

51

PYTHON PROGRAMS

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1# PYTHON PROGRAM TO FIND THE EXPONENTIATION OF A NUMBER

Exponentiation is a mathematical operation that involves raising a number (the base) to the power of an exponent. In Python, exponentiation can be performed using the `**` operator or the `pow()` function.

Here is the complete Python code:

```
def exponentiation(base, exponent):
    """
    This function takes two arguments:
    base - the base number
    exponent - the exponent to which the base is raised
    It returns the result of base raised to the power of exponent.
    """
    return base ** exponent

def main():
    # Prompt the user to enter the base and exponent
    base = float(input("Enter the base number: "))
    exponent = int(input("Enter the exponent: "))

    # Calculate the exponentiation
    result = exponentiation(base, exponent)

    # Display the result
    print(f"{base} raised to the power of {exponent} is {result}")

# Call the main function to execute the program
if __name__ == "__main__":
    main()
```

Here is the output you can see in the screenshot below:

```

PythonExample.py X
C:\Users\fewli> Downloads > Python > PythonExample.py > ...
1  def exponentiation(base, exponent):
2      """
3      This function takes two arguments:
4      base - the base number
5      exponent - the exponent to which the base is raised
6      It returns the result of base raised to the power of exponent.
7      """
8      return base ** exponent
9
10 def main():
11     # Prompt the user to enter the base and exponent
12     base = float(input("Enter the base number: "))
13     exponent = int(input("Enter the exponent: "))
14
15     # Calculate the exponentiation
16     result = exponentiation(base, exponent)
17
18     # Display the result
19     print(f"{base} raised to the power of {exponent} is {result}")
20
21 # Call the main function to execute the program
22 if __name__ == "__main__":
23     main()

```

```

PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS
PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python312/pytho
Enter the base number: 5
Enter the exponent: 3
5.0 raised to the power of 3 is 125.0
PS C:\Users\fewli>

```

2# PYTHON PROGRAM TO FIND REVERSE OF A NUMBER

Here is a Python program to reverse a number using a while loop, along with an explanation:

```

# Function to reverse a number
def reverse_number(num):
    reversed_num = 0
    while num > 0:
        digit = num % 10 # Extract the last digit
        reversed_num = reversed_num * 10 + digit # Append the digit to the
reversed number
        num = num // 10 # Remove the last digit from the original number
    return reversed_num

# Example usage
number = 1234

```

```
reversed_number = reverse_number(number)
print(f"The reverse of {number} is {reversed_number}")
```

Here is the output you can see in the screenshot below:

The screenshot shows a Python IDE with a file named 'PythonExample.py'. The code in the editor is as follows:

```
1 # Function to reverse a number
2 def reverse_number(num):
3     reversed_num = 0
4     while num > 0:
5         digit = num % 10 # Extract the last digit
6         reversed_num = reversed_num * 10 + digit # Append the digit to the reversed number
7         num = num // 10 # Remove the last digit from the original number
8     return reversed_num
9
```

The terminal output shows the command being executed and the result:

```
PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python312/python.exe c:/Users/fewli/Do
The reverse of 1234 is 4321
PS C:\Users\fewli>
```

Explanation:

1. Extract the Last Digit: We use `num % 10` to get the last digit of the number.
2. Append the Digit: We multiply the current `reversed_num` by 10 and add the extracted digit to it.
3. Remove the Last Digit: We use integer division `num // 10` to remove the last digit from the original number.
4. Loop Until Number is Zero: The loop continues until all digits are processed.

This method ensures that the digits of the original number are reversed and concatenated correctly to form the reversed number.

