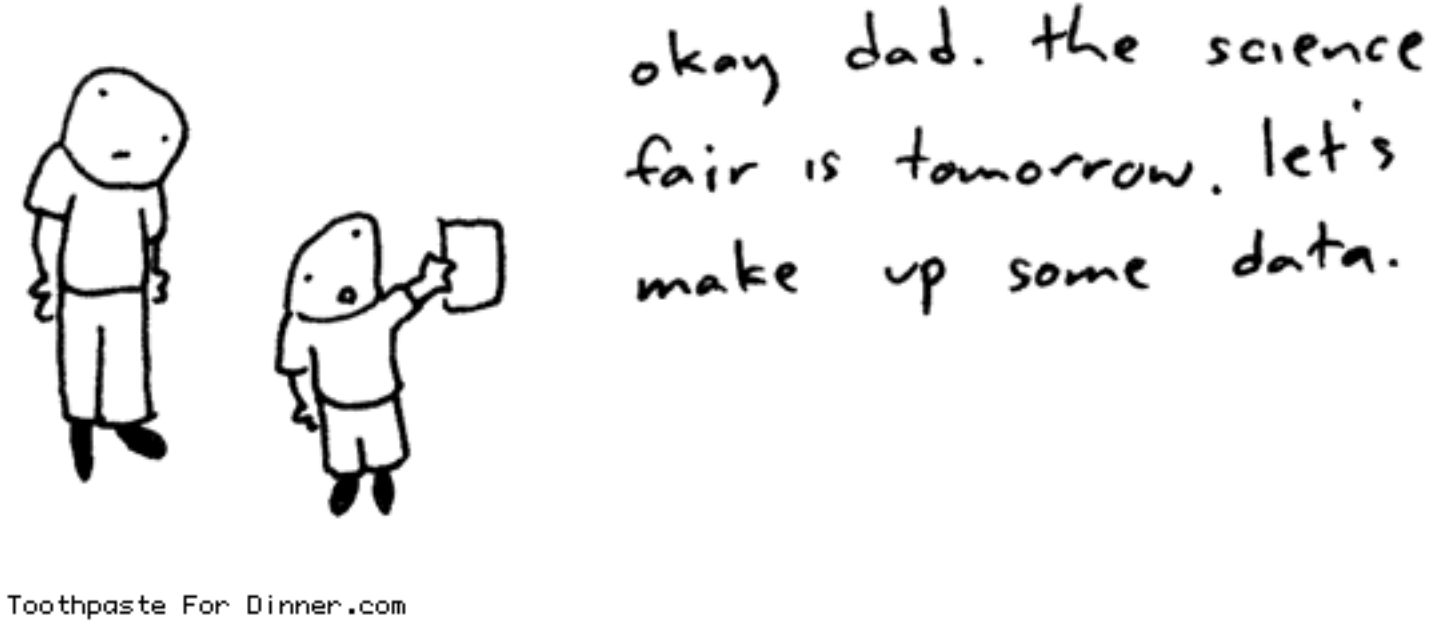
CSc 110, Sprint 2017

Lecture 16: Lists (cont.) and File Input



Weather question

- Use a list to solve the weather problem:

```
How many days' temperatures? 7
Day 1's high temp: 45
Day 2's high temp: 44
Day 3's high temp: 39
Day 4's high temp: 48
Day 5's high temp: 37
Day 6's high temp: 46
Day 7's high temp: 53
Average temp = 44.6
4 days were above average.
```

Weather answer

```
# Reads temperatures from the user, computes average and # days above average.
def main():
    days = int(input("How many days' temperatures? "))

    temps = [0] * days                  # list to store days' temperatures
    sum = 0

    for i in range(0, days):            # read/store each day's temperature
        temps[i] = int(input(("Day " + (i + 1) + "'s high temp: ")))
        sum = sum + temps[i]
    average = sum / days

    count = 0                           # see if each day is above average
    for i in range(0, days):
        if (temps[i] > average):
            count = count + 1
    # report results
    print("Average temp = " + str(average))
    print(str(count) + " days above average")
```

Weather question 2

- Modify the weather program to print the following output:

```
Type in a temperature or "done" to finish
Day 1's high temp: 45
Day 2's high temp: 44
Day 3's high temp: 39
Day 4's high temp: 48
Day 5's high temp: 37
Day 6's high temp: 46
Day 7's high temp: 53
Day 7's high temp: done
Average temp = 44.6
4 days were above average.
```

Problem

- We don't know how many elements the list will have
- We need a way to build a list while processing the input.

