APS106

UNIVERSITY OF TORONTO

Advanced Files: CSVs and Modules

Week 6 | Lecture 2 (6.2.2)

While waiting for class to start:

Download and open the Jupyter Notebook (.ipynb) for Lecture 6.2.2

You should **NOT** use JupyterHub for this lecture

Upcoming:

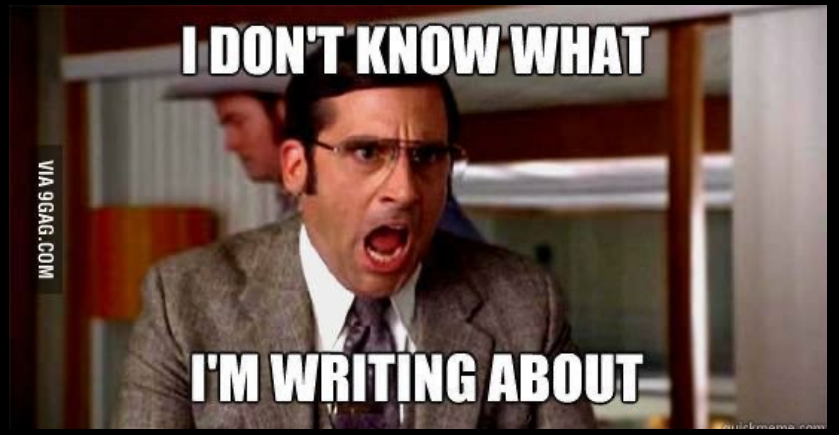
- Reflection 6 released Friday @ 11 AM
- Lab 5 due this Friday
- Behrang's Coffee Break / Office Hours Friday @ 1 PM
- PRA (Lab) on Friday @ 2PM this week
- Exam Review – Friday June 21 (Is online preferred?)

if nothing else, write #cleancode

The "Writing to Files" Recipe

go together

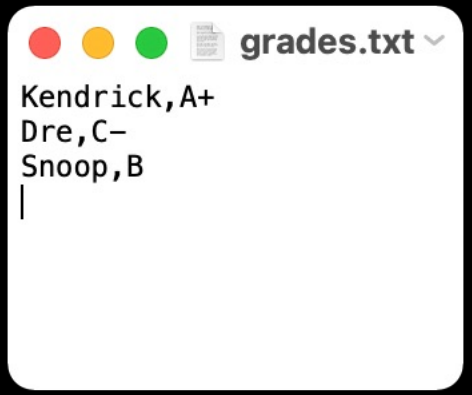
```
# open/create a file
myfile = open("grades.txt", "w")

# write to a file
myfile.write('string')

# close the file
myfile.close()
```



Example: Writing to Files

- How would we store a dictionary data structure in a file?

```
students = {'Kendrick': 'A+', 'Dre': 'C-', 'Snoop': 'B'}

# create a file
myfile = open("grades.txt", "w")

# store dictionary items to the file
for student in students:
    myfile.write(student + ',' + students[student] + '\n')

# close the file
myfile.close()
```



Let's Code!

- Let's take a look at how this works in Python!
  - Using a loop to write a dictionary to file

Open your notebook

Click Link:
1. Writing a dictionary to file

Different ways of Reading a File

- Reading a file is similar to writing a file. First we need to open a file for reading (“r”):

```
myfile = open('test.txt', 'r')
```

- If file doesn’t exist? ERROR
- Then to read a file we apply one of the following approaches which take advantage of various read methods:

1. The `read` approach
2. The `readline` approach
3. The `for line in file` approach
4. The `readlines` approach

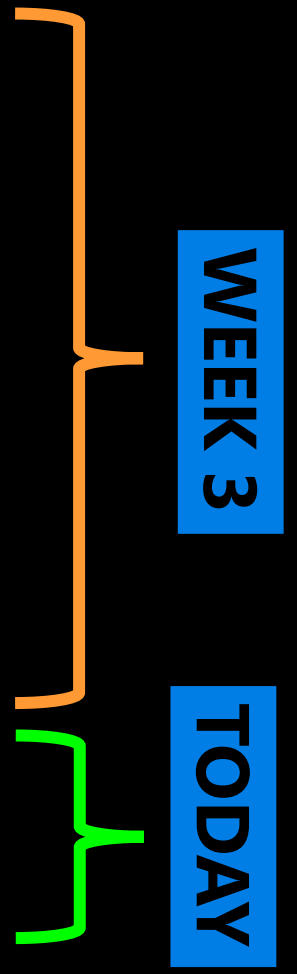
No correct approach!
Multiple methods to help with contexts and purposes

Different ways of Reading a File

Approach	Code	When to use it
The read approach	myfile = open(filename, 'r') contents = myfile.read() myfile.close()	When you want to read the whole file at once and use it as a single string.

