Compsci 101
Dictionaries

Susan Rodger

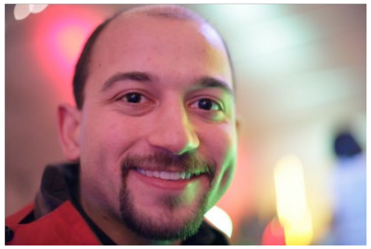
March 1, 2022

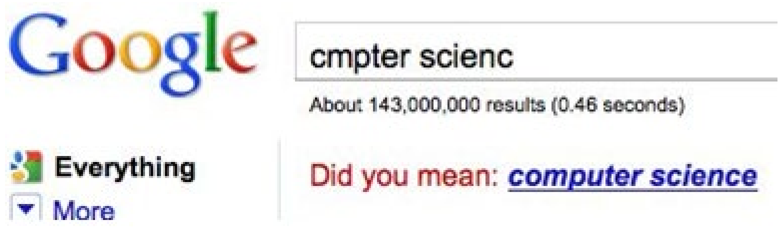
```
stuff is   {'color': 'black', 1: 2,
'cat': 100, (1, 1): 'yes', 1.5: 3}
```

N is for …

- **Nested Loops**
  - All pairs, all pixels, all 2D structures
- **None**
  - Default value for functions if no return
- **Newline**
  - The "\n" in a line

