CSc 110, Spring 2018

Lecture 32: Sets and Dictionaries

Adapted from slides by Marty Stepp and Stuart Reges

"Yes, some books come in high definition — dictionaries!"

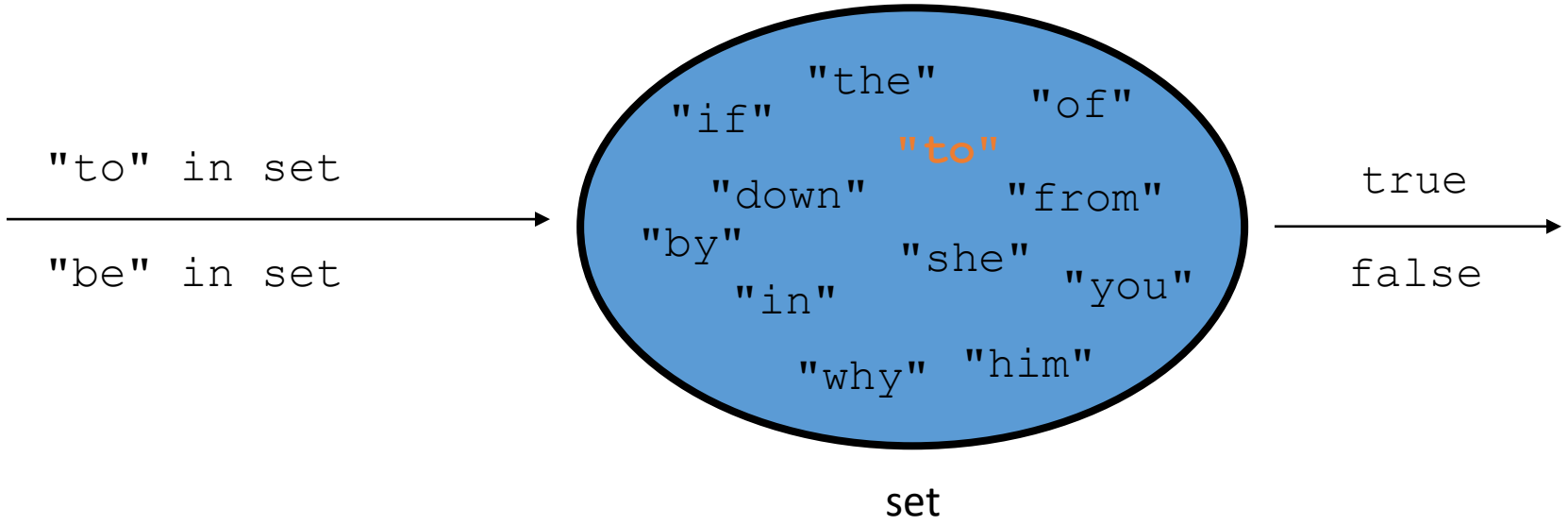
Exercise

- Write a program that counts the number of unique words in a large text file (say, *Moby Dick* or the King James Bible).
  - Store the words in a structure and report the # of unique words.
  - Once you've created this structure, allow the user to search it to see whether various words appear in the text file.

- What structure is appropriate for this problem? List? Tuple?

Sets

- **set**: A collection of unique values (no duplicates allowed) that can perform the following operations efficiently:
  - add, remove, search (contains)
  - We don't think of a set as having indexes; we just add things to the set in general and don't worry about order



Creating a `Set`

- An empty set:

```
a = set()
```

- A set with elements in it:

```
b = {"the", "hello", "happy"}
```

`a.add(`**val**`)`	adds element val to a
`a.discard(`**val**`)`	removes val from a if present
`a.pop()`	removes and returns a random element from a
`a - b`	returns a new set containing values in a but not in b
`a | b`	returns a new set containing values in either a or b
`a & b`	returns a new set containing values in both a and b
`a ^ b`	returns a new set containing values in a or b but not both

You can also use `in`, `len()`, etc.

Looping over a set?

- You must use a for element in structure loop
  - needed because sets have no indexes; can't `get` element `i`

