Objectives

- Dictionaries

Review

- What is a definite loop? What is an indefinite loop?
- What is the syntax for writing an indefinite loop?
- Which is more powerful—a `for` loop or a `while` loop? Why?

LOOKUP ALTERNATIVES

List/String Lookup

- How do we "lookup" a value in a list?
- Answer:
  - By its index/position
- Requires:
  - Knowing the index where a value is

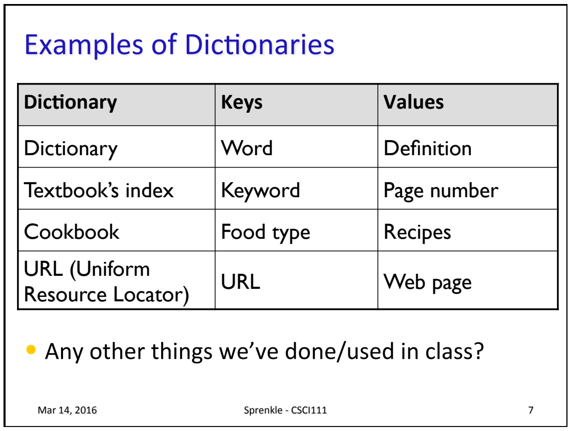
Alternative Lookup

- Alternative: look up something by its key
  - Example: When I lookup my friend's phone number in my contacts, I don't know that the number is at position X in my contacts. I can look up my friend's number by her *name*.
  - Have a fast way to figure out "given this key, what is the value associated with it?"
- This type of data structure is known as a ***dictionary*** in Python
  - Maps a **key** to a **value**
  - Contacts' key: "Friend's name", value: phone number

Examples of Dictionaries

Dictionary	Keys	Values
Dictionary		
Textbook's index		
Cookbook		
URL (Uniform Resource Locator)		

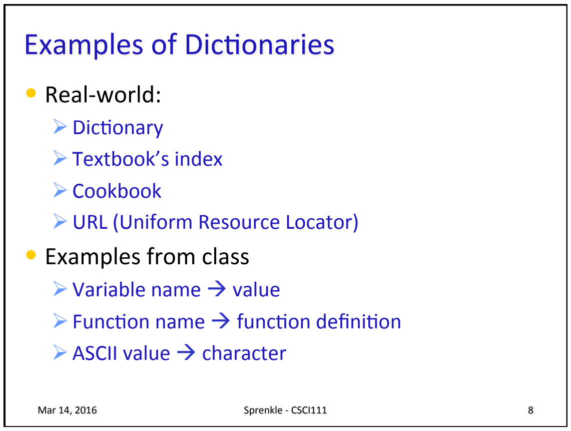
- Any other things we've done/used in class?



Examples of Dictionaries

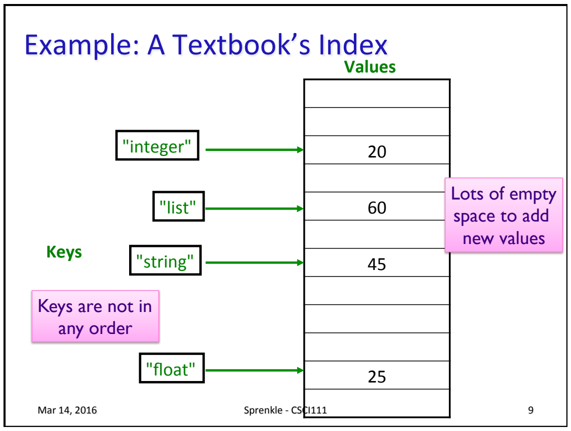
Dictionary	Keys	Values
Dictionary	Word	Definition
Textbook's index	Keyword	Page number
Cookbook	Food type	Recipes
URL (Uniform Resource Locator)	URL	Web page

- Any other things we've done/used in class?