Noam Shazeer
Computer Science Duke Alum





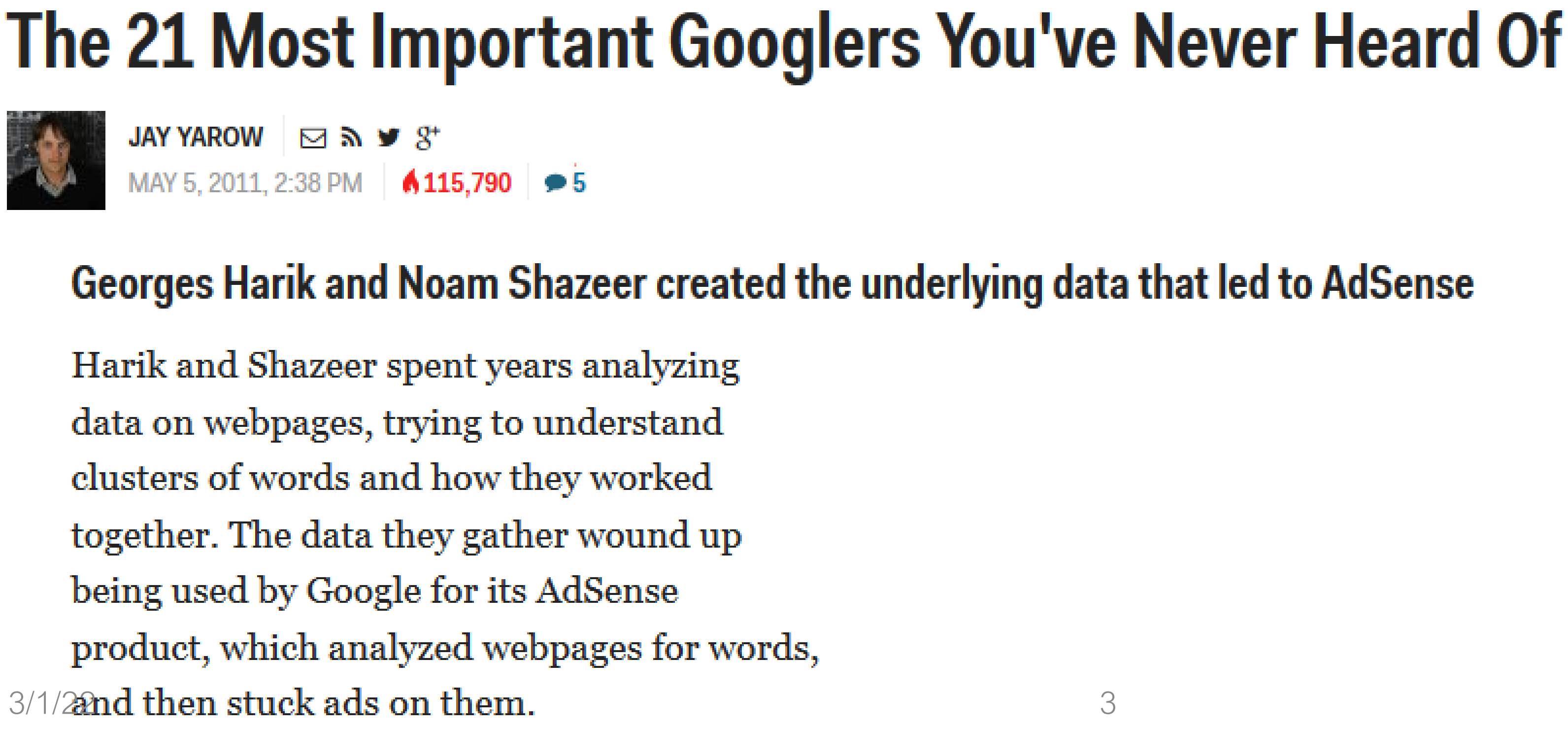
cmpter scienc

About 143,000,000 results (0.46 seconds)

Everything

More

Did you mean: ***computer science***



The 21 Most Important Googlers You've Never Heard Of

JAY YAROW

MAY 5, 2011, 2:38 PM | 115,790 | 5

Georges Harik and Noam Shazeer created the underlying data that led to AdSense

Harik and Shazeer spent years analyzing data on webpages, trying to understand clusters of words and how they worked together. The data they gather wound up being used by Google for its AdSense product, which analyzed webpages for words, and then stuck ads on them.

Announcements

- Assign 3 Transform due Today!
- Assign 4 is out, due Thursday, March 17

- APT 4 due this Thursday
- APT-5 out Thursday, due March 24

- No lab this week
- A few consulting hours during spring break
- Do not discuss Exam 1 or APT Quiz 1 with anyone until they are handed back

PFTD

- Dictionaries
- Solving Problems with Dictionaries

Problem: Given a name, what is their favorite ice cream?

- Assume you have a lot of people, over 1 million.

- How is the data stored?

- Assume we have parallel lists
  - students is list of names
  - icecream is list of corresponding favorite ice cream

Code might be

```
if name in students:
    pos = students.index(name)    # find position of name
    answer = icecream[pos]      # answer in same pos
```

If a billion names, this is not efficient

How does this code work?

How does search with .index work?

- Parallel Lists
  - Search for name first in students list
  - Use index location of name to find favorite ice cream

students =

['Astrachan', 'Sun', 'Rodger', 'Forbes']

0 1 2 3

icecream =

['Chocolate', 'Chocolate Chip', 'Chocolate Chip', 'Strawberry']

0 1 2 3

How does search with .index work?

- Parallel Lists
  - Search for name first in students list
  - Use index location of name to find favorite ice cream

Find Rodger's favorite ice cream

```
students =
['Astrachan',      'Sun',        'Rodger',        'Forbes']
      0               1              2                 3

icecream =
['Chocolate',    'Chocolate Chip', 'Chocolate Chip', 'Strawberry']
      0                1                 2                3
```

Code was easy

- But for a lot of data could take a long time.

- Let’s see another way, dictionaries

~~How the~~ Dictionary ~~is made~~

- **Using a dictionary is reasonably straight-forward**
  - We will be clients, not implementers
  - Efficiency not a large concern in 101
  - Our goal is to just get stuff done ☺

This Photo by Unknown Author is licensed under CC BY-NC-ND

This Photo by Unknown Author is licensed under CC BY-SA-NC

What is a Dictionary?

- A collection of (key, value) pairs (abstract view)
  - Look up key, find the value

- Very, very fast: essentially index by key
  - For list **`a[3]`** takes same time as **`a[3000]`**

