PES UNIVERSITY, BENGALURU

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UE25CS151A – PYTHON FOR COMPUTATIONAL PROBLEM SOLVING LAB MANUAL

WEEK 4

TOPICS:

Programs on Control Strutures in Python

OBEJCTIVE:

- Utilize **conditional statements (if, elif, else)** to implement decision-making logic and control program flow based on dynamic conditions or user inputs.
- Apply **for and while loops** to execute repetitive tasks and process data iteratively, enabling efficient solutions for problems like sequence generation and pattern creation.
- Integrate **branching and looping constructs** to develop robust Python programs that solve complex problems, such as validating inputs, generating patterns, or performing iterative calculations.

Problem Statement 1:

Given an integer n, print numbers from 1 to n.

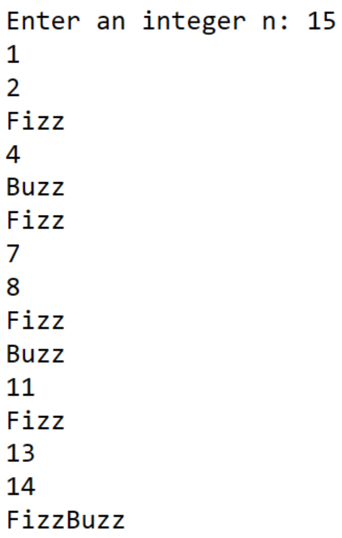
However, for multiples of three, print "Fizz" instead of the number.

For multiples of five, print "Buzz".

For numbers which are multiples of both three and five, print "FizzBuzz".

Solution:

```
n_str = input("Enter an integer n: ")
n = int(n_str)
# Loop from 1 to n (inclusive)
for i in range(1, n + 1):
  # Check for divisibility by both 3 and 5 first
  if i % 3 == 0 and i % 5 == 0:
    print("FizzBuzz")
  # Check for divisibility by 3
  elif i % 3 == 0:
    print("Fizz")
  # Check for divisibility by 5
  elif i % 5 == 0:
    print("Buzz")
  # Otherwise, print the number itself
  else:
    print(i)
```



```
Enter an integer n: 15
1
2
Fizz
4
Buzz
Fizz
7
8
Fizz
Buzz
11
Fizz
13
14
FizzBuzz
```

Problem Statement 2:

Given an integer, reverse its digits. The sign of the number should be preserved.

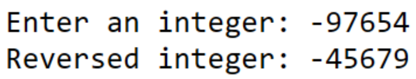
Example:

- Input: -123
- Output: -321

Solution:

```
# Get integer input from the user
num_str = input("Enter an integer: ")
num = int(num_str)
# Store the original number to check for sign later
original_num = num
reversed_num = 0
# Make the number positive for the reversal logic
if num < 0:
    num = -num
while num > 0:
  # Get the last digit
  digit = num % 10
  # Append the digit to the reversed number
  reversed_num = (reversed_num * 10) + digit
  # Remove the last digit from the original number
  num = num // 10
```

```
# Apply the original sign
if original_num < 0:
    reversed_num = -reversed_num
print("Reversed integer:", reversed_num)
```



```
Enter an integer: -97654
Reversed integer: -45679
```

Problem Statement 3:

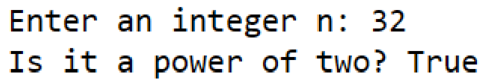
Given an integer n, determine if it is a power of two. An integer is a power of two if there exists an integer x such that n == 2^x.

Example:

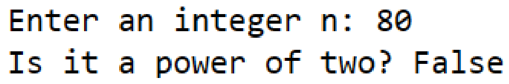
- Input: 16
- Output: True (Because 16 = 2^4)
- Input: 18
- Output: False

Solution:

```
# Get integer input from the user
n_str = input("Enter an integer n: ")
n = int(n_str)
is_power_of_two = False
# A power of two must be a positive number
if n > 0:
  # Repeatedly divide by 2 until it's no longer even
  while n % 2 == 0:
    n = n // 2
# If we are left with 1, it is a power of two
if n == 1:
    is_power_of_two = True
print("Is it a power of two?", is_power_of_two)
```



```
Enter an integer n: 32
Is it a power of two? True
```



```
Enter an integer n: 80
Is it a power of two? False
```

Problem Statement 4:

Given a positive integer num, write a program that returns True if num is a perfect square, and False otherwise without using built in functions.(math.sqrt())

Examples:

- Input: 16
- Output: True (since 4 * 4 = 16)
- Input: 14
- Output: False

A perfect square is a whole number that is the result of multiplying another whole number by itself

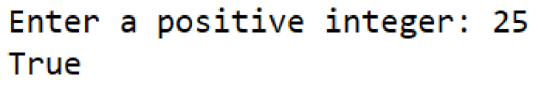
The simplest way to think about it is through multiplication.

