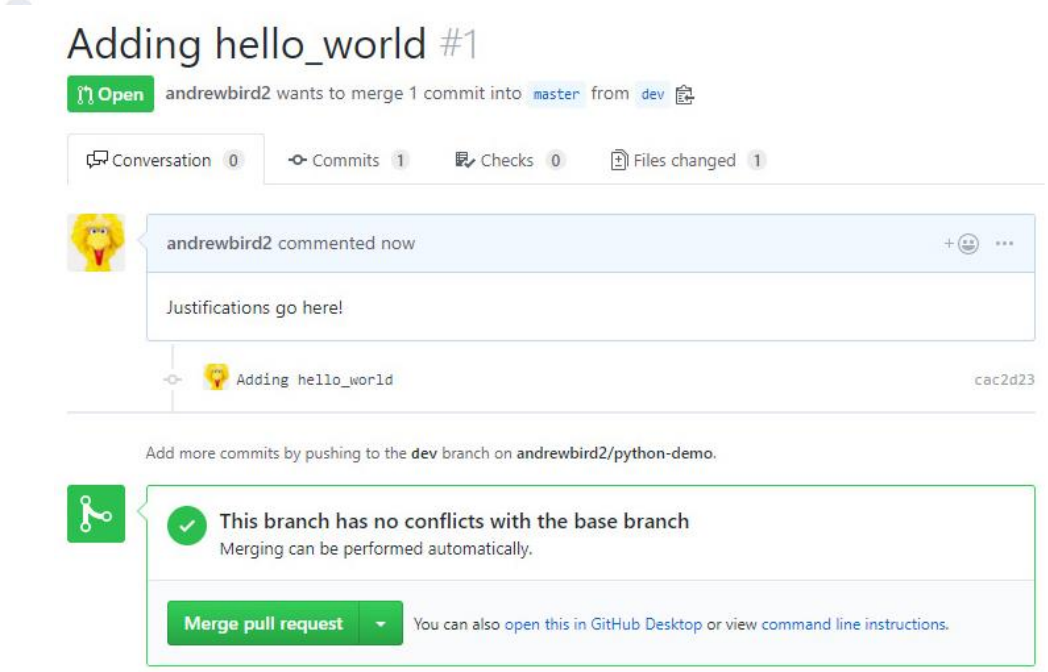


Open a pull request

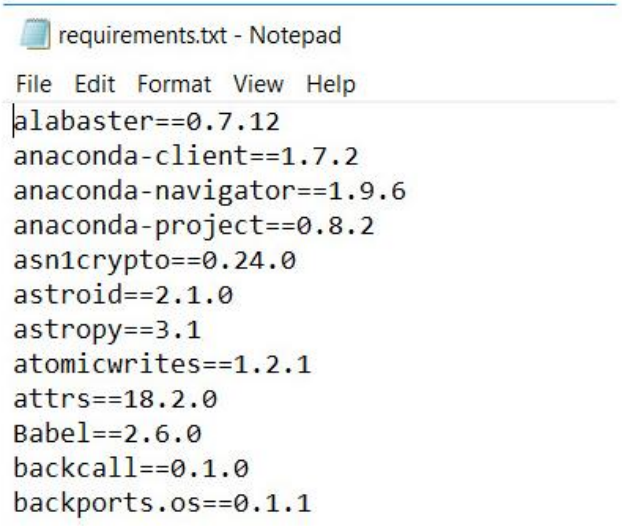
Create a new pull request by comparing changes across two branches. If you need to, you can also compare across forks.







```
(base) C:\Users\andrew.bird\Python-In-Demand>pip freeze
alabaster==0.7.12
anaconda-client==1.7.2
anaconda-navigator==1.9.6
anaconda-project==0.8.2
asn1crypto==0.24.0
astroid==2.1.0
astropy==3.1
atomicwrites==1.2.1
attrs==18.2.0
Babel==2.6.0
backcall==0.1.0
backports.os==0.1.1
```




```
(base) C:\Users\andrew.bird>conda create -n example_env numpy
Solving environment: done


==> WARNING: A newer version of conda exists. <==
  current version: 4.5.12
  latest version: 4.7.10

Please update conda by running

    $ conda update -n base -c defaults conda



## Package Plan ##

  environment location: C:\Users\andrew.bird\AppData\Local\conda\conda\envs\example_env

  added / updated specs:
    - numpy


The following packages will be downloaded:
```

```
(example_env) C:\Users\andrew.bird>conda install pandas
Solving environment: done


==> WARNING: A newer version of conda exists. <==
  current version: 4.5.12
  latest version: 4.7.10

Please update conda by running

    $ conda update -n base -c defaults conda



## Package Plan ##

  environment location: C:\Users\andrew.bird\AppData\Local\conda\conda\envs\example_env

  added / updated specs:
    - pandas


The following packages will be downloaded:
```

```
(base) C:\Users\andrew.bird\Python-In-Demand>
(base) C:\Users\andrew.bird\Python-In-Demand>docker run hello-world

Hello from Docker!
This message shows that your installation appears to be working correctly.

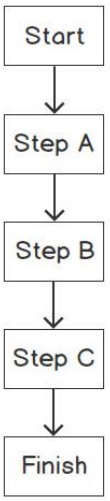
To generate this message, Docker took the following steps:
 1. The Docker client contacted the Docker daemon.
 2. The Docker daemon pulled the "hello-world" image from the Docker Hub.
    (amd64)
 3. The Docker daemon created a new container from that image which runs the
    executable that produces the output you are currently reading.
 4. The Docker daemon streamed that output to the Docker client, which sent it
    to your terminal.

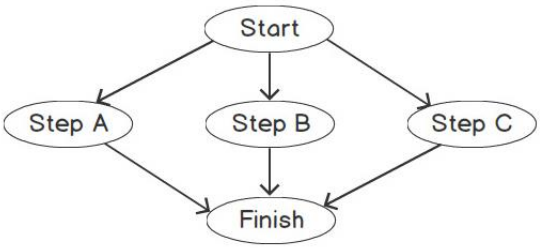
To try something more ambitious, you can run an Ubuntu container with:
 $ docker run -it ubuntu bash

Share images, automate workflows, and more with a free Docker ID:
 https://hub.docker.com/

For more examples and ideas, visit:
 https://docs.docker.com/get-started/
```

```
(base) C:\Users\andrew.bird\Python-In-Demand\Lesson09\fizzbuzz_docker>docker run testapp
1
2
Fizz
4
Buzz
Fizz
7
8
Fizz
Buzz
```






```
0 squared is 0
1 squared is 1
2 squared is 4
3 squared is 9
4 squared is 16
5 squared is 25
6 squared is 36
7 squared is 49
8 squared is 64
9 squared is 81
```

```
(base) C:\Users\andrew.bird\Python-In-Demand\Lesson09>python multi_processing.py
0 squared is 0
1 squared is 1
2 squared is 4
3 squared is 9
4 squared is 16
5 squared is 25
6 squared is 36
7 squared is 49
8 squared is 64
9 squared is 81

(base) C:\Users\andrew.bird\Python-In-Demand\Lesson09>
```

```
0 squared is 0
1 squared is 1
2 squared is 4
3 squared is 9
4 squared is 16
5 squared is 25
6 squared is 36
7 squared is 49
8 squared is 64
9 squared is 81
```

```
(base) C:\Users\andrew.bird\Python-In-Demand\Lesson09>python argparse_demo.py
The flag's value is False
```

```
(base) C:\Users\andrew.bird\Python-In-Demand\Lesson09>python argparse_demo.py --flag
The flag's value is True

(base) C:\Users\andrew.bird\Python-In-Demand\Lesson09>
```

```
(base) C:\Users\andrew.bird\Python-In-Demand\Lesson09>python argparse_demo.py --help
usage: argparse_demo.py [-h] [--flag]

Interpret a Boolean flag.

optional arguments:
  -h, --help  show this help message and exit
  --flag      Set the flag value to True.
```

```
(base) C:\Users\andrew.bird\Python-In-Demand\Lesson09>python positional_args.py
usage: positional_args.py [-h] source dest
positional_args.py: error: the following arguments are required: source, dest
```

```
(base) C:\Users\andrew.bird\Python-In-Demand\Lesson09>python positional_args.py Chichester Battersea
Picasso will cycle from Chichester to Battersea
```

```
(base) C:\Users\andrew.bird\Python-In-Demand\Lesson09>python eratosthenes.py
17.597791835
```

```
         2466 function calls in 0.021 seconds

   Ordered by: standard name

   ncalls  tottime  percall  cumtime  percall filename:lineno(function)
        1    0.000    0.000    0.000    0.000 <ipython-input-1-5aedc56b5f71>:2(__init__)
        1    0.000    0.000    0.000    0.000 <ipython-input-1-5aedc56b5f71>:4(__iter__)
     1230    0.020    0.000    0.020    0.000 <ipython-input-1-5aedc56b5f71>:6(__next__)
     1230    0.000    0.000    0.000    0.000 <string>:1(<lambda>)
        1    0.001    0.001    0.021    0.021 <string>:1(<listcomp>)
        1    0.000    0.000    0.021    0.021 <string>:1(<module>)
        1    0.000    0.000    0.021    0.021 {built-in method builtins.exec}
        1    0.000    0.000    0.000    0.000 {method 'disable' of '_lsprof.Profiler' objects}
```

```
       23708 function calls in 0.468 seconds

 Ordered by: standard name

 ncalls  tottime  percall  cumtime  percall filename:lineno(function)
  10006    0.455    0.000    0.455    0.000 <ipython-input-2-c6ffd796f813>:10(<listcomp>)
      1    0.000    0.000    0.000    0.000 <ipython-input-2-c6ffd796f813>:2(__init__)
      1    0.000    0.000    0.000    0.000 <ipython-input-2-c6ffd796f813>:5(__iter__)
   1230    0.011    0.000    0.466    0.000 <ipython-input-2-c6ffd796f813>:7(__next__)
   1230    0.000    0.000    0.000    0.000 <string>:1(<lambda>)
      1    0.001    0.001    0.468    0.468 <string>:1(<listcomp>)
      1    0.000    0.000    0.468    0.468 <string>:1(<module>)
      1    0.000    0.000    0.468    0.468 {built-in method builtins.exec}
  10006    0.001    0.000    0.001    0.000 {built-in method builtins.len}
   1230    0.000    0.000    0.000    0.000 {method 'append' of 'list' objects}
      1    0.000    0.000    0.000    0.000 {method 'disable' of '_lsprof.Profiler' objects}
```

```
       291158 function calls in 0.102 seconds

 Ordered by: standard name

 ncalls  tottime  percall  cumtime  percall filename:lineno(function)
 267345    0.023    0.000    0.023    0.000 <ipython-input-3-10d4133c7618>:11(<lambda>)
  10006    0.058    0.000    0.081    0.000 <ipython-input-3-10d4133c7618>:12(<listcomp>)
      1    0.000    0.000    0.000    0.000 <ipython-input-3-10d4133c7618>:2(__init__)
      1    0.000    0.000    0.000    0.000 <ipython-input-3-10d4133c7618>:5(__iter__)
   1265    0.018    0.000    0.100    0.000 <ipython-input-3-10d4133c7618>:7(__next__)
   1265    0.000    0.000    0.000    0.000 <string>:1(<lambda>)
      1    0.001    0.001    0.102    0.102 <string>:1(<listcomp>)
      1    0.000    0.000    0.102    0.102 <string>:1(<module>)
      1    0.000    0.000    0.102    0.102 {built-in method builtins.exec}
  10006    0.001    0.000    0.001    0.000 {built-in method builtins.len}
   1265    0.000    0.000    0.000    0.000 {method 'append' of 'list' objects}
      1    0.000    0.000    0.000    0.000 {method 'disable' of '_lsprof.Profiler' objects}
```

```
      64802 function calls in 0.033 seconds

Ordered by: standard name

ncalls  tottime  percall  cumtime  percall filename:lineno(function)
 61001    0.007    0.000    0.007    0.000 <ipython-input-4-4f9e19e7ebde>:11(<lambda>)
     1    0.000    0.000    0.000    0.000 <ipython-input-4-4f9e19e7ebde>:2(__init__)
     1    0.000    0.000    0.000    0.000 <ipython-input-4-4f9e19e7ebde>:5(__iter__)
  1265    0.024    0.000    0.032    0.000 <ipython-input-4-4f9e19e7ebde>:7(__next__)
  1265    0.000    0.000    0.000    0.000 <string>:1(<lambda>)
     1    0.001    0.001    0.033    0.033 <string>:1(<listcomp>)
     1    0.000    0.000    0.033    0.033 <string>:1(<module>)
     1    0.000    0.000    0.033    0.033 {built-in method builtins.exec}
  1265    0.000    0.000    0.000    0.000 {method 'append' of 'list' objects}
     1    0.000    0.000    0.000    0.000 {method 'disable' of '_lsprof.Profiler' objects}


      1329166 function calls in 147.528 seconds

Ordered by: standard name

ncalls  tottime  percall  cumtime  percall filename:lineno(function)
     1    0.000    0.000    0.000    0.000 <ipython-input-1-5aedc56b5f71>:2(__init__)
     1    0.000    0.000    0.000    0.000 <ipython-input-1-5aedc56b5f71>:4(__iter__)
664580  146.901    0.000  146.901    0.000 <ipython-input-1-5aedc56b5f71>:6(__next__)
664580    0.101    0.000    0.101    0.000 <string>:1(<lambda>)
     1    0.514    0.514  147.516  147.516 <string>:1(<listcomp>)
     1    0.011    0.011  147.528  147.528 <string>:1(<module>)
     1    0.000    0.000  147.528  147.528 {built-in method builtins.exec}
     1    0.000    0.000    0.000    0.000 {method 'disable' of '_lsprof.Profiler' objects}


        317503134 function calls in 106.236 seconds

   Ordered by: standard name

   ncalls  tottime  percall  cumtime  percall filename:lineno(function)
315507795   24.815    0.000   24.815    0.000 <ipython-input-4-4f9e19e7ebde>:11(<lambda>)
        1    0.000    0.000    0.000    0.000 <ipython-input-4-4f9e19e7ebde>:2(__init__)
        1    0.000    0.000    0.000    0.000 <ipython-input-4-4f9e19e7ebde>:5(__iter__)
   665111   80.611    0.000  105.523    0.000 <ipython-input-4-4f9e19e7ebde>:7(__next__)
   665111    0.114    0.000    0.114    0.000 <string>:1(<lambda>)
        1    0.583    0.583  106.221  106.221 <string>:1(<listcomp>)
        1    0.015    0.015  106.236  106.236 <string>:1(<module>)
        1    0.000    0.000  106.236  106.236 {built-in method builtins.exec}
   665111    0.097    0.000    0.097    0.000 {method 'append' of 'list' objects}
        1    0.000    0.000    0.000    0.000 {method 'disable' of '_lsprof.Profiler' objects}

          []
          [0.78155881]
          [0.61671875 0.96379795]
          [0.52748128 0.69182391 0.11764897]
          [0.89243527 0.75566451 0.88089298 0.15782374]
          [0.1140009  0.25980504 0.88632411 0.08730527 0.17493792]
          [0.41370041 0.01167654 0.60758276 0.73804504 0.73648781 0.29094613
          [0.8317736  0.57914287 0.01291246 0.61011878 0.91729392 0.50898183
           0.24640681]
          [0.4475645  0.94036652 0.69823962 0.37459892 0.15512432 0.15115215
           0.65882522 0.77908825]
          [0.42420881 0.7135031  0.22843178 0.20624473 0.32533328 0.86108686
           0.46407033 0.81794371 0.98958707]
```