Exercise

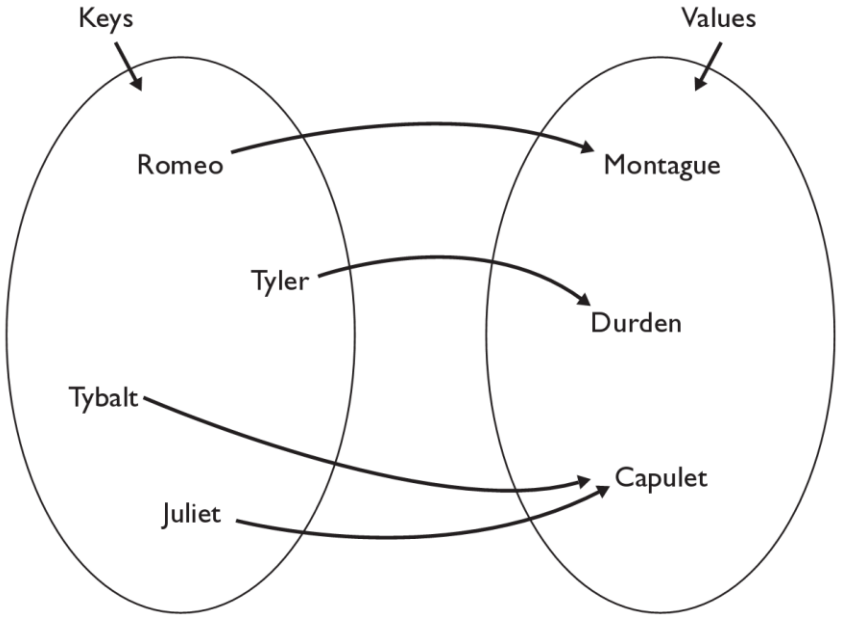
- Write a program to count the number of occurrences of each unique word in a large text file (e.g. *Moby Dick*).
  - Allow the user to type a word and report how many times that word appeared in the book.
  - Report all words that appeared in the book at least 500 times.

- What structure is appropriate for this problem?

Dictionaries

- **dictionary**: Holds a set of unique *keys* and a collection of *values*, where each key is associated with one value.
  - a.k.a. "map", "associative array", "hash"

- basic dictionary operations:
  - **put**(*key*, *value*): Adds a mapping from a key to a value.
  - **get**(*key*): Retrieves the value mapped to the key.
  - **remove**(*key*): Removes the given key and its mapped value.



`my_dict["Juliet"]` returns `"Capulet"`

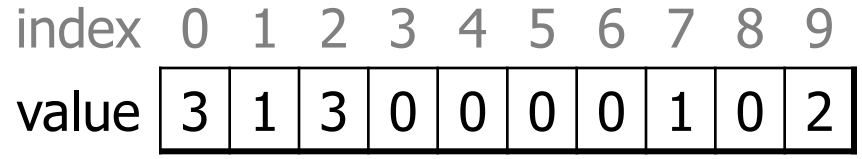
Dictionary functions

`my_dict[`**key**`] = `**value**	adds a mapping from the given key to the given value; if the key already exists, replaces its value with the given one
`my_dict[`**key**`]`	returns the value mapped to the given key (error if key not found)
`items()`	return a new view of the dictionary's items ((key, value) pairs)
`pop(`**key**`)`	removes any existing mapping for the given key and returns it (error if key not found)
`popitem()`	removes and returns an arbitrary (key, value) pair (error if empty)
`keys()`	returns the dictionary's keys
`values()`	returns the dictionary's values

You can also use `in`, `len()`, etc.

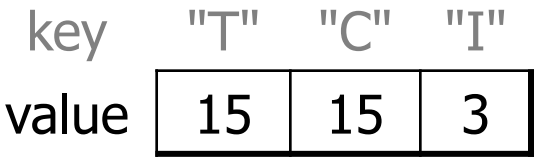
Maps and tallying

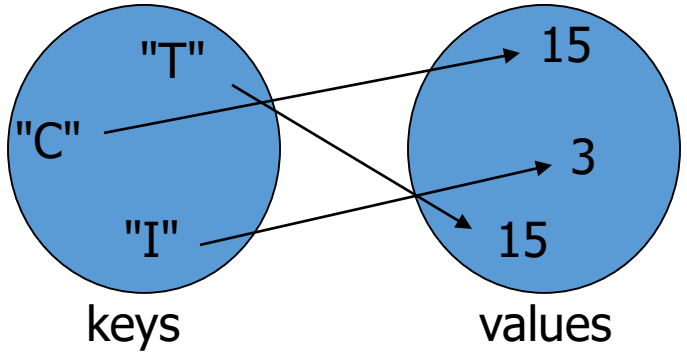
- a map can be thought of as generalization of a tallying list
  - the "index" (key) doesn't have to be an `int`
  - count digits: `2209231090 7`




```
# (T)rump, (C)linton, (I)ndependent
```

  - count votes: `"TCCCCCCTTTTTCCCCCCTCTTITCTTITCCTIC"`





items, keys and values

- `items` function returns tuples of each key-value pair
  - can loop over the keys in a for loop

```
ages = {}
ages["Merlin"] = 4
ages("Chester"] = 2
ages["Percival"] = 12
for cat, age in ages.items()):
    print(name + " -> " + str(age))
```

- `values` function returns all values in the dictionary
  - no easy way to get from a value to its associated key(s)
- `keys` function returns all keys in the dictionary