FILE HANDLING AND DICTIONARIES

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HEAR ME CODE

OBJECTIVE

- Review Lesson Two
- Learn how to read info from files
- Learn how and when to use dictionaries
- Using everything we've learned so far: strings, slicing, conditionals, lists, loops, file handling, dictionaries

LIGHTNING REVIEW

- Lists can hold multiple items at once
  - List of attendees
  - List of days in the week
  - List of months in the year
- Slicing allows us to view individual (or multiple) items in a list
- The **`in`** keyword allows us to check whether a given item appears in that list

LIGHTNING REVIEW

- **`.append()`** adds one item to the end of a list

```
months = ['January', 'February']
months.append('March')
print months
```

```
['January', 'February', 'March']
```

- **`.pop()`** removes one item from the end of a list

LIGHTNING REVIEW

- Use **`.split()`** on a string to turn it into a list

```
months = "Jan,Feb,Mar,Apr,May,Jun,Jul,Aug,Sep,Oct,Nov,Dec"
months = months.split(",")
```

```
['Jan', 'Feb', 'Mar', 'Apr', 'May', 'Jun', 'Jul', 'Aug', 'Sep',
'Oct', 'Nov', 'Dec']
```

LIGHTNING REVIEW

- Loops allow us to write code once but have it run multiple times
- For loops: for each item in this list, do something

```
for name in attendees:
    print name
```

LIGHTNING REVIEW

- **`enumerate()`** works with for loops to give you the **position** of the list item and the **list item itself** at the same time

```
for index, name in enumerate(attendees):
    print index, name
```


HEAR ME CODE

LIGHTNING REVIEW

```
 1 days = [
 2     'Monday',
 3     'Tuesday',
 4     'Wednesday',
 5     'Thursday',
 6     'Friday',
 7     'Saturday',
 8     'Sunday',
 9 ]
10
11 for day in days:
12     print day
```

```
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
```

LIGHTNING REVIEW

```
for index, day in enumerate(days):
    print index, day
```

```
0 Monday
1 Tuesday
2 Wednesday
3 Thursday
4 Friday
5 Saturday
6 Sunday
```

LIGHTNING REVIEW

```
for index, day in enumerate(days):
    print "index is: {0}".format(index)
    print "day is: {0}".format(day)
    print "days[index] is: {0}".format(days[index])
```

```
index is: 0
day is: Monday
days[index] is: Monday
index is: 1
day is: Tuesday
days[index] is: Tuesday
```

EDITING LISTS

- You can change individual list items if you know their position/slicing number.

```
class_dates = [
    'January 27',
    'February 24',
    'March ??'
]
class_dates[2] = 'March 24'
```

EDITING LISTS WITH ENUMERATE

- You can use this concept with **`enumerate()`** to edit every list item:

```
for index, date in enumerate(class_dates):
    class_dates[index] = '{0}, 2018'.format(date)

print class_dates
```

```
['January 27, 2018', 'February 24, 2018', 'March 24, 2018']
```

FILE HANDLING

- File handling lets Python read and write to files
  - Read from or write to a spreadsheet
  - Read from or write to a text file

FILE HANDLING: MOST COMMON SYNTAX

```
1 with open("states.txt", "r") as states_file:
2     states = states_file.read()
3
4 print states
```

`with` keyword: tells Python we're going to do something **`with`** a file we're about to open.

When all commands within the indentation have been run, the file is closed automatically.

FILE HANDLING: MOST COMMON SYNTAX

```
1 with open("states.txt", "r") as states_file:
2     states = states_file.read()
3
4 print states
```

`open()` is a built-in function that tells Python to open a file.

Argument 1: The file you want to open.

FILE HANDLING: MOST COMMON SYNTAX

```
1 with open("states.txt", "r") as states_file:
2     states = states_file.read()
3
4 print states
```

`open()` tells Python to open a file.

Argument 2: The "mode" to open the file in, as a string

- **`r`**: read-only mode
- **`w`**: write mode
- **`a`**: append mode

FILE HANDLING: MOST COMMON SYNTAX

```
1 with open("states.txt", "r") as states_file:
2     states = states_file.read()
3
4 print states
```

The **as** keyword creates a variable for your file handler.

