

File Edit View Run Kernel Git Tabs Settings Help PY0101EN-4-1-ReadFile.ipynb + Markdown git Run as Pipeline Python

 IBM Developer SKILLS NETWORK

Reading Files Python

Estimated time needed: 40 minutes

Objectives

After completing this lab you will be able to:

- Read text files using Python libraries

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Download Data

```
[7]: import urllib.request
url = 'https://s3-api.us-geo.objectstorage.softlayer.net/cf-courses-data/CognitiveClass/PY0101EN/labs/example1.txt'
filename = 'Example1.txt'
urllib.request.urlretrieve(url, filename)
```

```
[7]: ('Example1.txt', <http.client.HTTPMessage at 0x56fed30>)
```

```
[4]: # Download Example file

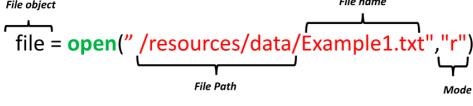
!wget -O /resources/data/Example1.txt https://s3-api.us-geo.objectstorage.softlayer.net/cf-courses-data/CognitiveClass/PY0101EN/labs/example1.txt
```

```
'wget' is not recognized as an internal or external command,
operable program or batch file.
```

```
[ ]:
```

Reading Text Files

One way to read or write a file in Python is to use the built-in `open` function. The `open` function provides a File object that contains the methods and attributes you need in order to read, save, and manipulate the file. In this notebook, we will only cover .txt files. The first parameter you need is the file path and the file name. An example is shown as follow:



The mode argument is optional and the default value is `r`. In this notebook we only cover two modes:

- `r` Read mode for reading files
- `w` Write mode for writing files

For the next example, we will use the text file `Example1.txt`. The file is shown as follow:

```
This is line 1
This is line 2
This is line 3
```

We read the file:

```
[15]: # Read the Example1.txt
example1 = "Example1.txt"
file1 = open(example1, "r")
```

We can view the attributes of the file.

The name of the file:

```
[ ]: # Print the path of file
file1.name
```

The mode the file object is in:

```
[ ]: # Print the mode of file, either 'r' or 'w'
file1.mode
```

We can read the file and assign it to a variable :

```
[ ]: # Read the file  
FileContent = file1.read()  
FileContent
```

The \n means that there is a new line.

We can print the file:

```
[ ]: # Print the file with '\n' as a new Line  
print(FileContent)
```

The file is of type string:

```
[ ]: # Type of file content  
type(FileContent)
```

It is very important that the file is closed in the end. This frees up resources and ensures consistency across different python versions.

```
[ ]: # Close file after finish  
file1.close()
```

A Better Way to Open a File

Using the `with` statement is better practice, it automatically closes the file even if the code encounters an exception. The code will run everything in the indent block then close the file object.

```
[10]: # Open file using with  
with open(example1, "r") as file1:  
    FileContent = file1.read()  
    print(FileContent)
```

This is line 1
This is line 2
This is line 3

The file object is closed, you can verify it by running the following cell:

```
[11]: # Verify if the file is closed  
file1.closed
```

```
[11]: True
```

We can see the info in the file:

```
[12]: # See the content of file  
print(FileContent)
```

This is line 1
This is line 2
This is line 3

The syntax is a little confusing as the file object is after the `as` statement. We also don't explicitly close the file. Therefore we summarize the steps in a figure:



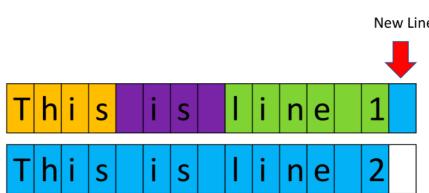
We don't have to read the entire file, for example, we can read the first 4 characters by entering three as a parameter to the method `.read()`:

```
[ ]: # Read first four characters  
with open(example1, "r") as file1:  
    print(file1.read(4))
```

Once the method `.read(4)` is called the first 4 characters are called. If we call the method again, the next 4 characters are called. The output for the following cell will demonstrate the process for different inputs to the method `read()`:

```
[ ]: # Read certain amount of characters  
with open(example1, "r") as file1:  
    print(file1.read(4))  
    print(file1.read(4))  
    print(file1.read(7))  
    print(file1.read(15))
```

