Objectives

- Lab 10 Reflection
- Overriding methods
- Helper methods
- Search strategies

Progression

- Lab 2: tricycle
  - Used API of objects/classes that were defined elsewhere
- Lab 9: training wheels
  - You were given most of a class definition
  - Had to test it, find common bugs
  - Fill in some methods
- Lab 10: training wheels came off
  - Given a “stub” of a class definition
  - Need to implement, test
  - Practice, practice, practice!

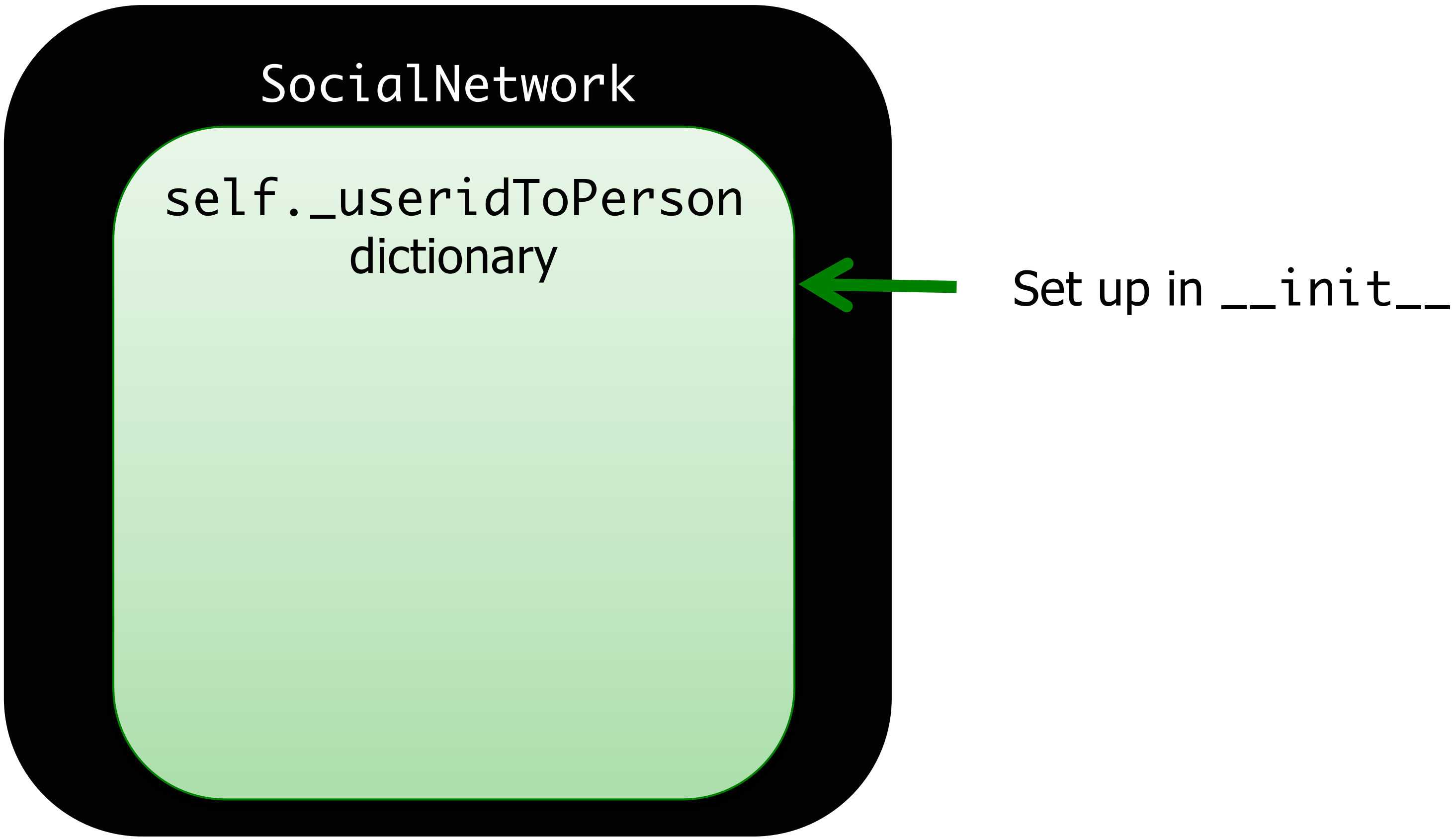
Lab 10 Reflection

- Solving a real problem
- Started with designing the solution from a vague specification
- Broke into smaller problems (different classes, different responsibilities)
- Implementing smaller components
  - Following the specification
- Building to large component

