Programming with Python - Open Elective

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Revision: variable, input(), print(), datatype: int, float, bool, str
arithmetic, relational and logical operator, operator associativity, operator precedence (arithmetic > relational > logical)

Loops: for loop

```
for variable in sequence:
    Statements
```

`for loop` Example: A bacterial colony doubles in number every hour. Write a program that:

- Asks the user for the initial number of bacteria and the number of hours to simulate. (Uses a for loop to calculate the population at each hour.)

```
# Ask for user input

initial_bacteria = int(input("Enter the initial number
of bacteria: "))

hours = int(input("Enter the number of hours to
simulate: "))

# Initialize population

population = initial_bacteria



# Simulate bacterial growth

for hour in range(1, hours + 1):

    population *= 2  #Double the population every hour

    print(f"Hour {hour}: {population} bacteria")
```

Loops: while loop

- A `while` loop executes a block of code as long as a condition remains true.
- Used when we don't know beforehand how many times the loop should run.
- While loops **repeat code until a condition becomes false**.

General Syntax:

```
while condition:
    # Code block
```

Example 1: Counting down from 5

```
count = 5
while count > 0:
    print(count)
    count -= 1
```

Q: What will happen if we remove count - = 1?

Example 2: A person takes a loan of Rs1000 at 10% interest per month and repays Rs200 monthly. How many months will it take to repay the loan?

```
loan = 1000
interest_rate = 0.1
monthly_payment = 200
months = 0

while loan > 0:
    loan += loan * interest_rate  # Add interest
    loan -= monthly_payment  # Deduct payment
    months += 1

print("Loan repaid in", months, "months.")
```

Q: What happens if the monthly payment is too low? (Loop runs indefinitely!)

Example 3: A bacteria culture starts with 10 cells and doubles every hour. Find how many hours it takes to exceed 1,000,000 cells.

```
bacteria = 10
hours = 0

while bacteria < 1000000:
    bacteria *= 2  # Double in each cycle
    hours += 1

print("It takes", hours, "hours for the bacteria to exceed 1,000,000.")
```

Q: What real-world factors might slow down bacterial growth?

Example 4: A student wants to write a 500-word essay but only writes 50 words per session. How many sessions will it take?

```
word_goal = 500
words_written = 0
sessions = 0

while words_written < word_goal:
    words_written += 50  # Writing per session
    sessions += 1

print("It takes", sessions, "sessions to complete the essay.")
```

Q: How can this be modified to include random word count per session?

Example 5: A battery starts at 100% charge and discharges 5% per hour. How many hours until it reaches 20%?

```
battery = 100
hours = 0

while battery > 20:
    battery -= 5  #Discharge rate
    hours += 1

print("Battery reaches 20% in", hours, "hours.")
```

Q: What if we add a random factor to simulate real battery usage?

Common Pitfalls:

Infinite loop:

```
count = 5
while count > 0:
    print(count)  # No decrement! Infinite loop.
```

Off-by-one Errors:

```
x = 1
while x < 5:
    print(x)
    x += 1  # Runs for x = 1,2,3,4 (not 5)
```

Exercise:

1. A journalist is summarizing a **1000-word** news article by removing **10% of words per revision**. How many revisions does it take to get below **250 words**?

2. A machine starts at **200°C** and cools down **by 7% per minute**. How long will it take to reach **30°C**?

3. A drug's concentration in the body **decreases by 12% per hour**. How many hours will it take for a 100mg dose to drop below **5mg**?

4. A company has an initial investment of **Rs 10,000** and earns **5% profit per month**. Write a Python program using a while loop to determine how many months it takes for the investment to double.