Chapter 10: Data Analytics with pandas and NumPy

$$\begin{bmatrix} 9 & 13 & 5 & 2 \\ 1 & 11 & 7 & 6 \\ 3 & 7 & 4 & 1 \\ 6 & 0 & 7 & 10 \end{bmatrix}$$

```
array([[0.30087333, 0.18694582, 0.32318268, 0.66574957, 0.5669708 ],
       [0.39825396, 0.37941492, 0.01058154, 0.1703656 , 0.12339337],
       [0.69240128, 0.87444156, 0.3373969 , 0.99245923, 0.13154007],
       [0.50032984, 0.28662051, 0.22058485, 0.50208555, 0.63606254],
       [0.63567694, 0.08043309, 0.58143375, 0.83919086, 0.29301825]])
```

```
CPU times: user 75.3 ms, sys: 8.14 ms, total: 83.5 ms
Wall time: 81.4 ms
```

```
0.5001355519953301
```

```
array([  1,   2,   3,   4,   5,   6,   7,   8,   9,  10,  11,  12,  13,
        14,  15,  16,  17,  18,  19,  20,  21,  22,  23,  24,  25,  26,
        27,  28,  29,  30,  31,  32,  33,  34,  35,  36,  37,  38,  39,
        40,  41,  42,  43,  44,  45,  46,  47,  48,  49,  50,  51,  52,
        53,  54,  55,  56,  57,  58,  59,  60,  61,  62,  63,  64,  65,
        66,  67,  68,  69,  70,  71,  72,  73,  74,  75,  76,  77,  78,
        79,  80,  81,  82,  83,  84,  85,  86,  87,  88,  89,  90,  91,
        92,  93,  94,  95,  96,  97,  98,  99, 100])
```

```
array([[  1,   2,   3,   4,   5],
       [  6,   7,   8,   9,  10],
       [ 11,  12,  13,  14,  15],
       [ 16,  17,  18,  19,  20],
       [ 21,  22,  23,  24,  25],
       [ 26,  27,  28,  29,  30],
       [ 31,  32,  33,  34,  35],
       [ 36,  37,  38,  39,  40],
       [ 41,  42,  43,  44,  45],
       [ 46,  47,  48,  49,  50],
       [ 51,  52,  53,  54,  55],
       [ 56,  57,  58,  59,  60],
       [ 61,  62,  63,  64,  65],
       [ 66,  67,  68,  69,  70],
       [ 71,  72,  73,  74,  75],
       [ 76,  77,  78,  79,  80],
       [ 81,  82,  83,  84,  85],
       [ 86,  87,  88,  89,  90],
       [ 91,  92,  93,  94,  95],
       [ 96,  97,  98,  99, 100]])
```

```
   array([[-49, -48, -47, -46, -45],
          [-44, -43, -42, -41, -40],
          [-39, -38, -37, -36, -35],
          [-34, -33, -32, -31, -30],
          [-29, -28, -27, -26, -25],
          [-24, -23, -22, -21, -20],
          [-19, -18, -17, -16, -15],
          [-14, -13, -12, -11, -10],
          [ -9,  -8,  -7,  -6,  -5],
          [ -4,  -3,  -2,  -1,   0],
          [  1,   2,   3,   4,   5],
          [  6,   7,   8,   9,  10],
          [ 11,  12,  13,  14,  15],
          [ 16,  17,  18,  19,  20],
          [ 21,  22,  23,  24,  25],
          [ 26,  27,  28,  29,  30],
          [ 31,  32,  33,  34,  35],
          [ 36,  37,  38,  39,  40],
          [ 41,  42,  43,  44,  45],
          [ 46,  47,  48,  49,  50]])
array([[  10,   20,   30,   40,   50],
       [  60,   70,   80,   90,  100],
       [ 110,  120,  130,  140,  150],
       [ 160,  170,  180,  190,  200],
       [ 210,  220,  230,  240,  250],
       [ 260,  270,  280,  290,  300],
       [ 310,  320,  330,  340,  350],
       [ 360,  370,  380,  390,  400],
       [ 410,  420,  430,  440,  450],
       [ 460,  470,  480,  490,  500],
       [ 510,  520,  530,  540,  550],
       [ 560,  570,  580,  590,  600],
       [ 610,  620,  630,  640,  650],
       [ 660,  670,  680,  690,  700],
       [ 710,  720,  730,  740,  750],
       [ 760,  770,  780,  790,  800],
       [ 810,  820,  830,  840,  850],
       [ 860,  870,  880,  890,  900],
       [ 910,  920,  930,  940,  950],
       [ 960,  970,  980,  990, 1000]])
```

```
      array([[  2,   4,   6,   8,  10],
             [ 12,  14,  16,  18,  20],
             [ 22,  24,  26,  28,  30],
             [ 32,  34,  36,  38,  40],
             [ 42,  44,  46,  48,  50],
             [ 52,  54,  56,  58,  60],
             [ 62,  64,  66,  68,  70],
             [ 72,  74,  76,  78,  80],
             [ 82,  84,  86,  88,  90],
             [ 92,  94,  96,  98, 100],
             [102, 104, 106, 108, 110],
             [112, 114, 116, 118, 120],
             [122, 124, 126, 128, 130],
             [132, 134, 136, 138, 140],
             [142, 144, 146, 148, 150],
             [152, 154, 156, 158, 160],
             [162, 164, 166, 168, 170],
             [172, 174, 176, 178, 180],
             [182, 184, 186, 188, 190],
             [192, 194, 196, 198, 200]])
array([[    1,     4,     9,    16,    25],
       [   36,    49,    64,    81,   100],
       [  121,   144,   169,   196,   225],
       [  256,   289,   324,   361,   400],
       [  441,   484,   529,   576,   625],
       [  676,   729,   784,   841,   900],
       [  961,  1024,  1089,  1156,  1225],
       [ 1296,  1369,  1444,  1521,  1600],
       [ 1681,  1764,  1849,  1936,  2025],
       [ 2116,  2209,  2304,  2401,  2500],
       [ 2601,  2704,  2809,  2916,  3025],
       [ 3136,  3249,  3364,  3481,  3600],
       [ 3721,  3844,  3969,  4096,  4225],
       [ 4356,  4489,  4624,  4761,  4900],
       [ 5041,  5184,  5329,  5476,  5625],
       [ 5776,  5929,  6084,  6241,  6400],
       [ 6561,  6724,  6889,  7056,  7225],
       [ 7396,  7569,  7744,  7921,  8100],
       [ 8281,  8464,  8649,  8836,  9025],
       [ 9216,  9409,  9604,  9801, 10000]])
```

```
array([[   55,   130,   205,   280,   355,   430,   505,   580,   655,
          730,   805,   880,   955,  1030,  1105,  1180,  1255,  1330,
         1405,  1480],
       [  130,   330,   530,   730,   930,  1130,  1330,  1530,  1730,
         1930,  2130,  2330,  2530,  2730,  2930,  3130,  3330,  3530,
         3730,  3930],
       [  205,   530,   855,  1180,  1505,  1830,  2155,  2480,  2805,
         3130,  3455,  3780,  4105,  4430,  4755,  5080,  5405,  5730,
         6055,  6380],
       [  280,   730,  1180,  1630,  2080,  2530,  2980,  3430,  3880,
         4330,  4780,  5230,  5680,  6130,  6580,  7030,  7480,  7930,
         8380,  8830],
       [  355,   930,  1505,  2080,  2655,  3230,  3805,  4380,  4955,
         5530,  6105,  6680,  7255,  7830,  8405,  8980,  9555, 10130,
        10705, 11280],
       [  430,  1130,  1830,  2530,  3230,  3930,  4630,  5330,  6030,
         6730,  7430,  8130,  8830,  9530, 10230, 10930, 11630, 12330,
        13030, 13730],
       [  505,  1330,  2155,  2980,  3805,  4630,  5455,  6280,  7105,
         7930,  8755,  9580, 10405, 11230, 12055, 12880, 13705, 14530,
        15355, 16180],
       [  580,  1530,  2480,  3430,  4380,  5330,  6280,  7230,  8180,
         9130, 10080, 11030, 11980, 12930, 13880, 14830, 15780, 16730,
        17680, 18630],
       [  655,  1730,  2805,  3880,  4955,  6030,  7105,  8180,  9255,
        10330, 11405, 12480, 13555, 14630, 15705, 16780, 17855, 18930,
        20005, 21080],
       [  730,  1930,  3130,  4330,  5530,  6730,  7930,  9130, 10330,
        11530, 12730, 13930, 15130, 16330, 17530, 18730, 19930, 21130,
        22330, 23530],
       [  805,  2130,  3455,  4780,  6105,  7430,  8755, 10080, 11405,
        12730, 14055, 15380, 16705, 18030, 19355, 20680, 22005, 23330,
        24655, 25980],
       [  880,  2330,  3780,  5230,  6680,  8130,  9580, 11030, 12480,
        13930, 15380, 16830, 18280, 19730, 21180, 22630, 24080, 25530,
        26980, 28430],
       [  955,  2530,  4105,  5680,  7255,  8830, 10405, 11980, 13555,
        15130, 16705, 18280, 19855, 21430, 23005, 24580, 26155, 27730,
        29305, 30880],
```

	Scotty	Joy	Kamala
0	63	48	87
1	75	98	86
2	88	92	85

	0	1	2
Scotty	63	75	88
Joy	48	98	92
Kamala	87	86	85

	Quiz_1	Quiz_2	Quiz_3
Scotty	63	75	88
Joy	48	98	92
Kamala	87	86	85

```
Quiz_1     63
Quiz_2     75
Quiz_3     88
Name: Scotty, dtype: int64
```

```
Scotty     63
Joy        48
Kamala     87
Name: Quiz_1, dtype: int64
```

```
Scotty     63
Joy        48
Kamala     87
Name: Quiz_1, dtype: int64
```

	Quiz_1	Quiz_2	Quiz_3
Scotty	63	75	88
Joy	48	98	92
Kamala	87	86	85

	Scotty	Joy	Kamala
0	63	48	87
1	75	98	86

	Quiz_2	Quiz_3
Scotty	75	88
Joy	98	92

	Quiz_2	Quiz_3
Scotty	75	88
Joy	98	92

	Quiz_1	Quiz_2	Quiz_3	Quiz_Avg
Scotty	63	75	88	75.333333
Joy	48	98	92	79.333333
Kamala	87	86	85	86.000000

	Quiz_1	Quiz_2	Quiz_3	Quiz_Avg	Quiz_4
Scotty	63	75	88	75.333333	92
Joy	48	98	92	79.333333	95
Kamala	87	86	85	86.000000	88

	Quiz_1	Quiz_2	Quiz_3	Quiz_4
Scotty	63	75	88	92
Joy	48	98	92	95
Kamala	87	86	85	88

	Quiz_1	Quiz_2	Quiz_3	Quiz_4
Scotty	63	75	88	92
Joy	48	98	92	95
Kamala	87	86	85	88

	Quiz_1	Quiz_2	Quiz_3	Quiz_4
Scotty	63.0	75.0	88.0	92.0
Joy	48.0	98.0	92.0	95.0
Kamala	87.0	86.0	85.0	88.0
Adrian	NaN	NaN	NaN	71.0

	Quiz_1	Quiz_2	Quiz_3	Quiz_4	Quiz_Avg
Scotty	63.0	75.0	88.0	92	79.50
Joy	48.0	98.0	92.0	95	83.25
Kamala	87.0	86.0	85.0	88	86.50
Adrian	NaN	NaN	NaN	71	71.00

type of file	code
csv files:	pd.read_csv('file_name')
excel files:	pd.read_excel('file_name')
feather files:	pd.read_feather('file_name')
html files:	pd.read_html('file_name')
json files:	pd.read_json('file_name')
sql database:	pd.read_sql('file_name')

	CRIM	ZN	INDUS	CHAS	NOX	RM	AGE	DIS	RAD	TAX	PTRATIO	B	LSTAT	MEDV
0	0.00632	18.0	2.31	0.0	0.538	6.575	65.2	4.0900	1	296	15.3	396.90	4.98	24.0
1	0.02731	0.0	7.07	0.0	0.469	6.421	78.9	4.9671	2	242	17.8	396.90	9.14	21.6
2	0.02729	0.0	7.07	0.0	0.469	7.185	61.1	4.9671	2	242	17.8	392.83	4.03	34.7
3	0.03237	0.0	2.18	0.0	0.458	6.998	45.8	6.0622	3	222	18.7	394.63	2.94	33.4
4	0.06905	0.0	2.18	0.0	0.458	7.147	54.2	6.0622	3	222	18.7	396.90	NaN	36.2

```
CRIM     per capita crime rate by town
ZN       proportion of residential land zoned for lots over 25,000 sq. ft.
INDUS    proportion of non-retail business acres per town
CHAS     Charles River dummy variable (= 1 if tract bounds river; 0 otherwise)
NOX      nitric oxide concentration (parts per 10 million)
RM       average number of rooms per dwelling
AGE      proportion of owner-occupied units built prior to 1940
DIS      weighted distances to five Boston employment centers
RAD      index of accessibility to radial highways
TAX      full-value property-tax rate per $10,000
PTRATIO  pupil-teacher ratio by town
LSTAT    % lower status of the population
MEDV     median value of owner-occupied homes in $1,000s
```

	CRIM	ZN	INDUS	CHAS	NOX	RM	AGE	DIS	RAD	TAX	PTRATIO	B
count	486.000000	486.000000	486.000000	486.000000	506.000000	506.000000	486.000000	506.000000	506.000000	506.000000	506.000000	506.000000
mean	3.611874	11.211934	11.083992	0.069959	0.554695	6.284634	68.518519	3.795043	9.549407	408.237154	18.455534	356.674032
std	8.720192	23.388876	6.835896	0.255340	0.115878	0.702617	27.999513	2.105710	8.707259	168.537116	2.164946	91.294864
min	0.006320	0.000000	0.460000	0.000000	0.385000	3.561000	2.900000	1.129600	1.000000	187.000000	12.600000	0.320000
25%	0.081900	0.000000	5.190000	0.000000	0.449000	5.885500	45.175000	2.100175	4.000000	279.000000	17.400000	375.377500
50%	0.253715	0.000000	9.690000	0.000000	0.538000	6.208500	76.800000	3.207450	5.000000	330.000000	19.050000	391.440000
75%	3.560263	12.500000	18.100000	0.000000	0.624000	6.623500	93.975000	5.188425	24.000000	666.000000	20.200000	396.225000
max	88.976200	100.000000	27.740000	1.000000	0.871000	8.780000	100.000000	12.126500	24.000000	711.000000	22.000000	396.900000

```
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 1   ZN       486 non-null    float64
 2   INDUS    486 non-null    float64
 3   CHAS     486 non-null    float64
 4   NOX      506 non-null    float64
 5   RM       506 non-null    float64
 6   AGE      486 non-null    float64
 7   DIS      506 non-null    float64
 8   RAD      506 non-null    int64
 9   TAX      506 non-null    int64
 10  PTRATIO  506 non-null    float64
 11  B        506 non-null    float64
 12  LSTAT    486 non-null    float64
 13  MEDV     506 non-null    float64
dtypes: float64(12), int64(2)
memory usage: 55.5 KB
```

```
CRIM          True
ZN            True
INDUS         True
CHAS          True
NOX          False
RM           False
AGE           True
DIS          False
RAD          False
TAX          False
PTRATIO      False
B            False
LSTAT         True
MEDV         False
dtype: bool
```

	CRIM	ZN	INDUS	CHAS	AGE	LSTAT
0	0.00632	18.0	2.31	0.0	65.2	4.98
1	0.02731	0.0	7.07	0.0	78.9	9.14
2	0.02729	0.0	7.07	0.0	61.1	4.03
3	0.03237	0.0	2.18	0.0	45.8	2.94
4	0.06905	0.0	2.18	0.0	54.2	NaN
5	0.02985	0.0	2.18	0.0	58.7	5.21

	CRIM	ZN	INDUS	CHAS	AGE	LSTAT
count	486.000000	486.000000	486.000000	486.000000	486.000000	486.000000
mean	3.611874	11.211934	11.083992	0.069959	68.518519	12.715432
std	8.720192	23.388876	6.835896	0.255340	27.999513	7.155871
min	0.006320	0.000000	0.460000	0.000000	2.900000	1.730000
25%	0.081900	0.000000	5.190000	0.000000	45.175000	7.125000
50%	0.253715	0.000000	9.690000	0.000000	76.800000	11.430000
75%	3.560263	12.500000	18.100000	0.000000	93.975000	16.955000
max	88.976200	100.000000	27.740000	1.000000	100.000000	37.970000

