Introduction to Computer Programming

Lecture 12
Count-Controlled loops
What is a Count-controlled Loop?

• A count-controlled loop executes the loop statements a specific number of times.

```python
# Loop iterates 5 times
for num in [1, 2, 3, 4, 5]:
    print("num is", num)
```

• `num` is called the “target variable”, which takes on successive values in the “iteration range”.

• Common name for this kind of loop is “for loop”
# Loop iterates 5 times

for num in [1, 2, 3, 4, 5]:
    print("num is", num)

num is 1
num is 2
num is 3
num is 4
num is 5
The range() function

range() is a built-in function that generates a custom range list. It takes 1, 2, or 3 arguments.

```
# generate an iteration range  [0, 1, ... 9 ]
# 10 is the upper bound
for num in range(10) :
    ...
```
# Loop iterates 10 times
for num in range(10):
    print("num is", num)

num is 0
num is 1
num is 2
num is 3
num is 4
num is 5
num is 6
num is 7
num is 8
num is 9
The range() function

`range()` is a built-in function that generates a custom range list. It takes 1, 2, or 3 arguments.

```python
# generate an iteration range [1, 2, ..., 10]
# 1 is the lower bound, 11 is the upper bound
for num in range(1, 11) :
    ..
```
# Loop iterates 10 times
for num in range(1, 11):
    print("num is", num)
	num is 1
	num is 2
	num is 3
	num is 4
	num is 5
	num is 6
	num is 7
	num is 8
	num is 9
	num is 10
The range() function

range() is a built-in function that generates a custom range list. It takes 1, 2, or 3 arguments.

# generate an iteration range [5, 7, 9, 11, ... 19]
# 5 is the lower bound, 20 is the upper bound, 2 is the step
for num in range(5, 20, 2) :
    .....
# Loop iterates 8 times
for num in range(5, 20, 2):
    print("num is", num)

num is 5
num is 7
num is 9
num is 11
num is 13
num is 15
num is 17
num is 19
**Practice Problem**

Write a program that prints a table of squares for the numbers from 1 to 10. The table should look something like:

<table>
<thead>
<tr>
<th>number</th>
<th>square</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>....</td>
<td>....</td>
</tr>
</tbody>
</table>
What is $\pi$?

$\pi$ is the ratio of a circle’s circumference to its diameter.

$C = 2 \pi r$

$C = \pi d$

$\pi = \frac{C}{d}$
What is π?

• People have been interested in π for thousands of years
  – Babylonians, Egyptians, Greeks,…

• It is an irrational number, which has an infinite, nonrepeating pattern of decimal digits

3.141592653589793238462643383279502…
How To Compute $\pi$?

Method 1. Leibniz formula, named after mathematician Gottfried Leibniz, who rediscovered the formula in the 18\textsuperscript{th} century.

\[ \frac{\pi}{4} = \frac{1}{1} - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \frac{1}{11} \ldots \]

\[ \pi = 4 \left( \frac{1}{1} - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \frac{1}{11} \ldots \right) \]