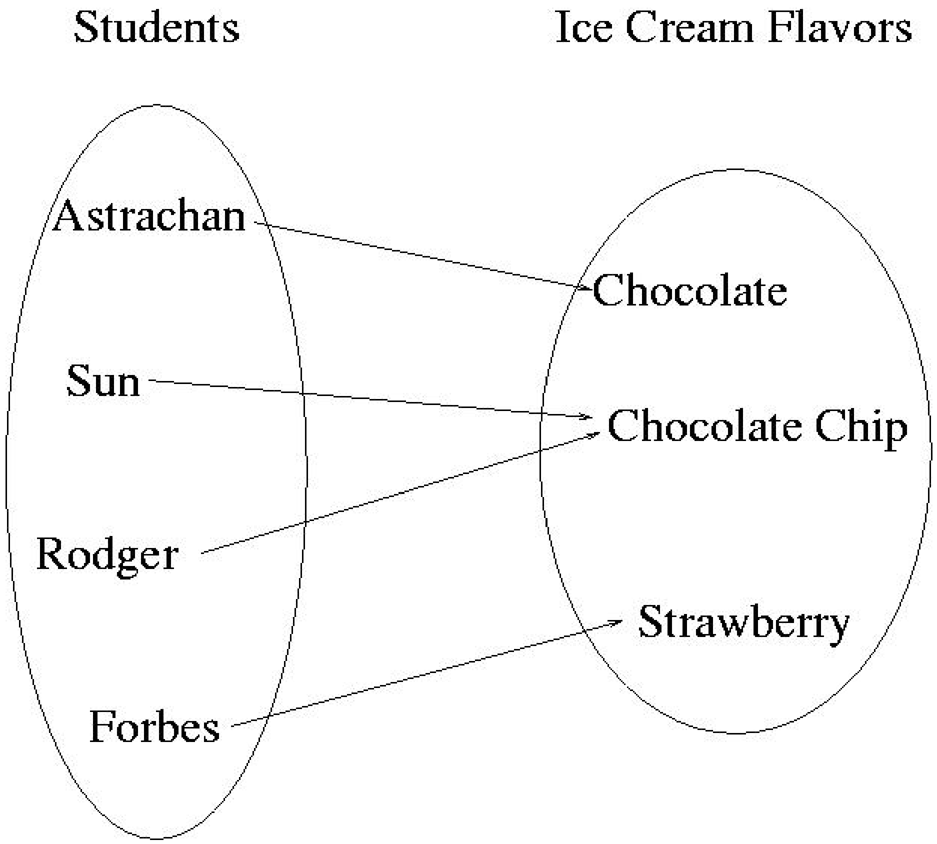
- For Dictionary: **`d["cake"]`**
  - Finding the value associated with "cake"

Dictionaries/Maps

- Dictionaries are another way of organizing data
- Dictionaries are sometimes called maps
- Keys and Values
  - Each key maps to a value
  - Some keys can map to the same value
  - Can change the value a key maps to