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 506 entries, 0 to 505
Data columns (total 14 columns):
 #   Column   Non-Null Count  Dtype
---  ------   --------------  -----
 0   CRIM     506 non-null    float64
 1   ZN       506 non-null    float64
 2   INDUS    506 non-null    float64
 3   CHAS     506 non-null    float64
 4   NOX      506 non-null    float64
 5   RM       506 non-null    float64
 6   AGE      506 non-null    float64
 7   DIS      506 non-null    float64
 8   RAD      506 non-null    int64
 9   TAX      506 non-null    int64
 10  PTRATIO  506 non-null    float64
 11  B        506 non-null    float64
 12  LSTAT    506 non-null    float64
 13  MEDV     506 non-null    float64
dtypes: float64(12), int64(2)
memory usage: 55.5 KB
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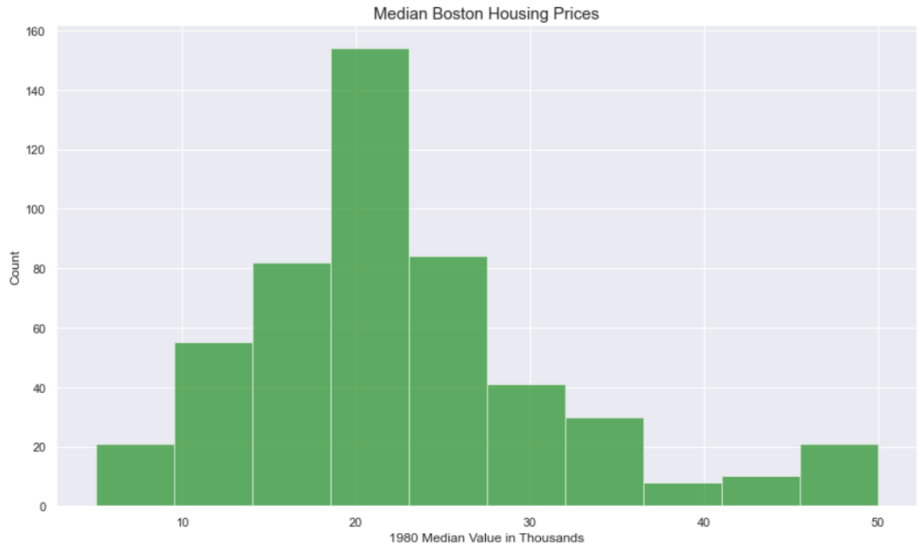
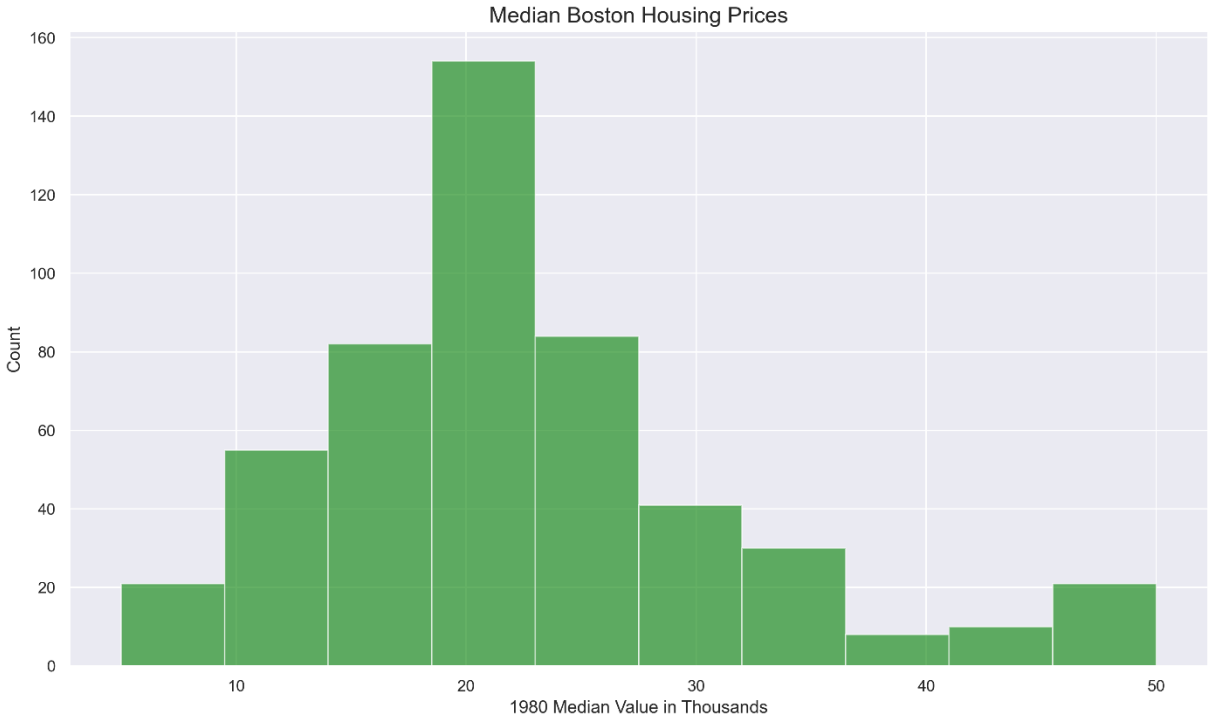
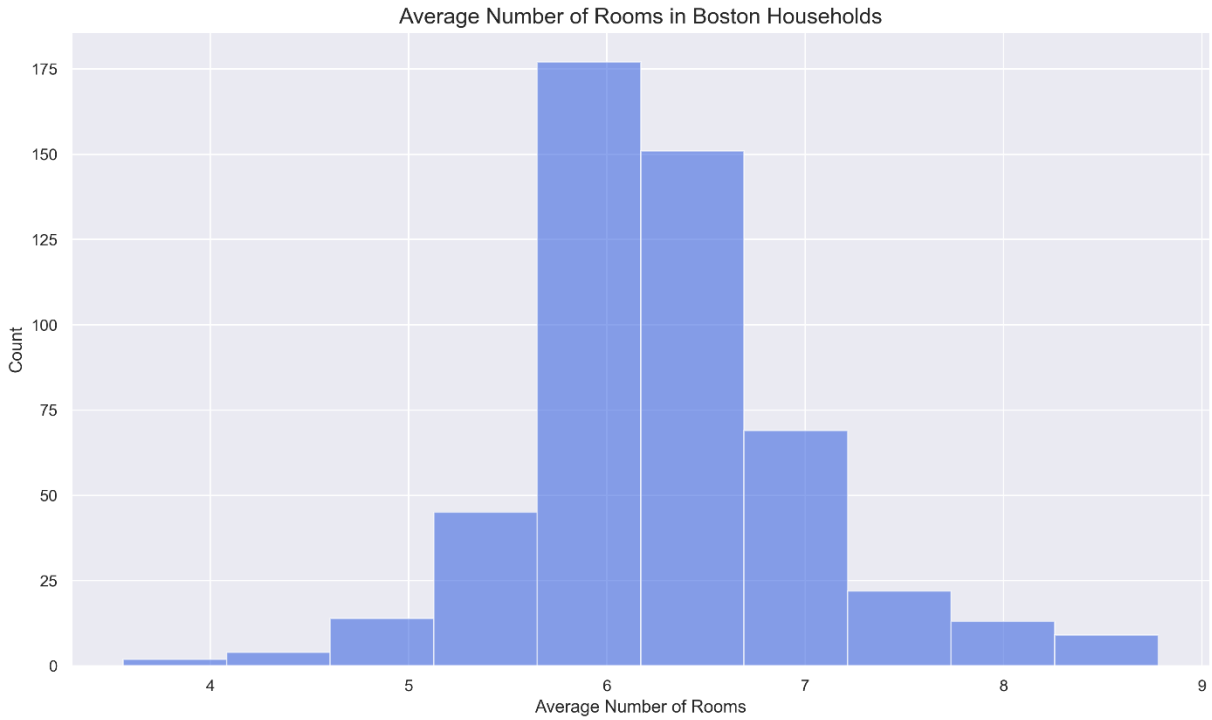
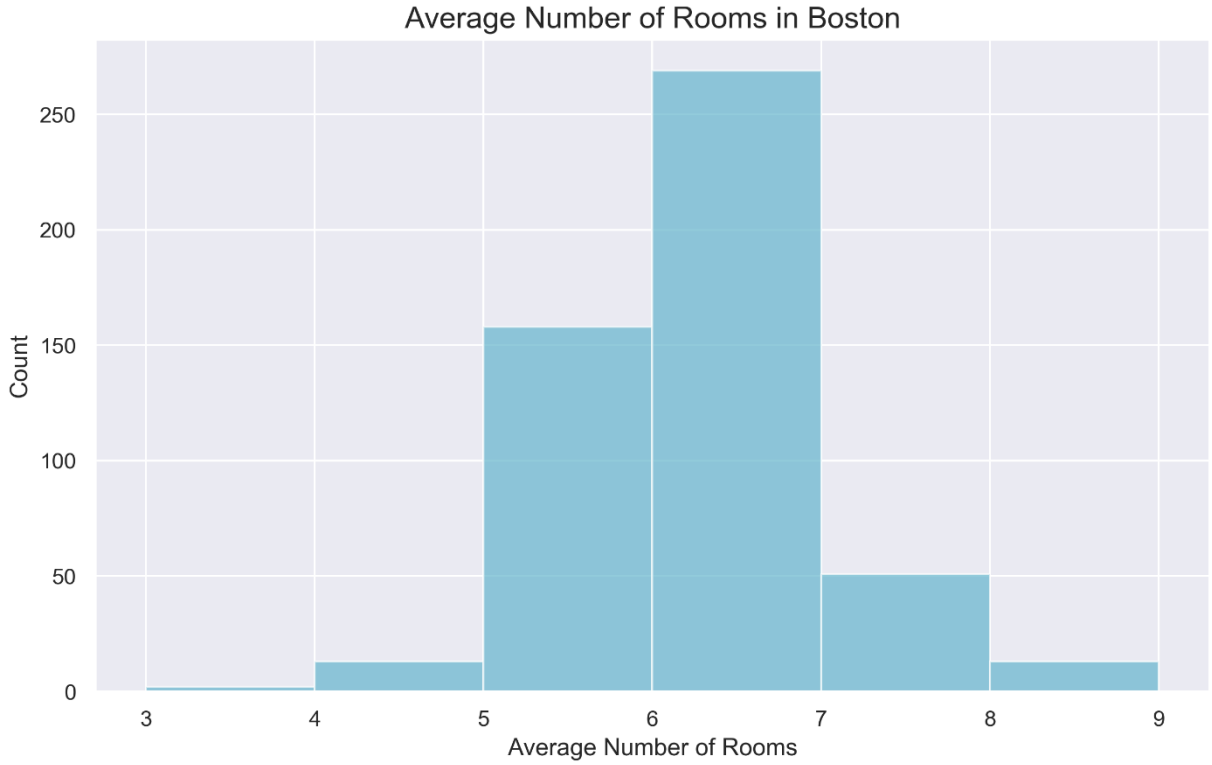
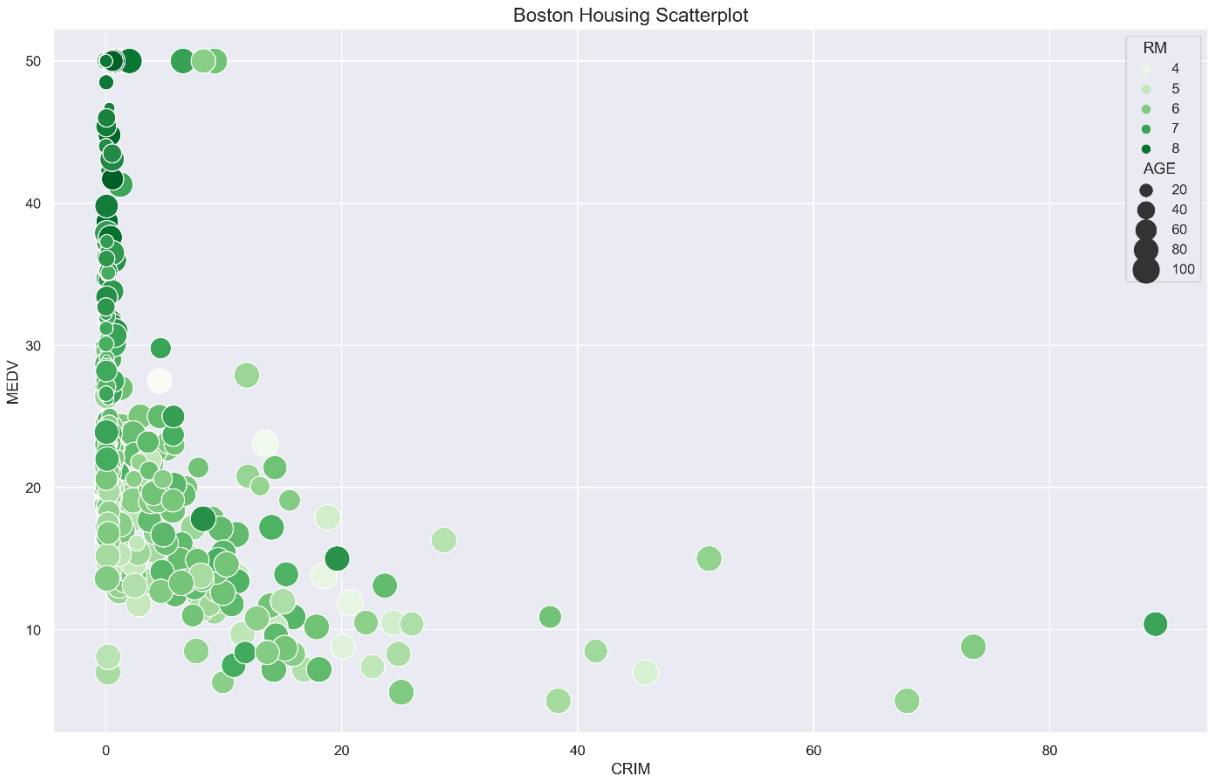
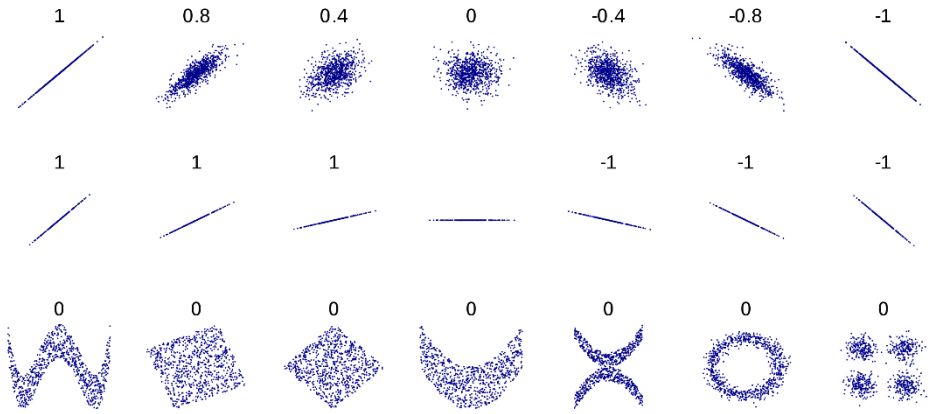