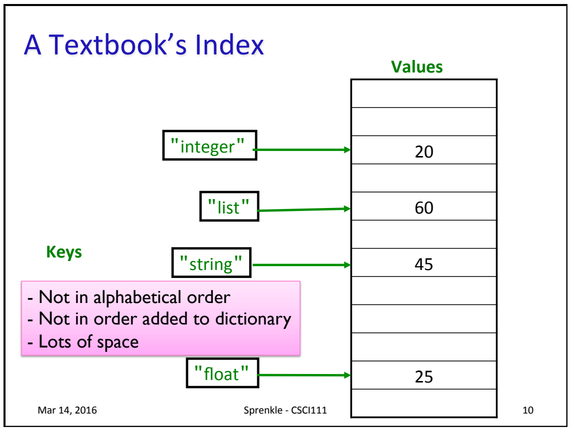
Examples of Dictionaries

- Real-world:
  - Dictionary
  - Textbook's index
  - Cookbook
  - URL (Uniform Resource Locator)
- Examples from class
  - Variable name → value
  - Function name → function definition
  - ASCII value → character

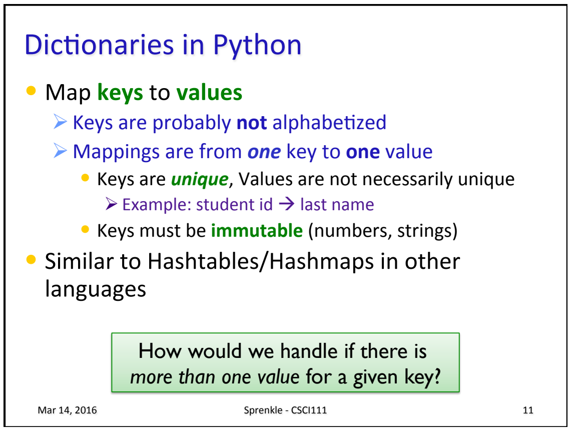


Example: A Textbook's Index

Values
"integer"
20
"list"
60
Lots of empty space to add new values
Keys
"string"
45
Keys are not in any order
"float"
25



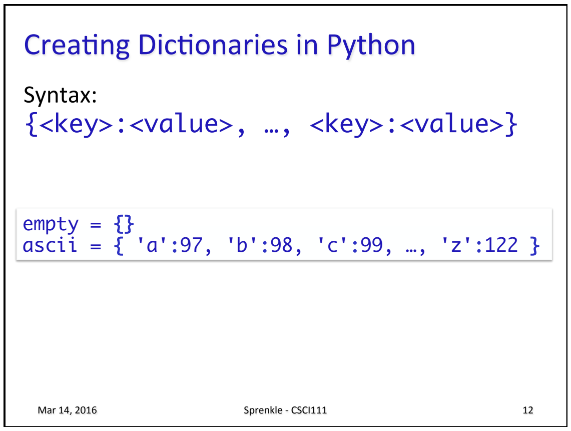
A Textbook's Index



Dictionaries in Python

- Map **keys** to **values**
  - Keys are probably **not** alphabetized
  - Mappings are from ***one*** key to **one** value
    - Keys are ***unique***, Values are not necessarily unique
      - Example: student id → last name
    - Keys must be **immutable** (numbers, strings)
- Similar to Hashtables/Hashmaps in other languages

How would we handle if there is *more than one value* for a given key?

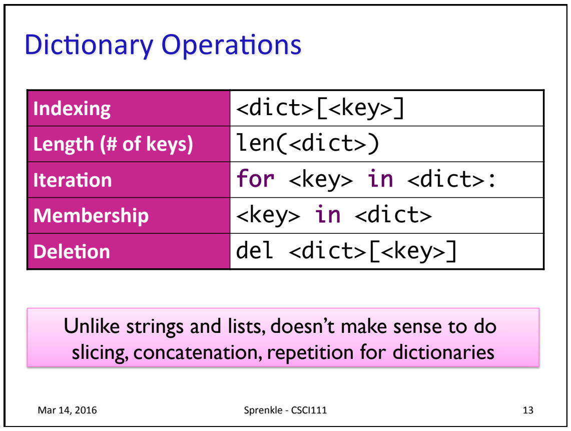


Creating Dictionaries in Python

Syntax:

```
{<key>:<value>, …, <key>:<value>}
```

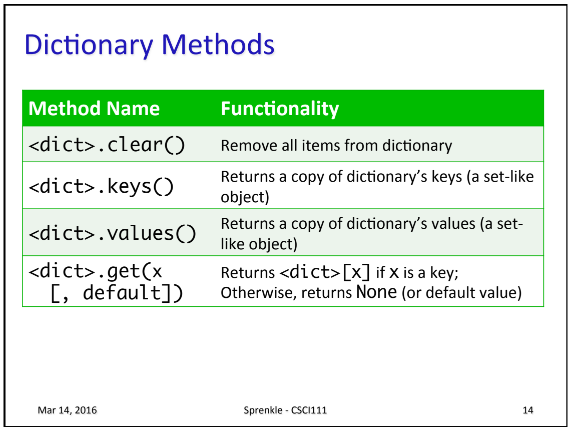
```
empty = {}
ascii = { 'a':97, 'b':98, 'c':99, …, 'z':122 }
```