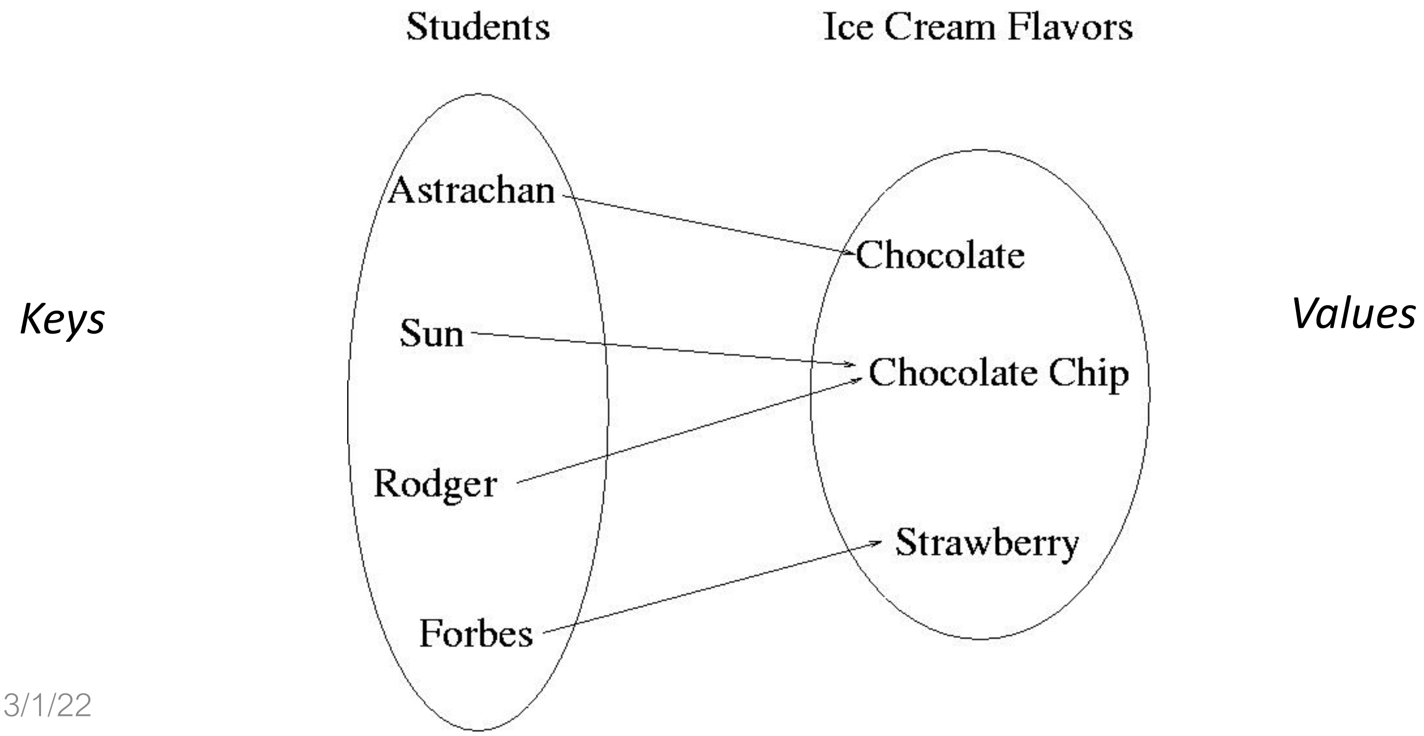
Example

- Each student could be mapped to their favorite ice cream flavor



How is dictionary different than a list?

- List – have to search for name first
- Dictionary – each key maps to a value
- getting name (or key) is automatic! Fast!