3# PYTHON PROGRAM TO CHECK IF A NUMBER IS A PRIME NUMBER

Here is a Python program to check if a number is prime, along with an example and a detailed explanation:

```
# Function to check if a number is prime
def is_prime(num):
    if num <= 1:
```

```
    return False # Numbers less than or equal to 1 are not prime
    for i in range(2, int(num**0.5) + 1): # Check divisors up to the square
root of num
        if num % i == 0:
            return False # If divisible, num is not prime
    return True # If no divisors found, num is prime

# Example usage
number = 29
if is_prime(number):
    print(f"{number} is a prime number.")
else:
    print(f"{number} is not a prime number.")
```

Explanation:

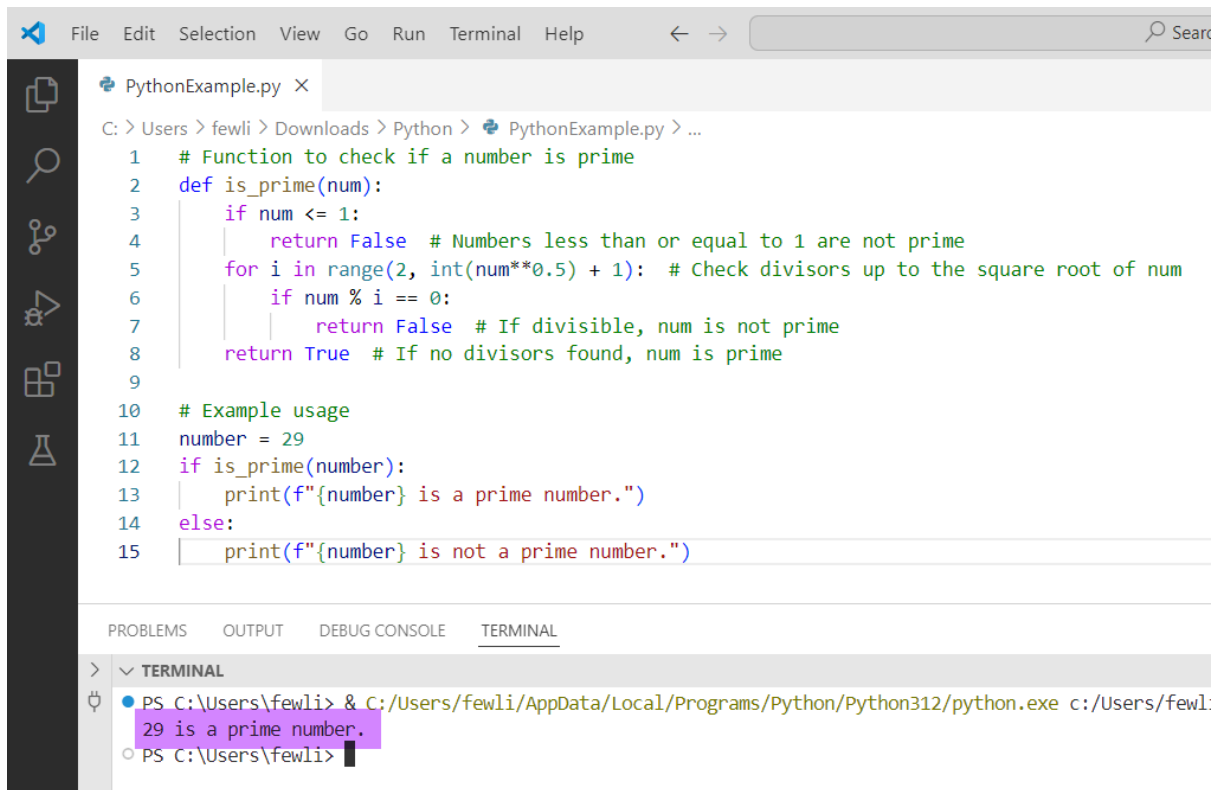
1. Check if Number is Less Than or Equal to 1: Prime numbers are greater than 1. So, if $\text{num} \leq 1$, the function returns False.
2. Check Divisors Up to the Square Root: We only need to check for factors up to the square root of the number ($\text{int}(\text{num}^{0.5}) + 1$). This is because a larger factor of the number would necessarily be paired with a smaller factor that we would have already checked.
3. Check for Divisibility: We use a for loop to iterate from 2 up to the square root of the number. If $\text{num} \% i == 0$ for any i , the number is not prime, and we return False.
4. Return True if No Divisors Found: If no divisors are found in the loop, the number is prime, and we return True.