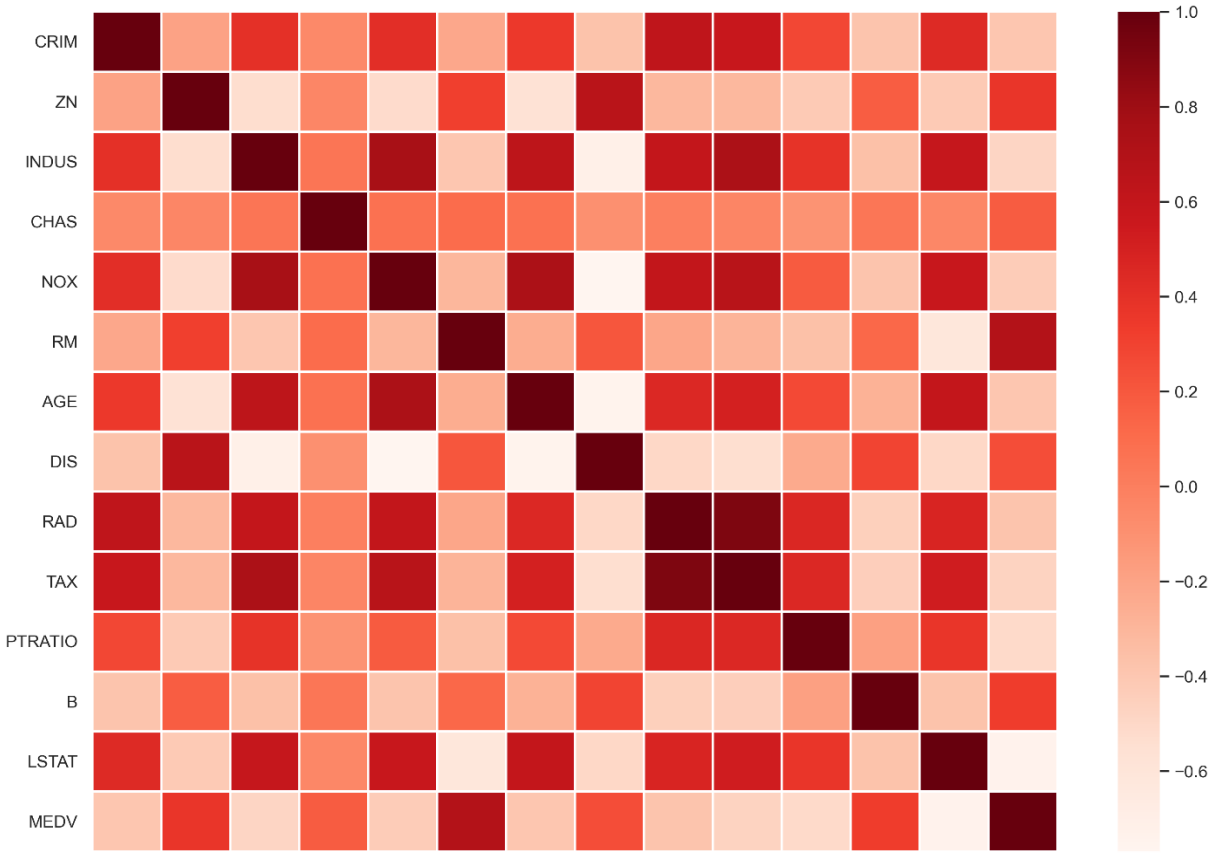

Average Number of Rooms in Boston Households
Count
175
150
125
100
75
50
25
0
4
5
6
7
8
9
Average Number of Rooms

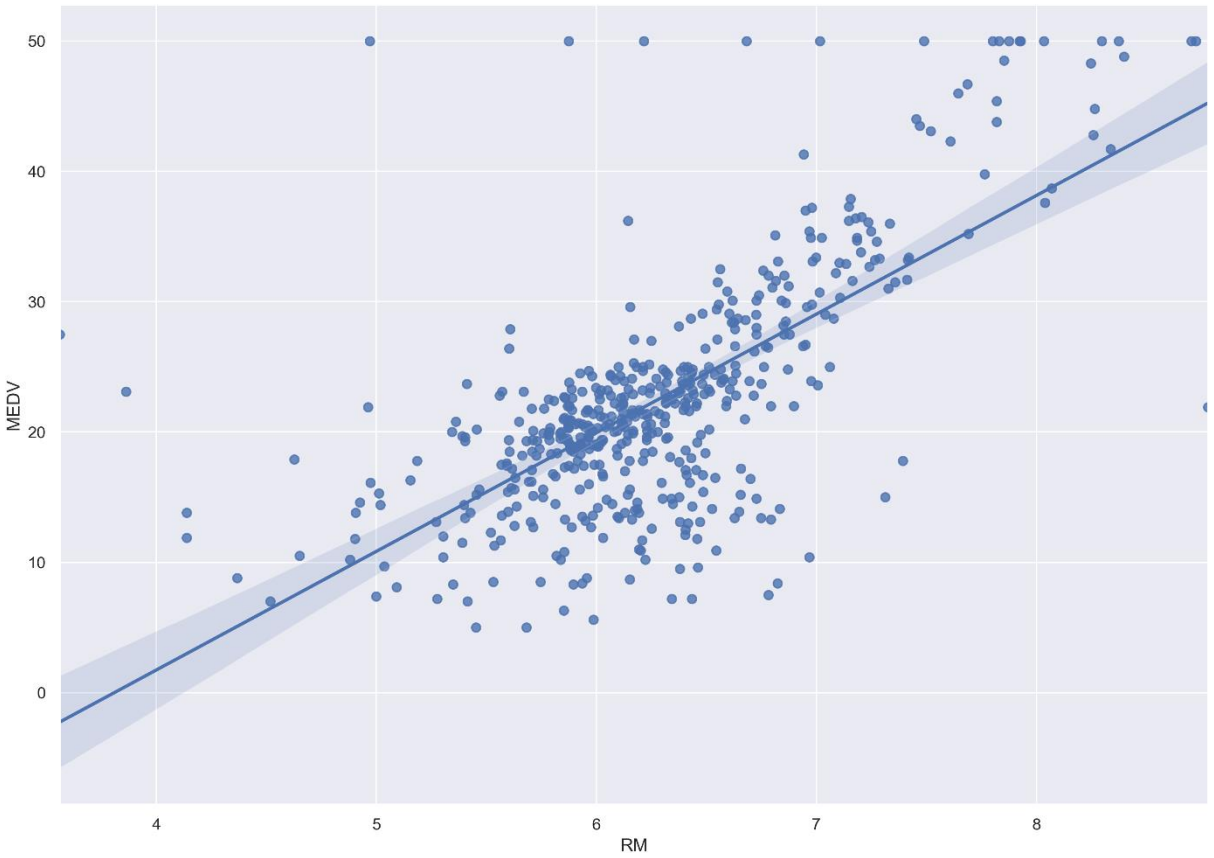

Average Number of Rooms in Boston
Count
250
200
150
100
50
0
3
4
5
6
7
8
9
Average Number of Rooms





	CRIM	ZN	INDUS	CHAS	NOX	RM	AGE	DIS	RAD	TAX	PTRATIO	B	LSTAT	MEDV
CRIM	1.000000	-0.191178	0.401863	-0.054355	0.417130	-0.219150	0.354342	-0.374166	0.624765	0.580595	0.281110	-0.381411	0.444943	-0.391363
ZN	-0.191178	1.000000	-0.531871	-0.037229	-0.513704	0.320800	-0.563801	0.656739	-0.310919	-0.312371	-0.414046	0.171303	-0.414193	0.373136
INDUS	0.401863	-0.531871	1.000000	0.059859	0.764866	-0.390234	0.638431	-0.711709	0.604533	0.731055	0.390954	-0.360532	0.590690	-0.481772
CHAS	-0.054355	-0.037229	0.059859	1.000000	0.075097	0.104885	0.078831	-0.093971	0.001468	-0.032304	-0.111304	0.051264	-0.047424	0.181391
NOX	0.417130	-0.513704	0.764866	0.075097	1.000000	-0.302188	0.731548	-0.769230	0.611441	0.668023	0.188933	-0.380051	0.582641	-0.427321
RM	-0.219150	0.320800	-0.390234	0.104885	-0.302188	1.000000	-0.247337	0.205246	-0.209847	-0.292048	-0.355501	0.128069	-0.614339	0.695360
AGE	0.354342	-0.563801	0.638431	0.078831	0.731548	-0.247337	1.000000	-0.744844	0.458349	0.509114	0.269226	-0.275303	0.602891	-0.394656
DIS	-0.374166	0.656739	-0.711709	-0.093971	-0.769230	0.205246	-0.744844	1.000000	-0.494588	-0.534432	-0.232471	0.291512	-0.493328	0.249929
RAD	0.624765	-0.310919	0.604533	0.001468	0.611441	-0.209847	0.458349	-0.494588	1.000000	0.910228	0.464741	-0.444413	0.479541	-0.381626
TAX	0.580595	-0.312371	0.731055	-0.032304	0.668023	-0.292048	0.509114	-0.534432	0.910228	1.000000	0.460853	-0.441808	0.536110	-0.468536
PTRATIO	0.281110	-0.414046	0.390954	-0.111304	0.188933	-0.355501	0.269226	-0.232471	0.464741	0.460853	1.000000	-0.177383	0.375966	-0.507787
B	-0.381411	0.171303	-0.360532	0.051264	-0.380051	0.128069	-0.275303	0.291512	-0.444413	-0.441808	-0.177383	1.000000	-0.369889	0.333461
LSTAT	0.444943	-0.414193	0.590690	-0.047424	0.582641	-0.614339	0.602891	-0.493328	0.479541	0.536110	0.375966	-0.369889	1.000000	-0.735822
MEDV	-0.391363	0.373136	-0.481772	0.181391	-0.427321	0.695360	-0.394656	0.249929	-0.381626	-0.468536	-0.507787	0.333461	-0.735822	1.000000


CRIM
ZN
INDUS
CHAS
NOX
RM
AGE
DIS
RAD
TAX
PTRATIO
B
LSTAT
MEDV
1.0
0.8
0.6
0.4
0.2
0.0
−0.2
−0.4
−0.6


MEDV
RM
50
40
30
20
10
0
4
5
6
7
8

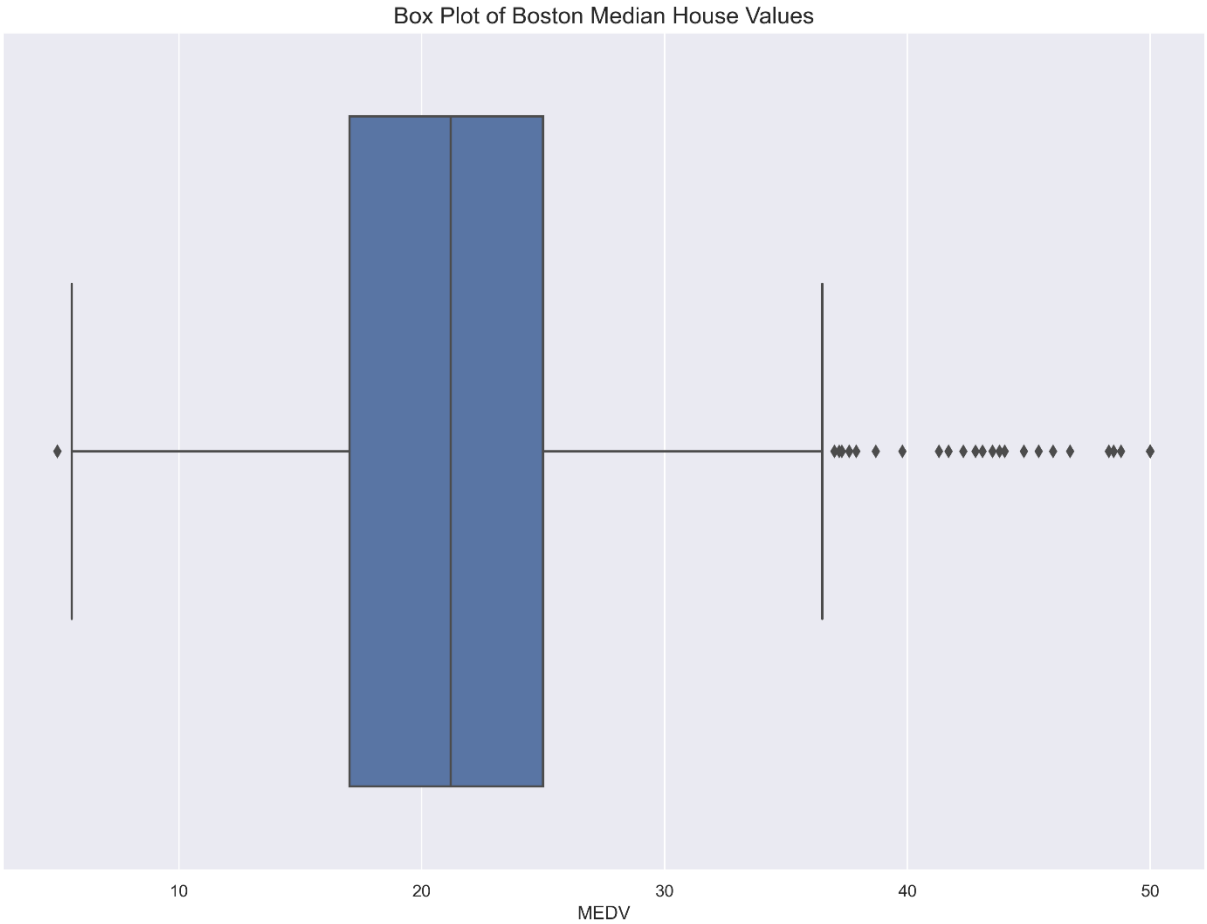
OLS Regression Results

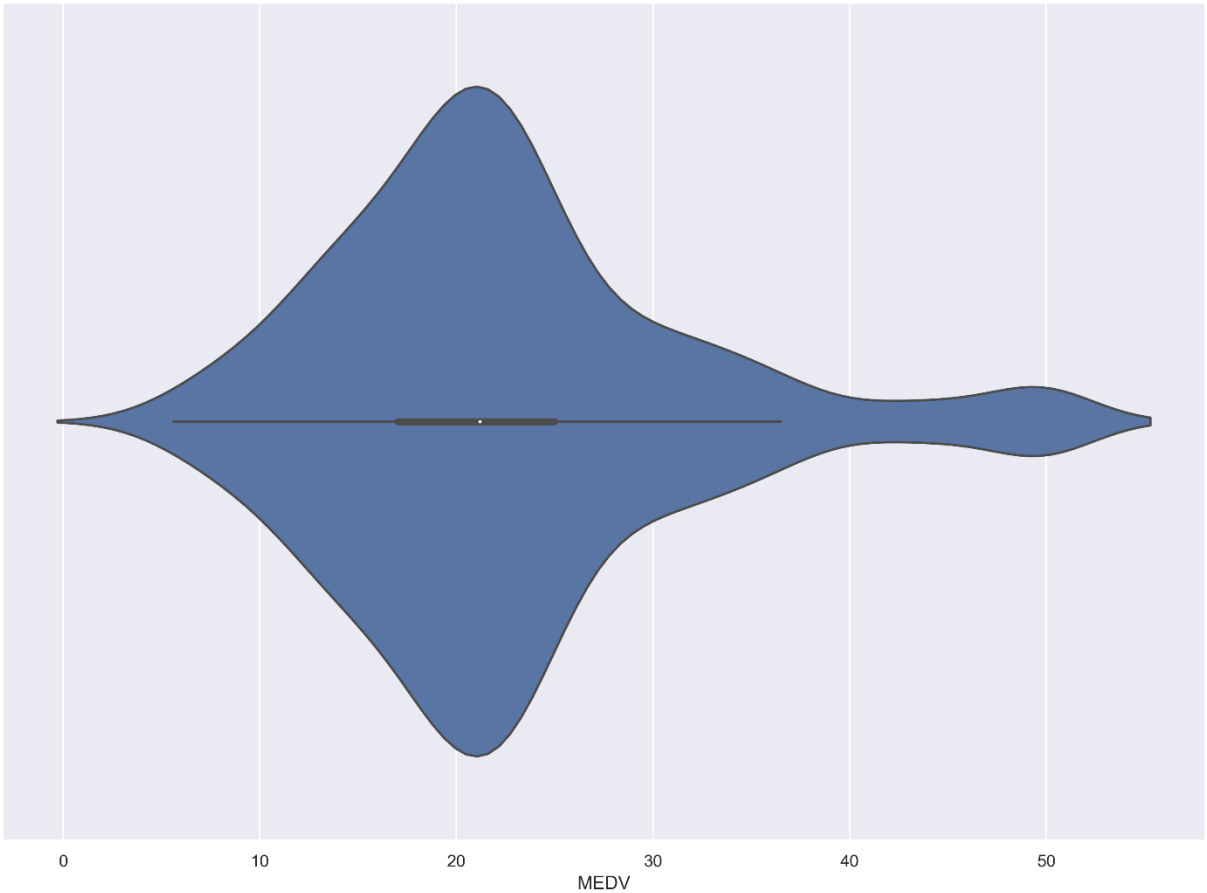
Dep. Variable:	MEDV	R-squared:	0.484
Model:	OLS	Adj. R-squared:	0.483
Method:	Least Squares	F-statistic:	471.8
Date:	Sat, 03 Sep 2022	Prob (F-statistic):	2.49e-74
Time:	19:37:20	Log-Likelihood:	-1673.1
No. Observations:	506	AIC:	3350.
Df Residuals:	504	BIC:	3359.
Df Model:	1		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
const	-34.6706	2.650	-13.084	0.000	-39.877	-29.465
RM	9.1021	0.419	21.722	0.000	8.279	9.925