- 9 is a perfect square because 3 × 3 = 9.
- 16 is a perfect square because 4 × 4 = 16.
- 25 is a perfect square because 5 × 5 = 25.
- 1 is a perfect square because 1 × 1 = 1.

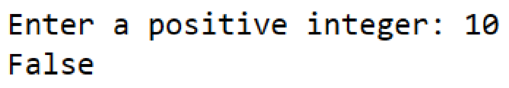
A number like 10 is not a perfect square because you can't multiply any single whole number by itself to get 10.

Solution:

```python
num = int(input("Enter a positive integer: "))
left = 1
right = num
is_square = False
while left <= right:
    mid = (left + right) // 2
    sq = mid * mid
    if sq == num:
        is_square = True
        break
    elif sq < num:
        left = mid + 1
    else:
        right = mid - 1
print(is_square)
```



```
Enter a positive integer: 25
True
```



```
Enter a positive integer: 10
False
```

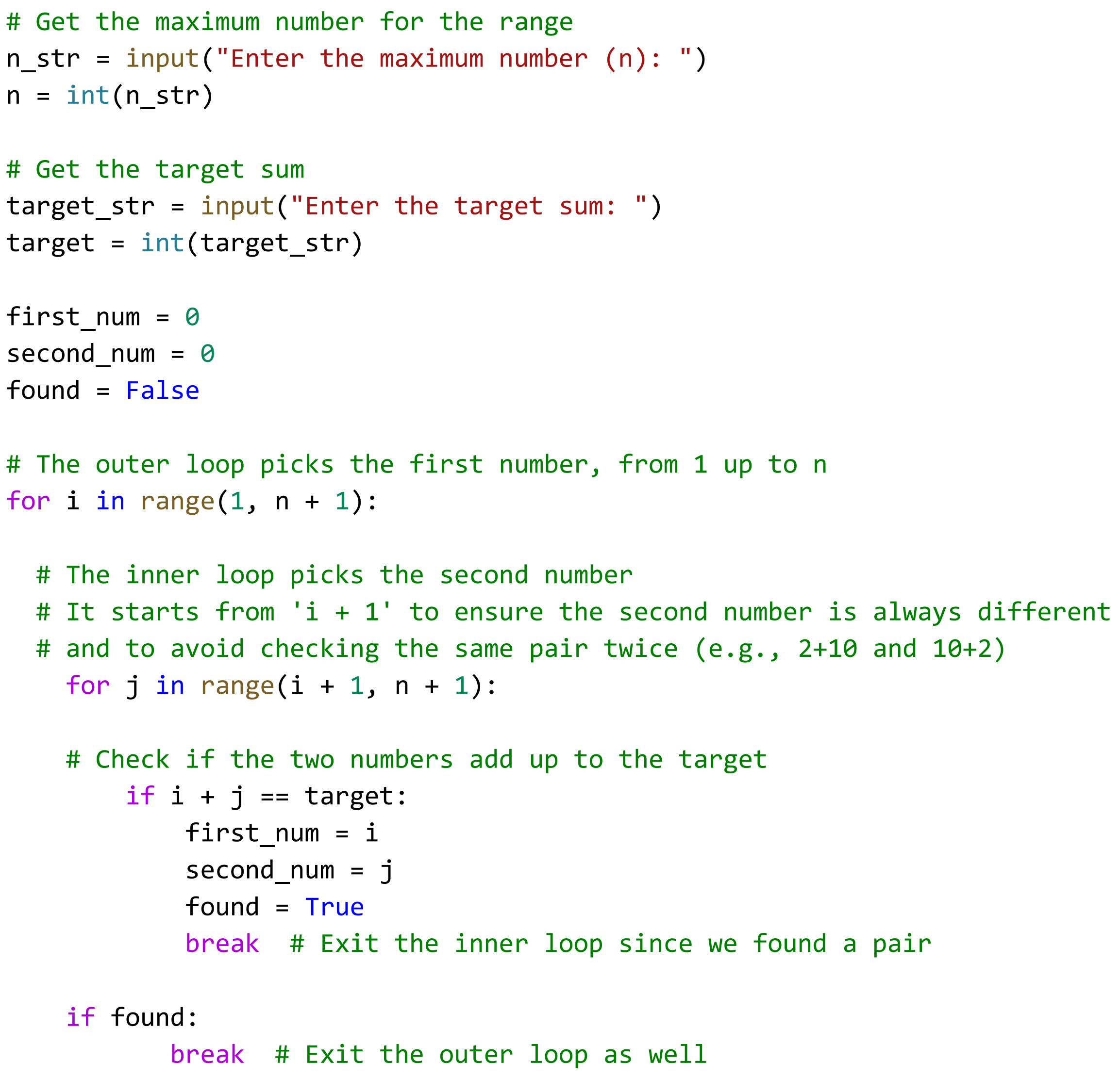
Problem Statement 5:

Given a maximum number n and a target number, find the first pair of two different integers between 1 and n (inclusive) that add up to the target.