The process is illustrated in the below figure, and each color represents the part of the file read after the method `read()` is called:



- 1)file1.read(4)
- 2)file1.read(4)
- 3)file1.read(7)

4)file1.read(15)

Here is an example using the same file, but instead we read 16, 5, and then 9 characters at a time:

```
[16]: # Read certain amount of characters
with open(example1, "r") as file1:
    print(file1.read(16))
    print(file1.read(5))
    print(file1.read(9))

This is line 1
```

This
is line 2

We can also read one line of the file at a time using the method `readline()`:

```
[ ]: # Read one Line
with open(example1, "r") as file1:
    print("first line: " + file1.readline())
```

We can also pass an argument to `readline()` to specify the number of characters we want to read. However, unlike `read()`, `readline()` can only read one line at most.

```
[24]: with open(example1, "r") as file1:
    print(file1.readline(20)) # does not read past the end of line
    print(file1.read(20)) # Returns the next 20 chars
```

This is line 1
This is line 2
This

We can use a loop to iterate through each line:

```
[18]: # Iterate through the Lines
with open(example1, "r") as file1:
    i = 0
    for line in file1:
        print("Iteration", str(i), ": ", line)
        i = i + 1
```

Iteration 0 : This is line 1
Iteration 1 : This is line 2
Iteration 2 : This is line 3

We can use the method `readlines()` to save the text file to a list:

```
[19]: # Read all Lines and save as a List
with open(example1, "r") as file1:
    FileasList = file1.readlines()
```

Each element of the list corresponds to a line of text:

```
[20]: # Print the first Line
FileasList[0]
```

```
[20]: 'This is line 1 \n'
```

Print the second line

```
FileasList[1]
```

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```
[21]: # Print the third Line
FileasList[2]
```

```
[21]: 'This is line 3'
```

Excercise

Weather Data

Your friend, a rising star in the field of meteorology, has called on you to write a script to perform some analysis on weather station data. Given below is a file "resources/ex4.csv", which contains some precipitation data for the month of June. Each line in the file has the format - Date,Precipitation (upto two decimal places). Note how the data is separated using ','. The first row of the file contains headers and should be ignored.

Your task is to complete the `<code>getNAvg</code>` function that computes a simple moving average for N days for the precipitation data, where N is a parameter. Your function should return a list of moving averages for the given data.

The formula for a k day moving average over a series - $n_0, n_1, n_2, \dots, n_m$ is:

$$\begin{aligned} M_i &= M_{i-1} + \frac{n_i - n_{i-k}}{k}, \quad \text{for } i = k \text{ to } m \\ \end{aligned}$$

$$\text{The skeleton code has been provided below. Edit only the required function.}$$

Double-click **here** for hints

<!--
- Each line of the file has a '\n' char which should be removed
- The lines in the file are read as strings and need to be typecasted to floats
- For a k day moving average, The data points for the last k days must be known-->

```
[2]: import matplotlib.pyplot as plt
```

```

statData = "ex4.csv"

def getNAvg(file,N):
    """
        file - File containing all the raw weather station data
        N - The number of days to compute the moving average over
    """
    Return a list of containing the moving average of all data points
    """
    pass

def plotData(mean,N):
    """
        mean - series to plot
        N - parameter for legend
        Plots running averages..
    """
    mean = [round(x,3) for x in mean]
    plt.plot(mean,label=str(N)+'.day.average')
    plt.xlabel('Day')
    plt.ylabel('Precipitation')
    plt.legend()

```

[]: Once you have finished, you can use the block below to plot your data

```
[201]: plotData(getNAvg(statData,1),1)
plotData([0 for x in range(1,5)]+ getNAvg(statData,5),5)
plotData([0 for x in range(1,7)] + getNAvg(statData,7),7)
```

```

-----
TypeError                                 Traceback (most recent call last)
<ipython-input-201-f8504fdca939> in <module>
--> 1 plotData(getNAvg(statData,1),1)
  2 plotData ([0 for x in range(1,5)]+ getNAvg(statData,5),5)
  3 plotData([0 for x in range(1,7)] + getNAvg(statData,7),7)