The variable in this example is **states_file**, but you could use any variable name you want.

FILE HANDLING: MOST COMMON SYNTAX

```
1 with open("states.txt", "r") as states_file:
2     states = states_file.read()
3
4 print states
```

`.read()` is a file method — a function that only works with file handlers. In this example, the file handler is **states_file.**

`.read()` will read the entire contents of the file. In line 2 above, I've saved it into the variable **states**.

FILE HANDLING: MOST COMMON SYNTAX

```
1 with open("states.txt", "r") as states_file:
2     states = states_file.read()
3
4 print states
```

Outcome:

1. Open a file (**states.txt**)
2. Create a variable called **states** that has the entire contents of the file **states.txt**

LET'S TRY IT OUT

- In the **python-lessons** repo, go to **section_07_(files)**
- Copy/paste or save **states.txt** onto your computer, in the same folder as your Python script.
- Write a script to open **states.txt** and print the contents of the file.

FILE HANDLING: MOST COMMON SYNTAX

```
1 with open("states.txt", "r") as states_file:
2     states = states_file.read()
3
4 print states
```

The variable **states** is a string containing the contents of your file **states.txt**.

LET'S TRY IT OUT: TEXT FILES

`.read()` gives us the file contents as a string. If we have a string, we can turn it into a list using **`.split()`**!

```
1 with open("states.txt", "r") as states_file:
2     states = states_file.read().split("\n")
3
4 print states
```

states is now a list rather than a string.

WE CAN OPEN SPREADSHEETS TOO

	A	B	C
1	**Class**	**Date**	**Attendees**
2	Lesson 1	February 24	44
3	Lesson 2	February 24	23
4	Lesson 3	February 24	12

CSV = COMMA SEPARATED VALUES

	A	B	C
1	**Class**	**Date**	**Attendees**
2	Lesson 1	February 24	44
3	Lesson 2	February 24	23
4	Lesson 3	February 24	12

```
1  Class,Date,Attendees
2  Lesson 1,February 24,44
3  Lesson 2,February 24,23
4  Lesson 3,February 24,12
```

WE START THE SAME AS WITH A TEXT FILE

- Let's open this CSV file and read from it

```
1 with open('class-stats.csv', 'r') as class_stats_file:
2     class_stats = class_stats_file.read()
3     print class_stats
```

```
Class,Date,Attendees
Lesson 1,February 24,44
Lesson 2,February 24,23
Lesson 3,February 24,12
```

THEN SPLIT ON THE NEWLINES

- Only lines 4 and 5 are new.

```
1 with open('class-stats.csv', 'r') as class_stats_file:
2     class_stats = class_stats_file.read()
3     # print class_stats
4     class_stats = class_stats.split('\n')
5     print class_stats
```

```
['Class,Date,Attendees', 'Lesson 1,February 24,44', 'Lesson
2,February 24,23', 'Lesson 3,February 24,12']
```

ANOTHER WAY TO PICTURE IT

```
1 with open('class-stats.csv', 'r') as class_stats_file:
2     class_stats = class_stats_file.read()
3     # print class_stats
4     class_stats = class_stats.split('\n')
5     print class_stats
```

```
Class,Date,Attendees
Lesson 1,February 24,44
Lesson 2,February 24,23
Lesson 3,February 24,12
```

CSV = COMMA SEPARATED VALUES

- Only lines 7-10 are new.

```
1  with open('class-stats.csv', 'r') as class_stats_file:
2      class_stats = class_stats_file.read()
3      # print class_stats
4      class_stats = class_stats.split('\n')
5      # print class_stats
6
7      for index, stat in enumerate(class_stats):
8          class_stats[index] = stat.split(',')
9
10     print class_stats
```

```
[['Class', 'Date', 'Attendees'], ['Lesson 1', 'February 24', '44'],
['Lesson 2', 'February 24', '23'], ['Lesson 3', 'February 24', '12']]
```

LET'S TAKE A CLOSER LOOK

```
7       for index, stat in enumerate(class_stats):
8           class_stats[index] = stat.split(',')
```