Example:

For the number 29:

- It is greater than 1.
- The square root of 29 is approximately 5.39, so we check divisors from 2 to 5.
- 29 is not divisible by 2, 3, 4, or 5.
- Since no divisors are found, 29 is a prime number.

Here is the exact output:



```

PythonExample.py X
C:\Users\fewli> Downloads\Python> PythonExample.py > ...
1 # Function to check if a number is prime
2 def is_prime(num):
3     if num <= 1:
4         return False # Numbers less than or equal to 1 are not prime
5     for i in range(2, int(num**0.5) + 1): # Check divisors up to the square root of num
6         if num % i == 0:
7             return False # If divisible, num is not prime
8     return True # If no divisors found, num is prime
9
10 # Example usage
11 number = 29
12 if is_prime(number):
13     print(f"{number} is a prime number.")
14 else:
15     print(f"{number} is not a prime number.")

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
> TERMINAL
● PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python312/python.exe c:/Users/fewli:
29 is a prime number.
○ PS C:\Users\fewli>

```

4# PYTHON PROGRAM TO FIND LARGEST OF THREE NUMBERS

Here is a Python program to find the largest of three numbers.

```

# Function to find the largest of three numbers
def find_largest(num1, num2, num3):
    if (num1 >= num2) and (num1 >= num3):
        largest = num1
    elif (num2 >= num1) and (num2 >= num3):
        largest = num2
    else:
        largest = num3
    return largest

# Example usage
number1 = 10
number2 = 25
number3 = 20
largest_number = find_largest(number1, number2, number3)
print(f"The largest number among {number1}, {number2}, and {number3} is {largest_number}")

```

Explanation:

1. Define the Function: The function `find_largest` takes three arguments: `num1`, `num2`, and `num3`.

2. Compare the Numbers:

- First, it checks if num1 is greater than or equal to both num2 and num3. If true, num1 is the largest.
- If the above condition is false, it checks if num2 is greater than or equal to both num1 and num3. If true, num2 is the largest.
- If neither of the above conditions is true, num3 is the largest.

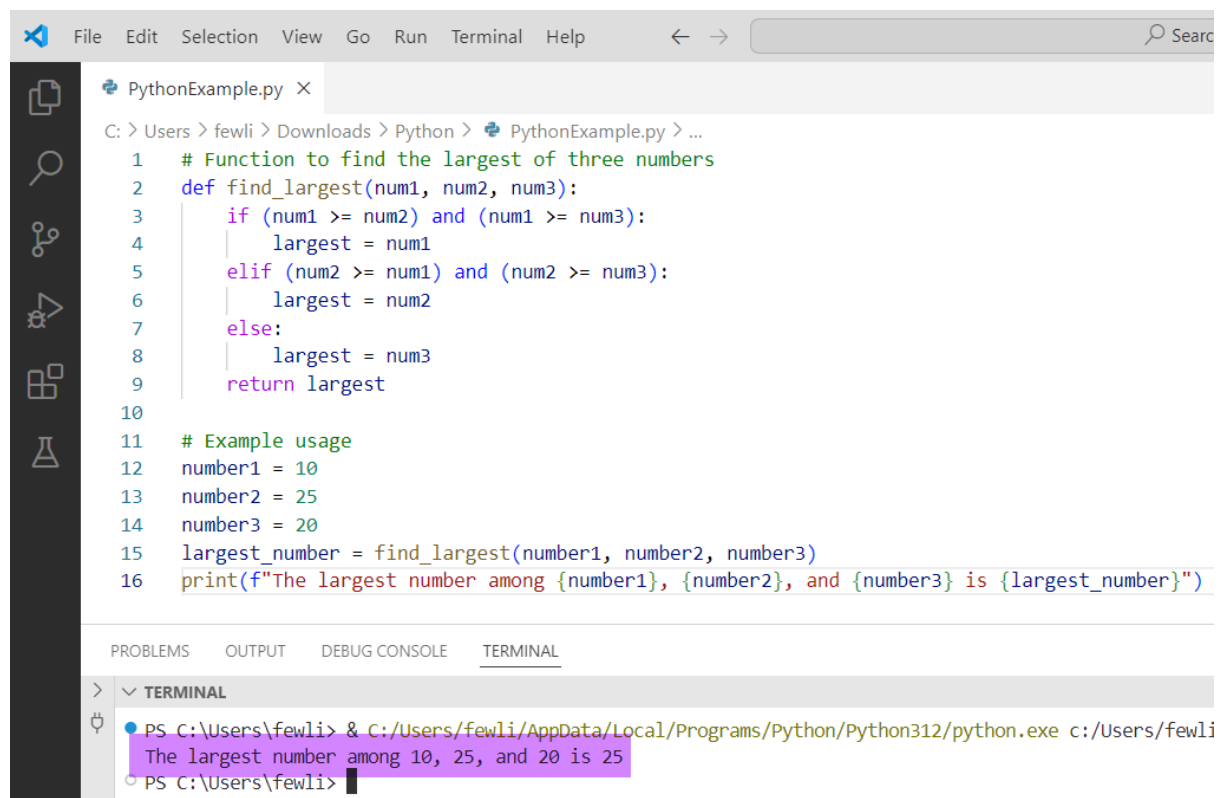
3. Return the Largest Number: The function returns the largest number.

