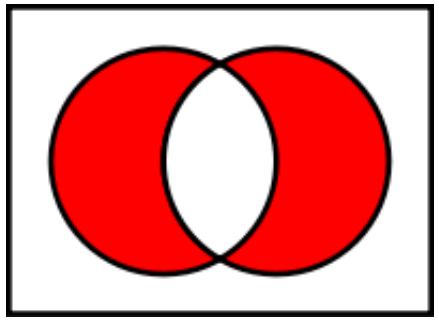
CompSci 101
Introduction to Computer Science



October 9, 2014

Prof. Rodger

Thanks to Prof. Azhar and Yossra Hamid for giving this lecture!

Announcements

- Reading for next time on calendar page
  - en.wikibooks.org/wiki/Python_Programming/Sets
  - RQ
- APT 4 is due today
  - APT 5 is out today
- Exam 1 was handed out Tuesday, grades are on Sakai, you will need to see Prof. Rodger next week to get your test back
- Today Sets
- Prof. Rodger is at a conference this week
  - http://gracehopper.org/

Python Sets

- Set – unordered collection of distinct items
  - Unordered – can look at them one at a time, but cannot count on any order
  - Distinct - one copy of each
- Operations on sets:
  - Modify: add, clear, remove
  - Create a new set: difference(-), intersection(&), union (|), symmetric_difference(^)
  - Boolean: issubset <=, issuperset >=
- Can convert list to set, set to list

Summary (from wikibooks)

```
set1 = set()                    # A new empty set
set1.add("cat")                 # Add a single member
set1.update(["dog", "mouse"])   # Add several members
set1.remove("cat")              # Remove a member - error if not there
print set1
for item in set1:               # Iteration AKA for each element
  print item
print "Item count:", len(set1)  # Length AKA size AKA item count
isempty = len(set1) == 0        # Test for emptiness
set1 = set(["cat", "dog"])      # Initialize set from a list
set3 = set1 & set2              # Intersection
set4 = set1 | set2              # Union
set5 = set1 - set3              # Set difference
set6 = set1 ^ set2              # Symmetric difference (elements in either
set but not both)
issubset = set1 <= set2         # Subset test
issuperset = set1 >= set2       # Superset test
set7 = set1.copy()              # A shallow copy (copies the set, not the
elements)
set8.clear()                    # Clear AKA empty AKA erase
```

Creating and changing a set

```
colorList = ['red', 'blue', 'red', 'red', 'green']
colorSet = set(colorList)
smallList = list(colorSet)
colorSet.clear()
colorSet.add("yellow")
colorSet.add("red")
colorSet.add("blue")
colorSet.add("yellow")
colorSet.add("purple")
colorSet.remove("yellow")
```

- See setsEasy.py

Set Operations

```
UScolors = set(["red", "white", "blue"])
dukeColors = set(["blue", "white"])
print dukeColors.union(UScolors)
print dukeColors | UScolors
print dukeColors.intersection(UScolors)
print dukeColors & UScolors
print dukeColors.difference(UScolors)
print dukeColors - UScolors
print UScolors - dukeColors
print dukeColors ^ UScolors
print UScolors ^ dukeColors
```

- See setsEasy.py

Set Examples
bit.ly/101fall14-1009-01

poloClub = set(['Mary', 'Laura', 'Dell'])

rugbyClub = set(['Fred', 'Sue', 'Mary'])

Question 1:

print [w for w in poloClub.intersection(rugbyClub)]

Question 2:

print [w for w in poloClub.union(rugbyClub)]

More Set Examples
bit.ly/101fall14-1009-02

```
lista = ['apple', 'pear', 'fig', 'orange', 'strawberry']
listb = ['pear', 'lemon', 'grapefruit', 'orange']
listc = [x for x in lista if x in listb]
listd = list(set(lista)|set(listb))
```

Question 1:

```
print listc
```

Question 2:

```
print listd
```

More Set Examples

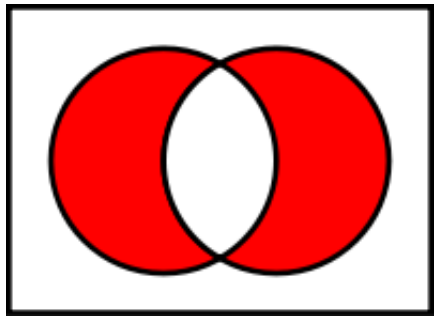
```
s = set(lista)
t = set(listb)
problem1 = (s-t) | (t-s)
print problem1
problem2 = (s|t) - (s&t)
print problem2
problem3 = (s|t|(s&t))
print problem3
```

```
lista = ['apple', 'pear', 'fig', 'orange', 'strawberry']
listb = ['pear', 'lemon', 'grapefruit', 'orange']
```

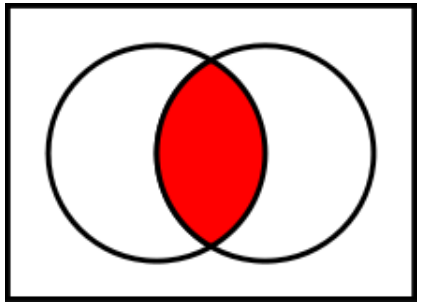
Set Operations from pictures
bit.ly/101fall14-1009-03

Question: Which picture is which operation?