The readline approach	myfile = open(filename, 'r')
	contents = ''
	line = myfile.readline()
	while line != '':
	  contents += line
	  line = myfile.readline()
	myfile.close()
		When you want to process only part of a file. Each time through the loop line contains one line of the file.

The for line in file approach	myfile = open(filename, 'r') contents = '' for line in myfile: contents += line myfile.close()	When you want to process every line in the file one at a time.
The readlines approach	myfile = open(filename, 'r') lines = myfile.readlines() myfile.close()	When you want to examine each line of a file by index.



Example: Reading a File

- Now that we have a file "grades.txt" stored. How would we go about retrieving and storing the data into a dictionary?

```
students = {}
myfile = open("grades.txt", "r")

# read each line of the file
for line in myfile:
    # find indices for slicing each line
    ind1 = line.find(',')
    ind2 = line.find('\\')
    name = line[:ind1]
    grade = line[ind1+1:ind2]
    students[name] = grade

myfile.close()
```

grades.txt

```
Kendrick,A+
Dre,C-
Snoop,B
```

```
>>> students
{'Kendrick': A+, 'Dre': 'C-', 'Snoop': 'B'}
```

Let's Code!

- Let's take a look at how this works in Python!
  - Different read approaches
    - read()
    - readline()
    - **for line in file**
    - **readlines()**

Open your notebook

Click Link:
2. More advanced file reading

The with Statement

- Every call on function `open` should have an accompanying call on the method `close`.
- Python provides a statement `with`, which automatically closes the file when the end of with block is reached.
- The general form of a with statement is as follows:

```
with open(filename, mode) as variable:
    body
```

Example: with Statement

- Modifying the previous example, of reading a file into a dictionary, to use the `with` statement.

```
students = {}
~~myfile = open("grades.txt", "r")~~
with open("grades.txt", "r") as myfile:

    # read each line of the file
    for line in myfile:
        ind1 = line.find(',')
        ind2 = line.find('\\')
        name = line[:ind1]
        grade = line[ind1+1:ind2]
        students[name] = grade

~~myfile.close()~~
```

Let's Code!

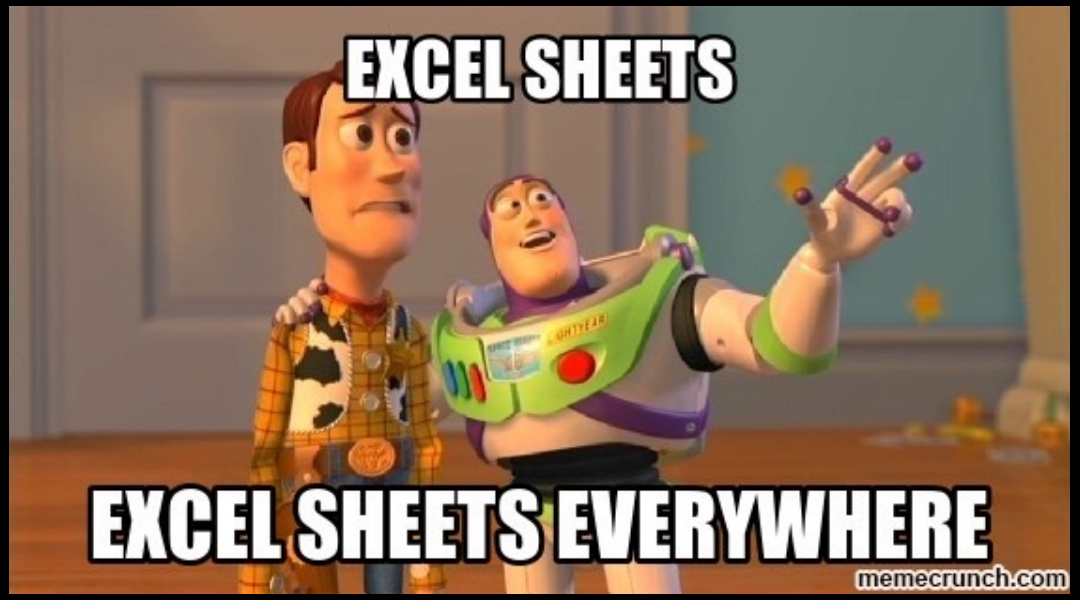
- Let's take a look at how this works in Python!
  - Opening and closing files with the with statement

Beakout Session!