Dictionary Operations

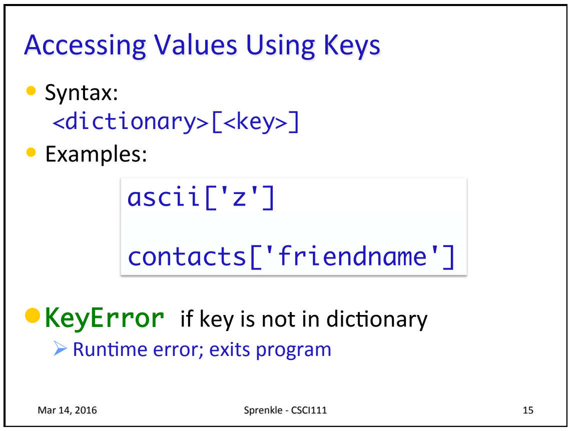
Indexing	`<dict>[<key>]`
Length (# of keys)	`len(<dict>)`
Iteration	`for <key> in <dict>:`
Membership	`<key> in <dict>`
Deletion	`del <dict>[<key>]`

Unlike strings and lists, doesn't make sense to do slicing, concatenation, repetition for dictionaries



Dictionary Methods

Method Name	Functionality
`<dict>.clear()`	Remove all items from dictionary
`<dict>.keys()`	Returns a copy of dictionary's keys (a set-like object)
`<dict>.values()`	Returns a copy of dictionary's values (a set-like object)
`<dict>.get(x [, default])`	Returns `<dict>[x]` if x is a key; Otherwise, returns None (or default value)



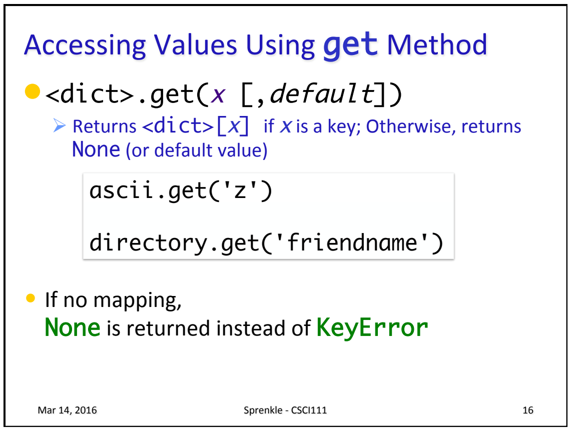
Accessing Values Using Keys

- Syntax:
  `<dictionary>[<key>]`
- Examples:

```
ascii['z']

contacts['friendname']
```

- KeyError if key is not in dictionary
  - Runtime error; exits program



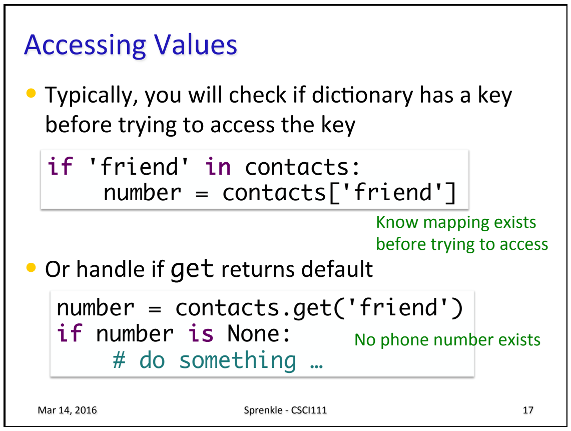
Accessing Values Using get Method

- `<dict>.get(`*x* `[,`*default*`])`
  - Returns `<dict>[`*x*`]` if *x* is a key; Otherwise, returns None (or default value)

```
ascii.get('z')

directory.get('friendname')
```