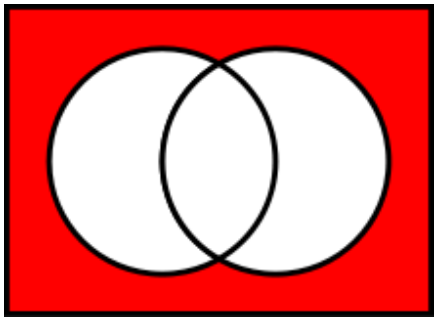
A)



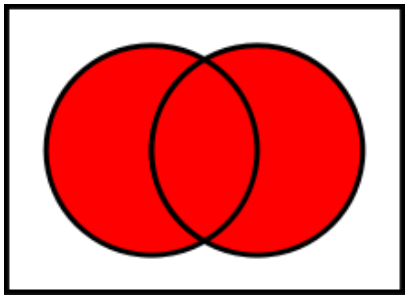
B)



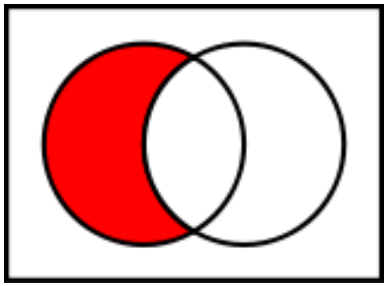
C)



D)



E)



Problems – snarf setExample.py

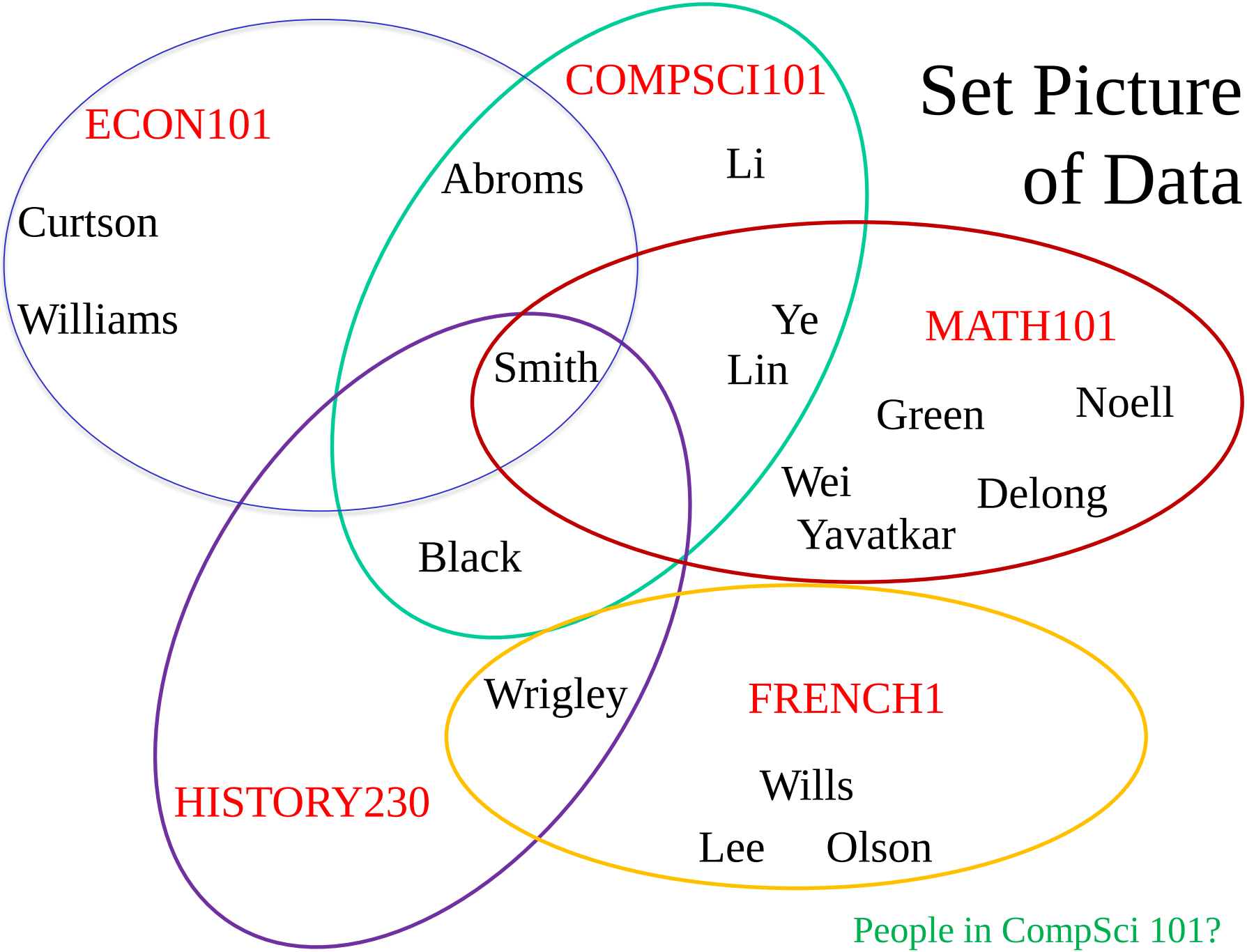
- Given a list of strings that have the name of a course (one word), followed by last names of people in the course:
  - Convert list into lists of strings of names for each course
  - Find total number of people taking any course
  - Find number of people taking just one course

```
["compsci101 Smith Ye Li Lin Abroms
Black", \
"math101 Green Wei Lin Yavatkar Delong
Noell Ye Smith", ...]
```

