### 13A. Lists of Numbers

Topics:

Lists of numbers List Methods: Void vs Fruitful Methods Setting up Lists A Function that returns a list

### We Have Seen Lists Before

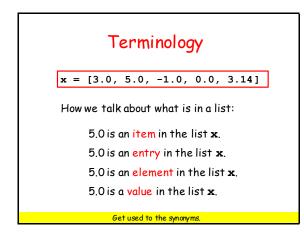
Recall that the rgb encoding of a color involves a triplet of numbers:

MyColor = [.3, .4, .5]

DrawDisk(0,0,1,FillColor = MyColor)

MyColor is a list.

A list of numbers is a way of assembling a sequence of numbers.



### A List Has a Length

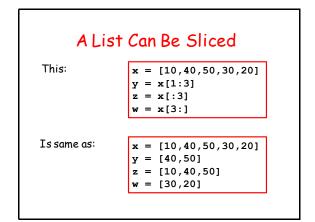
The following would assign the value of 5 to the variable n:

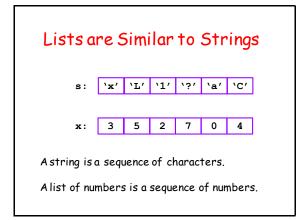
x = [3.0, 5.0, -1.0, 0.0, 3.14]n = len(x)

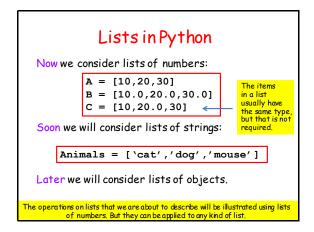
## The Entries in a List are Accessed Using Subscripts

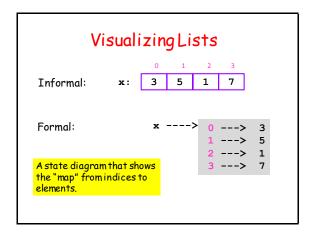
The following would assign the value of -1.0 to the variable a:

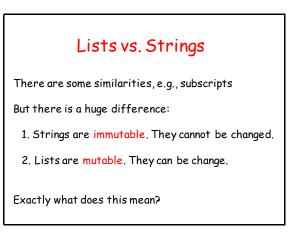
x = [3.0, 5.0, -1.0, 0.0, 3.14]a = x[2]

