Lists & The for Loop
Lists

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my_list = [1, 2, "Hello", "Python"]
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- `my_list[0]` is 1
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In lower-level programming languages, lists are stored as simply a base address in memory, and the value in the brackets is the offset. The offset is added to the base address to find the memory address of the item.

<table>
<thead>
<tr>
<th>Address</th>
<th>…</th>
<th>1350</th>
<th>1351</th>
<th>1352</th>
<th>1353</th>
<th>1354</th>
<th>…</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>…</td>
<td>12</td>
<td>13</td>
<td>7</td>
<td>21</td>
<td>3</td>
<td>…</td>
</tr>
</tbody>
</table>

Note: These addresses and values are just an example, not real values.
List Indexed Assignment

Lists can be changed once they are created, to do so, assign to the list at the index desired.

```python
mynums = [4, 5, 6]
mynums[2] = 7
print(mynums)
```

```
[4, 5, 7]
```

However, assignment to indices not currently in the list is not allowed. This example will cause an error.

```python
mynums = [4, 5, 6]
mynums[3] = 7  # bad, 3 is out of range!
```
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```
List Concatenation

Similar to how strings can be concatenated using the + operator, so can lists.

```python
a = [5, 6, 7, 8]
b = ["we", "can", "concatenate"]
c = a + b
print(a)
print(b)
print(c)
```

```
[5, 6, 7, 8]
["we", "can", "concatenate"]
[5, 6, 7, 8, "we", "can", "concatenate"]
```
Lists in Lists

Lists can store data of **any** type, *including lists*.

```python
nested = [[1, 2, 3], [4, 5, 6]]
```
Lists in Lists

Lists can store data of any type, including lists.

```python
nested = [[1, 2, 3], [4, 5, 6]]
```

Accessing and assigning is done by using another set of brackets.

```python
print(nested[0][0])
nested[0][0] = nested[1][0]
print(nested)
```

```
1
[[4, 2, 3], [4, 5, 6]]
```
Practice: List Manipulation

Open a new program and define this variable at the top:

```
magiclist = [[1, 2], [3, 4], ["Oh", "Hey"]]
```

Then, your program should (in order):

1. Set the second element in the first list to the first element in the first list
2. Subtract 1 from the first element in the second list
3. Set the second element in the second list to the length of the second element in the third list
4. Replace the third list with a string obtained by concatenating both elements of the third list together
5. Replace the string (the third element of `magiclist`) with its length
6. Print `magiclist`

If all went well, your program should print `[[1, 1], [2, 3], 5]`. 
Iterating Over a List using while

Using what we know about while loops, we can iterate over a list using a counter variable. Here is an example:

```python
i = 0
while i < len(my_list):
    print(my_list[i])
    i = i + 1
```

If `my_list` was `[1, 2, "Hello", "Python"]`, then this would print:

```
1
2
Hello
Python
```
Using what we know about `while` loops, we can iterate over a list using a counter variable. Here is an example:

```python
i = 0
while i < len(my_list):
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If `my_list` was `[1, 2, "Hello", "Python"]`, then this would print:

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```
Python provides a clean **range-based** construct for iterating over **iterables** called **for**. Here’s its syntax:

```python
for var_name in iterable:
    # do something
```

So here is an example of iterating over our previous list:

```python
for item in my_list:
    print(item)
```

```
1
2
Hello
Python
```
Iterating Over a List using for

Python provides a clean **range-based** construct for iterating over **iterables** called **for**. Here’s it’s syntax:

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So here is an example of iterating over our previous list:

```python
for item in my_list:
    print(item)
```

1
2
Hello
Python
Generating Ranges

The generator function `range` creates an iterable for looping over a sequence of numbers. The syntax is `range(start, stop, step).

- `start` is the number to start on
- `stop` is the number to stop **before**
- `step` is the amount to increment each time

```python
for i in range(0, 5, 1):
    print(i)
```

0
1
2
3
4
Range: step is Optional

If you do not provide step to the range function, Python will assume that you want to increment by one every time.

Here is an example:

```python
for i in range(0, 5):
    print(i)
```

0
1
2
3
4
Range: start is Optional

If you do not provide start or step to the range function, Python will assume that you want to increment by one every time and to start at zero.

Here is an example:

```python
for i in range(5):
    print(i)
```

```
0
1
2
3
4
```
Repeat \( n \) times

So you want to repeat something \( n \) times?

\[
\begin{align*}
n &= 5 \\
\text{for } i \text{ in range}(n): \\
&\quad \text{print("Hello, World!")}
\end{align*}
\]

Hello, World!
Hello, World!
Hello, World!
Hello, World!
Hello, World!
First, trace the loop by hand and determine the output. Then, type the loop into a Python script and run it to determine if you were correct.

```python
for i in range(3):
    for j in range(2):
        print(i, j)
```
Practice: Trace the Loops

First, trace the loop by hand and determine the output. Then, type the loop into a Python script and run it to determine if you were correct.

Loop 5

```python
favnums = [4, 3, 1]
stats = ["my new favorite", "okay", "boring"]
for num in favnums:
    for stat in stats:
        print(num, "is", stat)
    print("Tomorrow...")
print("I'm sticking with", favnums[1])
```