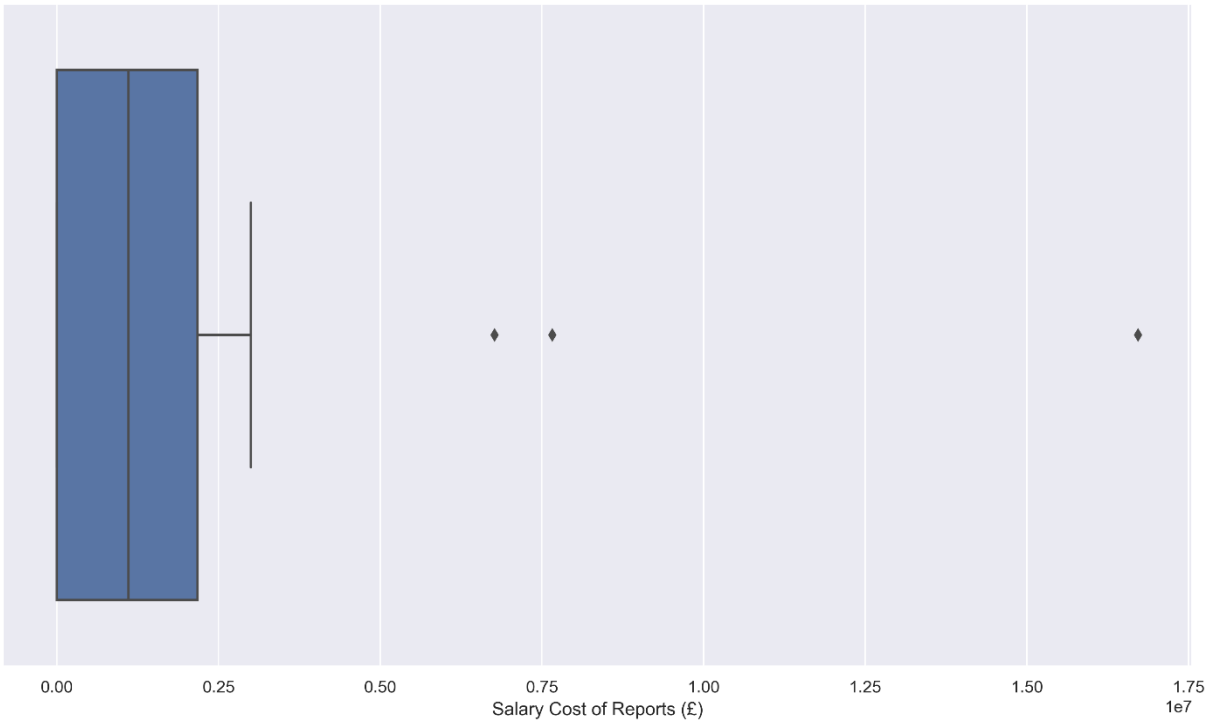
Omnibus:	102.585	Durbin-Watson:	0.684
Prob(Omnibus):	0.000	Jarque-Bera (JB):	612.449
Skew:	0.726	Prob(JB):	1.02e-133
Kurtosis:	8.190	Cond. No.	58.4

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.





Salary Cost Box Plot



Chapter 11: Machine Learning

	CRIM	ZN	INDUS	CHAS	NOX	RM	AGE	DIS	RAD	TAX	PTRATIO	B	LSTAT	MEDV
0	0.00632	18.0	2.31	0.0	0.538	6.575	65.2	4.0900	1	296	15.3	396.90	4.98	24.0
1	0.02731	0.0	7.07	0.0	0.469	6.421	78.9	4.9671	2	242	17.8	396.90	9.14	21.6
2	0.02729	0.0	7.07	0.0	0.469	7.185	61.1	4.9671	2	242	17.8	392.83	4.03	34.7
3	0.03237	0.0	2.18	0.0	0.458	6.998	45.8	6.0622	3	222	18.7	394.63	2.94	33.4
4	0.06905	0.0	2.18	0.0	0.458	7.147	54.2	6.0622	3	222	18.7	396.90	NaN	36.2

```
CRIM     per capita crime rate by town
ZN       proportion of residential land zoned for lots over 25,000 sq. ft.
INDUS    proportion of non-retail business acres per town
CHAS     Charles River dummy variable (= 1 if tract bounds river; 0 otherwise)
NOX      nitric oxide concentration (parts per 10 million)
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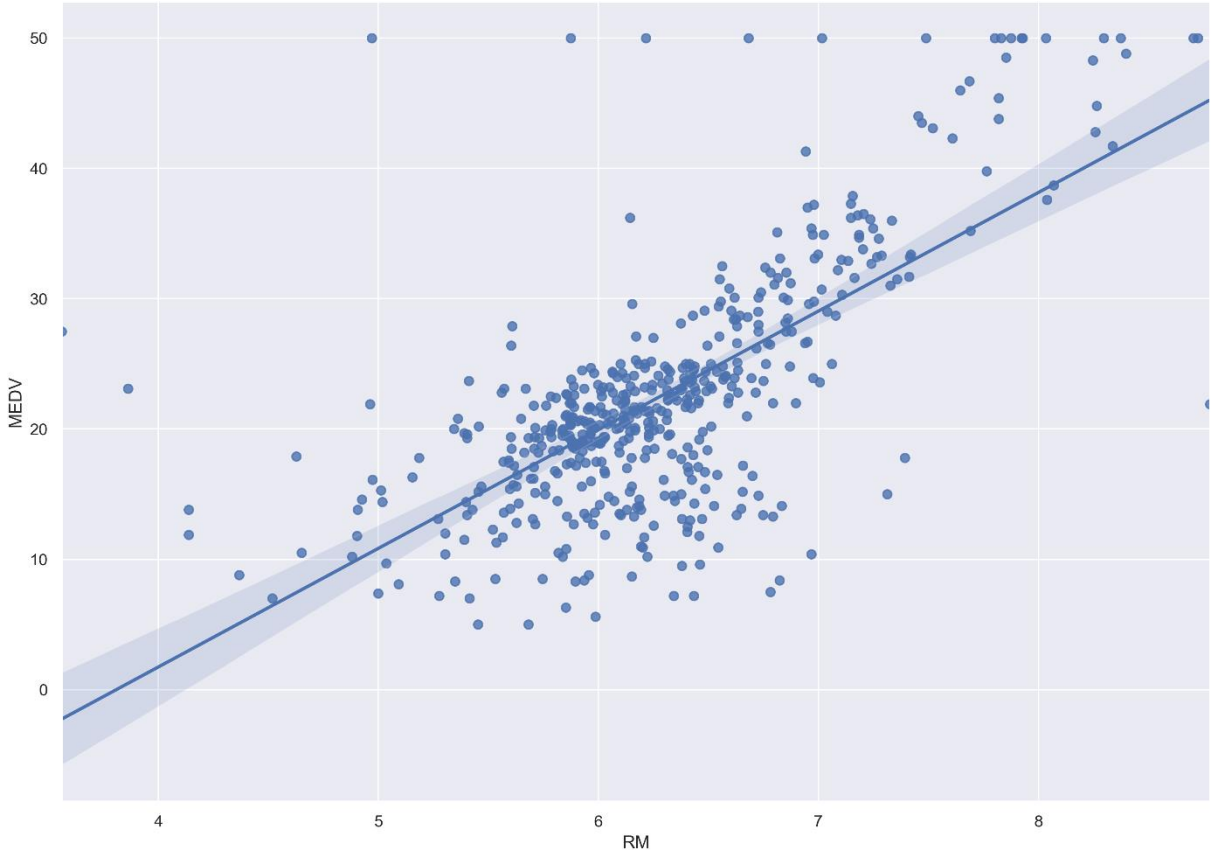
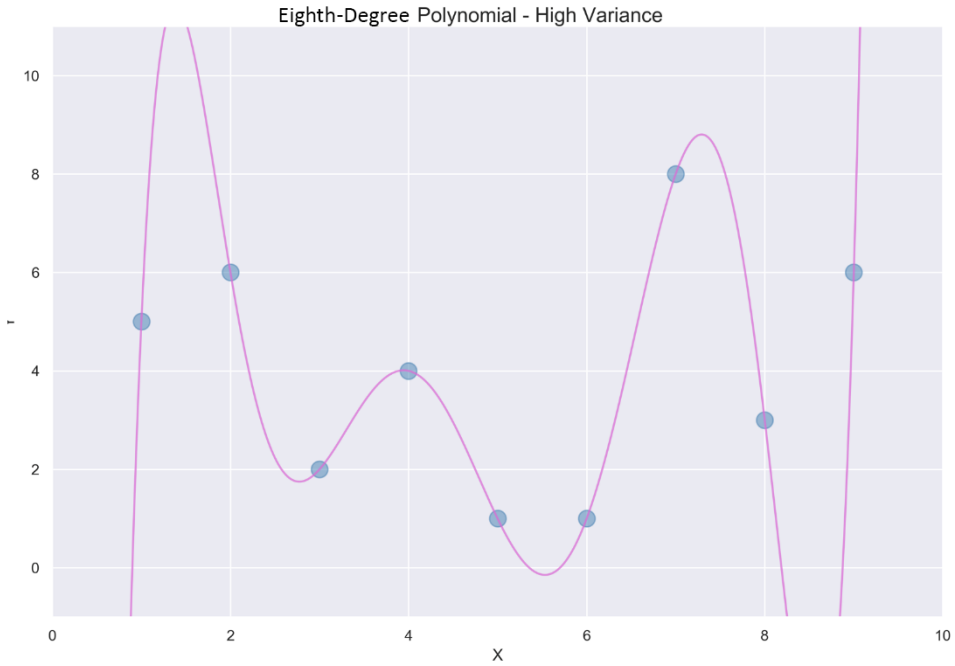
PTRATIO  pupil-teacher ratio by town
LSTAT    % lower status of the population
MEDV     median value of owner-occupied homes in $1,000s
```



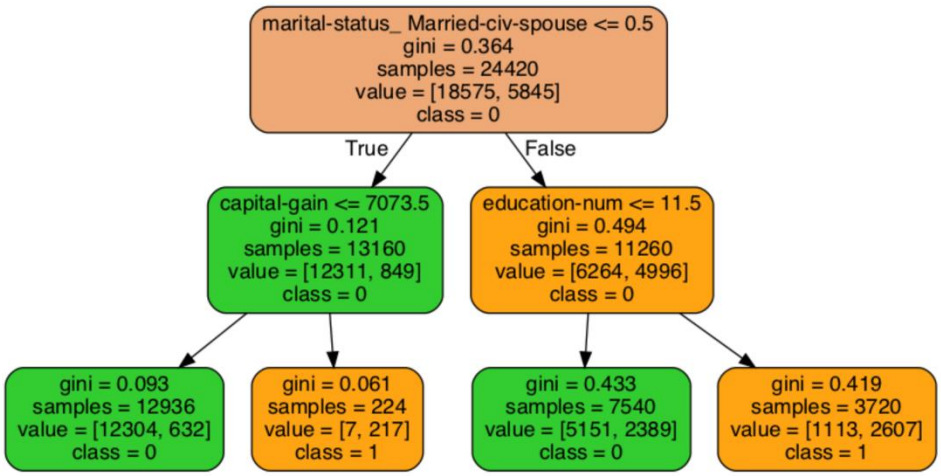
	CRIM	ZN	INDUS	CHAS	NOX	RM	AGE	DIS	RAD	TAX	PTRATIO	B	LSTAT	MEDV
0	0.00632	18.0	2.31	0.0	0.538	6.575	65.2	4.0900	1	296	15.3	396.90	4.98	24.0
1	0.02731	0.0	7.07	0.0	0.469	6.421	78.9	4.9671	2	242	17.8	396.90	9.14	21.6
2	0.02729	0.0	7.07	0.0	0.469	7.185	61.1	4.9671	2	242	17.8	392.83	4.03	34.7
3	0.03237	0.0	2.18	0.0	0.458	6.998	45.8	6.0622	3	222	18.7	394.63	2.94	33.4
4	0.06905	0.0	2.18	0.0	0.458	7.147	54.2	6.0622	3	222	18.7	396.90	NaN	36.2




```
Best n_neighbors: {'n_neighbors': 7}
Best score: 8.516767055977628
```

DECISION TREE - IMAGE

Census Dataset - max_depth=2



Index of /ml/machine-learning-databases/00372

- Parent Directory
- HTRU2.zip

Apache/2.4.6 (CentOS) OpenSSL/1.0.2k-fips SVN/1.7.14 Phusion_Passenger/4.0.53 mod_perl/2.0.11 Perl/v5.16.3 Server at archive.ics.uci.edu Port 443

	140.5625	55.68378214	-0.234571412	-0.699648398	3.199832776	19.11042633	7.975531794	74.24222492	0
0	102.507812	58.882430	0.465318	-0.515088	1.677258	14.860146	10.576487	127.393580	0
1	103.015625	39.341649	0.323328	1.051164	3.121237	21.744669	7.735822	63.171909	0
2	136.750000	57.178449	-0.068415	-0.636238	3.642977	20.959280	6.896499	53.593661	0
3	88.726562	40.672225	0.600866	1.123492	1.178930	11.468720	14.269573	252.567306	0
4	93.570312	46.698114	0.531905	0.416721	1.636288	14.545074	10.621748	131.394004	0

	Mean of integrated profile	Standard deviation of integrated profile	Excess kurtosis of integrated profile	Skewness of integrated profile	Mean of DM-SNR curve	Standard deviation of DM-SNR curve	Excess kurtosis of DM-SNR curve	Skewness of DM-SNR curve	Class
0	140.562500	55.683782	-0.234571	-0.699648	3.199833	19.110426	7.975532	74.242225	0
1	102.507812	58.882430	0.465318	-0.515088	1.677258	14.860146	10.576487	127.393580	0
2	103.015625	39.341649	0.323328	1.051164	3.121237	21.744669	7.735822	63.171909	0
3	136.750000	57.178449	-0.068415	-0.636238	3.642977	20.959280	6.896499	53.593661	0
4	88.726562	40.672225	0.600866	1.123492	1.178930	11.468720	14.269573	252.567306	0

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 1    (Standard deviation of integrated profile,)     17898 non-null  float64
 2    (Excess kurtosis of integrated profile,)        17898 non-null  float64
 3    (Skewness of integrated profile,)               17898 non-null  float64
 4    (Mean of DM-SNR curve,)                         17898 non-null  float64
 5    (Standard deviation of DM-SNR curve,)           17898 non-null  float64
 6    (Excess kurtosis of DM-SNR curve,)              17898 non-null  float64
 7    (Skewness of DM-SNR curve,)                     17898 non-null  float64
 8    (Class,)                                        17898 non-null  int64
dtypes: float64(8), int64(1)
memory usage: 1.2 MB
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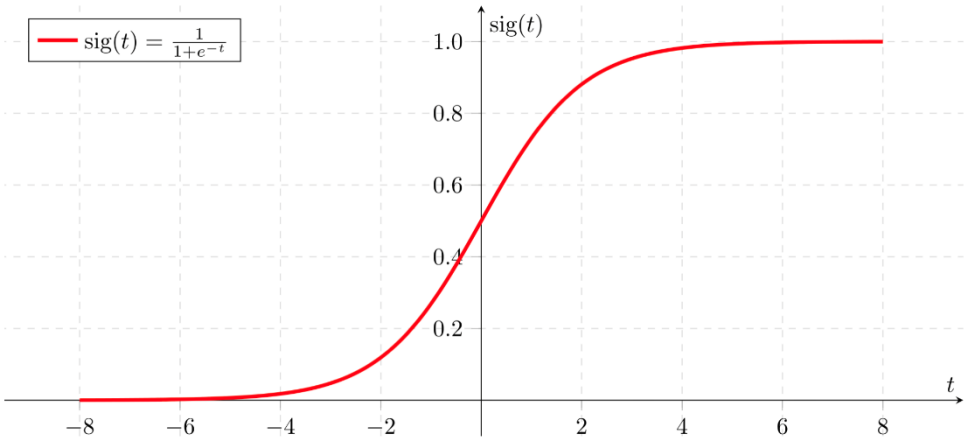
SIGMOID EQUATION



		True condition	
	Total population	Condition positive	Condition negative
Predicted condition	Predicted condition positive	True positive	False positive, Type I error
	Predicted condition negative	False negative, Type II error	True negative