<ipython-input-200-4f25945b698e> in plotData(mean, N)
  19
  20     """
--> 21     mean = [round(x,3) for x in mean]
  22     plt.plot(mean,label=str(N) + ' day average')
  23     plt.xlabel('Day')

TypeError: 'NoneType' object is not iterable

```

You can use the code below to verify your progress -

```
[1]: avg5 =[4.18,4.78,4.34,4.72,5.48,5.84,6.84,6.76,6.74,5.46,4.18,2.74,2.52,2.02,2.16,2.82,2.92,4.36,4.74,5.12,5.34,6.4,6.56,6.1,5.74,5.62,4.26]
avg7 =[4.043,4.757,5.071,5.629,6.343,5.886,6.157,5.871,5.243,4.386,3.514,2.714,2.586,2.443,2.571,3.643,4.143,4.443,4.814,5.6,6.314,6.414,5.429,5.443,4.986]

def testMsg(passed):
    if passed:
        return 'Test Passed'
    else:
        return 'Test Failed'

print("getNAvg...")
try:
    sol5 = getNAvg(statData,5)
    sol7 = getNAvg(statData,7)

    if(len(sol5)==len(avg5) and (len(sol7)==len(avg7))):
        err5 = sum([abs(avg5[index] - sol5[index])for index in range(len(avg5))])
        err7 = sum([abs(avg7[index] - sol7[index])for index in range(len(avg7))])
        print(testMsg((err5 < 1) and (err7 < 1)))

    else:
        print(testMsg(false))
except NameError as e:
    print('Error! Code: {} , Message: {}'.format(c.__type__(e).__name__, m.__str__(e)))
except:
    print("An error occurred. Recheck your function")
```

getNAvg :
Error! Code: NameError, Message: name 'getNAvg' is not defined

```

Double-click **here** for the solution

<!--
import matplotlib.pyplot as plt

statData = "ex4.csv"

def getNAvg(file,N):
    """
        file - File containing all the raw weather station data
        N - The number of days to compute the moving average over
    """
    Return a list of containing the moving average of all data points
    """
    row = 0 # keep track of rows
    lastN = [] # keep track of last N points
    mean = [0] # running avg

    with open(file,"r") as rawData:
        for line in rawData:
            if (row == 0): # Ignore the headers
                row = row + 1
                continue

            line = line.strip('\n')
            lineData = float(line.split(',')[1])

            if (row<=N):
                lastN.append(lineData)
                mean[0] = (lineData + mean[0]*(row-1))/row
            else:
                mean.append( mean[row - N - 1]+ (lineData - lastN[0])/N)
                lastN = lastN[1:]
                lastN.append(lineData)

            row = row + 1
    return mean

```

```

def pLotData(mean,N):
    """ Plots running averages """
    mean = [round(x,3) for x in mean]
    plt.plot(mean,Label=str(N) + ' day average')
    plt.xlabel('Day')
    plt.ylabel('Precipitation')
    plt.legend()

pLotData(getNAvg(statData,1),1)
pLotData ([0 for x in range(1,5)]+ getNAvg(statData,5),5 )
pLotData([0 for x in range(1,7)] + getNAvg(statData,7),7)

-->

[ ]: file = "ex4.csv"
with open(file,"r") as rawData:
    rawData.read()

```

Note: Files with sets of data separated using ',' or other characters are called '.csv' files. They are a very common way to store data. Usually when dealing with them, An external library is used that does the nitpicky tasks for you. In fact, There are numerous libraries for statistical functions to. You will learn about such libraries later in the course.

The last exercise!

Congratulations, you have completed your first lesson and hands-on lab in Python. However, there is one more thing you need to do. The Data Science community encourages sharing work. The best way to share and showcase your work is to share it on GitHub. By sharing your notebook on GitHub you are not only building your reputation with fellow data scientists, but you can also show it off when applying for a job. Even though this was your first piece of work, it is never too early to start building good habits. So, please read and follow [this article](#) to learn how to share your work.

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Change Log

Date (YYYY-MM-DD)	Version	Changed By	Change Description
2020-09-30	1.1	Arjun Swami	Added excercise "Weather Data"
2020-09-30	1.0	Arjun Swami	Added blurbs about closing files and read() vs readline()
2020-08-26	0.2	Lavanya	Moved lab to course repo in GitLab

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