

## Objectives

- Wrap up lists
- Introduction to Files

## Review

- What is a list?
- What is the syntax to describe a list?
- How are lists and strings similar?
- How are they different?
  - What are the implications of those differences?

## Review: Lists vs. Strings

- Strings are **immutable**
  - Can't be mutated?
  - Err, can't be modified/changed
- Lists are **mutable**
  - Can be changed
  - Changes how we call/use methods

```
groceryList=["milk", "eggs", "bread", "Doritos", "OJ", \
            "sugar"]
```

```
groceryList[0] = "skim milk"
groceryList[3] = "popcorn"
```

```
groceryList is now ["skim milk", "eggs", "bread", \
                    "popcorn", "OJ", "sugar"]
```

One effect: list methods modify the list on which the method was called  
→ Don't return a copy of the object, modified

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## Special Value: **None**

- Special value we can use
  - E.g., Return value from function/method when there is an error
  - Or if function/method does not return anything  
(Similar to **null** in Java)

- If you execute

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

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

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## Copies of Lists

- What does the following code output?

```
x = [1, 2, 3]
y = x
y[0] = -1
print(y)
print(x)
```

- Run in Python interpreter
- View in Python visualizer

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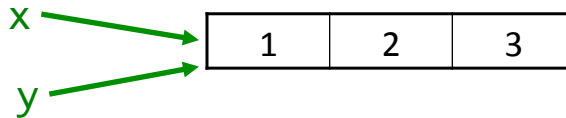
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## List Identifiers are **Pointers**



```
x = [1, 2, 3]
```

```
y = x
```



- **y is not a copy of x**
  - y points to what x points to
- How to make a copy of x?

```
y = x + [] OR y = []
                ↑
            Empty list
                y.extend(x)
```

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Immutable vs Mutable Parameters

## PASSING PARAMETERS

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## Passing Parameters

- Only *copies* of the actual parameters are given to the function
  - For **immutable** data types Which are?
- The *actual* parameters in the calling code do not change
- **Swap example:**
  - Swap two values in script
  - Then, put into a function



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## Immutable Data is Passed by Value

```
def swap(a, b):  
    tmp = a  
    a = b  
    b = tmp  
    print(a, b)
```

```
x = 5  
y = 7
```

```
swap(x, y)
```

```
# at the end, y should be 5 and x should be 7  
print("x =", x)  
print("y =", y)
```

This code does not have the desired effect.

Because the integers are passed *by value*, the value of `x` and `y` are not changed by the call to the `SWAP` function.

## Lists as Parameters to Functions

If a list that is passed as a parameter into a function is **modified in the function**, the list is **modified outside the function**

- Lists are **not** passed-by-value/copied
- Different from immutable types (e.g., numbers, strings)
- Parameter is actually a **pointer** to the list in memory

Problem: Sort a list of 3 numbers, in descending order

```
# order list such that list3[0] >= list3[1] >= list3[2]
def descendSort3Nums( list3 ):
```

Called as:

```
list = ...
descendSort3Nums(list)
print(list)
```

How implemented with list methods?  
Can we do this using only 3 comparisons?

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descendSort.py 13

## Descend Sort a List w/ 3 elements

```
def descendSort3Nums(list3):
    if list3[1] > list3[0]:
        # swap 'em
        tmp = list3[0]
        list3[0] = list3[1]
        list3[1] = tmp

    if list3[2] > list3[1]:
        tmp = list3[1]
        list3[1] = list3[2]
        list3[2] = tmp

    if list3[1] > list3[0]:
        tmp = list3[0]
        list3[0] = list3[1]
        list3[1] = tmp
```

```
def main():
    list = [1,2,3]
    descendSort3Nums(list)
    print(list)
```

Function does **not** return anything.  
Simply modifies the `list3` parameter.

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## Sources of Input to Program

- User input
  - Slow if need to enter a lot of data
  - Error-prone
    - User enters the wrong value!
  - What if want to run again after program gets modified?

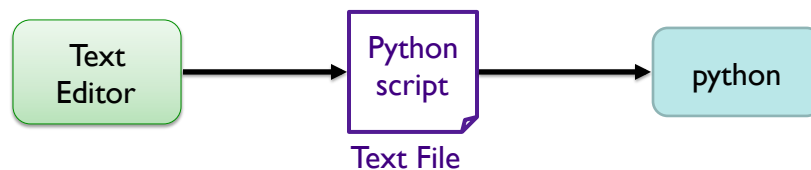
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## Sources of Input to Program

- Text files
  - Enter data once into a file, save it, and reuse it
  - Good for large amounts of data
  - Programs can use files to *communicate*
  - Need to be able to *read from* and *write to* files