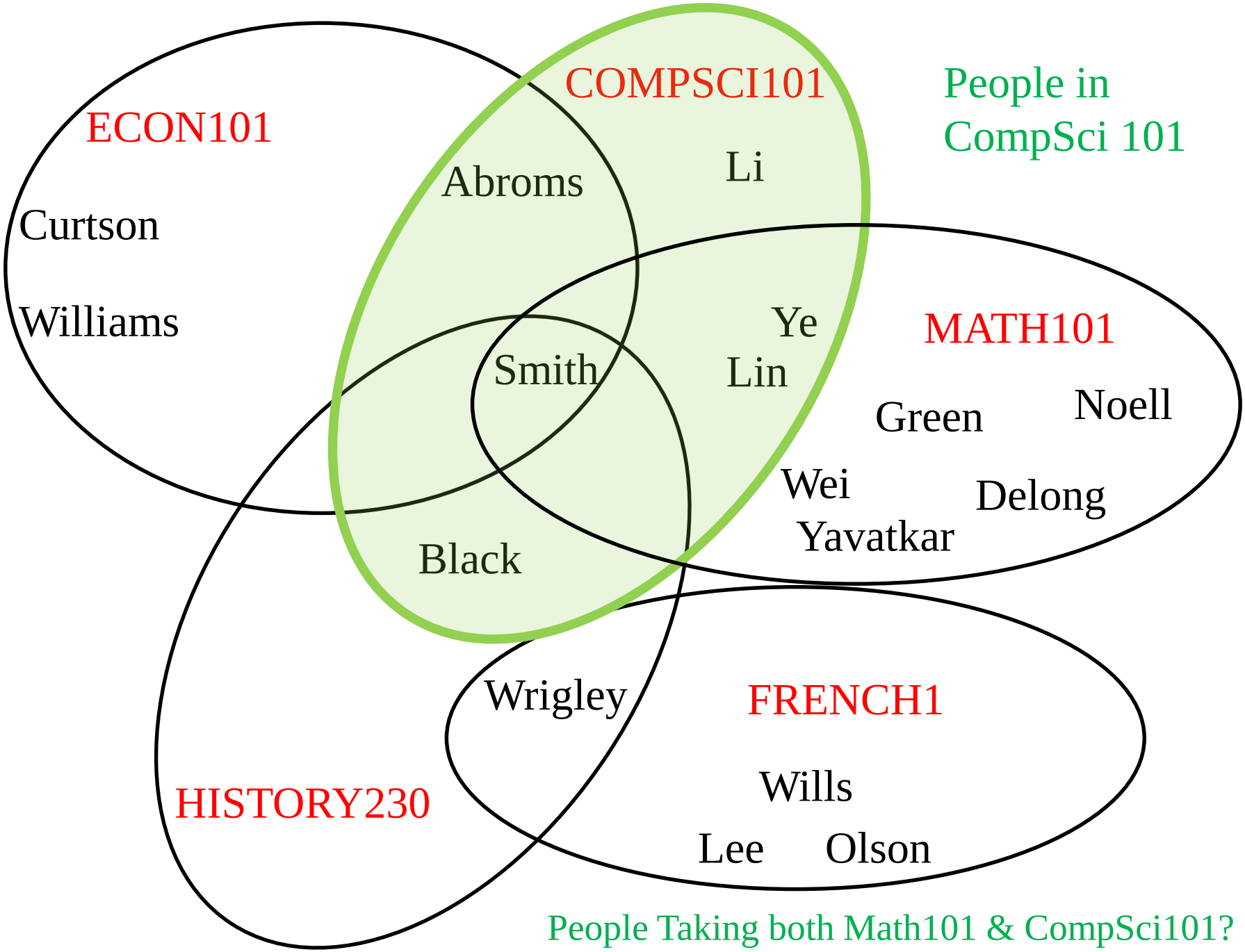
Data for example

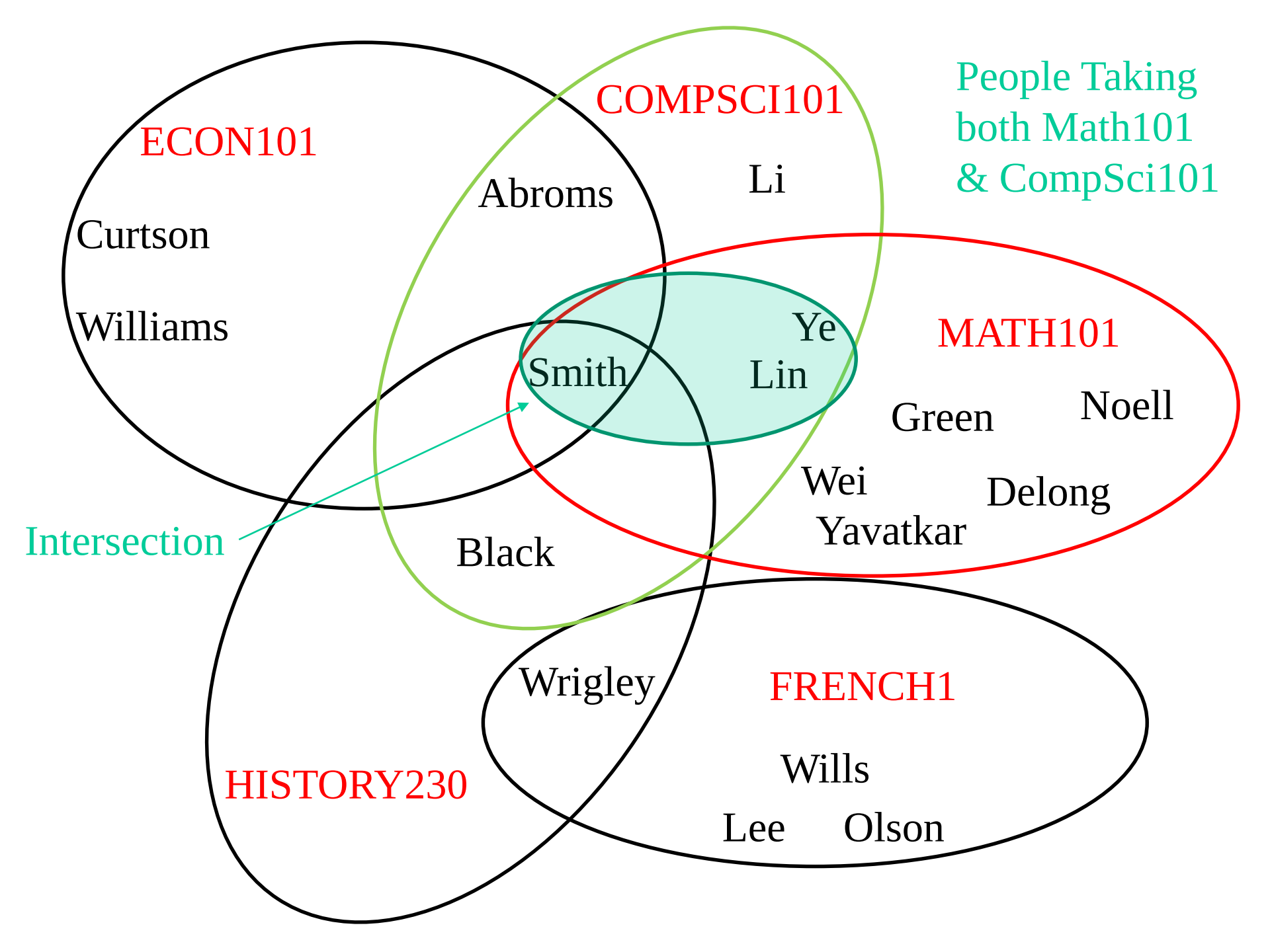
```
["compsci101 Smith Ye Li Lin Abroms Black", \
"math101 Green Wei Lin Yavatkar Delong Noell Ye Smith", \
"econ101 Abroms Curtson Williams Smith", \
"french1 Wills Wrigley Olson Lee", \
"history230 Black Wrigley"]
```

Set Picture of Data



People in CompSci 101?


ECON101
Curtson
Williams
COMPSCI101
Abroms
Li
Ye
Lin
Smith
Black
MATH101
Green
Noell
Wei
Delong
Yavatkar
FRENCH1
Wrigley
Wills
Lee
Olson
HISTORY230
People in CompSci 101
People Taking both Math101 & CompSci101?


People Taking
both Math101
& CompSci101
ECON101
Curtson
Williams
COMPSCI101
Abroms
Li
Ye
Smith
Lin
MATH101
Green
Noell
Wei
Delong
Yavatkar
Intersection
Black
Wrigley
FRENCH1
Wills
Lee
Olson
HISTORY230

Part 1 – processList

bit.ly/101fall14-1009-04

- Given a list of strings that have the name of a course (one word), followed by last names of people in the course:
  - Convert list into lists of strings of names for each course

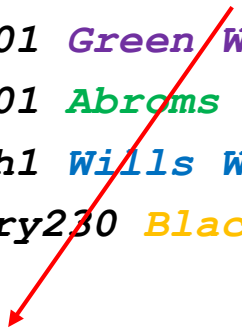
```
["compsci101 Smith Ye Li Lin Abroms Black", \
"math101 Green Wei Lin Yavatkar Delong Noell Ye
Smith", ...]

[['Smith', 'Ye', 'Li', 'Lin', 'Abroms', 'Black'],
['Green', 'Wei', 'Lin', 'Yavatkar', 'Delong',
'Noell', 'Ye', 'Smith'], ...]
```

Process List

```
def processList(stringList):
    '''
    process the list of strings to
    return a list of lists
    and remove the course number since it is not needed
    '''
    allLists = []
    for line in stringList:
        linelist = line.split()
        # append after removing course number
        allLists.append(linelist[1:])
    return allLists
```