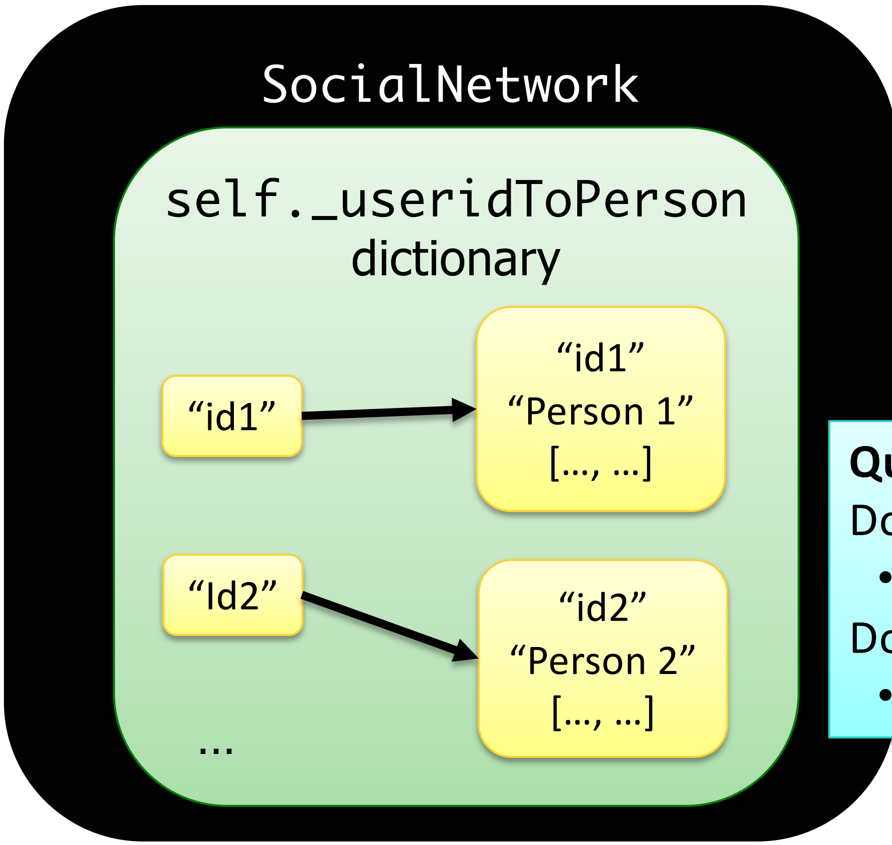
Lab 10 Discussion

- How can we call *other* methods of that data type when we're in one method of the data type?
  - Example: If I'm in the `__str__(self)` method of the `Person` class, how can I call the `getNumFriends()` method?
- How do the `SocialNetwork` class and `Person` class work together?

Lab 10: SocialNetwork



Lab 10: SocialNetwork



Questions to ask yourself:

Do I need to do operations on the dictionary?

- Then operate on `self._useridToPerson`

Do I need to do operations on a `SocialNetwork`?

- Then, call methods on `self`.

Notice How Problems Break Down…

- In `Person` class
  - Concatenating strings was probably the hardest part
- In `SocialNetwork` class
  - What can I do with a dictionary? How do I do this on a dictionary?
  - What can I do with a file?
- Big problems break down into problems that you can easily solve, if you are comfortable with strings, dictionaries, files, …

The Common Conundrum

- You have a large tool box.
- Keep track of all the tools you have in your box
  - You will be combining a variety of tools in different ways

*This is **Problem Solving**!*

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*This is **Problem Solving**!*

- How can you figure out what tool to use?
  - What information do I have? What do I need?
  - How is the information represented? What is its type?
  - What operations/methods/functions are available?
  - When I ran into this situation before, how did I solve it?
  - How can I make it clearer what is going on?