Example:

For the numbers 10, 25, and 20:

- The function first checks if 10 is greater than or equal to 25 and 20, which is false.
- Then it checks if 25 is greater than or equal to 10 and 20, which is true.
- Therefore, 25 is determined to be the largest number.

Here is the output you can see:



```
PythonExample.py X
C:\> Users > fewli > Downloads > Python > PythonExample.py > ...
1 # Function to find the largest of three numbers
2 def find_largest(num1, num2, num3):
3     if (num1 >= num2) and (num1 >= num3):
4         largest = num1
5     elif (num2 >= num1) and (num2 >= num3):
6         largest = num2
7     else:
8         largest = num3
9     return largest
10
11 # Example usage
12 number1 = 10
13 number2 = 25
14 number3 = 20
15 largest_number = find_largest(number1, number2, number3)
16 print(f"The largest number among {number1}, {number2}, and {number3} is {largest_number}")

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
> v TERMINAL
• PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python312/python.exe c:/Users/fewli
The largest number among 10, 25, and 20 is 25
○ PS C:\Users\fewli>
```

5# PYTHON PROGRAM TO FIND SUM AND AVERAGE OF THREE NUMBERS

Here is a Python program to find the sum and average of three numbers.

```
# Function to calculate the sum and average of three numbers
def sum_and_average(num1, num2, num3):
    # Calculate the sum
    total_sum = num1 + num2 + num3
    # Calculate the average
    average = total_sum / 3
    return total_sum, average

# Example usage
number1 = 10
number2 = 20
number3 = 30
total_sum, average = sum_and_average(number1, number2, number3)
print(f"The sum of {number1}, {number2}, and {number3} is {total_sum}")
print(f"The average of {number1}, {number2}, and {number3} is {average}")
```

Explanation:

1. Define the Function: The function `sum_and_average` takes three arguments: `num1`, `num2`, and `num3`.
2. Calculate the Sum: The sum of the three numbers is calculated using the expression `num1 + num2 + num3` and stored in the variable `total_sum`.
3. Calculate the Average: The average is calculated by dividing the `total_sum` by 3 and stored in the variable `average`.
4. Return the Results: The function returns both the `total_sum` and the `average`.

Example:

For the numbers 10, 20, and 30:

- The sum is calculated as $10 + 20 + 30 = 60$.
- The average is calculated as $60 / 3 = 20$.
- The function returns 60 as the sum and 20 as the average.