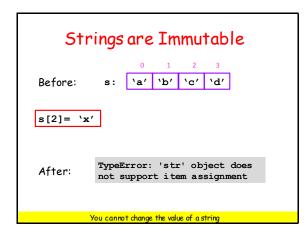


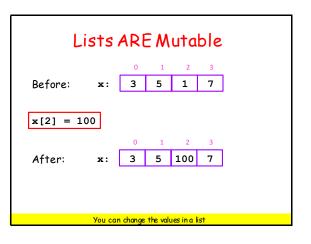




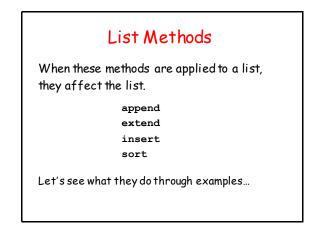


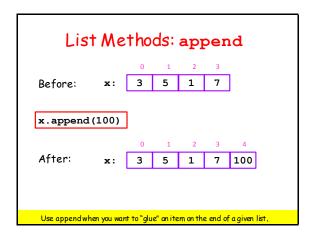


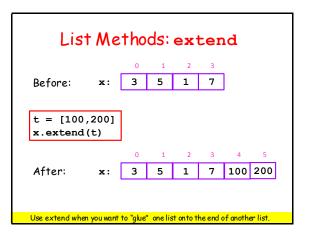


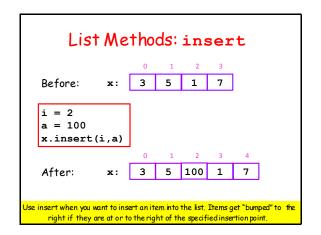


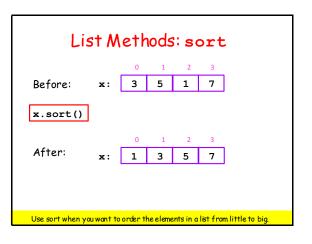
L	Lists ARE Mutable							
Before	x:	0 3	1	2	3 7			
			_					
x[1:3] =	= [100,	,200]		2	3			
After	x:	3	100	200	7			
	You cai	<mark>1 change</mark>	the valu	<mark>ies in a l</mark> i	st			



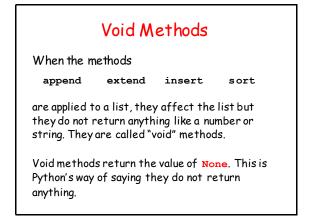


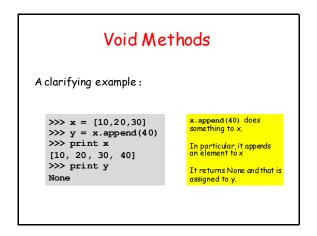


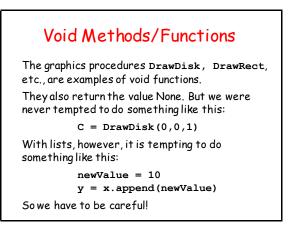


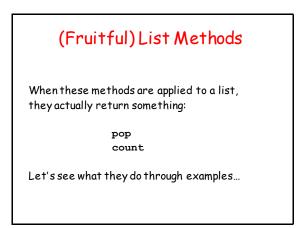


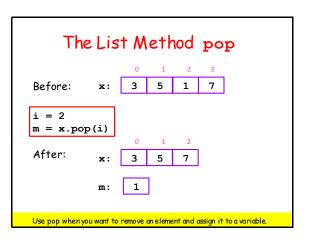
Li	st M	etł	ods	s	ort	:			
		0	1	2	3				
Before:	х:	3	5	1	7				
L	<b>x.sort(reverse=True)</b> 0 1 2 3								
After:	<b>x</b> :	7	5	3	1	]			
Use sort when y	Use sort when you want to order the elements in a list from big to little.								

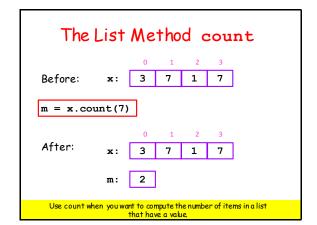


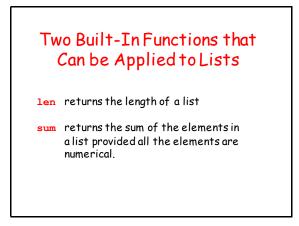


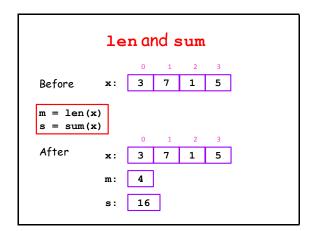












### len and sum: Common errors

>>> x = [10, 20, 30]

```
>>> s = x.sum()
AttributeError: 'list' object
    has no attribute 'sum'
```

```
>>> n = x.len()
AttributeError: 'list' object
has no attribute 'len'
```

# Legal But Not What You Probably Expect

```
>>> x = [10,20,30]
>>> y = [11,21,31]
>>> z = x+y
>>> print z
[10,20,30,11,21,31]
```

### Legal But Not What You Probably Expect

>>> x = [10,20,30]
>>> y = 3\*x
>>>print y
[10,20,30,10,20,30,10,20,30]

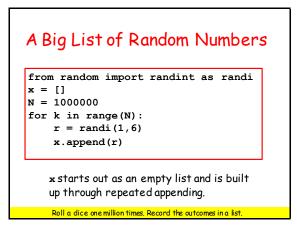


### Working with Big Lists

Setting up a big list requires a loop.

