

Lesson 3: Loops

Objectives:

- Understand and use loops in Python to perform repetitive tasks.
- Apply loops to simulate repetitive space phenomena.

Lesson Plan

1. Introduction (10 minutes)

Engagement:

- Discuss how repetitive processes occur in space, such as planetary orbits, rotations, and phases of the moon.
- Show a simple example of a loop in Python to simulate a repetitive process.

2. Explanation (15 minutes)

Looping in Python:

For Loops:

- Introduce for loops and explain how they can be used to repeat actions a specific number of times.

Example Code:

```
for i in range(5):  
    print("This is loop iteration", i)
```

While Loops:

- Introduce while loops and explain how they can be used to repeat actions while a condition is true.

Example Code:

```
count = 0  
while count < 5:  
    print("This is loop iteration", count)  
    count += 1
```

Application to Space Science:

- Use loops to simulate the orbit of a planet around the Sun.

Example Code:

```
orbits = 5  
for orbit in range(orbits):  
    print("Planet has completed orbit number", orbit + 1)
```

3. Hands-On Activity (20 minutes)

Task:

Students will write Python programs to simulate various repetitive space phenomena using loops.

Worksheet (below):

- Practice with for and while loops.
- Exercises to simulate orbits, rotations, and other repetitive space events.

Example Worksheet Tasks:

Example Code:

```
# Simulate the orbit of Earth around the Sun
orbits = int(input("Enter the number of orbits to simulate: "))
for orbit in range(orbits):
    print("Earth has completed orbit number", orbit + 1)

# Simulate the phases of the Moon
phases = ["New Moon", "First Quarter", "Full Moon", "Last Quarter"]
for phase in phases:
    print("The current phase of the Moon is:", phase)
```

4. Review (10 minutes)

Q&A:

- Address any questions students might have about variables, data types, or the example code.

Exit Ticket:

1. What is a loop in Python?
 - A. A function that takes user input
 - B. A statement that performs different actions based on a condition
 - C. A sequence of instructions that repeats until a certain condition is met
 - D. A type of data structure

Answer: C

2. What are the two types of loops we discussed today?
 - A. if loops and else loops
 - B. for loops and while loops
 - C. input loops and output loops
 - D. function loops and variable loops

Answer: B

3. Which of the following for loops prints the names of the planets in the solar system?

- A.

```
planets = ["Mercury", "Venus", "Earth", "Mars", "Jupiter", "Saturn",
           "Uranus", "Neptune"]
for planet in planets:
    print(planet)
```
- B.

```
planets = ["Mercury", "Venus", "Earth", "Mars", "Jupiter", "Saturn",
           "Uranus", "Neptune"]
while planet in planets:
    print(planet)
```
- C.

```
planets = ["Mercury", "Venus", "Earth", "Mars", "Jupiter", "Saturn",
           "Uranus", "Neptune"]
for i in range(len(planets)):
    print(planets[i])
```
- D.

```
planets = ["Mercury", "Venus", "Earth", "Mars", "Jupiter", "Saturn",
           "Uranus", "Neptune"]
while i < len(planets):
    print(planets[i])
    i += 1
```

Answer: A

Worksheet 3: Loops

Section 1: Using For Loops

1. Write a `for` loop that prints the names of the planets in the solar system.
2. Write a `for` loop that simulates the orbit of a planet around the Sun 10 times.

Section 2: Using While Loops

3. Write a `while` loop that prints numbers from 1 to 10.
4. Write a `while` loop that simulates a planet's rotation until it completes a full day (24 hours).

Section 3: Simulating Space Phenomena with Loops

5. Write a program that simulates the phases of the Moon using a `for` loop.
6. Write a program that uses a `while` loop to simulate the orbit of a planet until it completes a specified number of orbits.

ANSWER KEY:

Section 1: Using For Loops

1. Write a `for` loop that prints the names of the planets in the solar system.

```
planets = ["Mercury", "Venus", "Earth", "Mars", "Jupiter", "Saturn", "Uranus",
           "Neptune"]
for planet in planets:
    print(planet)
```

2. Write a `for` loop that simulates the orbit of a planet around the Sun 10 times.

```
for orbit in range(10):
    print("The planet has completed orbit number", orbit + 1)
```

Section 2: Using While Loops

3. Write a `while` loop that prints numbers from 1 to 10.

```
count = 1
while count <= 10:
    print(count)
    count += 1
```

4. Write a `while` loop that simulates a planet's rotation until it completes a full day (24 hours).

```
hours = 0
while hours < 24:
    print("Hour", hours + 1, ": The planet is rotating.")
    hours += 1
```

Section 3: Simulating Space Phenomena with Loops

5. Write a program that simulates the phases of the Moon using a `for` loop.

```
phases = ["New Moon", "First Quarter", "Full Moon", "Last Quarter"]
for phase in phases:
    print("The current phase of the Moon is:", phase)
```

6. Write a program that uses a `while` loop to simulate the orbit of a planet until it completes a specified number of orbits.

```
orbits = int(input("Enter the number of orbits to simulate: "))
count = 0
while count < orbits:
    print("The planet has completed orbit number", count + 1)
    count += 1
```