Click Link:
3. The with statement

Comma Separated Values files

- We use them often in Excel, and other spreadsheet software
- Remember our old friend MS Excel? They work with Python too…



CSV Files

- Text data is commonly organized in a spreadsheet format using columns and rows.
- A common way to do this is to use a comma-separated value (CSV) file format that uses commas to separate data items, called fields.

Name	Test1	Test2	Final
Kendrick	100	50	29
Dre	76	32	33
Snoop	25	75	95

grades.csv

```
Name,Test1,Test2,Final
Kendrick,100,50,29
Dre,76,32,33
Snoop,25,75,95
```

Example: Opening a CSV File

- Let's see what happens when we try to read the CSV file, `'grades.csv'` using the file reading techniques discussed earlier.

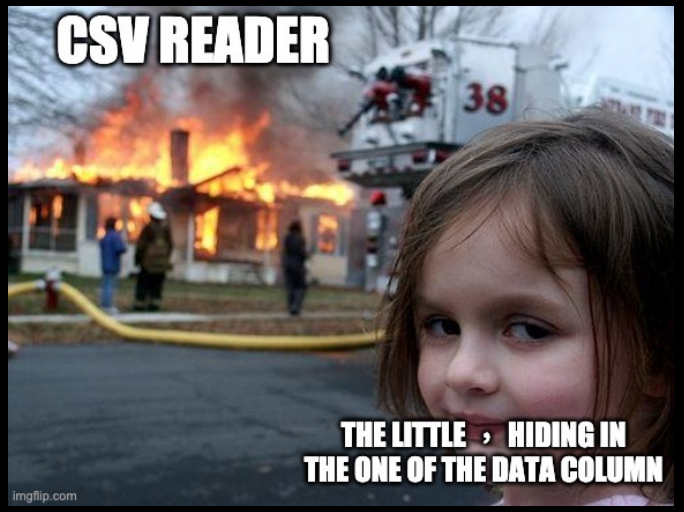
```
with open('grades.csv', 'r') as file:
    contents = file.read()
```

```
>>> contents
'Name,Test1,Test2,Final\nKendrick,100,50,29\nDre,76,32,33\nSnoop,25,75,95\n'
```

- How can we use this to obtain column and row information?

Reading CSV Files

- The CSV module is a powerful solution developed for working with CSV files.
- Reading of CSV files is done using the CSV reader. You can construct a reader object using `csv.reader()` which takes the file object as input.
- The reader object can be used to iterate through the contents of the CSV file, similarly to how a file object was used to iterate through the contents in a text file.

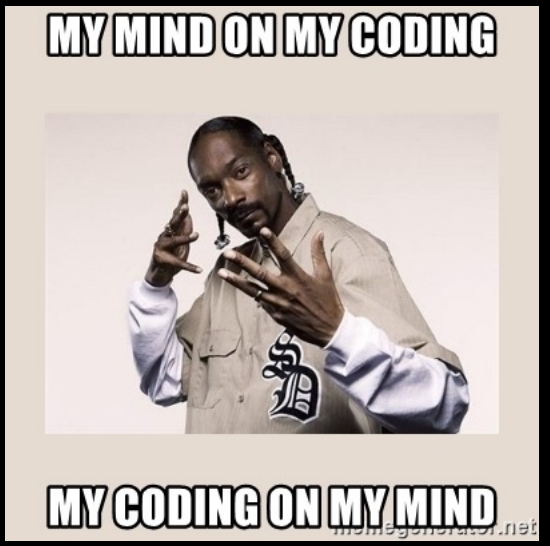


Example: Reading a CSV File (open/close)

- Read each row of a CSV file using open/close

```
import csv
myfile = open("grades.csv", "r")
grades_reader = csv.reader(myfile)

row_num = 1
for row in grades_reader:
    print('Row #', row_num, ':', row)
    row_num += 1

csvfile.close()
```

```
Row # 1 : ['Name', 'Test1', 'Test2', 'Final']
Row # 2 : [`Kendrick', '100', '50', '29']
Row # 3 : [`Dre', '76', '32', '33']
Row # 4 : [`Snoop', '25', '75', '95']
```