Implementing a Dictionary/Map
Keys map to values

- **Create Empty dictionary**

  somemap = {}

- **Put in a key and its value**

  somemap[“Forbes”] = “Strawberry”

- **Get a value for a dictionary**

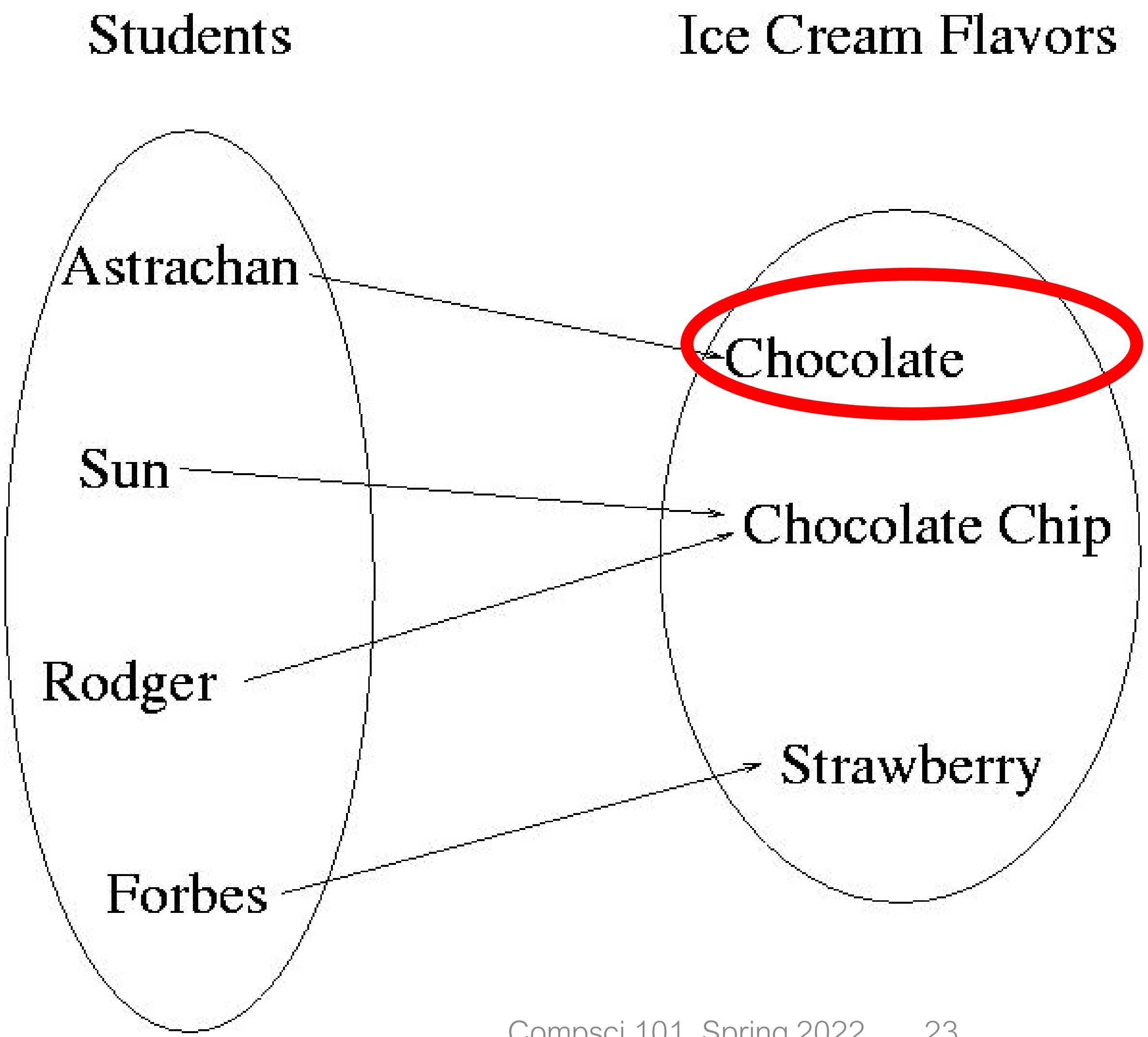
  value = somemap[“Forbes”]