True positive	Prediction positive and label positive
True negative	Prediction negative and label negative
False positive	Prediction positive but label negative
False negative	Prediction negative but label positive

```
[[3985   91]
[  65  334]]
```

```
Confusion Matrix: [[3985   91]
                   [  65  334]]

Classification Report:
                precision recall  f1-score   support

             0       0.98      0.98      0.98      4076
             1       0.79      0.84      0.81       399
avg / total          0.97      0.97      0.97      4475
```

```
     0     1
0 [[3985   91]
1 [  65  334]]
```

```
[[4095   20]
 [  63  297]]
              precision    recall  f1-score   support

           0       0.98      1.00      0.99      4115
           1       0.94      0.82      0.88       360

    accuracy                           0.98      4475
   macro avg       0.96      0.91      0.93      4475
weighted avg       0.98      0.98      0.98      4475
```

```
[[4077   38]
 [  69  291]]
              precision    recall  f1-score   support

           0       0.98      0.99      0.99      4115
           1       0.88      0.81      0.84       360

    accuracy                           0.98      4475
   macro avg       0.93      0.90      0.92      4475
weighted avg       0.98      0.98      0.98      4475
```

```
[[3946  169]
 [  52  308]]
              precision    recall  f1-score   support

           0       0.99      0.96      0.97      4115
           1       0.65      0.86      0.74       360

    accuracy                           0.95      4475
   macro avg       0.82      0.91      0.85      4475
weighted avg       0.96      0.95      0.95      4475
[[4095   20]
 [  59  301]]
              precision    recall  f1-score   support

           0       0.99      1.00      0.99      4115
           1       0.94      0.84      0.88       360

    accuracy                           0.98      4475
   macro avg       0.96      0.92      0.94      4475
weighted avg       0.98      0.98      0.98      4475
[[4094   21]
 [  63  297]]
              precision    recall  f1-score   support

           0       0.98      0.99      0.99      4115
           1       0.93      0.82      0.88       360

    accuracy                           0.98      4475
   macro avg       0.96      0.91      0.93      4475
weighted avg       0.98      0.98      0.98      4475
[[4083   32]
 [  56  304]]
              precision    recall  f1-score   support

           0       0.99      0.99      0.99      4115
           1       0.90      0.84      0.87       360

    accuracy                           0.98      4475
   macro avg       0.95      0.92      0.93      4475
weighted avg       0.98      0.98      0.98      4475
```

```
Reg rmse: [3.79117796 3.50477724 5.90361934 6.24188092 4.20210617]
Reg mean: 4.72871232513736
Reg rmse: [3.25617197 3.70205981 5.8595083  6.47060538 3.56108012]
Reg mean: 4.569885116033572
```

```
[[1186  129]
 [ 203  243]]
              precision    recall  f1-score   support

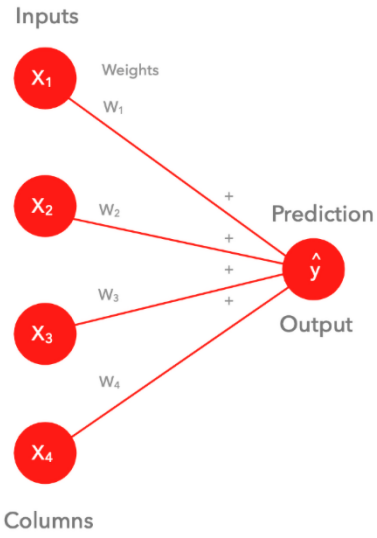
           0       0.85      0.90      0.88      1315
           1       0.65      0.54      0.59       446

    accuracy                           0.81      1761
   macro avg       0.75      0.72      0.74      1761
weighted avg       0.80      0.81      0.81      1761
```

```
AdaBoostClassifier()
```

Chapter 12: Deep Learning with Python

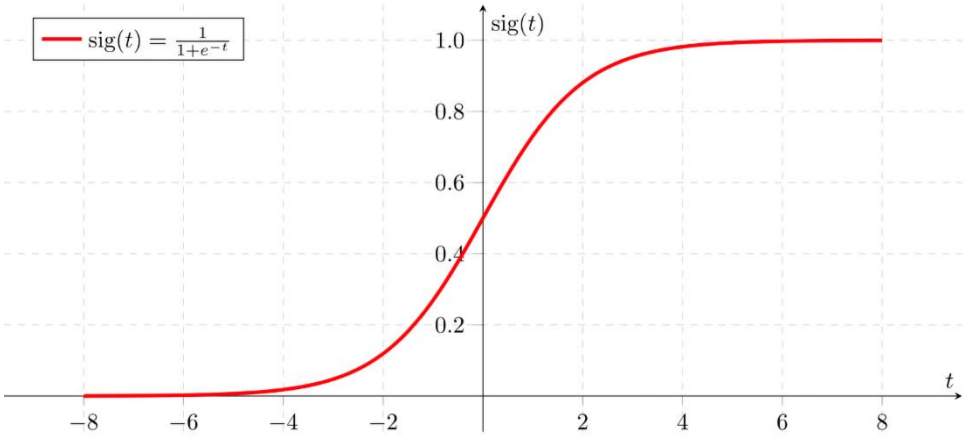
	CRIM	ZN	INDUS	CHAS	NOX	RM	AGE	DIS	RAD	TAX	PTRATIO	B	LSTAT	MEDV
0	0.00632	18.0	2.31	0.0	0.538	6.575	65.2	4.0900	1	296	15.3	396.90	4.98	24.0
1	0.02731	0.0	7.07	0.0	0.469	6.421	78.9	4.9671	2	242	17.8	396.90	9.14	21.6
2	0.02729	0.0	7.07	0.0	0.469	7.185	61.1	4.9671	2	242	17.8	392.83	4.03	34.7
3	0.03237	0.0	2.18	0.0	0.458	6.998	45.8	6.0622	3	222	18.7	394.63	2.94	33.4
4	0.06905	0.0	2.18	0.0	0.458	7.147	54.2	6.0622	3	222	18.7	396.90	NaN	36.2

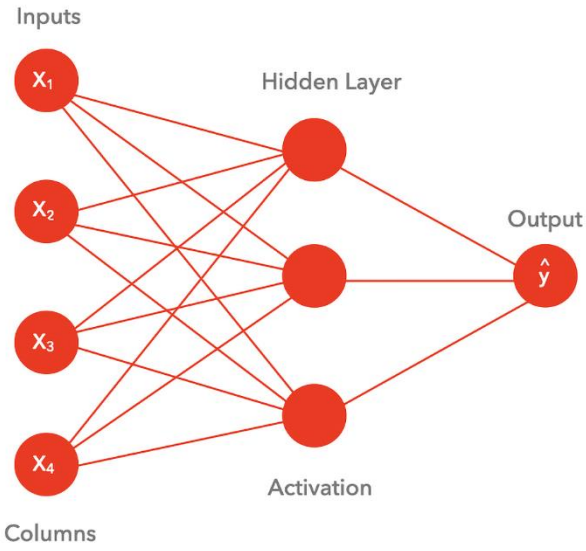


LINEAR REGRESSION

- This is one row of data.
- Picture depth for N rows.
- Multiply X by W and sum the results.
- Find Ws to minimize the error.

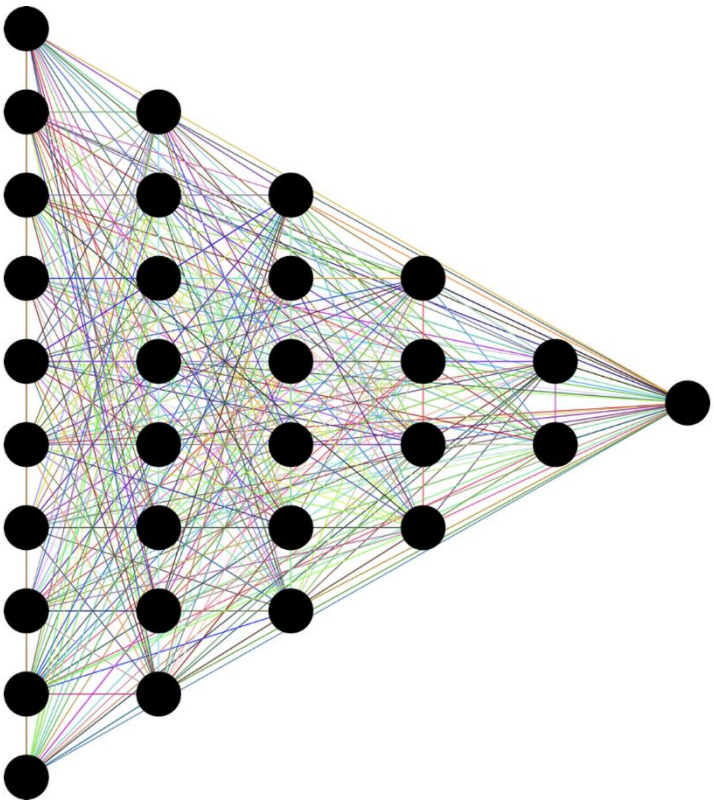
SIGMOID EQUATION





NEURAL NETWORK

This Neural Network has a hidden layer of 3 nodes. You can have as many hidden layers with as many nodes as you want. Each node after the first layer contains an activation function. This allows for nonlinearity and much greater complexity in models. The final node needs an activation function if the dataset requires classification; for regression it's uncommon.



Python_Workshop_Deep_Learning.ipynb

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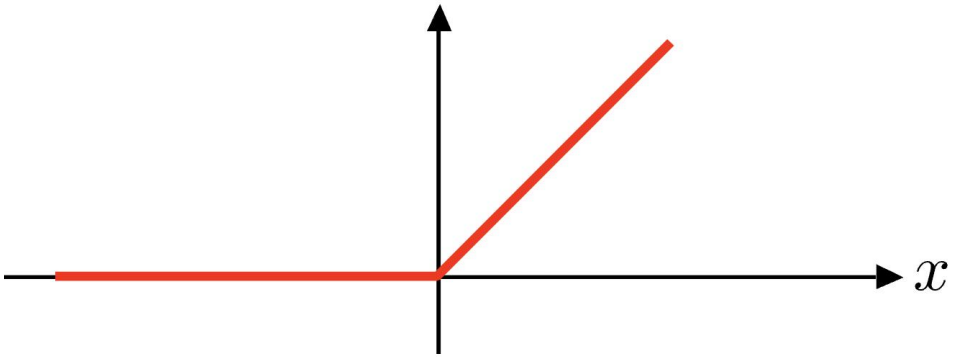
```
[1] import pandas as pd
    from sklearn.model_selection import train_test_split
    from tensorflow import keras
    from keras.models import Sequential
    from keras.layers import Dense
```

	CRIM	ZN	INDUS	CHAS	NOX	RM	AGE	DIS	RAD	TAX	PTRATIO	B	LSTAT	MEDV
0	0.00632	18.0	2.31	0.0	0.538	6.575	65.2	4.0900	1	296	15.3	396.90	4.98	24.0
1	0.02731	0.0	7.07	0.0	0.469	6.421	78.9	4.9671	2	242	17.8	396.90	9.14	21.6
2	0.02729	0.0	7.07	0.0	0.469	7.185	61.1	4.9671	2	242	17.8	392.83	4.03	34.7
3	0.03237	0.0	2.18	0.0	0.458	6.998	45.8	6.0622	3	222	18.7	394.63	2.94	33.4
4	0.06905	0.0	2.18	0.0	0.458	7.147	54.2	6.0622	3	222	18.7	396.90	NaN	36.2

$$\mathrm{ReLU}(x) \triangleq \max(0, x)$$



Intro_To_Deep_Learning.ipynb

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```
model = Sequential()
num_cols = X.shape[1]
model.add(Dense(20, input_shape=(num_cols,), activation='relu'))
model.add(Dense(10, activation='relu'))
model.add(Dense(1))
print(model.summary())
```

```
Model: "sequential_6"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 dense_14 (Dense)            (None, 20)                280

 dense_15 (Dense)            (None, 10)                210

 dense_16 (Dense)            (None, 1)                 11

=================================================================
Total params: 501
Trainable params: 501
Non-trainable params: 0
_________________________________________________________________
None
```

Intro_To_Deep_Learning.ipynb

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```
[6] model.compile(optimizer='adam', loss='mse')
    model.fit(X_train, y_train, epochs=10)
    model.evaluate(X_test, y_test)**0.5
```

```
Epoch 1/10
10/10 [==============================] - 1s 3ms/step - loss: 5056.6523
Epoch 2/10
10/10 [==============================] - 0s 7ms/step - loss: 1153.6791
Epoch 3/10
10/10 [==============================] - 0s 3ms/step - loss: 485.1138
Epoch 4/10
10/10 [==============================] - 0s 3ms/step - loss: 522.5190
Epoch 5/10
10/10 [==============================] - 0s 4ms/step - loss: 339.5237
Epoch 6/10
10/10 [==============================] - 0s 5ms/step - loss: 243.8954
Epoch 7/10
10/10 [==============================] - 0s 4ms/step - loss: 209.8001
Epoch 8/10
10/10 [==============================] - 0s 3ms/step - loss: 179.0468
Epoch 9/10
10/10 [==============================] - 0s 3ms/step - loss: 159.0161
Epoch 10/10
10/10 [==============================] - 0s 4ms/step - loss: 141.8488
4/4 [==============================] - 0s 3ms/step - loss: 98.4526
9.922327130446453
```

Intro_To_Deep_Learning.ipynb

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```
Epoch 38/50
10/10 [==============================] - 0s 2ms/step - loss: 51.9401
Epoch 39/50
10/10 [==============================] - 0s 3ms/step - loss: 51.9600
Epoch 40/50
10/10 [==============================] - 0s 3ms/step - loss: 51.9430
Epoch 41/50
10/10 [==============================] - 0s 3ms/step - loss: 50.8828
Epoch 42/50
10/10 [==============================] - 0s 3ms/step - loss: 51.9591
Epoch 43/50
10/10 [==============================] - 0s 2ms/step - loss: 51.9238
Epoch 44/50
10/10 [==============================] - 0s 2ms/step - loss: 51.1781
Epoch 45/50
10/10 [==============================] - 0s 3ms/step - loss: 50.0570
Epoch 46/50
10/10 [==============================] - 0s 3ms/step - loss: 49.9222
Epoch 47/50
10/10 [==============================] - 0s 3ms/step - loss: 50.4149
Epoch 48/50
10/10 [==============================] - 0s 3ms/step - loss: 49.6352
Epoch 49/50
10/10 [==============================] - 0s 3ms/step - loss: 50.0986
Epoch 50/50
10/10 [==============================] - 0s 3ms/step - loss: 49.5561
4/4 [==============================] - 0s 4ms/step - loss: 35.3090
5.9421394292034035
```

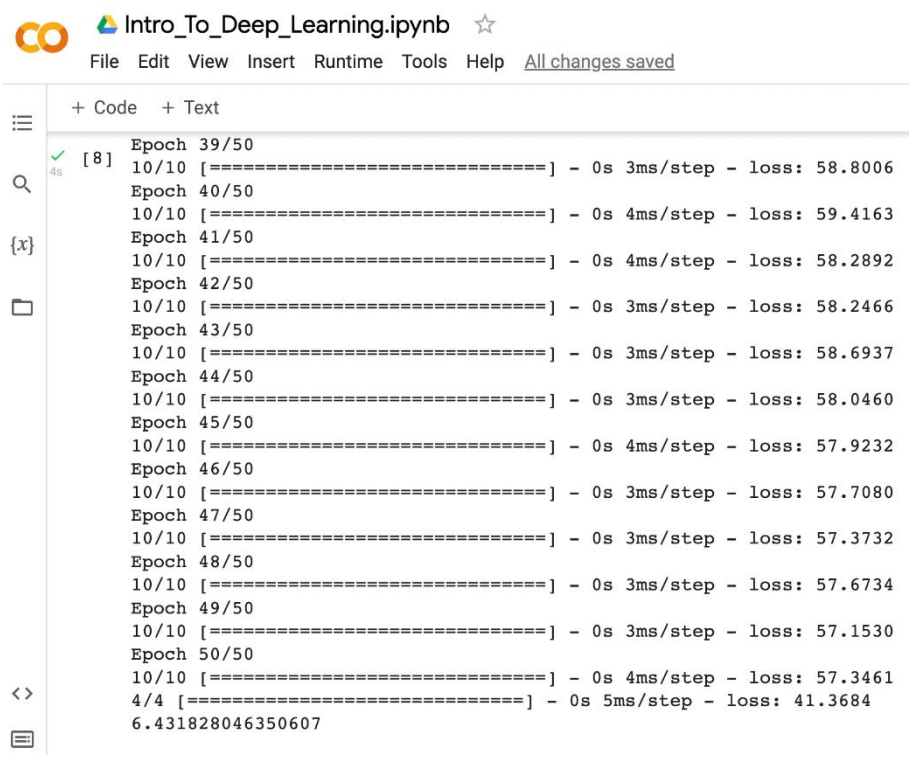
```
Model: "sequential_2"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 dense_6 (Dense)             (None, 24)                336