- New method:

  append(x) - add an item to the end of a list

Weather 2 answer

```
# Reads temperatures from the user, computes average and # days above average.
def main():
    temps = []
    avg = 0
    day = 1
    temp = input("Day " + str(day) + "'s high temperature: ")
    while(temp != "done"):
        avg = avg + int(temp)
        temps.append(int(temp))
        day = day + 1
        temp = input("Day " + str(day) + "'s high temperature: ")

    # counts days above average
    avg = avg / len(temps)
    above = 0
    for number in temps:
        if(number > avg):
            above = above + 1

    print("Average temperature = " + str(round(avg, 1)))
    print(str(above) + " days above average.")
    print()
    print("Temperatures: " + str(temps))
```

Weather question 3

- Modify the weather program to print the following output:

```
How many days' temperatures? 7
Day 1's high temp: 45
Day 2's high temp: 44
Day 3's high temp: 39
Day 4's high temp: 48
Day 5's high temp: 37
Day 6's high temp: 46
Day 7's high temp: 53
Average temp = 44.6
4 days were above average.

Temperatures: [45, 44, 39, 48, 37, 46, 53]
Two coldest days: 37, 39
Two hottest days: 53, 48
```

List functions

Function	Description
`append(x)`	Add an item to the end of the list. Equivalent to `a[len(a):] = [x]`.
`extend(L)`	Extend the list by appending all the items in the given list. Equivalent to `a[len(a):] = L`
`insert(i, x)`	Inserts an item at a given position. i is the index of the element before which to insert, so `a.insert(0, x)` inserts at the front of the list.
`remove(x)`	Removes the first item from the list whose value is *x*. Errs if there is no such item.
`pop(i)`	Removes the item at the given position in the list, and returns it. `a.pop()` removes and returns the last item in the list.
`clear()`	Remove all items from the list.
`index(x)`	Returns the index in the list of the first item whose value is *x*. Errs if there is no such item.
`count(x)`	Returns the number of times *x* appears in the list.
`sort()`	Sort the items of the list
`reverse()`	Reverses the elements of the list
`copy()`	Return a copy of the list.

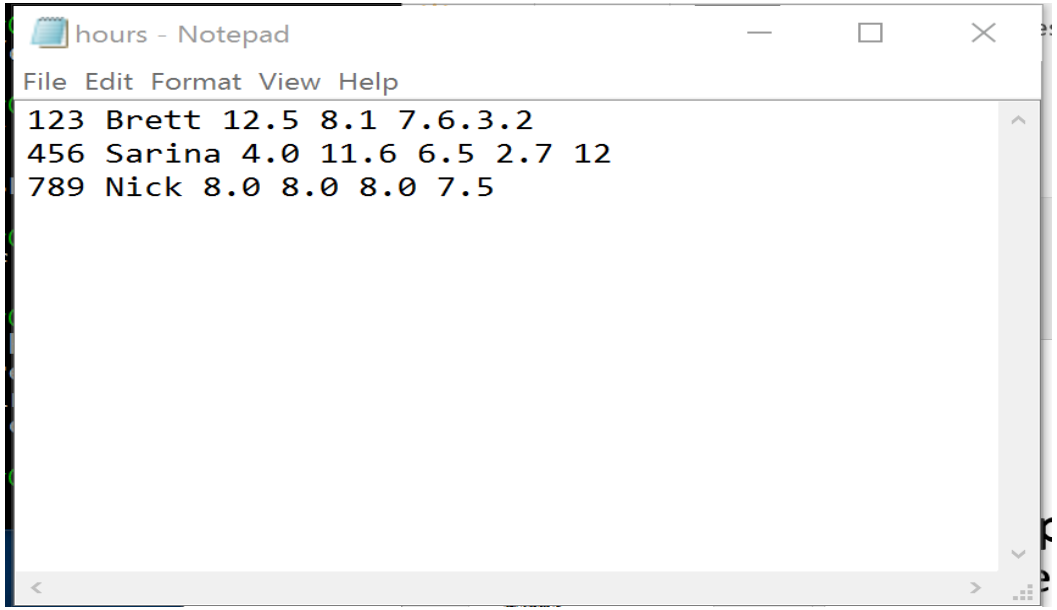
Weather answer 3

```
# Reads temperatures from the user, computes average and # days above average.
def main():
    temps = []
    avg = 0
    day = 1
    temp = input("Day " + str(day) + "'s high temperature: ")
    while(temp != "done"):
        avg = avg + int(temp)
        temps.append(int(temp))
        day = day + 1
        temp = input("Day " + str(day) + "'s high temperature: ")

    # counts days above average
    avg = avg / len(temps)
    above = 0
    for number in temps:
        if(number > avg):
            above = above + 1

    print("Average temperature = " + str(round(avg, 1)))
    print(str(above) + " days above average.")
    print()
    print("Temperatures: " + str(temps))
    temps.sort()
    print("Two coldest: " + str(temps[0]) + ", " + str(temps[1]))
    print("Two hottest: " + str(temps[-1]) + ", " + str(temps[-2]))
```

File Input



- **open(name)** – a built-in function that opens the specified file and returns a file object. The type of **name** is `str`.
- Example:

```
f = open("hours.txt")
```

File paths

- **absolute path**: specifies a drive or a top `"/"` folder

  `C:/Documents/smith/hw6/input/data.csv`

  - Windows can also use backslashes to separate folders.

