Exam 2 on Thursday, November 7
Loops

- Introduce nonlinearity into programs
- Repeatedly execute blocks of code
- For-loops
- While-loops
For-Loops

For-Loops

Repeats a block of code a specified number of times

Like printing a list of numbers

```python
for i in range(n):
    print(i)
```
While-Loops

While loops are more flexible, but also more error-prone

Must initialize variable and set increment

```python
i = 0
while i < 10:
    print(i)
    i = i + 1
```
Repetition Structures

For-Loops and While-Loops

↓

initialization_block

↓

Is condition true?

(yes) ↓

body_block

(no) ↑

after_block

↓
String Formatting Expressions

Python defines the % operator to work on strings

When applied to strings, % provides a compact way to code multiple string substitutions

Operator on left is conversion target

On the right, provide the object you want Python to insert in its place

print('%d %s' % (i, 'str'))

Most common: %s %d %f
Break Statement

Let's you jump out of a loop from within the loop body

Allows you to skip over unnecessary statements

Should only be used when it makes your code simpler
Continue Statement

continue

Related to break statement

Lets you jump to the next iteration of a currently-executing loop

Good for when you want to continue with the loop without doing anything
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Functions
Encapsulating Logic
**Functions**

Groups of statements that can be run more than once in a program

Reusable chunks of code

Take input, provide output

Can be reused in a variety of contexts

Maximize code reuse, minimize code redundancy

Encapsulate logic, splitting complex systems into manageable parts
Calling Functions

\texttt{type(3.7)}

Function name
Arguments passed into function
Return Value

( ) tells Python to execute the function

Even if a function takes no input, the brackets are still required

Some functions do not return a value
Defining Functions

Just like writing a Python program but with some extra syntax

Function header:

• Begins with `def`
• Followed by name of function
• Function parameter list
• Ends with a `:`
Documentation String

Doc String

Optionally follows function header

Explains what function will do

May include example(s)

Almost always good to include for clarity and as a reminder
Function Body

All the code that follows the header

Simply an indented block of code with necessary statements

This code can use the variables from the function header

Function should return a value with the keyword `return`

After `return`, Python jumps out of the function and back to the program
Function Syntax

```
def name(parameters):
  statements

A return value is not required

return None

Anything besides return are called “side effects”

A print() statement is an example of a side effect
```
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Functions
Local and Global Variables
Variables
Local and Global

Variable scope is something we must pay attention to when using functions

When and where is a variable accessible to your program?

Local variables are only usable within the function they are local to

Global variables are usable by any function or code within your program
Local Variables

```python
def area(rad):
    import math
    return math.pi * rad ** 2

When this function ends, rad is automatically deleted because it is local.
```
Global Variables

rad = 5

def area():
    import math
    return math.pi * rad ** 2

def change_rad(new_rad):
    rad = new_rad

This program will not allow rad to be changed because it is global

To change the radius variable:
global rad
Main Function

main()

It is both common and a good idea to use a main function in your programs. This is usually the starting point of a program and is run by typing: `main()`.

This simplifies rerunning programs and as well as passing input values.
Function Parameters

Used to pass input into a function

Python passes values by reference

Default values can be set for parameters

```
def name(parameter = 'default')
```
Modules

A module is a group of related functions

Different from a regular Python program in that it acts like a toolbox

A module usually does not have a main() function

To use a module, simply import it
Importing Modules and Calling Functions

Calling function after importing module:

```python
import module_name
module_name.function()
```

Calling function after importing module along with all of its functions:

```python
from module_name import *
function()
```
Module Namespaces

Functions within a module are available when you import them.

Modules form namespaces.

Different modules with the same function name will not clash in the same program.

module1.function(parameter)
module2.function(parameter)

The only time functions may conflict is when you import all using *
Strings

Strings and Characters
Strings

Strings are one of Python’s primary data types.

Strings can be used to represent anything that can be encoded as text.

Examples: symbols, words, text files, Python programs, and Web pages.

We’ve already been using strings quite a bit and will now focus on accessing and processing them.
Indexing

$s[i]$  

Strings are defined as ordered collections of characters. Therefore, we can access these characters by position with “indexing.” Offsets start at 0 and end at one less than the length of the string. Offset can also be specified negatively.
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Characters

`ord('a')`

All characters have a corresponding character code.

Python uses Unicode to assign character codes.

Unicode is a common standard for encoding thousands of symbols and characters from many languages.

The `ord()` function can be used to get the Unicode number for any character.

The `chr()` function can be used to get the character for any Unicode number.
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</table>
“Escape characters” are a special notation for whitespace and other unprintable characters.

Used for characters without a standard symbol or symbols Python sets aside.

Escape characters begin with a backslash.

Escape sequences are considered one character.
Slicing Strings

$s[\text{begin:end}]$

Slicing is for extracting substrings from a string.

To slice a string, indicate the first character you want and one past the last character.

First index location is always 0.

Last index location is always the length of the string minus one.
String Functions

s.function()
Exam 2 on Thursday, November 7