Looking for things in a big list requires a loop.

Let's consider some examples.

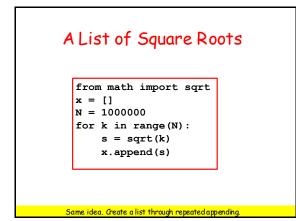


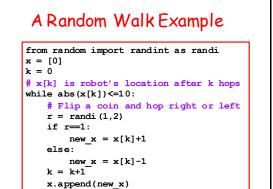


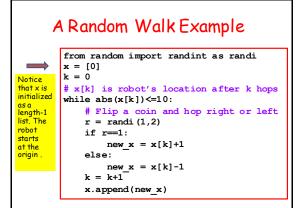
from random import randint as randi
x = []
N = 1000000
for k in range(N):
 r = randi(1,6)
 x[k] = r

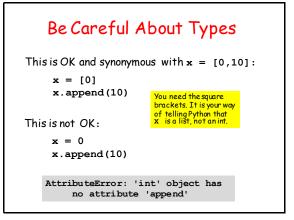
x[k] = r IndexError: list assignment index out of range

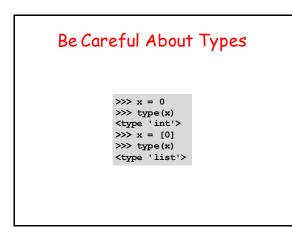
x[0] = r does not work because x is the empty list—it has no components











### Functions and Lists

Let's start with a function that returns a list.

In particular, a function that returns a list of random integers from a given interval.

Then we will use that function to estimate various probabilities when a pair of dice are rolled.

# A List of Random Integers from random import randint as randi def randiList(L,R,n): """ Returns a length-n list of random integers from interval [L,R] PreC: L,R,n ints with L<=R and n>=1 """ x = [] for k in range(n): r = randi(L,R)

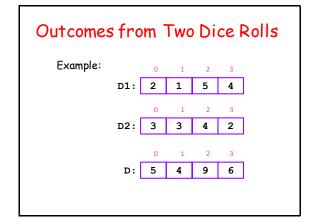
### x.append(r) return x

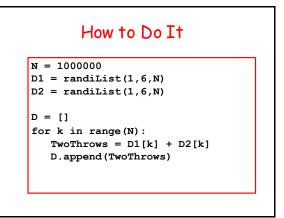
### Outcomes from Two Dice Rolls

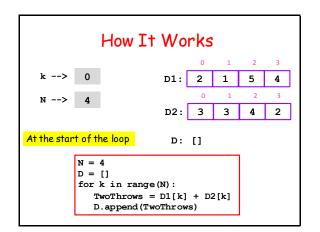
Roll a pair of dice N times

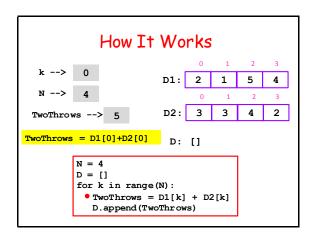
Store the outcomes of each dice roll in a pair of length-N lists.

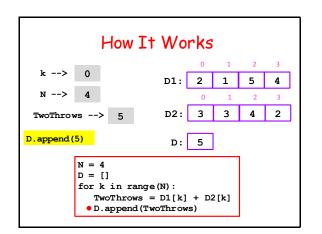
Then using those two lists, create a third list that is the sum of the outcomes in another list.