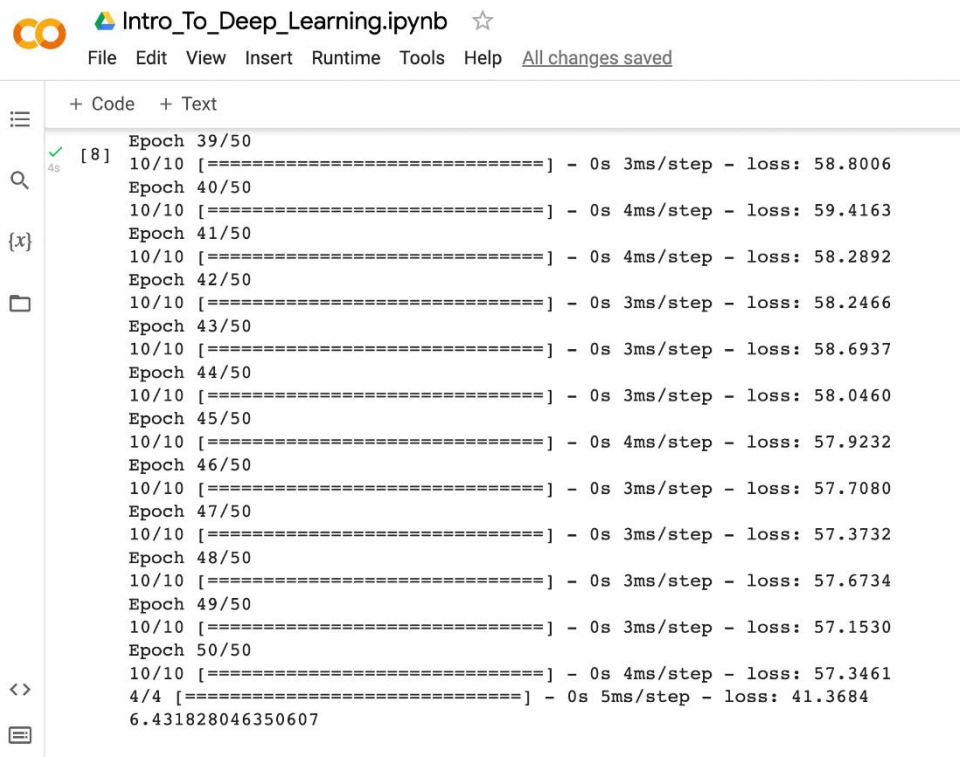
 dense_7 (Dense)             (None, 24)                600

 dense_8 (Dense)             (None, 24)                600

 dense_9 (Dense)             (None, 1)                 25

=================================================================
Total params: 1,561
Trainable params: 1,561
Non-trainable params: 0
```



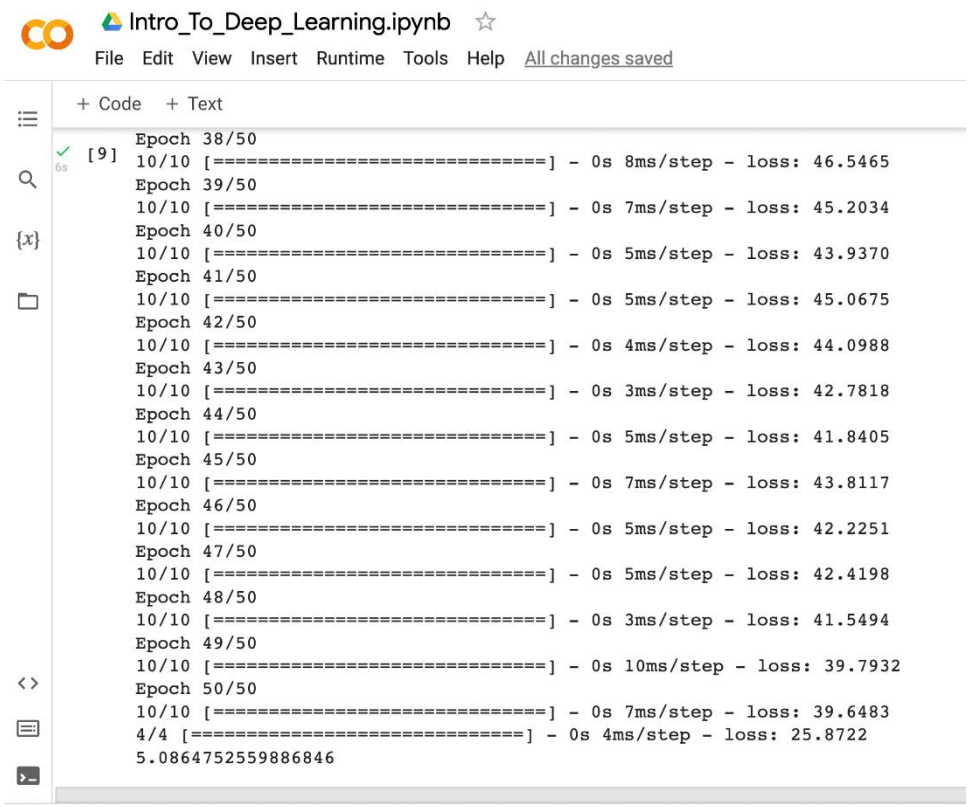



```
Model: "sequential_3"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 dense_10 (Dense)            (None, 48)                672

 dense_11 (Dense)            (None, 16)                784

 dense_12 (Dense)            (None, 1)                 17

=================================================================
Total params: 1,473
Trainable params: 1,473
Non-trainable params: 0
```




```
Model: "sequential_4"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 dense_13 (Dense)            (None, 100)               1400

 dense_14 (Dense)            (None, 1)                 101

=================================================================
Total params: 1,501
Trainable params: 1,501
Non-trainable params: 0
```

Intro_To_Deep_Learning.ipynb

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[26]
```
Epoch 38/50
10/10 [==============================] - 0s 2ms/step - loss: 39.0250
Epoch 39/50
10/10 [==============================] - 0s 2ms/step - loss: 39.3789
Epoch 40/50
10/10 [==============================] - 0s 2ms/step - loss: 39.1006
Epoch 41/50
10/10 [==============================] - 0s 2ms/step - loss: 38.4823
Epoch 42/50
10/10 [==============================] - 0s 2ms/step - loss: 38.8776
Epoch 43/50
10/10 [==============================] - 0s 2ms/step - loss: 37.0495
Epoch 44/50
10/10 [==============================] - 0s 3ms/step - loss: 37.2557
Epoch 45/50
10/10 [==============================] - 0s 2ms/step - loss: 36.2107
Epoch 46/50
10/10 [==============================] - 0s 2ms/step - loss: 35.8049
Epoch 47/50
10/10 [==============================] - 0s 2ms/step - loss: 36.7325
Epoch 48/50
10/10 [==============================] - 0s 2ms/step - loss: 35.8743
Epoch 49/50
10/10 [==============================] - 0s 2ms/step - loss: 38.4962
Epoch 50/50
10/10 [==============================] - 0s 2ms/step - loss: 35.1725
4/4 [==============================] - 0s 3ms/step - loss: 23.5795
4.855870593161364
```

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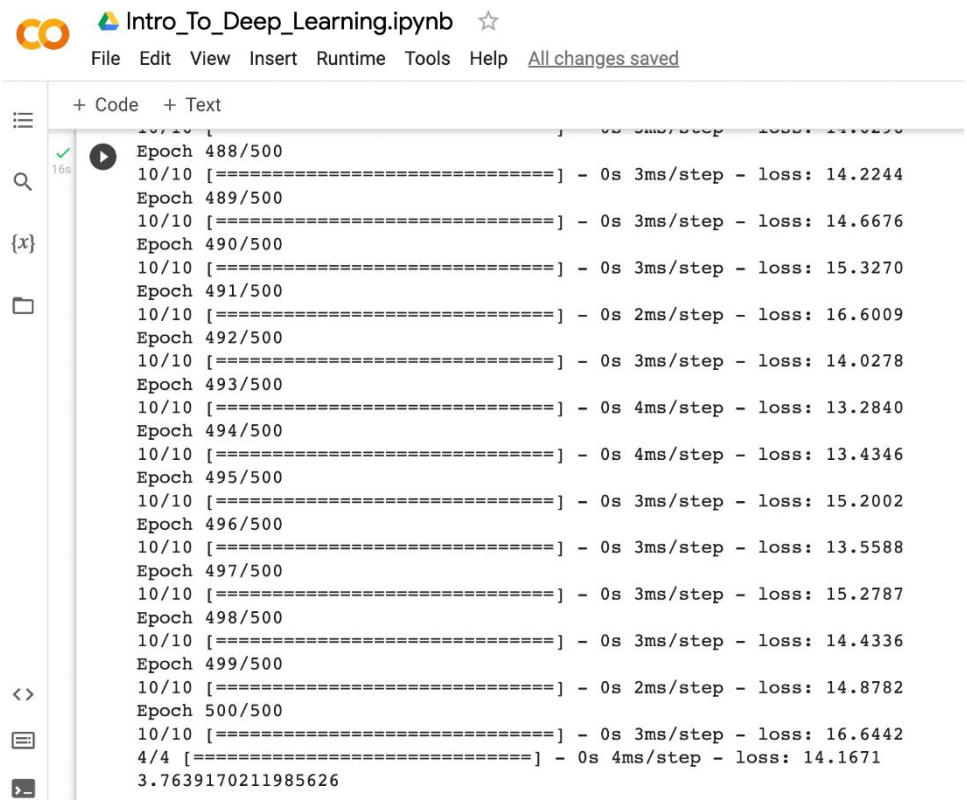
```
Epoch 38/50
10/10 [==============================] - 0s 2ms/step - loss: 53.2083
Epoch 39/50
10/10 [==============================] - 0s 2ms/step - loss: 51.9169
Epoch 40/50
10/10 [==============================] - 0s 3ms/step - loss: 52.1243
Epoch 41/50
10/10 [==============================] - 0s 2ms/step - loss: 51.6049
Epoch 42/50
10/10 [==============================] - 0s 2ms/step - loss: 51.3687
Epoch 43/50
10/10 [==============================] - 0s 2ms/step - loss: 51.0009
Epoch 44/50
10/10 [==============================] - 0s 2ms/step - loss: 50.7503
Epoch 45/50
10/10 [==============================] - 0s 2ms/step - loss: 50.5870
Epoch 46/50
10/10 [==============================] - 0s 3ms/step - loss: 50.4171
Epoch 47/50
10/10 [==============================] - 0s 2ms/step - loss: 49.9279
Epoch 48/50
10/10 [==============================] - 0s 2ms/step - loss: 49.4315
Epoch 49/50
10/10 [==============================] - 0s 2ms/step - loss: 49.8662
Epoch 50/50
10/10 [==============================] - 0s 2ms/step - loss: 49.2663
4/4 [==============================] - 0s 3ms/step - loss: 38.8294
6.231320352262395
```


Intro_To_Deep_Learning.ipynb
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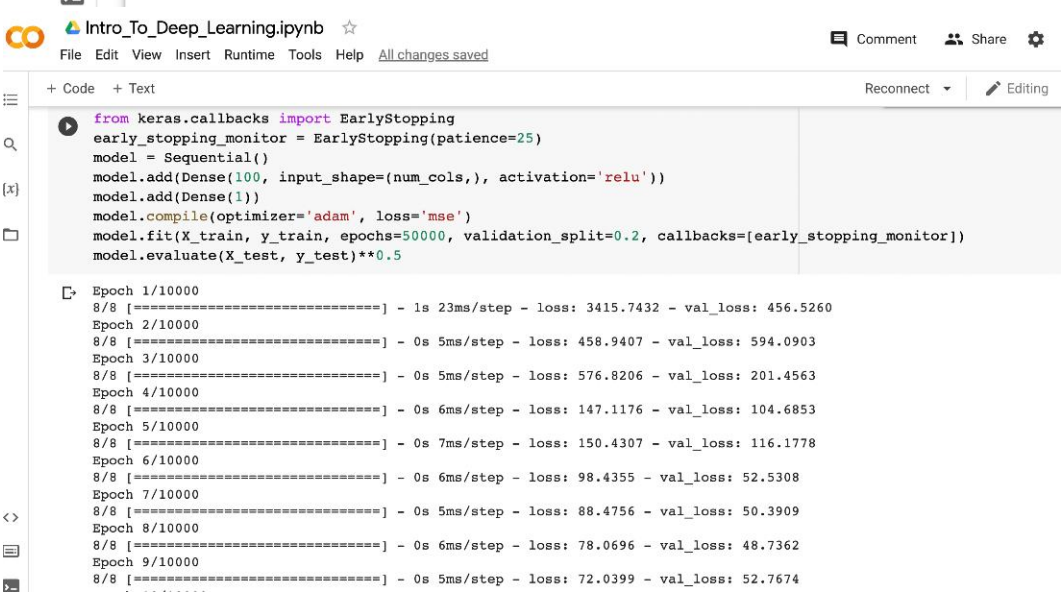
+ Code + Text
Epoch 488/500
10/10 [==========] - 0s 3ms/step - loss: 14.2244
Epoch 489/500
10/10 [==========] - 0s 3ms/step - loss: 14.6676
Epoch 490/500
10/10 [==========] - 0s 3ms/step - loss: 15.3270
Epoch 491/500
10/10 [==========] - 0s 2ms/step - loss: 16.6009
Epoch 492/500
10/10 [==========] - 0s 3ms/step - loss: 14.0278
Epoch 493/500
10/10 [==========] - 0s 4ms/step - loss: 13.2840
Epoch 494/500
10/10 [==========] - 0s 4ms/step - loss: 13.4346
Epoch 495/500
10/10 [==========] - 0s 3ms/step - loss: 15.2002
Epoch 496/500
10/10 [==========] - 0s 3ms/step - loss: 13.5588
Epoch 497/500
10/10 [==========] - 0s 3ms/step - loss: 15.2787
Epoch 498/500
10/10 [==========] - 0s 3ms/step - loss: 14.4336
Epoch 499/500
10/10 [==========] - 0s 2ms/step - loss: 14.8782
Epoch 500/500
10/10 [==========] - 0s 3ms/step - loss: 16.6442
4/4 [==========] - 0s 4ms/step - loss: 14.1671
3.7639170211985626


Intro_To_Deep_Learning.ipynb
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Reconnect Editing
from keras.callbacks import EarlyStopping
early_stopping_monitor = EarlyStopping(patience=25)
model = Sequential()
model.add(Dense(100, input_shape=(num_cols,), activation='relu'))
model.add(Dense(1))
model.compile(optimizer='adam', loss='mse')
model.fit(X_train, y_train, epochs=50000, validation_split=0.2, callbacks=[early_stopping_monitor])
model.evaluate(X_test, y_test)**0.5
Epoch 1/10000
8/8 [==========] - 1s 23ms/step - loss: 3415.7432 - val_loss: 456.5260
Epoch 2/10000
8/8 [==========] - 0s 5ms/step - loss: 458.9407 - val_loss: 594.0903
Epoch 3/10000
8/8 [==========] - 0s 5ms/step - loss: 576.8206 - val_loss: 201.4563
Epoch 4/10000
8/8 [==========] - 0s 6ms/step - loss: 147.1176 - val_loss: 104.6853
Epoch 5/10000
8/8 [==========] - 0s 7ms/step - loss: 150.4307 - val_loss: 116.1778
Epoch 6/10000
8/8 [==========] - 0s 6ms/step - loss: 98.4355 - val_loss: 52.5308
Epoch 7/10000
8/8 [==========] - 0s 5ms/step - loss: 88.4756 - val_loss: 50.3909
Epoch 8/10000
8/8 [==========] - 0s 6ms/step - loss: 78.0696 - val_loss: 48.7362
Epoch 9/10000
8/8 [==========] - 0s 5ms/step - loss: 72.0399 - val_loss: 52.7674

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```
8/8 [==============================] - 0s 6ms/step - loss: 27.0941 - val_loss: 18.7136
Epoch 278/10000
8/8 [==============================] - 0s 6ms/step - loss: 21.9076 - val_loss: 19.9482
Epoch 279/10000
8/8 [==============================] - 0s 6ms/step - loss: 24.2312 - val_loss: 16.2313
Epoch 280/10000
8/8 [==============================] - 0s 6ms/step - loss: 25.3306 - val_loss: 21.5997
Epoch 281/10000
8/8 [==============================] - 0s 6ms/step - loss: 25.1975 - val_loss: 17.0677
Epoch 282/10000
8/8 [==============================] - 0s 6ms/step - loss: 24.6308 - val_loss: 16.0429
Epoch 283/10000
8/8 [==============================] - 0s 6ms/step - loss: 23.2410 - val_loss: 22.0824
Epoch 284/10000
8/8 [==============================] - 0s 6ms/step - loss: 25.4052 - val_loss: 22.8287
Epoch 285/10000
8/8 [==============================] - 0s 7ms/step - loss: 33.2490 - val_loss: 18.4719
Epoch 286/10000
8/8 [==============================] - 0s 6ms/step - loss: 27.2933 - val_loss: 20.8524
Epoch 287/10000
8/8 [==============================] - 0s 6ms/step - loss: 23.5024 - val_loss: 15.5922
Epoch 288/10000
8/8 [==============================] - 0s 6ms/step - loss: 22.8261 - val_loss: 16.3161
Epoch 289/10000
8/8 [==============================] - 0s 5ms/step - loss: 21.9586 - val_loss: 16.4420
4/4 [==============================] - 0s 4ms/step - loss: 16.3988
4.049541758291725
```