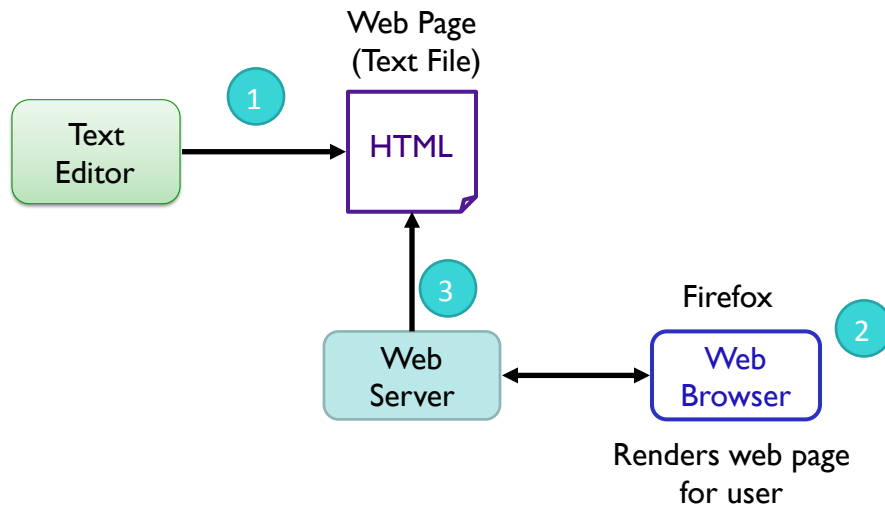


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## Example Use of Files

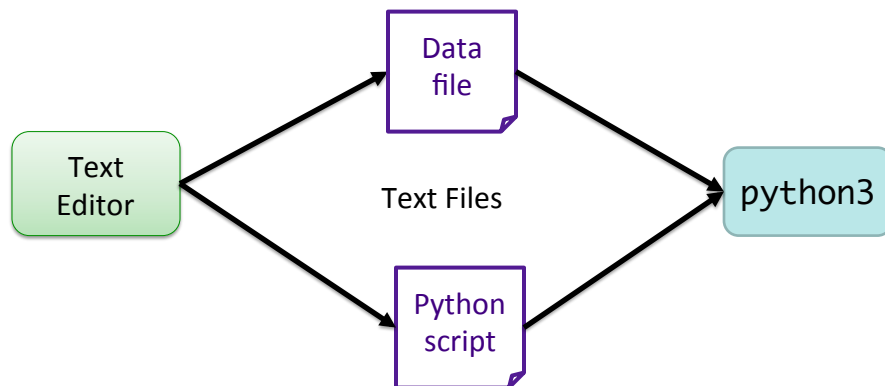


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## Example Use of Text File as Input



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## Wheel of Fortune

- Uses a file of puzzles
  - Can modify puzzle file to get different puzzles

## Files

- Conceptually, a file is a **sequence** of data stored in memory
- To use a file in a Python script, create an object of type **file**
  - **file** is a *data type*
  - `<varname> = open(<filename>, <mode>)`
    - `<filename>`: string
    - `<mode>`: string, "r" for read, "w" for write, "a" for append (and others)
  - Ex: `dataFile = open( "years.dat", "r" )`

**Built-in function**  
"constructs" a file object

## Common File Methods

Method Name	Functionality
<code>read()</code>	Read the entire content from the file, returned as a string object
<code>readline()</code>	Read one line from file, returned as a string object (which includes the “\n”). If it returns "", then you’ve reached the end of the file
<code>write(string)</code>	Write a string to the file
<code>close()</code>	Close the file. Must close the file after done reading from/writing to a file

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## Reading from a File

- Examples of reading from a file using file methods

➤ Show file: `data/years.dat`

Typically use `.dat` or `.txt` file extension to name files containing data or text

- `file_read.py` (using `read()`)

- How is what Python printed different than the file’s content?
- How to fix?

- Using `readline()`

- Hold off on using to read a whole file

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## Reading from a File

- Recall that a file is a *sequence* of data
- Can use a **for** loop to iterate through a file

A *line* (of type **str**) from the file (includes `\n`)

**file** object

```
for line in dataFile:  
    print(line)
```

➤ Read as: for each line in the file, do something

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file\_read2.py

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## Data Types of Loop Variables

What are the data types of the loop variable **x**?

```
string = "some string"  
dataFile = open("datafile.dat", "r")  
  
for x in range(len(string)):  
    # loop body ...  
  
for x in string:  
    # loop body ...  
  
for x in dataFile:  
    # loop body ...
```

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## Data Types of Loop Variables

What are the data types of the loop variable **x**?

```
string = "some string"
dataFile = open("datafile.dat", "r")

for x in range(len(string)):           integer
    # loop body ...

for x in string:                       string → single
    # loop body ...                   characters

for x in dataFile:                     string → line
    # loop body ...                   (include \n)
```

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## Problem: Searching a File

- We want to search a file for some term. We want to know *which lines* of the file contain that term and a *count* of the number of lines that contained that term

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`file_search.py`

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## Looking Ahead

- Lab 7 due Friday
- BI: Cryptography due Friday