Introduction to `for` Loop in Python

A `for` loop is used to repeat a block of code multiple times. In Python, the `for` loop is typically used to go through each item in a sequence (like a list, string, or range of numbers).

```
for variable in sequence:
    # Code to repeat
```

`variable`: A name that you choose to represent each item in the sequence during each loop.
`sequence`: A collection of items like a list, string, or range of numbers that Python will loop through.

Example:

Let's say we have a list of fruits, and we want to print each fruit:

```
fruits = ["apple", "banana", "cherry"]
for fruit in fruits:
    print(fruit)
```

Output:
apple
banana
cherry

Step-by-Step Explanation

1. The `for` loop starts by picking the first item from the `fruits` list (`"apple"`).
2. It stores `"apple"` in the variable `fruit` and then prints it.
3. Next, it picks the second item (`"banana"`) and repeats the process until all items are printed.

Iterating Over Different Sequences

1. Iterating Over Lists

A list is a collection of items in a specific order. You can use a `for` loop to go through each item in the list.

```
numbers = [1, 2, 3, 4]

for number in numbers:

    print(number)
```

Output:

```
1
2
3
4
```

2. Iterating Over Strings

You can also use a `for` loop to go through each character in a string.

```
name = "Python"
for char in name:
    print(char)
```

Output:

```
P
y
t
h
o
n
```

`range()` Function in `for` Loop

The `range()` function generates a sequence of numbers, which is useful for looping a specific number of times.

Example:

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

Output:

```
0
1
2
3
4
```

`range(5)` generates numbers from 0 to 4 (5 is not included).
You can also specify a start and end point: `range(start, stop)`.

```
for i in range(1, 6):
    print(i)
```

Output:

```
1
2
3
4
5
```

Nested `for` Loops

You can also put one `for` loop inside another. This is useful when working with lists of lists (like a grid or table).

Example:

```
for i in range(3):
    for j in range(2):
        print(f"i: {i}, j: {j}")
```

Output:

```
i: 0, j: 0
i: 0, j: 1
i: 1, j: 0
i: 1, j: 1
i: 2, j: 0
i: 2, j: 1
```

Practice Exercises

Beginner Level

1. **Print each element of a list:**
   - **Given a list of numbers `[10, 20, 30, 40]`, write a `for` loop to print each number.**

```
numbers = [10, 20, 30, 40]
for num in numbers:
    print(num)
```

2. **Iterate over a string:**

- **Write a `for` loop that prints each letter of the word `"Hello"`**

```
= "Hello"
```

```
for letter in word:

    print(letter)
```

Intermediate Level

3. **Sum of numbers:**
   - **Write a program that uses a `for` loop to find the sum of all numbers in a list `[5, 10, 15, 20]`.**

```
numbers = [5, 10, 15, 20]
total = 0
for num in numbers:
    total += num
print("Sum:", total)
```

4. **Loop through a range of numbers:**

```
for i in range(1, 11):

    print(i)
```

Advanced Level

5. **Nested Loops - Multiplication Table:**
    - **Use nested `for` loops to print a multiplication table for numbers 1 to 5**

```python
for i in range(1, 6):

    for j in range(1, 6):

        print(i * j, end=" ")

    print()   # For a new line
```

6. Count Vowels in a String:

- **Write a `for` loop that counts the number of vowels (`a, e, i, o, u`) in a given string**

```python
sentence = "Hello, welcome to Python programming!"
vowels = "aeiou"
count = 0
for char in sentence:
    if char.lower() in vowels:
        count += 1
print("Number of vowels:", count)
```

Practice :

Set 15: Loops (for Loop)

1. **Write a program to print the numbers from 1 to 10 using a `for` loop.**
2. **Create a program that prints all even numbers from 1 to 20 using a `for` loop.**
3. **Write a program to calculate the sum of the first 10 natural numbers.**
4. **Create a program to print the elements of a list using a `for` loop.**
5. **Write a program to reverse a string using a `for` loop.**
6. **Create a program to print the multiplication table of 5 using a `for` loop.**
7. **Write a program to find the factorial of a number using a `for` loop.**
8. **Use a `for` loop to print the numbers from 10 down to 1 in reverse order.**