Intro_To_Deep_Learning.ipynb

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```
from keras.layers import Dropout
model = Sequential()
model.add(Dense(128, input_shape=(num_cols,), activation='relu'))
model.add(Dropout(0.1))
model.add(Dense(32, activation='relu'))
model.add(Dropout(0.1))
model.add(Dense(1))
model.compile(optimizer='adam', loss='mse')
early_stopping_monitor = EarlyStopping(patience=50)
model.fit(X_train, y_train, epochs=10000, validation_split=0.2, callbacks=[early_stopping_monitor])
model.evaluate(X_test, y_test)**0.5
```

```
Epoch 1/10000
8/8 [==============================] - 1s 26ms/step - loss: 536.5046 - val_loss: 44.3476
Epoch 2/10000
8/8 [==============================] - 0s 6ms/step - loss: 302.7124 - val_loss: 109.5779
Epoch 3/10000
8/8 [==============================] - 0s 6ms/step - loss: 228.4950 - val_loss: 43.9412
Epoch 4/10000
8/8 [==============================] - 0s 7ms/step - loss: 158.5551 - val_loss: 40.3001
Epoch 5/10000
8/8 [==============================] - 0s 6ms/step - loss: 149.4862 - val_loss: 49.3337
Epoch 6/10000
8/8 [==============================] - 0s 6ms/step - loss: 116.8722 - val_loss: 33.6004
```

Intro_To_Deep_Learning.ipynb

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```
Epoch 344/10000
8/8 [==============================] - 0s 6ms/step - loss: 31.3027 - val_loss: 20.8417
Epoch 345/10000
8/8 [==============================] - 0s 6ms/step - loss: 30.7046 - val_loss: 14.1126
Epoch 346/10000
8/8 [==============================] - 0s 7ms/step - loss: 25.9081 - val_loss: 16.2591
Epoch 347/10000
8/8 [==============================] - 0s 6ms/step - loss: 30.4376 - val_loss: 13.2208
Epoch 348/10000
8/8 [==============================] - 0s 6ms/step - loss: 28.1602 - val_loss: 14.1591
Epoch 349/10000
8/8 [==============================] - 0s 7ms/step - loss: 25.8209 - val_loss: 15.3344
Epoch 350/10000
8/8 [==============================] - 0s 6ms/step - loss: 36.2935 - val_loss: 13.8483
Epoch 351/10000
8/8 [==============================] - 0s 6ms/step - loss: 31.5222 - val_loss: 17.8962
Epoch 352/10000
8/8 [==============================] - 0s 6ms/step - loss: 26.0782 - val_loss: 14.1782
Epoch 353/10000
8/8 [==============================] - 0s 6ms/step - loss: 28.5210 - val_loss: 14.6101
Epoch 354/10000
8/8 [==============================] - 0s 6ms/step - loss: 24.0455 - val_loss: 14.8872
Epoch 355/10000
8/8 [==============================] - 0s 8ms/step - loss: 28.2430 - val_loss: 14.9235
Epoch 356/10000
8/8 [==============================] - 0s 6ms/step - loss: 26.6224 - val_loss: 14.2847
4/4 [==============================] - 0s 3ms/step - loss: 11.3833
3.3739098095012743
```

	age	fnlwgt	education-num	capital-gain	capital-loss	hours-per-week	workclass_?	workclass_Federal-gov	workclass_Local-gov	workclass_Never-worked	...	native-country_Puerto-Rico
0	39	77516	13	2174	0	40	0	0	0	0	...	0
1	50	83311	13	0	0	13	0	0	0	0	...	0
2	38	215646	9	0	0	40	0	0	0	0	...	0
3	53	234721	7	0	0	40	0	0	0	0	...	0
4	28	338409	13	0	0	40	0	0	0	0	...	0

5 rows × 93 columns

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 dense (Dense)               (None, 8)                 744

 dense_1 (Dense)             (None, 1)                 9

=================================================================
Total params: 753
Trainable params: 753
Non-trainable params: 0
_________________________________________________________________
```

```
Epoch 20/10000
611/611 [==============================] - 2s 3ms/step - loss: 12.8306 - accuracy: 0.7302 - val_loss: 2.5190 - val_accuracy: 0.8106
Epoch 21/10000
611/611 [==============================] - 2s 3ms/step - loss: 14.5757 - accuracy: 0.7367 - val_loss: 10.2165 - val_accuracy: 0.7969
Epoch 22/10000
611/611 [==============================] - 1s 2ms/step - loss: 13.4995 - accuracy: 0.7352 - val_loss: 5.3369 - val_accuracy: 0.8104
Epoch 23/10000
611/611 [==============================] - 2s 3ms/step - loss: 11.4023 - accuracy: 0.7411 - val_loss: 3.1207 - val_accuracy: 0.7244
Epoch 24/10000
611/611 [==============================] - 1s 2ms/step - loss: 14.6037 - accuracy: 0.7339 - val_loss: 21.1346 - val_accuracy: 0.3710
Epoch 25/10000
611/611 [==============================] - 1s 2ms/step - loss: 12.8796 - accuracy: 0.7313 - val_loss: 17.6294 - val_accuracy: 0.7916
Epoch 26/10000
611/611 [==============================] - 1s 2ms/step - loss: 9.2974 - accuracy: 0.7528 - val_loss: 2.5884 - val_accuracy: 0.8260
Epoch 27/10000
611/611 [==============================] - 1s 2ms/step - loss: 13.3042 - accuracy: 0.7384 - val_loss: 19.8166 - val_accuracy: 0.7985
Epoch 28/10000
611/611 [==============================] - 1s 2ms/step - loss: 11.3829 - accuracy: 0.7384 - val_loss: 4.6464 - val_accuracy: 0.8206
Epoch 29/10000
611/611 [==============================] - 1s 2ms/step - loss: 12.0870 - accuracy: 0.7468 - val_loss: 9.4172 - val_accuracy: 0.8133
Epoch 30/10000
611/611 [==============================] - 1s 2ms/step - loss: 10.2922 - accuracy: 0.7491 - val_loss: 3.9530 - val_accuracy: 0.8190
255/255 [==============================] - 0s 2ms/step - loss: 4.2645 - accuracy: 0.8048
[4.264492034912109, 0.8048151135444641]
```

```
Epoch 72/1000
6/6 [==============================] - 0s 8ms/step - loss: 0.4675 - accuracy: 0.8232 - val_loss: 0.5302 - val_accuracy: 0.7174
Epoch 73/1000
6/6 [==============================] - 0s 9ms/step - loss: 0.3969 - accuracy: 0.8287 - val_loss: 0.3581 - val_accuracy: 0.8478
Epoch 74/1000
6/6 [==============================] - 0s 8ms/step - loss: 0.3702 - accuracy: 0.8343 - val_loss: 0.5377 - val_accuracy: 0.7174
Epoch 75/1000
6/6 [==============================] - 0s 8ms/step - loss: 0.3664 - accuracy: 0.8453 - val_loss: 0.4179 - val_accuracy: 0.8043
Epoch 76/1000
6/6 [==============================] - 0s 10ms/step - loss: 0.4303 - accuracy: 0.7845 - val_loss: 0.3773 - val_accuracy: 0.8478
Epoch 77/1000
6/6 [==============================] - 0s 8ms/step - loss: 0.4266 - accuracy: 0.8453 - val_loss: 0.6357 - val_accuracy: 0.6522
Epoch 78/1000
6/6 [==============================] - 0s 8ms/step - loss: 0.4155 - accuracy: 0.8232 - val_loss: 0.4632 - val_accuracy: 0.8261
Epoch 79/1000
6/6 [==============================] - 0s 9ms/step - loss: 0.4151 - accuracy: 0.8122 - val_loss: 0.4614 - val_accuracy: 0.7826
Epoch 80/1000
6/6 [==============================] - 0s 8ms/step - loss: 0.3488 - accuracy: 0.8453 - val_loss: 0.3515 - val_accuracy: 0.7826
3/3 [==============================] - 0s 4ms/step - loss: 0.4404 - accuracy: 0.8026
[0.44042325019836426, 0.8026315569877625]
```

	0	1	2	3	4	5	6	7	8	9	...	775	776	777	778	779	780	781	782	783	784
0	6	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
1	5	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
2	7	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
3	9	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
4	5	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0

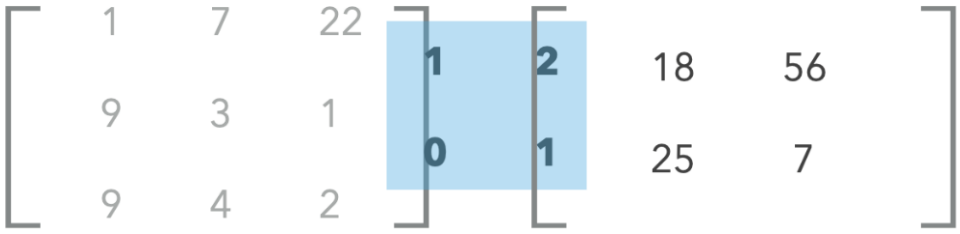
$$\begin{bmatrix} 1 & 7 & 22 \\ 9 & 3 & 1 \\ 9 & 4 & 2 \end{bmatrix}$$

3

$$\begin{bmatrix} 1 & 7 & 22 \\ 9 & 3 & 1 \\ 9 & 4 & 2 \end{bmatrix} \quad \begin{bmatrix} 1 & 7 & 22 \\ 9 & 3 & 1 \\ 9 & 4 & 2 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 7 & 22 \\ 9 & 3 & 1 \\ 9 & 4 & 2 \end{bmatrix} \quad \begin{bmatrix} 1 & 7 & 22 \\ 9 & 3 & 1 \\ 9 & 4 & 2 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 7 & 22 \\ 9 & 3 & 1 \\ 9 & 4 & 2 \end{bmatrix} \quad \begin{bmatrix} \mathbf{1} & \mathbf{2} \\ \mathbf{0} & \mathbf{1} \end{bmatrix}$$



Model: "sequential"

Layer (type)	Output Shape	Param #
conv2d (Conv2D)	(None, 26, 26, 32)	320
max_pooling2d (MaxPooling2D)	(None, 13, 13, 32)	0
conv2d_1 (Conv2D)	(None, 11, 11, 16)	4624
max_pooling2d_1 (MaxPooling2D)	(None, 5, 5, 16)	0
flatten (Flatten)	(None, 400)	0
dense (Dense)	(None, 10)	4010

Total params: 8,954
Trainable params: 8,954
Non-trainable params: 0

```
Epoch 15/20
625/625 [==============================] - 13s 21ms/step - loss: 0.0157 - accuracy: 0.9948
Epoch 16/20
625/625 [==============================] - 13s 21ms/step - loss: 0.0124 - accuracy: 0.9958
Epoch 17/20
625/625 [==============================] - 13s 21ms/step - loss: 0.0131 - accuracy: 0.9958
Epoch 18/20
625/625 [==============================] - 13s 21ms/step - loss: 0.0105 - accuracy: 0.9964
Epoch 19/20
625/625 [==============================] - 13s 21ms/step - loss: 0.0085 - accuracy: 0.9975
Epoch 20/20
625/625 [==============================] - 13s 21ms/step - loss: 0.0103 - accuracy: 0.9961
313/313 [==============================] - 3s 8ms/step - loss: 0.0760 - accuracy: 0.9810
[0.07597225904464722, 0.9810000061988831]
```

```
Epoch 15/20
1875/1875 [==============================] - 6s 3ms/step - loss: 0.2109 - accuracy: 0.9232
Epoch 16/20
1875/1875 [==============================] - 7s 4ms/step - loss: 0.2068 - accuracy: 0.9244
Epoch 17/20
1875/1875 [==============================] - 6s 3ms/step - loss: 0.2037 - accuracy: 0.9257
Epoch 18/20
1875/1875 [==============================] - 6s 3ms/step - loss: 0.2019 - accuracy: 0.9255
Epoch 19/20
1875/1875 [==============================] - 6s 3ms/step - loss: 0.1955 - accuracy: 0.9269
Epoch 20/20
1875/1875 [==============================] - 6s 3ms/step - loss: 0.1952 - accuracy: 0.9282
313/313 [==============================] - 1s 3ms/step - loss: 0.2489 - accuracy: 0.9100
[0.24885225296020508, 0.9100000262260437]
```

Chapter 13: New Features in Python


```
name='Python' birthday=datetime.date(1991, 2, 20)
```


```
{'key1': 'd1', 'key3': 'd2', 'key2': 'd2'}
{'key1': 'd1', 'key3': 'd2', 'key2': 'd2'}
```


```
$ python2.7 example.py
  File "example.py", line 2
    def func(): pass
        ^
SyntaxError: invalid syntax
```

```
$ python3.10 example.py
  File "/home/mcorcherojim/tmp/packt/example.py", line 1
    d = {"key": "value", "key2": ["value"]
        ^
SyntaxError: '{' was never closed
```

```
$ python3.9 example.py
Traceback (most recent call last):
  File "/home/mcorcherojim/tmp/packt/example.py", line 2, in <module>
    print(d["key"]["key2"]["key3"])
TypeError: 'NoneType' object is not subscriptable
```

```
$ python3.11 example.py
Traceback (most recent call last):
  File "/home/mcorcherojim/tmp/packt/example.py", line 2, in <module>
    print(d["key"]["key2"]["key3"])
          ~~~~~~~~~~~~~~~~~^^^^^^^
TypeError: 'NoneType' object is not subscriptable
```

```
$ python3.10 example.py
Traceback (most recent call last):
  File "/home/mcorcherojim/tmp/packt/example.py", line 4, in <module>
    print((x + y) * int(str_num) + y + str_num)
TypeError: unsupported operand type(s) for +: 'int' and 'str'
```

```
$ python3.11 example.py
Traceback (most recent call last):
  File "/home/mcorcherojim/tmp/packt/example.py", line 4, in <module>
    print((x + y) * int(str_num) + y + str_num)
          ~~~~~~~~~~~~~~~~~~~~~~~~~~~^~~~~~~~~
TypeError: unsupported operand type(s) for +: 'int' and 'str'
```

```
$ python3.11 tomllib_example.py
{'build-system': {'build-backend': 'setuptools.build_meta',
                  'requires': ['setuptools', 'setuptools-scm']},
 'project': {'dependencies': ['flask', 'python-dateutil'],
             'description': 'An example package',
             'name': 'packt_package',
             'scripts': {'example-script': 'packt_package._main:main'}}}
```

```
$ python3.11 exception_notes.py
Traceback (most recent call last):
  File "/home/mcorcherojim/tmp/packt/Chapter13/exception_notes.py", line 11, in <module>
    secret_function(0)
  File "/home/mcorcherojim/tmp/packt/Chapter13/exception_notes.py", line 6, in secret_function
    func(10_000, number)
  File "/home/mcorcherojim/tmp/packt/Chapter13/exception_notes.py", line 2, in func
    return x / y
           ~~^~~
ZeroDivisionError: division by zero
A note to help with debugging
```