Lab 10 FAQ for common issues

Testing Mutators

(Assuming object was already created)

1. Execute mutator method
2. Use getter to test that mutator worked

References

- Check out the slides for lab10
  - Hints on reading in files
- Lab 10 FAQ
- When did I solve a similar problem? – Refer back to that problem

__LT__ and __EQ__ METHODS

Special Methods in Python

- We've seen __ used in a various places
- If we override the "__" methods, then Python can hook things up for us
  - Example, calling constructor using the class name, calls the __init__ method
  - Stringifying an object or printing an object calls the __str__ method

__eq__: Compare Objects of Same Type

- Header: `def __eq__(self, other)`
  - **Assumption:** `other` is another object of the *same type*
- Returns
  - `True` if `self` is equivalent to `other`
  - `False` otherwise
- If *override* the method in your class, can use objects in comparison expressions with `==`

How would you determine if two `Card` objects are equivalent?

`__lt__`: Compare Objects of Same Type

- Header: `def __lt__(self, other)`
  - **Assumption: `other`** is another object of the *same type*
- Returns
  - `True` if `self` < `other`
  - `False` otherwise
- If *override* method in your class, can use objects in comparison expressions, such as with `<` and `sort`

How do you compare two `Card` objects?

Comparing Objects of the Same Type

```
def __eq__(self, other):
    """ Compares Card objects by their ranks and suits """
    if type(self) != type(other):
        return False

    return self._rank == other._rank and self._suit == other._suit
```

```
def __lt__(self, other):
    """ Compares Card objects by their ranks """
    if type(self) != type(other):
        return False

    return self._rank < other._rank

# Could compare by black jack or rummy value
```


card.py

DataFrequency Object

```
def __lt__(self, other):
   """
   Compares this object with other, which is also a
   DataFrequency object.
   Used by default when using the list's sort method.
   """

   return self._count < other._count
```

Could then sort the list of DataFrequency objects as

```
myDataFreqList = … #create list
myDataFreqList.sort()
```

`sort` automatically calls the `__lt__` method

The **key** parameter to sort method adds flexibility/customization

HELPER METHODS

Helper Methods

- Part of the class
- **Not** part of the API
- Make your code easier to write (internally) but others outside the class shouldn't use
- Convention: method name begins with "_"

Let's create a method that determines if a Card is a face card!

Example Helper Method

Helper Method:

```
def _isFaceCard(self):
   if self._rank > 10 and self._rank < 14:
      return True
   return False
```

In use:

```
def rummyValue(self):
   if self._isFaceCard():
      return 10
    elif self._rank == 10:
      return 10
   elif self._rank == 14:
      return 15
   else:
      return 5
```


`card.py`

Helper Method Conventions

- Naming with underscore *loosely* enforces that other can't use
  - Does not show up in `help`
  - Does show up in `dir`
    - Shows all properties, methods of object

Helper Method:

```
def _isFaceCard(self):
   if self._rank > 10 and self._rank < 14:
      return True
   return False
```

`card.py`

In SocialNetwork class

- Suggested _writePersonToFile(fileobj, userid) method
  - Writes the Person with the given userid to the given fileobj
- Then, can call method in exportPeople(filename), which writes all of the people to the given filename

SEARCHING

Search Using `in`

- Iterates through a list, checking if the element is found
- Known as ***linear search***
- **Implementation:**

```
def linearSearch(searchlist, key):
    for elem in searchlist:
        if elem == key:
            return True
    return False
```

value	8	5	3	7
pos	0	1	2	3

What are the strengths and weaknesses of implementing search this way?

`linear_search.py`

Linear Search

- **Overview**: Iterates through a list, checking if the element is found
- **Benefits:**
  - Works on *any* list
- **Drawbacks**:
  - Slow -- needs to check each element of list if the element is not in the list

High-Low Game/TPIR Clock Game

- I’m thinking of a number between 1-100
- You want to guess the number as quickly as possible, i.e., in fewest guesses
- For every number you guess, I’ll tell you if you got it right. If you didn’t, I’ll tell you whether you’re too high or too low

Reminder: write down guesses

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→ What is your best guessing strategy?

