

Lab 3: “for” Loop Introduction

1 Examples

Example 1.

Consider the following sequence: $\{1, 4, 9, 16, \dots, n^2, \dots\}$. Use a “for” loop to find the 11th term and display the message as calculated by your script.

```
for i in range(1, 12):
    s = i**2
print(f'The {i}th term of the sequence is {s} \n')
```

Run this script you should get

The 11th term of the sequence is 121.

Keep the “print” command inside the loop to see all the first 11 terms.

Example 2.

Consider the following sequence: $\{1, 4, 7, 10, 13, \dots\}$. Use a “for” loop to find and display the 10th term of the sequence.

```
s = 1 # Initialize the first term
for i in range(1, 10):
    s += 3 # current term is previous term plus 3
print(f'The {i+1}th term of the sequence is {s}')
```

\emph{equivalently}

```
s = [0]*11 # placeholder
s[0]=1 # first term
for i in range(1, 11):
    s[i] = s[i - 1] + 3 # current term is previous term plus 3
print(f'The {i}th term of the sequence is {s[i - 1]}')
```

Run this script you should get

The 10th term of the sequence is 28.

Example 3.

Repeat Example 2 to display each of the first 10 terms of the sequence.

```
s = [0]*11 # placeholder
s[0]=1 # first term

for i in range(1, 11):
    s[i] = s[i - 1] + 3 # current term is previous term plus 3
    print(f'The {i}th term of the sequence is {s[i - 1]}') #inside the loop
```

After we run the script we get the following:

```
The 1th term of the sequence is 1
The 2th term of the sequence is 4
The 3th term of the sequence is 7
The 4th term of the sequence is 10
The 5th term of the sequence is 13
The 6th term of the sequence is 16
The 7th term of the sequence is 19
The 8th term of the sequence is 22
The 9th term of the sequence is 25
The 10th term of the sequence is 28
```

Example 4.

Write a script that calculates the following sum.

$$2^2 + 4^2 + \dots + 50^2.$$

```
sum = 0 # Initialize the sum

for i in range(2, 51, 2): # 2,4,6,...,50
    sum += i ** 2 # update the sum
print(sum)
```

Run the script to get the sum

22100

Example 5.

Write a script file that calculates the following sum.

$$2^2 + 4^2 + \dots + 50^2 + 51^2 + 53^2 + \dots + 99^2.$$

Sol: We can divide the sum into two: $2^2 + 4^2 + \dots + 50^2$ and $51^2 + 53^2 + \dots + 99^2$

```
sum1 = 0
# Iterate over the specified range
for i in range(2, 51, 2):
    sum1 += i ** 2
sum2 = 0
for j in range(51, 100, 2):
    sum2 += j ** 2

print(sum1+sum2)
```

When we run the this script we get this sum

167925

Equivalently, we can have the following shorter script:

```
sum = 0

for i in range(2, 51, 2):
    sum += i ** 2

for j in range(51, 100, 2):
    sum += j ** 2

print(sum) # or we can display the sum as below
print(f'The sum of the sequence is', sum)
```

Alternatively, the following script should work as well

```
sum = 0
for i in list(range(2,51,2))+list(range(51,100,2)):
    sum +=i**2
print(sum)
```

Exercises

1. Write a script to find the 30th term of the sequence, and display it.

$$\{1, 5, 9, 13, \dots\}.$$

2. Write a script to find the first 15 terms and display them for the sequence

$$\{2, 5, 10, 17, \dots, n^2 + 1, \dots\}.$$

3. Write a script that calculates the following sum.

$$1 + 3 + 5 + \dots + 99.$$

4. Write a script that calculates the following sum.

$$3^3 + 6^3 + 9^3 + \dots + 33^3 + 40^2 + 50^2 + \dots + 90^2.$$

5. Write a script that calculates the following sum.

$$1 + \frac{1}{2} + \frac{1}{3} + \dots + \frac{1}{400}.$$