- If no mapping,
  None is returned instead of KeyError



Accessing Values

- Typically, you will check if dictionary has a key before trying to access the key

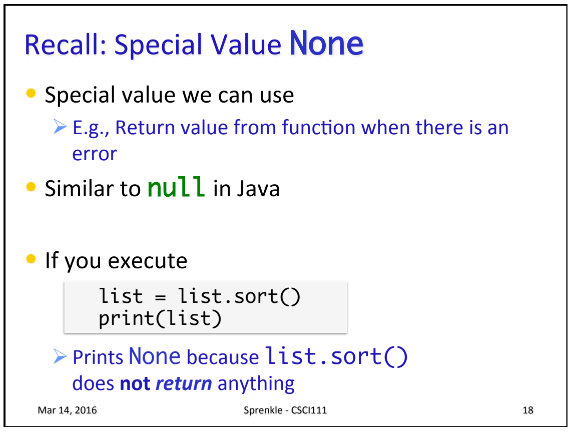
```
if 'friend' in contacts:
    number = contacts['friend']
```

Know mapping exists before trying to access

- Or handle if get returns default

```
number = contacts.get('friend')
if number is None:
    # do something …
```

No phone number exists



Recall: Special Value None

- Special value we can use
  - E.g., Return value from function when there is an error
- Similar to `null` in Java
- If you execute

```
list = list.sort()
print(list)
```

  - Prints None because `list.sort()` does **not *return*** anything

Example Using None

```
# returns the lowercase letter translated by the key.
# If letter is not a lowercase letter, returns None
def translateLetter( letter, key ):
    if letter < 'a' or letter > 'z':
        return None
    #As usual …
```

```
# example use
encLetter = translateLetter(char, key)
if encLetter is None:
     print("Error in message: ", char)
```

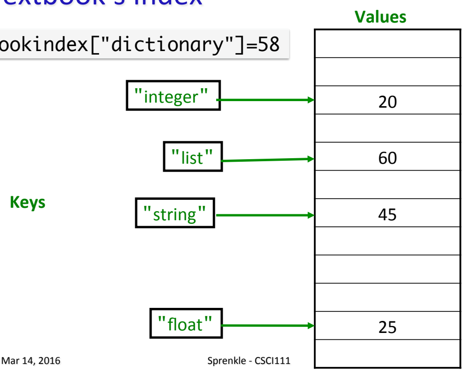
Inserting Key-Value Pairs

- Syntax:
  `<dictionary>[<key>] = <value>`
- `ascii['a'] = 97`
  - Creates new mapping of 'a' → 97

ascii_dictionary.py

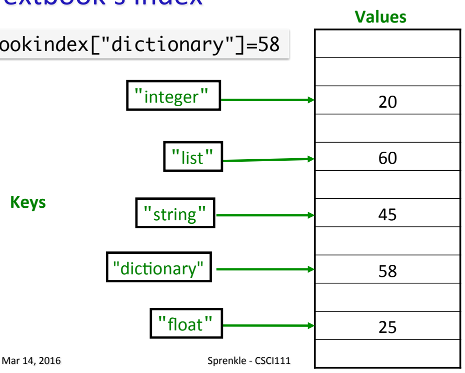
Textbook's Index

`bookindex["dictionary"]=58`



Textbook's Index

`bookindex["dictionary"]=58`



Adding/Modifying Key-Value Pairs

- Syntax:
  `<dictionary>[<key>] = <value>`
- `directory['registrar'] = 8455`
  - Adds mapping for `'registrar'` to 8455

  OR
  - Modifies old entry if it existed to 8455

Methods keys() and values()

- Don't actually return a `list` object
- But can be used similarly to a list
- If you want to make them into a list:

```
keys = list(mydict.keys())
```

Using Dictionaries

using_dictionary.py

- Demonstrate lots of operations, methods, etc. in using dictionaries

Problem

years_dictionary.py

- Part 1:
  - Given a file of the form
    - <lastname> <class>
  - Goal: I want to quickly find out what a student's class is
    - How do we want to model the data?
    - What is the key? What is the value?
    - How to display the mapping in a pretty way?
    - What order is the data printed in?
- Part 2:
  - Prompt user for the last name of the student
  - Display the student's graduation year

Part 3: Repeat Part 2

This Week

- Lab 8
- Exam 2 Friday
  - Bring review questions Wed