Strategy: Eliminate Half the Possibilities

- Repeat until find value or looked through all values
  - Guess middle value of possibilities
  - If match, found!
  - Otherwise, find out too high or too low
  - Modify your possibilities
    - Eliminate the possibilities from your number and higher/lower, as appropriate
- Known as ***Binary Search***

Searching…

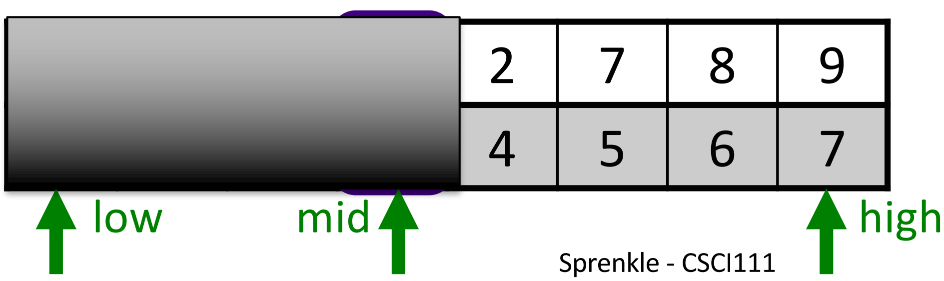
value	-3	0	0	1	2	7	8	9
pos	0	1	2	3	4	5	6	7

Use algorithm to search for key = 8

Searching for 8

-3	0	0	1	2	7	8	9
0	1	2	3	4	5	6	7

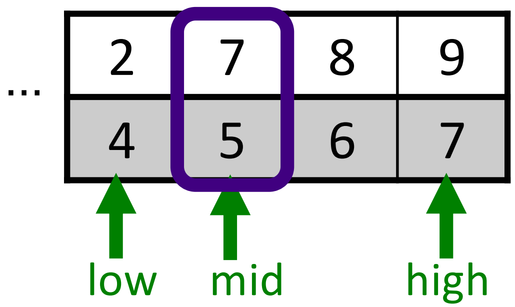
- Find the middle of the list
  - Positions: 0-7, so mid position is ((7+0)//2) = 3
- Check if the key equals the value at mid (1)
  - If so, report the location
- Check if the key is higher or lower than value at mid
  - Search the appropriate half of the list



8 > 1, so look in upper half

Searching for 8

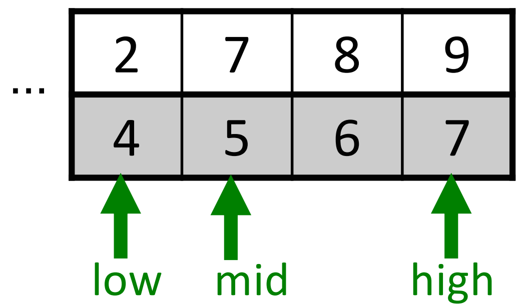
- mid is 5 ((7+4)//2), list[5] is 7



8>7,
so look in upper half

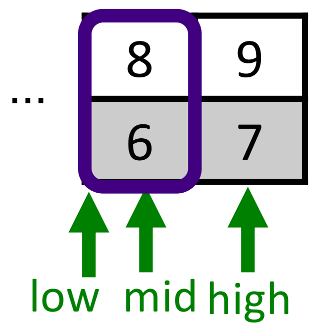
Searching for 8

- mid is 5 ((7+4)//2), list[5] is 7



8>7,
so look in upper half

- mid is 6 ((7+6)//2), list[6] is 8



8==8,
FOUND IT at position 6!

What if searched for 6 instead of 8?

Searching…

value	-3	0	0	1	2	7	8	9
pos	0	1	2	3	4	5	6	7

Use algorithm to search for key = 6

Searching for 6

-3	0	0	1	2	7	8	9
0	1	2	3	4	5	6	7

- Will follow same execution flow, but 6 is not in the list
- mid is 6, list[5] is 7

…	2	7	8	9
	4	5	6	7

low mid high

6 < 7, so will try to look in lower half of the list

- mid is 4, list[4] is 2

…	2	…
	4	

6>2, so will try to look in upper half of the list,
but we've already determined it's not there.
How do we know to stop looking?

Implementation Group Work

```
def search(searchlist, key):
    """Pre: searchlist is a list of integers in
    sorted order.
    Returns the position of key (an integer) in
    the list of integers (searchlist) or -1 if
    not found"""
```

- Trace through your function using examples
  - Start simple (small lists)
  - Do what the program says *exactly*, not what you *think* the program says

Looking Ahead

- Lab 10 due Friday
- No broader issue