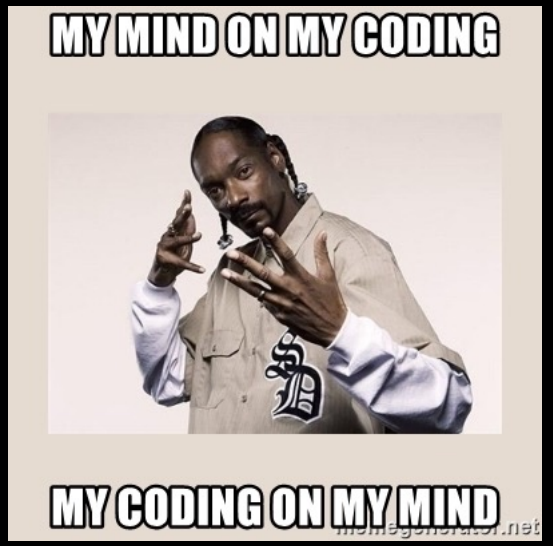


Example: Reading a CSV File (with)

- Read each row of a CSV file using with

```
import csv
with open('grades.csv', 'r') as myfile:
    grades_reader = csv.reader(myfile)

    row_num = 1
    for row in grades_reader:
        print('Row #', row_num, ':', row)
        row_num += 1
```

```
Row # 1 : ['Name', 'Test1', 'Test2', 'Final']
Row # 2 : ['Kendrick', '100', '50', '29']
Row # 3 : ['Dre', '76', '32', '33']
Row # 4 : ['Snoop', '25', '75', '95']
```



Writing CSV Files

- To write to the file we would first need to create a CSV writer object, `csv.writer()`, which similar to how we made a, CSV reader object.
- Once the CSV writer object is created, we can use the `writerow()` method to populate it with data.
- The `writerow()` method can only write a single row to the file at a time.

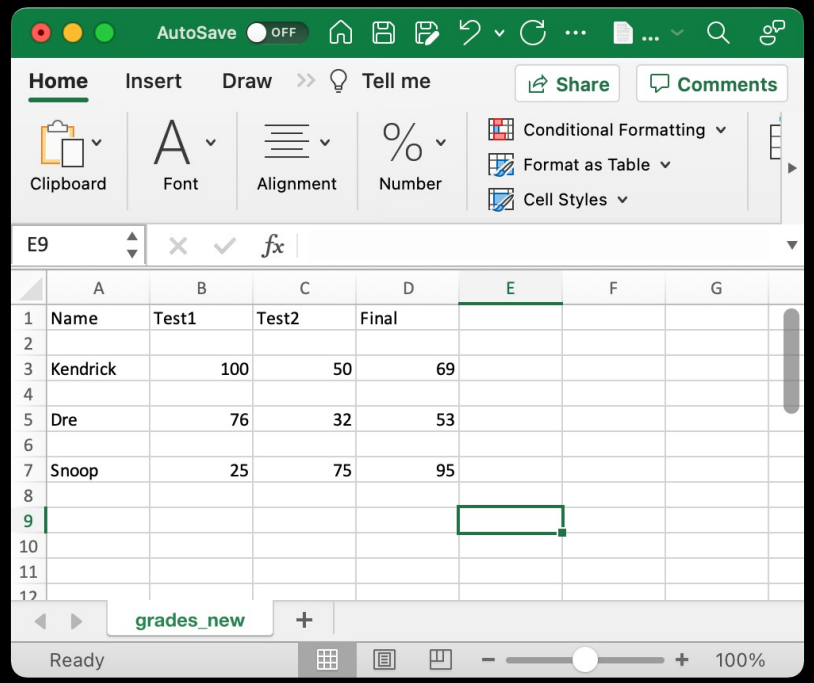
Example: CSV Files

- In the previous grade example there were a few marking errors on the final exam and both Kendrick and Dre should have received a higher grade. Update the grades using the CSV `writerow()` method.

```
import csv

grades = [['Name', 'Test1', 'Test2', 'Final'],
          ['Kendrick', '100', '50', '69'],
          ['Dre', '76', '32', '53'],
          ['Snoop', '25', '75', '95']]

with open('grades_new.csv', 'w') as myfile:
    grades_writer = csv.writer(myfile)

    for row in grades:
        grades_writer.writerow(row)
```

Opening CSV File in Excel

- In the previous example we created a CSV file which can be opened in any commonly used spreadsheet software (e.g. Excel).
- In some cases a formatting error may occur, probably due to the difference between newlines and carriage returns in Windows vs. Mac/Linux.
- To correct this error in formatting, we will need to prevent the new line from forming. Add the parameter newline='', and that should resolve the problem.




```
with open('grades_new.csv', 'w', newline='') as csvfile:
```

Let's Code!

