Lecture 14: Lists (cont'd)

CS 51P   October 28, 2019

Lists

- a list is an ordered set of elements:

```
[3, 6, 2, 1]
```

- many ways to create a list including:

```
a_list = [3, 6, 2, 1]
b_list = []
c_list = "a b c d".split()
d_list = open("temp.txt","r").readlines()
```

- a list is a sequence, so can index into, loop over, check for membership, slice, etc

- operators: + and *

- lists are mutable

adding to a list

- a_list.extend(*list*)
- a_list.append(*elem*)
- a_list.insert(*index*, *elem*)

other

- min(a_list), max(a_list), len(a_list)
- *elem* in a_list
  - returns bool
- a_list.index(*elem*)
  - returns int or error

removing from a list

- del(a_list[*slice*])
- a_list.remove(*elem*)
  - error if *elem* not in a_list
- a_list.pop()
  - returns (and removes) a_list[-1]
- a_list.pop(*index*)
  - returns (and removes) a_list[index]

modifying a list

- direct assignment

Tuples

- a tuple is an ordered set of elements:

```
(3, 6, 2, 1)
```

- ways to create a tuple:

```
tup1 = (3, 6, 2, 1)
tup2 = ()
tup3 = tuple(["a","b","c"])
```

- a tuple is a sequence, so can index into, loop over, check for membership, slice, etc

- operators: + and *

- tuples are immutable

Example

- Can we define a variable that stores the colors of the rainbow?
  - colors = ("red", "orange", "yellow", "green", "blue", "purple")

functions that operate on lists

- write a function `odds` that takes a list of ints and returns a list of the odd elements
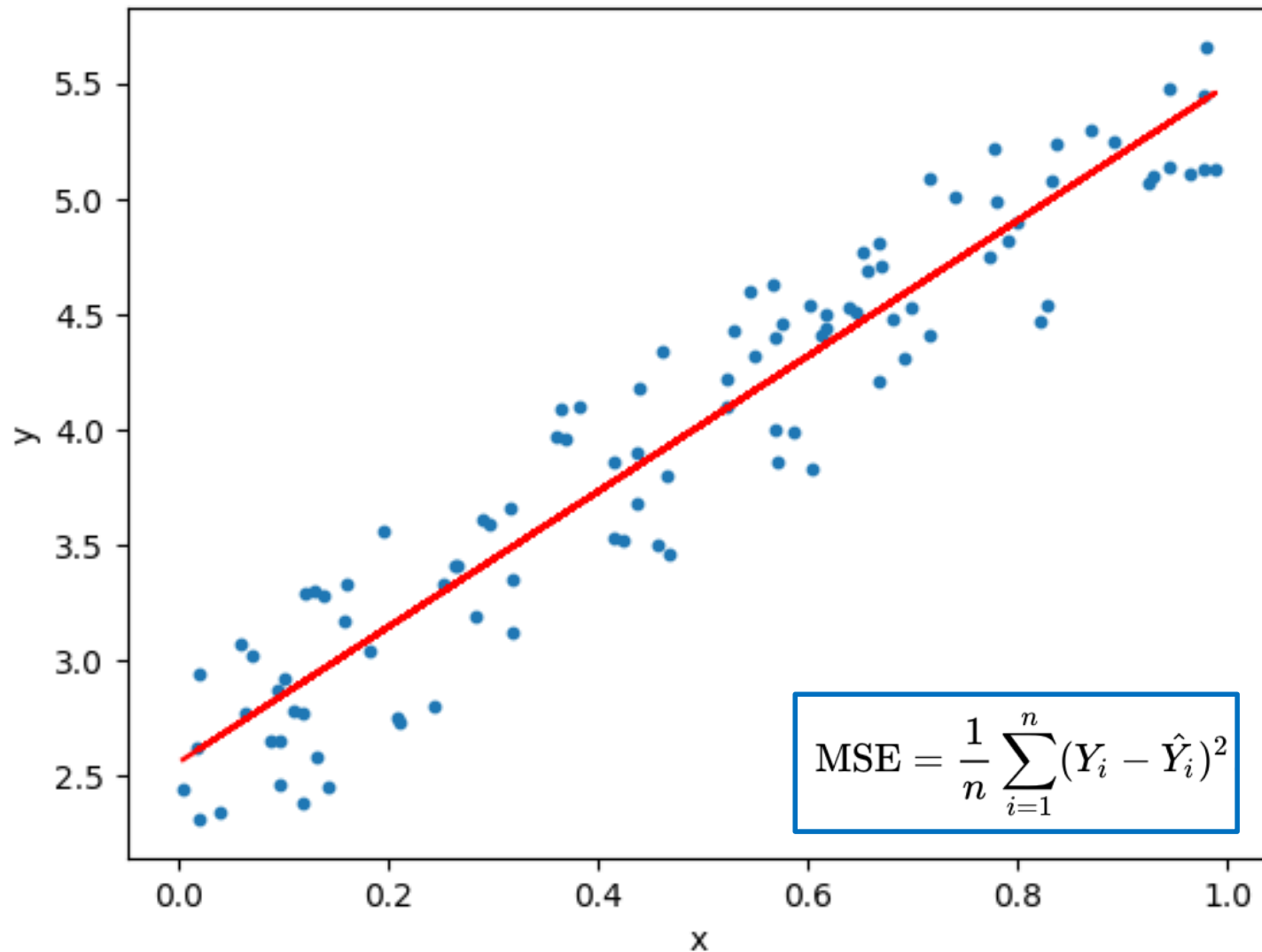
filter

- write a function `double` that takes a list of ints and returns a list with every number doubled

map

- write a function `max` that takes a list of ints and returns the largest value

reduce

Example: Mean Square Error

$$\text{MSE} = \frac{1}{n} \sum_{i=1}^{n} (Y_i - \hat{Y}_i)^2$$

Example: Mean Square Error

```
data = [(y0,y_hat0),(y1,y_hat1),…,(yn,y_hatn)]
```

- Write a function that takes a list of pairs (two-element tuples where the first element is the observed value and the second element is the estimated value) and replaces each element with the square of the differences between those two elements

- Write a function that takes a list of numeric values and returns the mean (average) of those values

- Write a function that takes a list of pairs (two-element tuples where the first element is the observed value and the second element is the estimated value) returns the mean square error of that estimator.

MapReduce (map + reduce)

list comprehension (filter + map)

```
new_list = []
for i in old_list:
    if filter(i):
        new_list.append(map(i))
```

```
new_list = [map(i) for i in old_list if filter(i)]
```

- Example: rewrite odds using list comprehension

list comprehension (filter + map)

```
new_list = []
for i in old_list:
    if filter(i):
        new_list.append(map(i))
```

```
new_list = [map(i) for i in old_list if filter(i)]
```

- Exercise: rewrite double using list comprehension
- Exercise: given a list of ints, create a new list that contains the squares of the even elements