Class	Date	Attendees
Lesson 1	February 24	44
Lesson 2	February 24	23
Lesson 3	February 24	12

ANOTHER WAY TO PICTURE IT

```
1  with open('class-stats.csv', 'r') as class_stats_file:
2      class_stats = class_stats_file.read()
3      # print class_stats
4      class_stats = class_stats.split('\n')
5      # print class_stats
6
7      for index, stat in enumerate(class_stats):
8          class_stats[index] = stat.split(',')
9
10     print class_stats
```

```
[['Class', 'Date', 'Attendees'],
 ['Lesson 1', 'February 24', '44'],
 ['Lesson 2', 'February 24', '23'],
 ['Lesson 3', 'February 24', '12']]
```

HOW TO GET TO ITEMS IN A NESTED LIST

- **`class_stats[0]`** is a list
- **`class_stats[0][0]`** is a string

	[0]	[1]	[2]
class_stats[0]	**Class**	**Date**	**Attendees**
class_stats[1]	Lesson 1	February 24	44
class_stats[2]	Lesson 2	February 24	23
class_stats[3]	Lesson 3	February 24	12

WHY USE PYTHON FOR SPREADSHEETS?

- Compare attendance
  - Lesson and class size separated out
  - What is the average size of lesson 1?
  - What was the lowest class size?
  - The highest?
  - How many lesson 2s have I run?
  - What is the difference in class sizes between lessons?

WHY USE PYTHON FOR SPREADSHEETS?

- Given a spreadsheet of petition signatures, create a nicely-formatted document to send to the printer
- Bulk import records into a database
- Turn a spreadsheet of museum locations into a map: **https://shannonvturner.com/museums**

LET'S TRY IT OUT: CSV FILES

In line 5, we split each row into its columns and make those changes stick. We end up with a nested list by line 7.

```
1 with open('states.csv', 'r') as states_file:
2     states = states_file.read().split('\n')
3
4 for index, state in enumerate(states):
5     states[index] = state.split(',')
6
7 print states
```

LISTS WITHIN LISTS

This nested list (a list of lists) is a list of each US state. The lists inside have the abbreviation and state name.

```
1 with open('states.csv', 'r') as states_file:
2     states = states_file.read().split('\n')
3
4 for index, state in enumerate(states):
5     states[index] = state.split(',')
6
7 print states
```

```
[['AL', 'Alabama'], ['AK', 'Alaska'], ['AZ', 'Arizona'], ['AR',
'Arkansas'], ['CA', 'California'], ['CO', 'Colorado'], ['CT',
'Connecticut'], ['DE', 'Delaware'], ['DC', 'District Of Columbia'], ['FL',
'Florida'], ['GA', 'Georgia'], ['HI', 'Hawaii'], ['ID', 'Idaho'], ['IL',
'Illinois'], ['IN', 'Indiana'], ['IA', 'Iowa'], ['KS', 'Kansas'], ['KY',
'Kentucky'], ['LA', 'Louisiana'], ['ME', 'Maine'], ['MD', 'Maryland'],
```

LISTS WITHIN LISTS

```
[['AL', 'Alabama'], ['AK', 'Alaska'], ['AZ', 'Arizona'], ['AR',
'Arkansas'], ['CA', 'California'], ['CO', 'Colorado'], ['CT',
'Connecticut'], ['DE', 'Delaware'], ['DC', 'District Of Columbia'], ['FL',
'Florida'], ['GA', 'Georgia'], ['HI', 'Hawaii'], ['ID', 'Idaho'], ['IL',
'Illinois'], ['IN', 'Indiana'], ['IA', 'Iowa'], ['KS', 'Kansas'], ['KY',
'Kentucky'], ['LA', 'Louisiana'], ['ME', 'Maine'], ['MD', 'Maryland'],
```

We're already familiar with how to view one item in a list:

```
8 print states[0]
['AL', 'Alabama']
```

LISTS WITHIN LISTS

But states[0] is also a list! So to view one item in the states[0] list:

```
8 print states[0][0]
AL
```

or

```
8 print states[0][1]
Alabama
```

LISTS WITHIN LISTS

What type of object is **states**? A list.