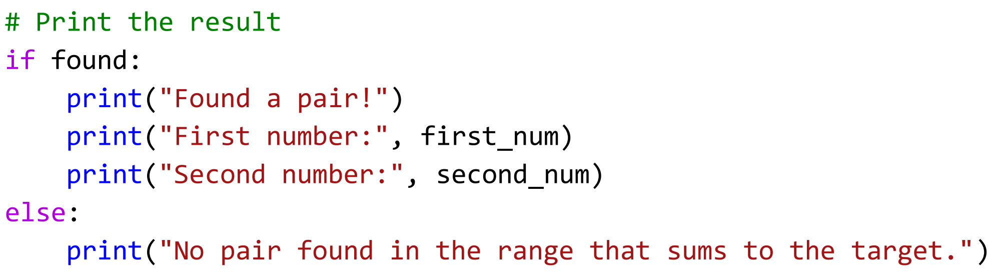
Example:

- Input: n = 10, target = 12
- Output: First number: 2, Second number: 10
- Reason: The first pair the program finds is 2 + 10, which equals 12. (Although 3+9, 4+8, and 5+7 also work, the program stops after finding the first one).

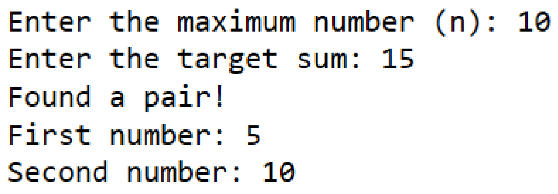
Solution:



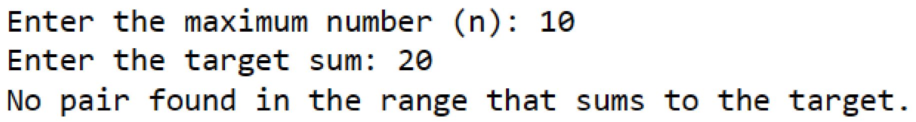
```
# Get the maximum number for the range
n_str = input("Enter the maximum number (n): ")
n = int(n_str)

# Get the target sum
target_str = input("Enter the target sum: ")
target = int(target_str)

first_num = 0
second_num = 0
found = False

# The outer loop picks the first number, from 1 up to n
for i in range(1, n + 1):

  # The inner loop picks the second number
  # It starts from 'i + 1' to ensure the second number is always different
  # and to avoid checking the same pair twice (e.g., 2+10 and 10+2)
    for j in range(i + 1, n + 1):

    # Check if the two numbers add up to the target
        if i + j == target:
            first_num = i
            second_num = j
            found = True
            break  # Exit the inner loop since we found a pair

    if found:
           break  # Exit the outer loop as well
```



```
# Print the result
if found:
    print("Found a pair!")
    print("First number:", first_num)
    print("Second number:", second_num)
else:
    print("No pair found in the range that sums to the target.")
```



```
Enter the maximum number (n): 10
Enter the target sum: 15
Found a pair!
First number: 5
Second number: 10
```



```
Enter the maximum number (n): 10
Enter the target sum: 20
No pair found in the range that sums to the target.
```

Practice Programs:

1. Number Guessing Game

Objective: Create a simple game where the user tries to guess a secret number.

Description: Hard-code a "secret number" in your program (e.g., secret_number = 42). Use a while loop to repeatedly ask the user to guess the number. Inside the loop, tell the user if their guess is "Too high" or "Too low". The loop should continue until the user guesses correctly, at which point you print "Congratulations!" and the loop ends.

Example:

(Assuming secret_number is 42)

Input: 50 -> **Output:** Too high

Input: 30 -> **Output:** Too low

Input: 42 -> **Output:** Congratulations!

Concepts to Use: while loop, if-elif-else, break statement.

2. **Print a Right-Angled Triangle**

   Objective: Use nested loops to print a pattern of stars (*).
   Description: Ask the user for an integer rows. Then, print a right-angled triangle of that height using stars.
   Example:
   Input: 5
   Output:

```
*
**
***
****
*****
```

3. **Armstrong Number Checker**

   Objective: Check if a number is an Armstrong number.
   Description: An Armstrong number (of order n) is a number that is equal to the sum of its own digits each raised to the power of the number of digits. For example, **153** is an Armstrong number because it has 3 digits, and $1^3 + 5^3 + 3^3 = 1 + 125 + 27 = 153$.
   Task: Ask the user for an integer. First, you'll need a loop to count how many digits are in the number. Then, you'll need another loop to extract each digit and calculate the sum of the digits raised to the power of the digit count. Finally, compare the sum to the original number.

- **Example:**
  - **Input:** 153
  - **Output:** 153 is an Armstrong number.
  - **Input:** 120
  - **Output:** 120 is not an Armstrong number.
- **Concepts to Use:** while loops, modulo (%) and integer division (//) to manipulate digits.

Every solved problem adds a brick to your foundation of knowledge