- **Change a value for a dictionary**

  somemap[“Forbes’] = “Chocolate”

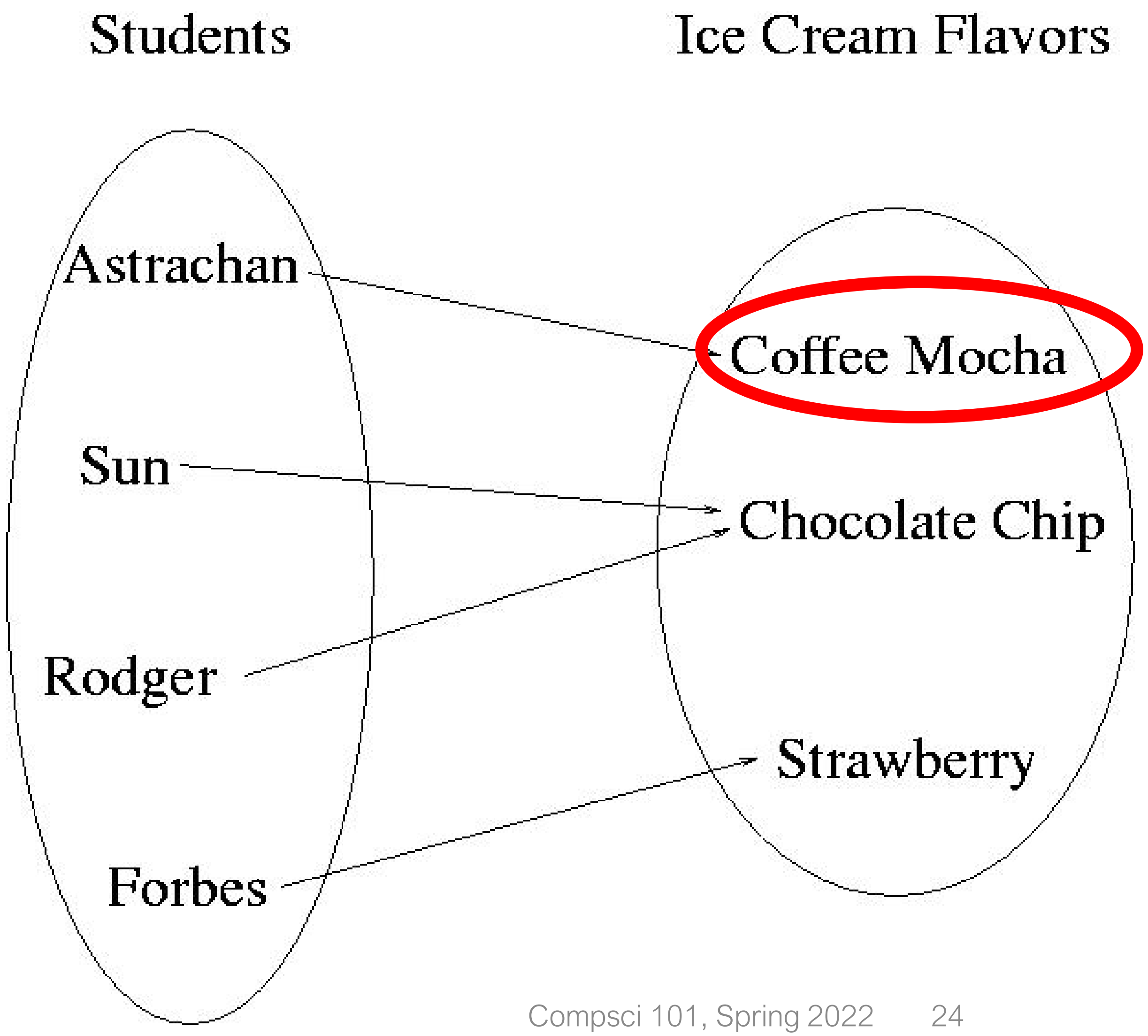
Change Astrachan’s value

somemap[“Astrachan”] = Coffee Mocha

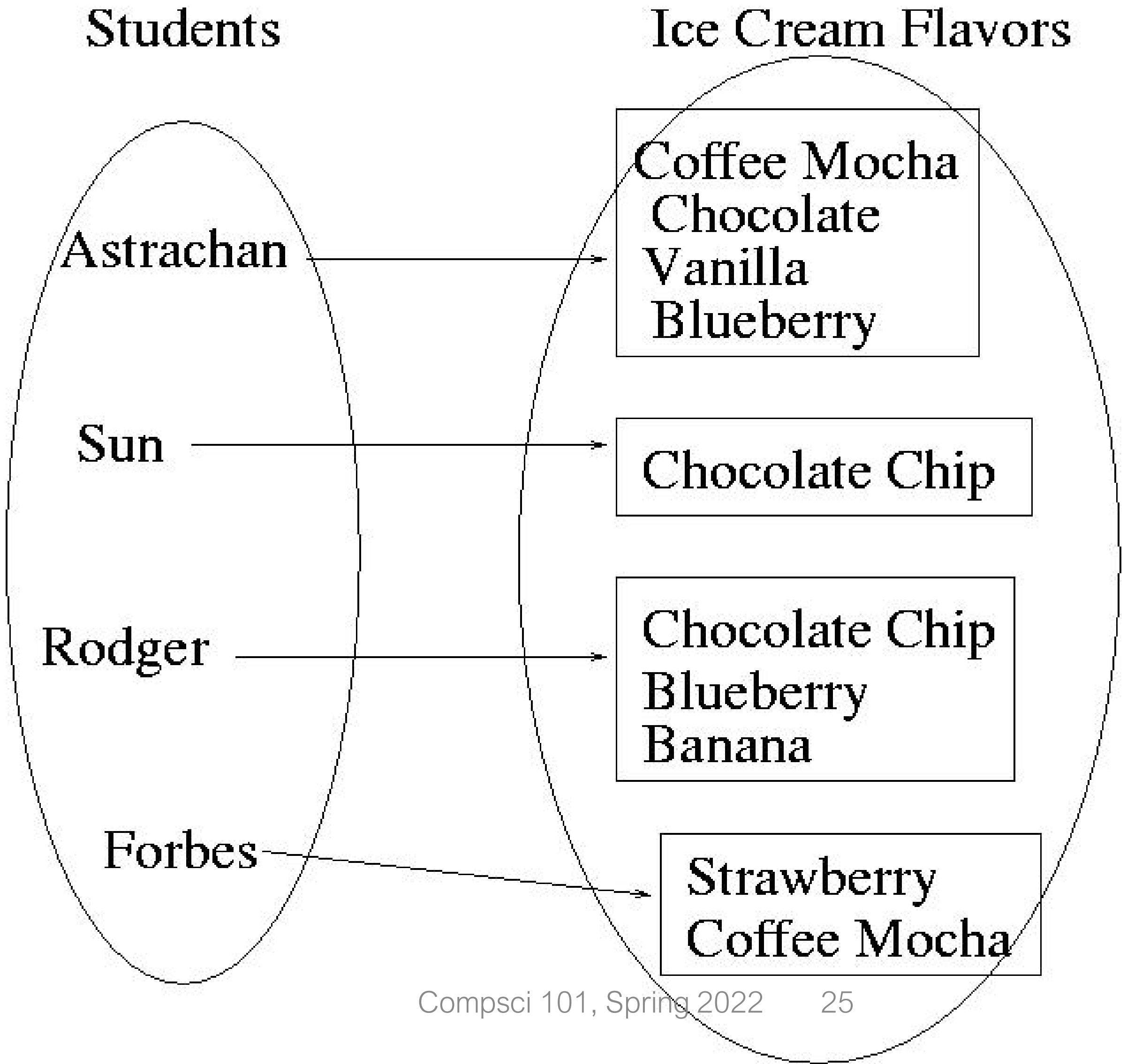


Change Astrachan's value

somemap["Astrachan"] = Coffee Mocha



Value could be a set or list



How to use a Dictionary

- Create: d = **`{}`**
  - `d = {'a': 10, 'b': 100}`
  - `d = dict([('a', 10), ('b', 100)])`
- Insert: **`d[KEY] = VALUE`**
- Update/Reassign: **`d[KEY] = VALUE`**
- Get a value (like list indexing): **`d[KEY]`**
- *Key* membership (not values): **`KEY in d`**
  - No membership check for values

Examples OUTPUT

```
stuff={}
print(stuff)
print(type(stuff))
stuff['color'] = 'black'
stuff[1] = 2
stuff['cat'] = 100
stuff[(1,1)] = 'yes'
stuff[1.5] = 3
print(stuff)
```

Examples OUTPUT

stuff is {'color': 'black', 1: 2, 'cat': 100, (1, 1): 'yes', 1.5: 3}

```
print(len(stuff))
stuff[3] = [6, 3, 2]



stuff[[4,7]] = ‘go’
```

Examples

```
d={}                                d is {}
d['color'] = 'black’

d['color'] = ‘red’

d[‘red’] = ‘color’


r = d[d[‘red’]]

r = d[‘monkey’]
```

Examples

```
d = {'a':'cat’, 'e':'dog’}

‘dog’ in d
‘a’ in d
‘pig’ in d
```

WOTO-1 Dictionaries
http://bit.ly/101s22-0301-1

More on Dictionary

- Like lists, but with keys
- KEY – immutable type, unique within dictionary
- VALUE – any type, not unique within dictionary
- Dictionary is unordered collection of (KEY, VALUE) pairs

More on using a Dictionary/Map

- Get all the keys (as a list)
  - `listKeys = somemap.keys()`
- Get all the values (as a list)
  - `listValues = somemap.values()`
- Other methods
  - `clear` – empty dictionary
  - `items` – return (key,value) pairs
  - `iteritems` – return (key,value) pairs more efficiently, *iterator – must use with for*
  - `update` – update with another dictionary

Examples

```
d = {'a’:4, 'e’: 3, ‘b’:4 }

v = d.values()
k = d.keys()
p = d.items()

for t in d.items():
    print(t)
```