What type is **states[0]**?

```
8 print states[0]
['AL', 'Alabama']
```

What type is **states[0][1]**?

```
8 print states[0][1]
Alabama
```

Can I slice those things to see a smaller part?

EXERCISE: PART ONE

Building from the previous slide, open **states.csv** and loop through to create two lists:

- One with all of the state names
- Another with all of the abbreviations.

Break everything into smaller steps, run and test often!

EXERCISE: PART TWO

Loop through your two lists to write their contents to two files:

- One with all of the state names
- Another with all of the abbreviations.

```
with open('state-abbrevs.txt', 'w') as abbrev_file:
    for abbreviation in abbreviations:
        abbrev_file.write(abbreviation)
        abbrev_file.write('\n')
```

DICTIONARIES: WHY

How would we …

- Create a list of names and Github handles for each student in the class
- If we wanted to look up a specific person's Github handle, how could we do that?

- … there's got to be a better way

DICTIONARIES: PERFECT FOR CONTACT LISTS

Dictionaries are another way of storing information in Python.

Dictionaries have two components: a **key** and its corresponding **value**.

Think of it like a phone book or contact list! If you know my name, (**key**) you can look up my number (**value**)!

CREATING A DICTIONARY

Creating an empty dictionary:

```
phonebook = {}
```

Creating a dictionary with items in it:

```
phonebook = {
    'Shannon': '202-555-1234',
    'Bridgit': '703-555-9876',
    'Christine': '410-555-1293'
}
```

READING PART OF A DICTIONARY

Reading part of a string:

```
name[0:5] # Shann
```

Reading part of a list:

```
attendees[:3] # Amy, Jen, Julie
```

Reading part of a dictionary:

```
phonebook['Shannon'] # 202-555-1234
```

ADDING TO A DICTIONARY

Add an item to a dictionary:

```
phonebook['Mel'] = '301-555-1111'
```

Dictionaries are **unordered**.

The order of your dictionary may change as you add or remove items!

REAL PHONEBOOKS ARE A BIT MORE COMPLEX

In your phone's contacts app, what fields might you find?

- Name
- Organization
- Phone number (and type)
- Email
- Address
- ... a whole lot more

REAL PHONEBOOKS ARE COMPLEX

```
contacts = {
    'Shannon Turner': {
        'organization': 'Hear Me Code',
        'phone': {
            'mobile': '202-555-1234'
        },
        'email': 'shannon@hearmecode.com',
        'address': {
            'address1': '123 SEA LANE SW',
            'address2': 'Apartment 987',
            'city': 'Washington',
            'state': 'DC',
            'zip': '20000'
        },
    },
}
```

"SLICE" IT LIKE A NESTED LIST

We have a dictionary within a dictionary:

```
18 print contacts['Shannon Turner']
19
```

```
{'organization': 'Hear Me Code', 'address': {'address1': '123 SEA LANE SW',
'address2': 'Apartment 987', 'state': 'DC', 'zip': '20000', 'city':
'Washington'}, 'email': 'shannon@hearmecode.com', 'phone': {'mobile':
'202-555-1234'}}
```

