

## Objectives

- Dictionary wrap up
- Loose ends:
  - Using/improving documentation
  - Default parameter values
- Digging into Object Oriented Programming
- Broader Issue: Diversity in Computing

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## Lab 6 Solution

- My complete solution will be in today's examples directory

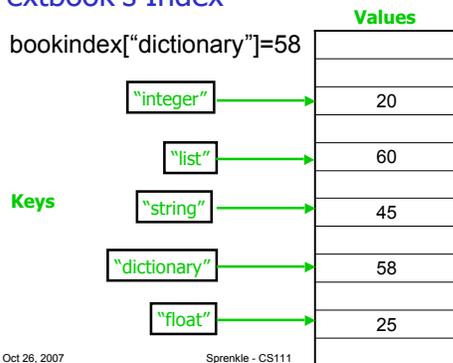
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## Textbook's Index

- `bookindex["dictionary"]`=58



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## Lists vs. Dictionaries

Lists	Dictionaries
<code>integer</code> positions (0, ...) to any type of value	Map immutable keys (int, float, string) to any type of value
Ordered	Unordered
Slower to find a value (in)	Fast to find a value (use key)
Fast to print in order	Slower to print in order (by key)
Only as big as you make it	Takes up a lot of space (so can add elements in the middle)

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## Getting Documentation

- `dir`: function that returns a list of methods and attributes in an object
  - `dir(<type>)`
- `help`: get documentation
  - Example Use in the Python shell
    - `help(<type>)`
    - `import <module name>`
    - `help(<module name>)`

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## Where is Documentation Coming From?

- Comes from the code itself in "`doc strings`"
  - i.e., "documentation strings"
- Doc strings are simply strings *after* the function header
  - Typically use triple-quoted strings because documentation goes across several lines

```
def verse(animal, sound):  
    """ prints a verse of Old MacDonald, filling  
    in the strings for animal and sound """
```

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## Defaults for Parameters

- Saw with the `xrange` function
  - Didn't have to specify start or increment when calling the function
  - Default start to 0
  - Default increment to 1
- Can assign a **default value** to a parameter
  - In general, default parameter should come after all the parameters that need to be defined

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## Using Default Parameters

- By default the `rollDie` function could assume that a die has 6 sides

Assigns a value **ONLY IF** not passed a parameter

```
def rollDie(sides=6):  
    return random.randint(1,sides)
```

Examples of calling the function:

```
rollDie(6)  
rollDie()  
rollDie(12)
```

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`game.py`

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## Problem: Student Majors

- We want to keep track of the number of majors of each type
  - Twist: Not every student has a major (don't declare until sophomore year)
  - Make a function to handle updating the dictionary
  - New data file: `data/majors.all.dat`

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## Problem: Student Majors, revised

- Students can have more than one major
  - Should count these separately
- How can we modify the previous program to do that?

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## Why Majors Problem Ad Nauseam?

- "Parsing" data files for different purposes is very common in science

### Simplified web application access log:

```
128.4.131.54 [09/Aug/2005:14:01:35] GET /dspace/simple-search  
128.4.133.79 [09/Aug/2005:14:13:13] GET /dspace/simple-search  
128.4.133.139 [09/Aug/2005:14:28:20] GET /dspace/simple-search  
128.4.133.139 [09/Aug/2005:14:32:45] GET /dspace/adv-search  
...
```

### I write scripts to

- create user sessions (use as test cases)
- analyze user sessions (avg. length, patterns)
- emulate user sessions

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## Programming Paradigm: Imperative

- Most modern programming languages are **imperative**
- Have **data** (numbers and strings in variables)
- Perform **operations** on data using operations, such as **+** (addition and concatenation)
- Data and operations are separate
  
- Add to imperative: object-oriented programming

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## Object-Oriented Programming

- Program is a collection of **objects**
- Objects **combine** data and methods together
- Objects interact by invoking methods on other objects
  - Methods perform some operation on object



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## Using a Graphics Module/Library

- Allows us to handle graphical input and output
  - Example input: Pictures
  - Example output: Mouse clicks
- Not part of a standard Python distribution
- Made up of a collection of related **classes** of data and operations (**methods**) that manipulate the data
- ➔ Use the library to help us learn OO programming

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## Using a Graphics Module/Library

- Handout lists the various classes
  - **Constructor** is in bold
    - Review: creates an object of that type
  - Methods and their parameters are listed for each class
  - Drawn objects have some common methods
    - Listed at end of handout
- Known as an **API**
  - **Application Programming Interface**

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## Snippet of Code

- Using the handout, what does this code do?

```
from graphics import *

def main():
    win = GraphWin("My Circle", 100, 100)
    c = Circle(Point(50,50), 10)
    c.draw(win)
    win.getMouse()

main()
```

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## Snippet of Code

- Using the handout, what does this code do?

```
from graphics import *
def main():
    win = GraphWin("My Circle", 100, 100)
    c = Circle(Point(50,50), 10)
    c.draw(win)
    win.getMouse()
main()
```

GraphWin object → win = GraphWin("My Circle", 100, 100)  
 Also known as an **instance of the GraphWin class**  
 Constructor → GraphWin("My Circle", 100, 100)  
 Method called on GraphWin object → win.getMouse()

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## Mid-Semester Evaluation: Agree on

- Course material - interesting
- Lectures - clear
- Examples - about right (1 dissent each direction)
- Textbook - N/A or useless (2 dissent, positive)
- Web Site - good
- Grading - fair
- Lab assignments: helpful in learning; just about right length/diff
  - 3 dissents - too long; 1 dissent - too hard
- Difficulty - same or increasing
- ➔ Readings - right length/difficulty; good discussion, understanding; OK to enjoyable

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## Disagree on

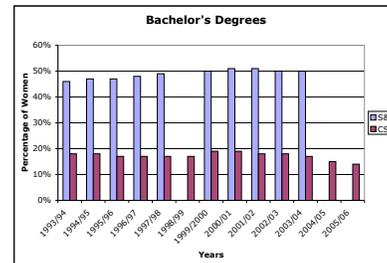
- Pace: 5 - right; 2 - fast; 3 slow
- Workload compared to others: bell curve

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## Diversity in Computer Science



- S&E around 50%, CS < 20%

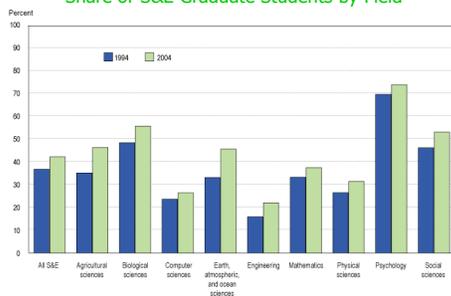
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## Graduate Enrollment

Share of S&E Graduate Students by Field



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## Attracting Computer Scientists

- Demand for software engineers is high
  - > Create new software, applications --> improve productivity
- Computer science majors are decreasing
  - > Dropped with dot-com bust
  - > Losing "normal" people of all genders, ethnicities
- Need to attract and retain more majors
  - > Maintain technical innovation, diversity of ideas
  - > Computing's effect on other fields
- Does attracting new majors compromise/weaken the discipline?

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## Discussion

- Two groups. Any guesses how divided?

Stereotype	% Truth	Perception changed?	How to Address?

Some stereotypes have some truth to them

Since W&L or since CS111

In classroom?  
As a profession?  
Recruitment tools?

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