Here is the exact output:

```

PythonExample.py X
C: > Users > fewli > Downloads > Python > PythonExample.py > ...
2  def sum_and_average(num1, num2, num3):
5      # Calculate the average
6      average = total_sum / 3
7      return total_sum, average
8
9  # Example usage
10 number1 = 10
11 number2 = 20
12 number3 = 30
13 total_sum, average = sum_and_average(number1, number2, number3)
14 print(f"The sum of {number1}, {number2}, and {number3} is {total_sum}")
15 print(f"The average of {number1}, {number2}, and {number3} is {average}")

PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL
>
  v TERMINAL
  • PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python312/python.
    The sum of 10, 20, and 30 is 60
    The average of 10, 20, and 30 is 20.0
  ○ PS C:\Users\fewli>

```

6# PYTHON PROGRAM TO FIND GCD AND LCM OF TWO NUMBERS

Here is a Python program to find the Greatest Common Divisor (GCD) and Least Common Multiple (LCM) of two numbers.

Here is the Python program.

```

import math

# Function to calculate GCD
def calculate_gcd(num1, num2):
    return math.gcd(num1, num2)

# Function to calculate LCM
def calculate_lcm(num1, num2):
    gcd = calculate_gcd(num1, num2)
    return abs(num1 * num2) // gcd

# Example usage
number1 = 12
number2 = 15
gcd = calculate_gcd(number1, number2)
lcm = calculate_lcm(number1, number2)
print(f"The GCD of {number1} and {number2} is {gcd}")
print(f"The LCM of {number1} and {number2} is {lcm}")

```

Explanation:

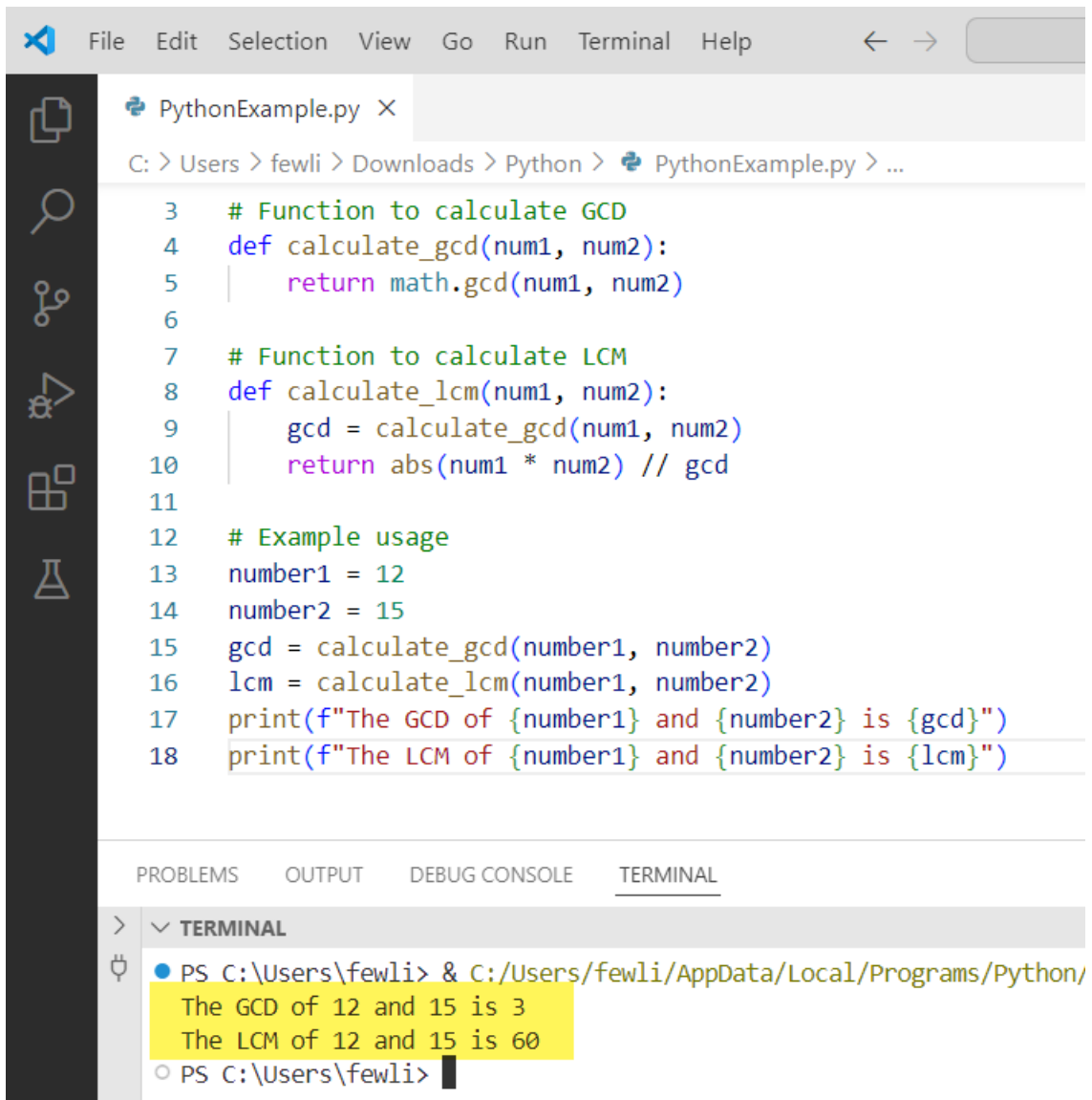
1. Import the math Module: We use Python's built-in math module to calculate the GCD.
2. Calculate GCD:
 - The function `calculate_gcd` uses `math.gcd(num1, num2)` to compute the GCD of `num1` and `num2`.
3. Calculate LCM:
 - The function `calculate_lcm` first calculates the GCD using the `calculate_gcd` function.
 - The LCM is then calculated using the formula `abs(num1 * num2) // gcd`. This formula works because the product of the GCD and LCM of two numbers equals the product of the numbers themselves.
4. Example Usage:
 - For the numbers 12 and 15:
 - The GCD is calculated as `math.gcd(12, 15)`, which is 3.
 - The LCM is calculated as `abs(12 * 15) // 3`, which is 60.