Just keep slicing:

```
19 print contacts['Shannon Turner']['organization']
```

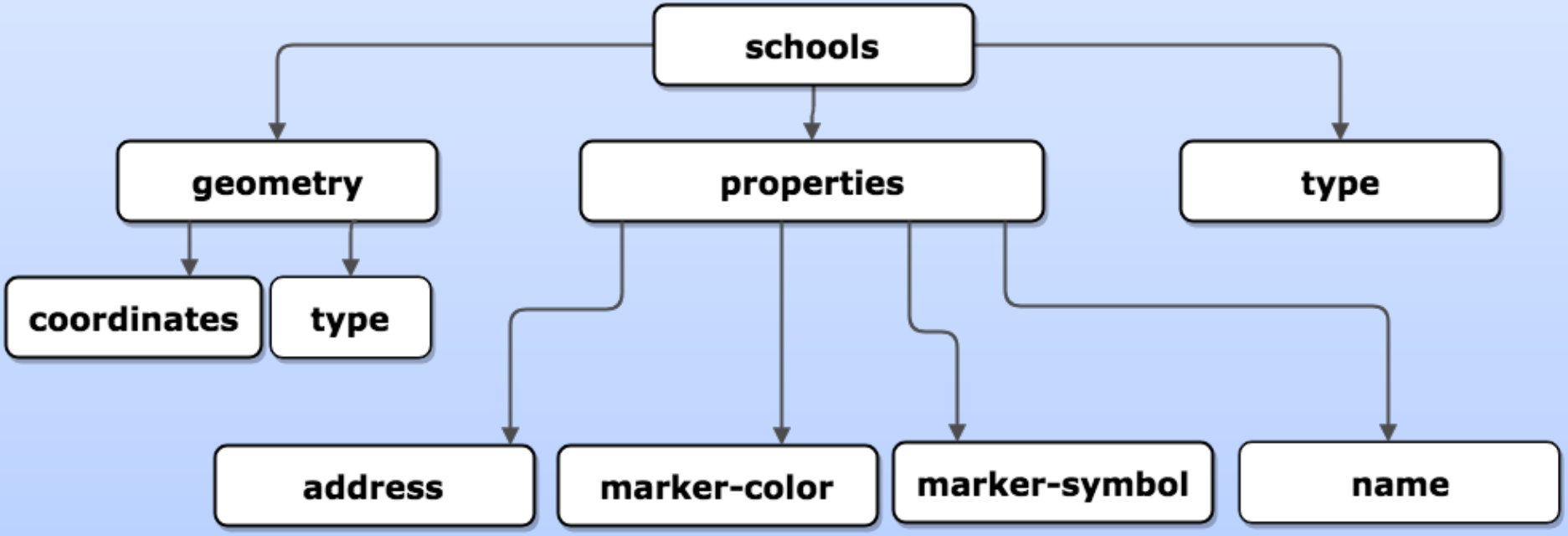
```
Hear Me Code
```

DICTIONARIES CAN CONTAIN ...

... strings, lists, even other dictionaries!

```
schools = {
    "geometry": {
        "coordinates": [
            -81.50572799999999,
            39.21675500000001
        ],
        "type": "Point"
    },
    "properties": {
        "address": "300 Campus Drive, Parkersburg, WV 26104",
        "marker-color": "#3F3040",
        "marker-symbol": "circle",
        "name": "West Virginia University at Parkersburg"
    },
    "type": "Feature"
}
```

LET'S VISUALIZE IT DIFFERENTLY



EXERCISE

Save these **exercise instructions** to your computer, open it in Sublime/IDLE and work from there!

```
schools = {
    "geometry": {
        "coordinates": [
            -81.50572799999999,
            39.21675500000001
        ],
        "type": "Point"
    },
    "properties": {
        "address": "300 Campus Drive, Parkersburg, WV 26104",
        "marker-color": "#3F3040",
        "marker-symbol": "circle",
        "name": "West Virginia University at Parkersburg"
    },
    "type": "Feature"
}
```

DICTIONARIES ARE FLEXIBLE

We just met Carla, so we don't have as many details about her in our phonebook as we do for Shannon.

```
contacts['Carla Conference'] = {
    'phone': {
        'mobile': '301-555-0000'
    },
    'notes': 'I met her at a conference!'
}
```

I DON'T HAVE THAT KEY

```
contacts['Carla Conference'] = {
    'phone': {
        'mobile': '301-555-0000'
    },
    'notes': 'I met her at a conference!'
}
```

```
28 print contacts['Carla Conference']['organization']
```

```
Traceback (most recent call last):
  File "/Users/shannon/Documents/L3-review/lesson3.py", line 28, in <module>
    print contacts['Carla Conference']['organization']
KeyError: 'organization'
```

USE .GET( ) TO KEEP GOING

When you get a KeyError, your program stops. That's not always what you want.

```
28 # If there is no 'organization' key, Python will stop with a KeyError
29 print contacts['Carla Conference']['organization']
30
31 # I'll get None if there is no 'organization' key:
32 print contacts['Carla Conference'].get('organization')
33
34 # Or I could specify a default value if the 'organization' key does not
   exist:
35 print contacts['Carla Conference'].get('organization', "I don't know
       their organization!")
```

EXERCISE

Save these **exercise instructions** to your computer, open it in Sublime/IDLE and work from there!

