Objectives

- More on functions
 - Passing parameters
 - Refactoring
 - > Testing functions
- Broader Issue: Smart Houses

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Review

- What is the keyword we use to create a new function?
- How do we get output from a function?
- What happens in the program execution when a function reaches a return statement?
- Why do we write functions?

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Review: Functions

What does this program do?

What is the control flow/execution path?

first = eval(input("Enter the first number: "))

second = eval(input("Enter the second number: "))

computedVal = myFunction(first, second)

print("The answer is", computedVal)

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What variables can

function "see" here?

What vars can't it see?

def myFunction(x, y):
 result = x*x + y*y
 return result

main()

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Review: Why Functions?

- Organize code
- Easier to read
- Easier to change
- Easier to reuse

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Terminology note: what the program outputs (displays) is different Practice from what the function outputs (returns)s • What does this program output? Example: user enters 4 def main(): num = eval(input("Enter a number to be squared: ")) squared = square(num)print("The square is", squared) def square(n): return n * n main() practice1.py 5 Sprenkle - CSCI111 March 3, 2017

```
Practice
• What does this program output?
   Example: user enters 4
 def main():
     num = eval(input("Enter a number to be squared: "))
     squared = square(num)
     print("The square is", squared)
     print("The original num was", n) 
 def square(n):
                                        Error! n does not
     return n * n
                                         have a value in
                                         function main()
 main()
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```

```
Practice: fixed

• What does this program output?

➤ Example: user enters 4

def main():
    num = eval(input("Enter a number to be squared: "))
    squared = square(num)
    print("The square is", squared)
    print("The original num was", num)

def square(n):
    return n * n

main()

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```

WHAT MAKES A GOOD FUNCTION?

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Writing a "Good" Function

- Should be an "intuitive chunk"
 - > Doesn't do too much or too little
 - ➤ If does too much, try to break into more functions
- Should be reusable
- Always have comment that tells what the function does

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Writing Comments for Functions

- Good style: Each function *must* have a comment
 - Describes functionality at a high-level
 - ➤ Include the *precondition*, *postcondition*
 - Describe the parameters (their types) and the result of calling the function (precondition and postcondition may cover this)

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Writing Comments for Functions

- Include the function's pre- and post- conditions
- Precondition: Things that must be true for function to work correctly
 - E.g., num must be even
- Postcondition: Things that will be true when function finishes (if precondition is true)
 - > E.g., the returned value is the max

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Example Comment

- Describes at high-level
- Describes parameters

Comments from docstrings show up when you use help function

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Where is Documentation Coming From?

- Comes from the code itself in "doc strings"
 - ▶ i.e., "documentation strings"

Pre/Post Conditions

only 0s and 1s

 $dec_value = 0$

string

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def binaryToDecimal(binary_string):

for pos in range(len(binNum)):

exp = len(binNum) - pos - 1

add it to the decimal value

bit = int(binNum[pos])

decVal += val

return dec_value

pre: binary_string is a string that contains

post: returns the decimal value for the binary

compute the decimal value of this bit
val = bit * 2 ** exp

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- Doc strings are simply strings after the function header
 - Typically use triple-quoted strings because documentation goes across several lines

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

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Getting Documentation

- dir: function that returns a list of methods and attributes in an object
 - >dir(<type>)
- help: get documentation
- In the Python shell
 - > help(<type>)
 - > import <modulename>
 - > help(<modulename>)

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REFACTORING

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Refactoring

- After you've written some code and it passes all your test cases, the code is probably still not perfect
- Refactoring is the process of improving your code without changing its functionality
 - Organization
 - Abstraction
 - Example: Easier to read, change
 - Easier to test
- Part of iterative design/development process
- Where to refactor with functions
 - Duplicated code
 - "Code smell"
 - Reusable code
 - Multiple lines of code for one purpose

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Refactoring:

Converting Functionality into Functions

- 1. Identify functionality that should be put into a function
 - ➤ What is the function's input?
 - What is the function's output?
- 2. Define the function
 - Write comments
- 3. Call the function where appropriate
- Create a main function that contains the "driver" for your program
 - > Put at top of program
- 5. Call main at bottom of program

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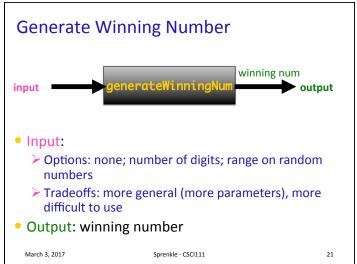
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Refactoring Practice

- pick4num.py
- Where are places that we can refactor and add functions?

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Broader Issue Groups

Ashley

Burke

Lexi

Charlotte

Austin

Buddy

Jae

John

Mike

Alex

Mira

Collin

Josette

Leslie

Win

Robert

Zander

Anna Kate

George

Sarah

Victor

Broader Issue Discussion

- What are promising home activities to automate?
 - > What are the challenges in automatically regulating a home?
 - ➤ What are difficult tasks to automate?
- What are the privacy concerns briefly mentioned in the articles?
 - ➤ Do they require deeper discussion?
- Why does the UVA group focus on smarter people rather than smarter thermostats?
 - ➤ Is that the right focus?

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