- Let's take a look at how this works in Python!
  - Reading and Writing to CSV Files
  - Parsing through CSV Files
  - Modules

Open your notebook

Click Link:
4. CSV Files

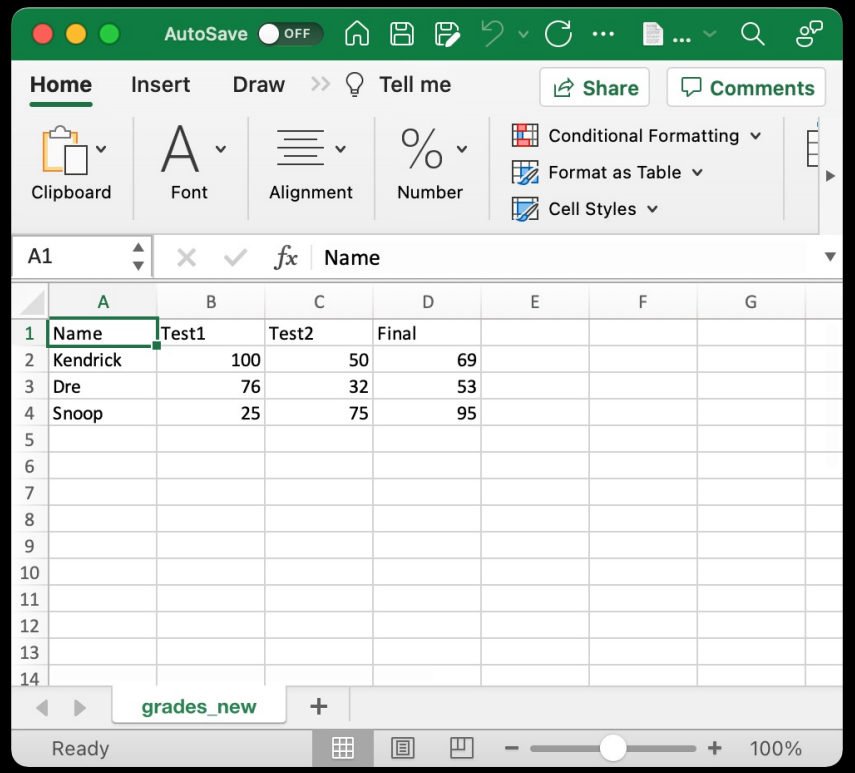
Summary: Reading Files

Requirement: "grades.csv"

```
################################
 reading a file using standard approach
################################

# open communication to a file (to read)
myfile = open('grades.csv', 'r')

# read from file
L = myfile.readlines()
for row in L:
    print(row, end = '')

myfile.close()
```

Requires find() method to obtain data!

```
################################
reading a file using CSV Module
################################
import csv

# open communication to a file (to read)
myfile = open('grades.csv', 'r')

# read from file
csv_reader = csv.reader(myfile)
for row in csv_reader:
    print(row)

myfile.close()
```



	A	B	C	D
1	Name	Test1	Test2	Final
2	Kendrick	100	50	69
3	Dre	76	32	53
4	Snoop	25	75	95

Summary: Writing Files

Requirement: grades needs to be defined

```
grades = [['Name', 'Test1', 'Test2', 'Final'],
          ['Kendrick', '100', '50', '69'],
          ['Dre', '76', '32', '53'],
          ['Snoop', '25', '75', '95']]
```

```
#####################################
#writing to a file using standard approach
#####################################

# open communication to a file (to write)
myfile = open('new_grades.csv', 'w')

# write to file
for row in grades:
    for col in row:
        myfile.write(col + ',')
    myfile.write('\n')

myfile.close()
```

```
#####################################
#writing to a file using CSV Module
#####################################
import csv

# open communication to a file (to write)
myfile = open('new_grades.csv', 'w')

# write to file
grades_writer = csv.writer(myfile)
for row in grades:
    grades_writer.writerow(row)

myfile.close()
```

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Advanced Files: CSVs and Modules

Week 6 | Lecture 2 (6.2.2)

if nothing else, write #cleancode