Just do #1 for now. Once we've added items to our dictionary, we'll see how to loop through it in the next slides.

```
contacts = {
    "Hear Me Code": {
        "twitter": "@hearmecode",
        "github": "https://github.com/hearmecode"
    },
    "Shannon Turner": {
        "twitter": "@svthmc",
        "github": "https://github.com/shannonturner"
    },
}
```

LOOPING THROUGH A DICTIONARY

Let's loop through the contacts list we just created. We have a handful of ways to do this.

1. Looping by keys (Shannon, Hear Me Code, everyone else at your table…)

2. Looping by key / value pairs together

.KEYS( ) CREATES A LIST

`.keys()` creates a list of all of the keys in your dictionary.

```
 12 print contacts.keys()
['Hear Me Code', 'Shannon Turner']
```

Because **dictionaries are unordered**, you might get keys in a different order than you see below, or a different order than you put them in. That's okay.

WE CAN LOOP OVER A LIST!

`.keys()` will create a list of all of the keys in your dictionary.

```
12 print contacts.keys()
```

```
['Hear Me Code', 'Shannon Turner']
```

If you have a list, you can loop over it!

```
14 for name in contacts.keys():
15     print name
```

```
Hear Me Code
Shannon Turner
```

WE CAN LOOP OVER A LIST!

`.keys()` will create a list of all of the keys in your dictionary.

```
12 print contacts.keys()
```

```
['Hear Me Code', 'Shannon Turner']
```

If you have a list, you can loop over it!

```
14 for name in contacts.keys():
15     print contacts[name]
```

```
{'twitter': '@hearmecode', 'github': 'https://github.com/hearmecode'}
{'twitter': '@svthmc', 'github': 'https://github.com/shannonturner'}
```

DICTIONARIES ARE UNORDERED

Dictionaries themselves have no ordering, but we can order their keys:

```
for name in sorted(contacts.keys()):
    print contacts[name]
```

`sorted()` is a built-in function that sorts a list.

.ITEMS( ) CREATES A LIST OF KEY/VALUE PAIRS

`.items()` will create a list of all of the key/value pairs in your dictionary.

```
12 print contacts.items()
13
```

```
[('Hear Me Code', {'twitter': '@hearmecode', 'github': 'https://github.com/hearmecode'}), ('Shannon Turner', {'twitter': '@svthmc', 'github': 'https://github.com/shannonturner'})]
```

As with **`.keys()`**, if we have a list, we can loop over it. **`.items()`** gives us a list of lists!

.ITEMS( ) CREATES A NESTED LIST

`.items()` will create a list of all of the key/value pairs in your dictionary.

```
12 for key, value in contacts.items():
13     print key, value
```

```
Hear Me Code {'twitter': '@hearmecode', 'github': 'https://github.com/hearmecode'}
Shannon Turner {'twitter': '@svthmc', 'github': 'https://github.com/shannonturner'}
```

.ITEMS( ) CREATES A NESTED LIST

`.items()` will create a list of all of the key/value pairs in your dictionary.

```
12 for name, details in contacts.items():
13     print name, details
```

```
Hear Me Code {'twitter': '@hearmecode', 'github': 'https://github.com/
hearmecode'}
Shannon Turner {'twitter': '@svthmc', 'github': 'https://github.com/
shannonturner'}
```

EXERCISE: PART 2

Loop through the **contacts** dictionary to display everyone's contact information, like this:

```
Hear Me Code's contact info:
    twitter: @hearmecode
    github: https://github.com/hearmecode
Shannon Turner's contact info:
    twitter: @svthmc
    github: https://github.com/shannonturner
```

PLAYTIME!

Check out the **Hear Me Code slides** repo for practical examples, code samples, and more!

- Beginner: US States tables
- Beginner: Contacts list
- Advanced: Comparing two CSVs

WHAT NOW?

- Lessons 4 & 5
- Organize a study group on the listserv
- Come be a teaching assistant
- Practice, practice, practice