Process List: Data Visualization

```
["compsci101 Smith Ye Li Lin Abroms Black", \
"math101 Green Wei Lin Yavatkar Delong Noell Ye Smith", \
"econ101 Abroms Curtson Williams Smith", \
"french1 Wills Wrigley Olson Lee", \
"history230 Black Wrigley"]
```



```
[['Smith', 'Ye', 'Li', 'Lin', 'Abroms', 'Black'],
['Green', 'Wei', 'Lin', 'Yavatkar', 'Delong',
'Noell', 'Ye', 'Smith'], ['Abroms', 'Curtson',
'Williams', 'Smith'], ['Wills', 'Wrigley',
'Olson', 'Lee'], ['Black', 'Wrigley']]
```

Part 2 – peopleTakingCourses

bit.ly/101fall14-1009-05

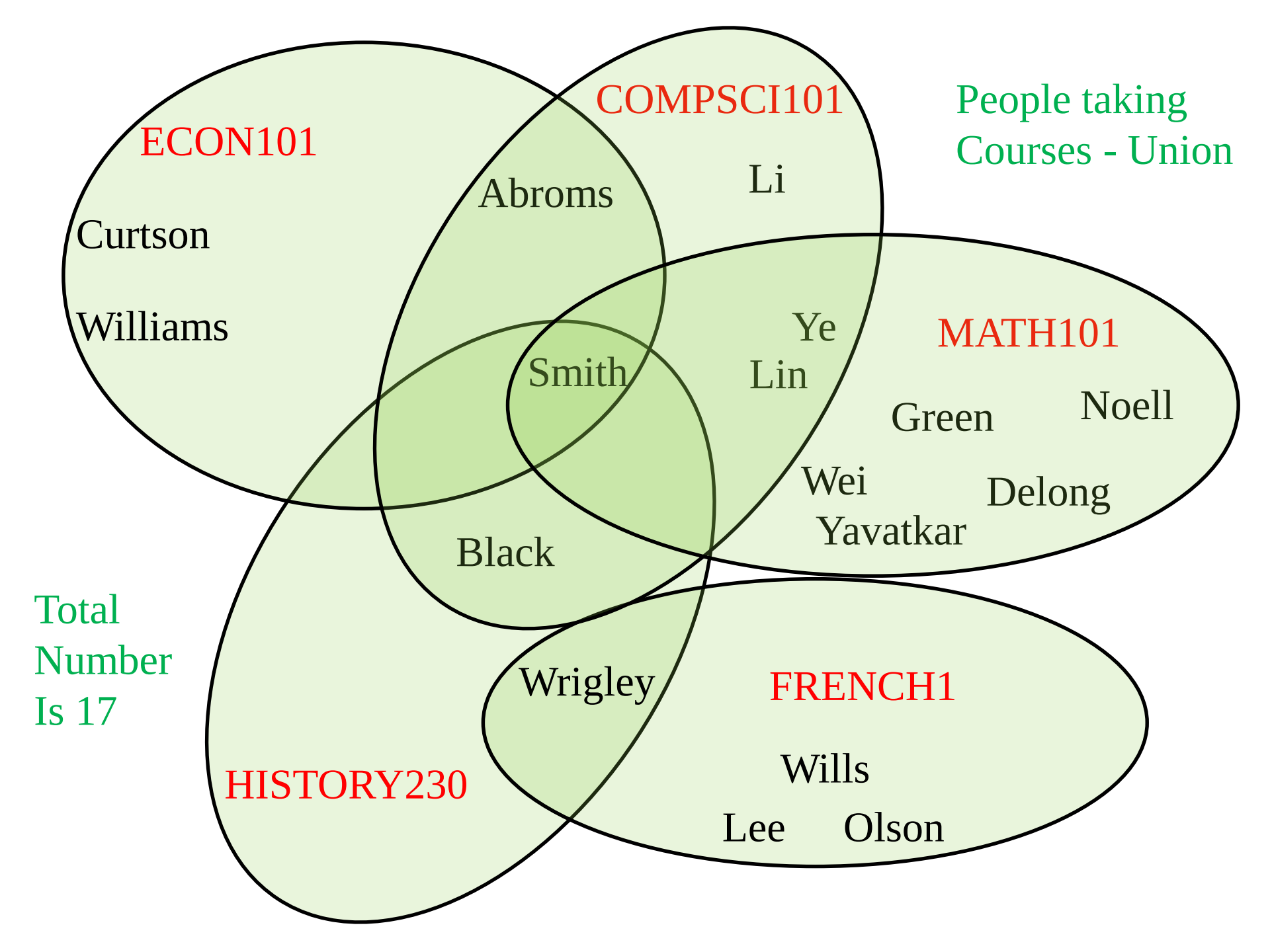
- Given a list of strings that have the name of a course (one word), followed by last names of people in the course:
  - Find total number of people taking any course

```
["compsci101 Smith Ye Li Lin Abroms Black", \
"math101 Green Wei Lin Yavatkar Delong Noell Ye
Smith", .. ]
```

```
[['Smith', 'Ye', 'Li', 'Lin', 'Abroms',
'Black'], ['Green', 'Wei', 'Lin',
'Yavatkar', 'Delong', 'Noell', 'Ye',
'Smith'], ...]
```

Which ones did I miss?