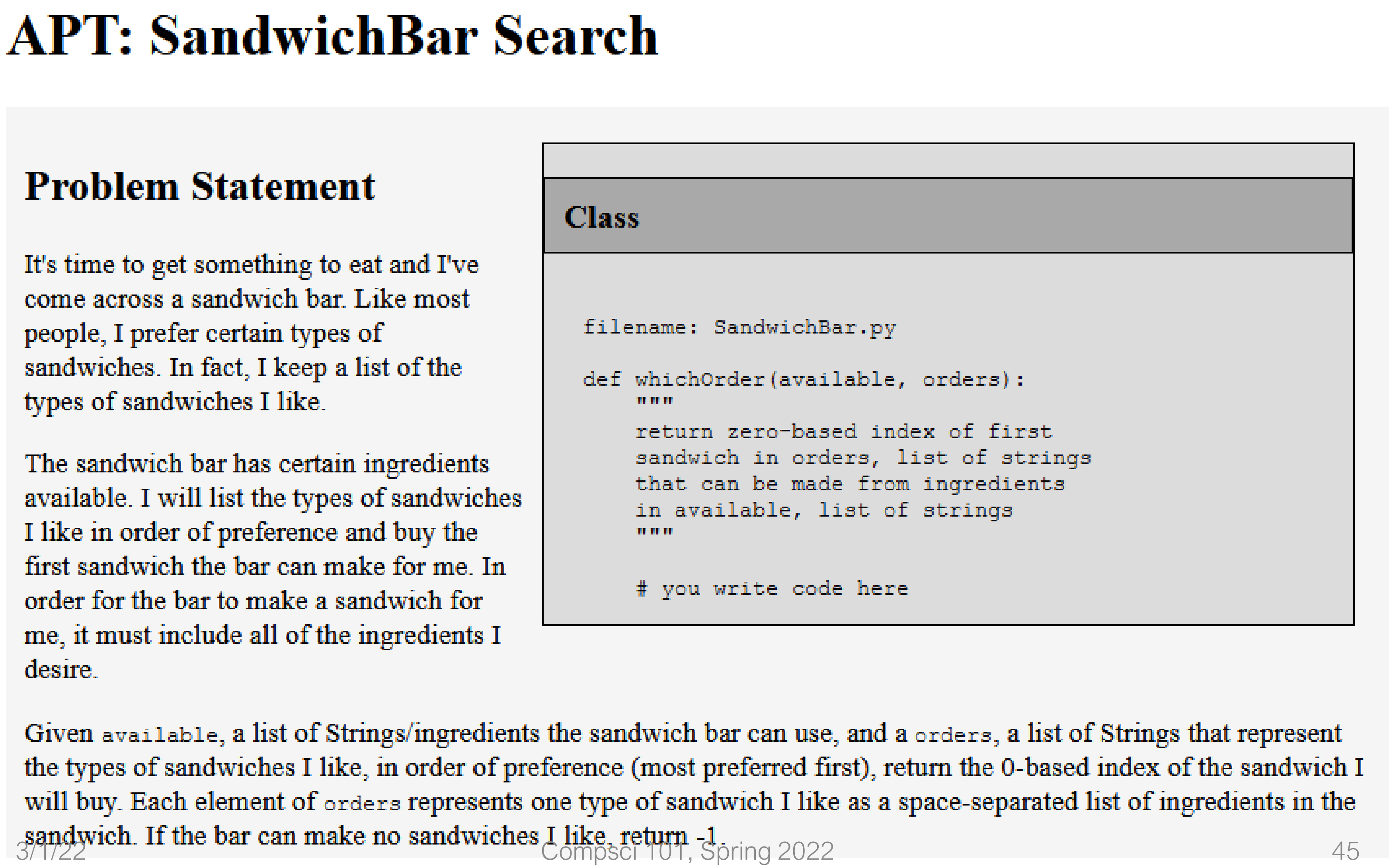
Problem

- Given a list of names of people who ate at a restaurant, who ate there the most?
- A name appears more than once if they ate their more than once

- names = ['Sarah', 'Beth', 'Sarah', 'Purnima', 'Beth', 'Beth', 'Purnima']

WOTO-2 Problem Solving
http://bit.ly/101s22-0301-2

Sandwich Bar



APT: SandwichBar Search

Problem Statement

It's time to get something to eat and I've come across a sandwich bar. Like most people, I prefer certain types of sandwiches. In fact, I keep a list of the types of sandwiches I like.

The sandwich bar has certain ingredients available. I will list the types of sandwiches I like in order of preference and buy the first sandwich the bar can make for me. In order for the bar to make a sandwich for me, it must include all of the ingredients I desire.

Given `available`, a list of Strings/ingredients the sandwich bar can use, and a `orders`, a list of Strings that represent the types of sandwiches I like, in order of preference (most preferred first), return the 0-based index of the sandwich I will buy. Each element of `orders` represents one type of sandwich I like as a space-separated list of ingredients in the sandwich. If the bar can make no sandwiches I like, return -1.

Class

```
filename: SandwichBar.py

def whichOrder(available, orders):
    """
    return zero-based index of first
    sandwich in orders, list of strings
    that can be made from ingredients
    in available, list of strings
    """

    # you write code here
```

Sandwich Bar Example

- available = ["cheese", "cheese", "cheese", "tomato"]
- orders = ["ham ham ham", "water", "pork", "bread", "cheese tomato cheese", "beef"]

WOTO-3 SandwichBar
http://bit.ly/101s22-0301-3

Assignment 4: Guess Word

- We give you most of the functions to implement
  - Partially for testing, partially for guiding you
- But still more open ended than prior assignments
- If the doc does not tell you what to do:
  - Your chance to decide on your own!
    - Okay to get it wrong on the first try
  - Discuss with TAs and friends, brainstorm!