- **relative path**: does not specify any top-level folder

  `names.dat`
  `input/kinglear.txt`

  - Assumed to be relative to the *current directory*:

```
file = open("data/readme.txt")
```

If our program is in `H:/hw6`,
`open` will look for `H:/hw6/data/readme.txt`

NOTE: We will put files in the same directory as our Python programs.

File Input

- Now we need a way to access the contents of the file.

```
f = open("hours.text")
```

- **`read()`** – a method that reads a file and returns the contents as a string. Requires the "." notation for use.
- Example:

```
f.read()
```

```
>>> f = open("hours.txt")
>>> f.read()
'123 Brett 12.5 8.1 7.6 3.2\n
456 Sarina 4.0 11.6 6.5 2.7 12\n
789 Nick 8.0 8.0 8.0 8.0 7.5\n'
```

More File methods

- `readline()` – Reads the next line of a file and returns it as a string.
- `readlines()` – Reads the contents of a file and returns it as a list.
- What if there are no more lines?

```
>>> f = open("hours.txt")
>>> f.readline()
'123 Susan 12.5 8.1 7.6 3.2\n'

>>> f = open("hours.txt")
>>> f.readlines()
['123 Brett 12.5 8.1 7.6 3.2\n',
'456 Sarina 4.0 11.6 6.5 2.7 12\n',
'789 Nick 8.0 8.0 8.0 8.0 7.5\n']
```

Process a file one line at a time

- Use `readlines()` to return the contents of the file as a list.

- Loop through the list:

```
f = open("hours.txt")
hours = f.readlines()          # hours is a list
for i in range(0, len(hours)):
     print(hours[i])
```

Interesting output. Why?

```
>>>
...

123 Brett 12.5 8.1 7.6 3.2

456 Sarina 4.0 11.6 6.5 2.7 12

789 Nick 8.0 8.0 8.0 8.0 7.5
```

Process a file one line at a time

- Use `readlines()` to return the contents of the file as a list

- **`strip()`** – a method that removes newlines "\n"

```
f = open("hours.txt")
hours = f.readlines
for i in range(0, len(hours)):
     print(hours[i].strip())
```

```
>>> for i in range(0, len(hours)):
...     print(hours[i].strip())   # strip() removes \n

123 Brett 12.5 8.1 7.6 3.2
456 Sarina 4.0 11.6 6.5 2.7 12
789 Nick 8.0 8.0 8.0 8.0 7.5
```

File input question

- We have a file `weather.txt`:

```
16.2
23.5
19.1
7.4
22.8
18.5
-1.8
14.9
```

- Write a program that prints the change in temperature between each pair of neighboring days.

```
16.2 to 23.5, change = 7.3
23.5 to 19.1, change = -4.4
19.1 to 7.4, change = -11.7
7.4 to 22.8, change = 15.4
22.8 to 18.5, change = -4.3
18.5 to -1.8, change = -20.3
-1.8 to 14.9, change = 16.7
```

File input answer

```
# Displays changes in temperature from data in an input file.

def main():
    input = open("weather.txt")
    lines = input.readlines()
    prev = float(lines[0])        # fencepost

    for i in range(1, len(lines)):
        float(next) = lines[i]
        print(str(prev) + " to " + str(next) + ", change = " +
              str(next - prev))
        prev = next
```

Gas prices question

- Write a program that reads a file `gasprices.txt`
  - Format: *Belgium $/gal*
    US $/gal
    date

```
8.20
3.81
3/21/11
8.08
3.84
3/28/11
...
```

- The program should print the average gas price over all data in the file for both countries:

```
Belgium average: 8.3 $/gal
USA average: 3.9 $/gal
```

Gas prices solution

```
def main():
    file = open("gasprices.txt")
    belgium = 0
    usa = 0
    count = 0
    lines = file.readlines()

    for i in range(0, len(lines), 3):
      belgium = belguim + float(lines[i])
      usa = usa + float(lines[i + 1])

    print("Belgium average: " + str(belgium / count) + " $/gal")
    print("USA average: " + str(usa / count) + " $/gal")
```