Answer: 11 for this data (union will remove duplicates)


People taking
Courses - Union
ECON101
COMPSCI101
MATH101
HISTORY230
FRENCH1
Curtson
Williams
Abroms
Li
Ye
Lin
Smith
Green
Noell
Wei
Delong
Yavatkar
Black
Wrigley
Wills
Lee
Olson
Total
Number
Is 17

peopleTakingCourses

```
def peopleTakingCourses(data):
    ''' data is a list of lists of names for each course,
    return list of all strings that appear at least once '''
    names = set([])
    for lista in data:
        seta = set(lista)
        names = names | seta
    return list(names)
    # return [w for w in names]
```

peopleTakingCourses: Data Visualization

```
["compsci101 Smith Ye Li Lin Abroms Black", \
"math101 Green Wei Lin Yavatkar Delong Noell Ye Smith", \
"econ101 Abroms Curtson Williams Smith", \
"french1 Wills Wrigley Olson Lee", \
"history230 Black Wrigley"]
```

```
['Smith', 'Ye', 'Li', 'Lin', 'Abroms',
'Black', 'Green', 'Wei', 'Yavatkar',
'Delong', 'Noell', 'Curtson', 'Williams',
'Wills', 'Wrigley', 'Olson', 'Lee']
```

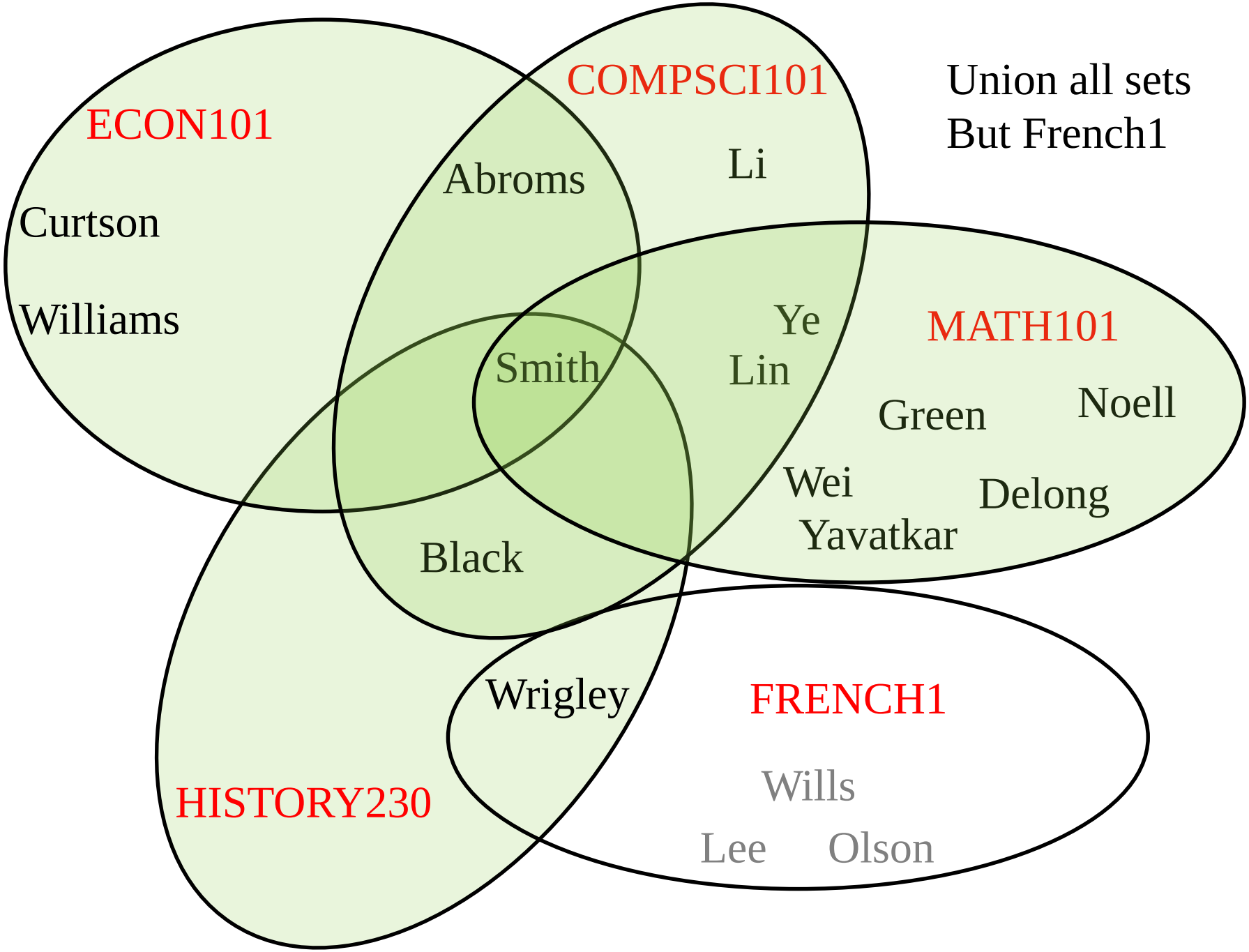
17 people taking one or more courses

Part 3 –

bit.ly/101fall14-1009-06

- Given a list of strings that have the name of a course (one word), followed by last names of people in the course:
  - Find number of people taking just one course
    - BUT FIRST, lets write this helper method unionAllSetsButMe

```
[['Smith', 'Ye', 'Li', 'Lin', 'Abroms', 'Black'],
['Green', 'Wei', 'Lin', 'Yavatkar', 'Delong',
'Noell', 'Ye', 'Smith'], ['Abroms', 'Curtson',
'Williams', 'Smith'], ['Wills', 'Wrigley',
'Olson', 'Lee'], ['Black', 'Wrigley']]
```