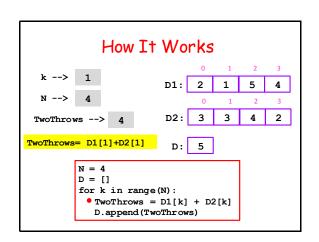


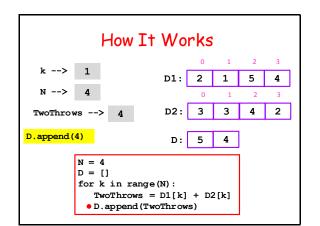


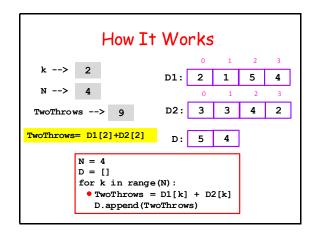


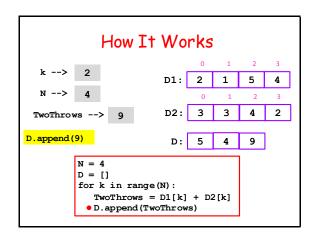


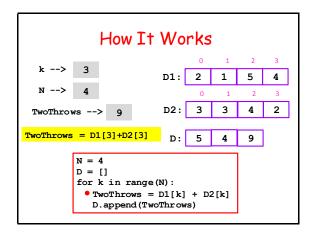


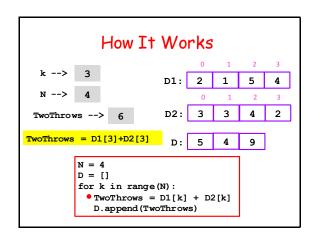


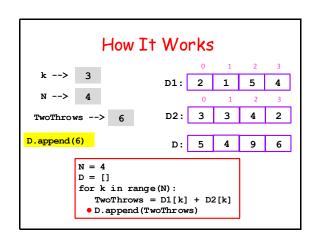


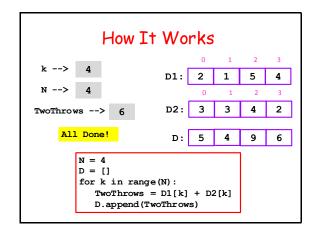


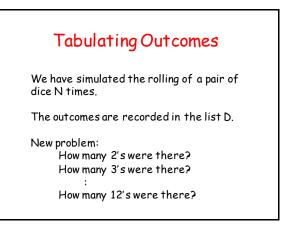


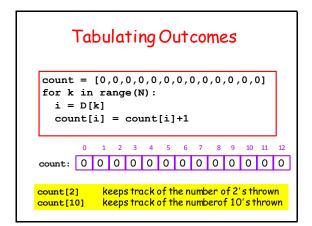








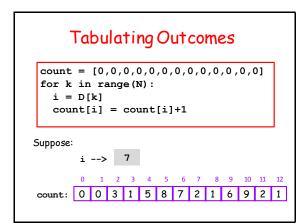


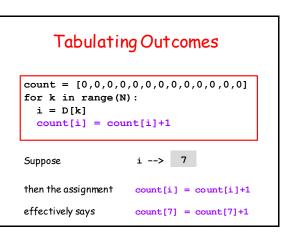


### Tabulating Outcomes

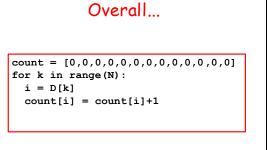
count = [0,0,0,0,0,0,0,0,0,0,0,0]
for k in range(N):
 i = D[k]
 count[i] = count[i]+1

The variable i is assigned the outcome of the k-th 2-die roll.





-	Tabulating Outcomes												
for k i =	<pre>count = [0,0,0,0,0,0,0,0,0,0,0,0,0] for k in range(N):     i = D[k]     count[i] = count[i]+1</pre>												
	i	>		7									
Before:	0	1	2	3	4	5	6	7	8	9	10	11	12
count:	0	0	3	1	5	8	7	2	1	6	9	2	1
After:	0	1	2	3	4	5	6	7	8	9	10	11	12
count:	0	0	3	1	5	8	7	3	1	6	9	2	1



Sample Results, N = 10000 k count[k] for k in range(2,13): 5 6 7 8 9 1100 print k,count[k] 1 399 1 650 1 321 11 

A list of counters.