**5.6 For Loops and Vectorized Code**

In general, in coding, **for** loops are used to iterate through the indices of data structures such as Python sequences in order to perform the same operation on every element. In Python, the general form of this is for a sequence *seq* is:

for i in range(len(seq)):

# do something with seq[i]

In Python, rather than iterating through the indices of the sequence, it is possible to iterate through the sequence itself, as in:

for item in seq:

# do something with item

Vectorizing code essentially means getting rid of loops, and instead using built-in functions and operators.

This can involve using operators such as the \* concatenation operator, functions such as **min**, **max**, **sum**, and **sorted**, and methods such as **count** and **reverse**.

Another powerful way to vectorize Python code when creating lists is to use ***list comprehensions.***

Comprehensions do not add any power to the language, but provide a convenient, succinct way to create sequences. A comprehension essentially compresses using a **for** loop to create and add expressions to a sequence into one line.

List comprehensions are the most common, but it is also possible to create other comprehensions.

The simplest general form of a list comprehension is

[expression for i in iterable]

which creates a list of the expressions for all values of i. For example,

*>>> [i \*\* 3 for i in range(5)]*

[0, 1, 8, 27, 64]

This creates a list of the cubes of all values of i in the range from 0 to 4 inclusive. Assigning this to a list variable

*>>> cubelist = [i\*\*3 for i in range(5)]*

is equivalent to

*cubelist = []*

*for i in range(5):*

*cubelist.append(i\*\*3)*

Conditionals can be added to the list comprehension to determine which expressions based on the iterator variable to include in the list. For example,

*>>> cubelisteven = [i\*\*3 for i in range(7) if i%2==0]*

creates a list of cubes of the even integers in the range from 0 to 6 inclusive, and is equivalent to:

*cubelisteven = []*

*for i in range(7):*

*if i%2 == 0:*

*cubelisteven.append(i\*\*3)*