ECON101
Curtson
Williams
COMPSCI101
Abroms
Li
Union all sets
But French1
Ye
Lin
MATH101
Green
Noell
Smith
Wei
Delong
Yavatkar
Black
Wrigley
FRENCH1
Wills
Lee
Olson
HISTORY230

unionAllSetsButMe

```
[['Smith', 'Ye', 'Li', 'Lin', 'Abroms', 'Black'],
['Green', 'Wei', 'Lin', 'Yavatkar', 'Delong',
'Noell', 'Ye', 'Smith'], ['Abroms', 'Curtson',
'Williams', 'Smith'], ['Wills', 'Wrigley',
'Olson', 'Lee'], ['Black', 'Wrigley']]
```



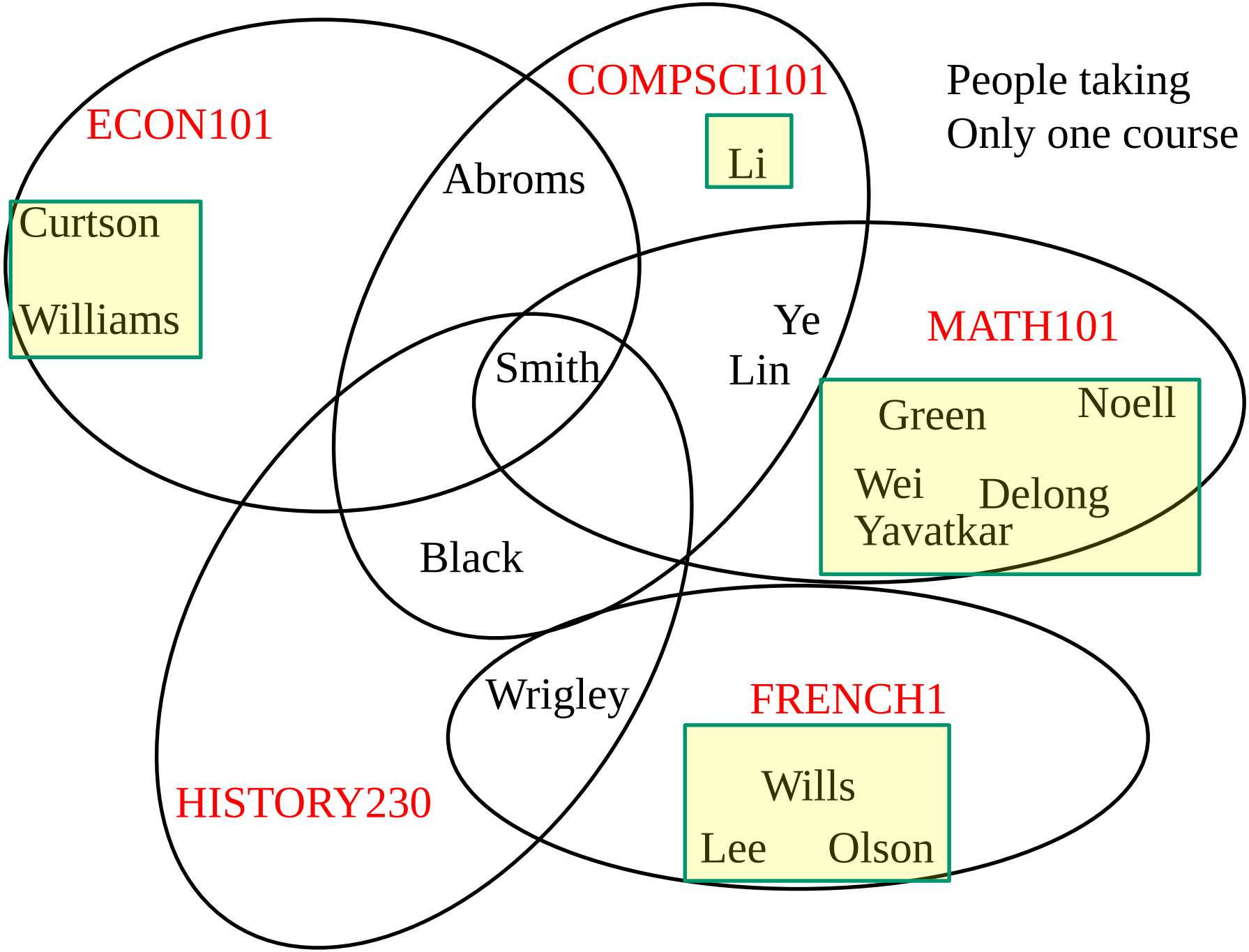
```
[['Green', 'Wei', 'Lin',
'Yavatkar', 'Delong', 'Noell',
'Ye', 'Smith', 'Abroms', 'Curtson',
'Williams', 'Wills', 'Wrigley',
'Olson', 'Lee', 'Black']
```

Part 4 – peopleTakingOnlyOneCourse

bit.ly/101fall14-1009-07

- Given a list of strings that have the name of a course (one word), followed by last names of people in the course:
  - Find number of people taking just one course

```
[['Smith', 'Ye', 'Li', 'Lin', 'Abroms', 'Black'],
['Green', 'Wei', 'Lin', 'Yavatkar', 'Delong',
'Noell', 'Ye', 'Smith'], ['Abroms', 'Curtson',
'Williams', 'Smith'], ['Wills', 'Wrigley',
'Olson', 'Lee'], ['Black', 'Wrigley']]
11 people taking only one course
['Curtson', 'Delong', 'Green', 'Lee', 'Li', 'Noell',
'Olson', 'Wei', 'Williams', 'Wills', 'Yavatkar']
```

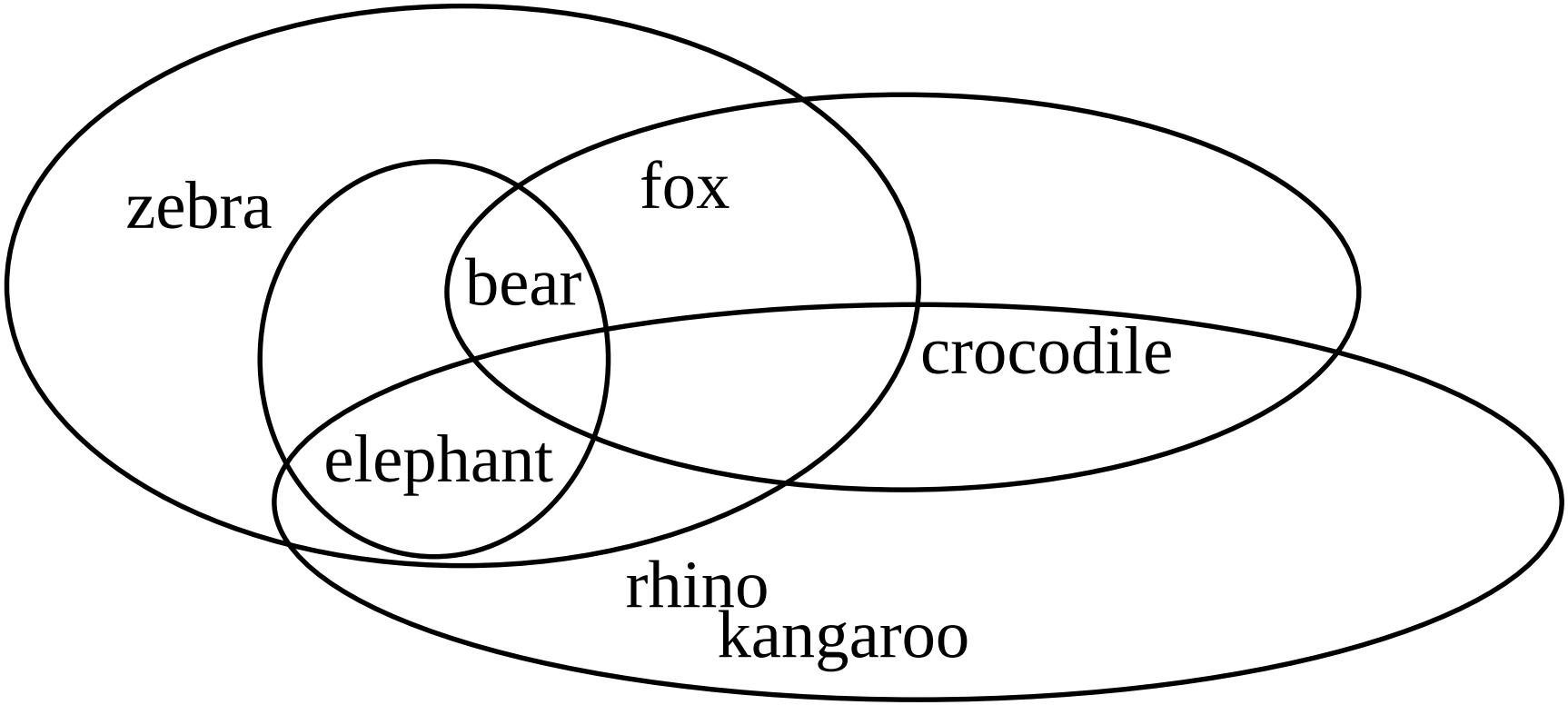

ECON101
COMPSCI101
People taking
Only one course
Li
Abroms
Curtson
Williams
Ye
Lin
MATH101
Smith
Green
Noell
Wei
Delong
Yavatkar
Black
Wrigley
FRENCH1
Wills
Lee
Olson
HISTORY230

APT - UniqueZoo

- How do you solve this problem?
- How is it similar to the problem we just solved

Example Data for UniqueZoo

```
["zebra bear fox elephant","bear crocodile fox",
"rhino elephant crocodile kangaroo",
"elephant bear"]
```



UniqueZoo – two zoos have unique animals