Example:

For the numbers 12 and 15:

- The GCD is 3.
- The LCM is 60.

Here is the exact output you can see in the screenshot below:



The screenshot shows a Python IDE window titled 'PythonExample.py'. The code defines two functions: `calculate_gcd` and `calculate_lcm`. `calculate_gcd` uses `math.gcd` to find the greatest common divisor of two numbers. `calculate_lcm` uses `abs(num1 * num2) // gcd` to find the least common multiple. The script then uses these functions to calculate the GCD and LCM of 12 and 15, printing the results.

```
3 # Function to calculate GCD
4 def calculate_gcd(num1, num2):
5     return math.gcd(num1, num2)
6
7 # Function to calculate LCM
8 def calculate_lcm(num1, num2):
9     gcd = calculate_gcd(num1, num2)
10    return abs(num1 * num2) // gcd
11
12 # Example usage
13 number1 = 12
14 number2 = 15
15 gcd = calculate_gcd(number1, number2)
16 lcm = calculate_lcm(number1, number2)
17 print(f"The GCD of {number1} and {number2} is {gcd}")
18 print(f"The LCM of {number1} and {number2} is {lcm}")
```

The terminal output shows the execution of the script:

```
PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/
The GCD of 12 and 15 is 3
The LCM of 12 and 15 is 60
PS C:\Users\fewli>
```

7# PYTHON PROGRAM TO FIND HCF AND LCM OF TWO NUMBERS

Here is a Python program to find the Greatest Common Divisor (GCD) and Least Common Multiple (LCM) of two numbers.

```
import math

# Function to calculate HCF (GCD)
def calculate_hcf(num1, num2):
    return math.gcd(num1, num2)

# Function to calculate LCM
def calculate_lcm(num1, num2):
    hcf = calculate_hcf(num1, num2)
    return abs(num1 * num2) // hcf

# Example usage
number1 = 12
```

```
number2 = 15
hcf = calculate_hcf(number1, number2)
lcm = calculate_lcm(number1, number2)
print(f"The HCF of {number1} and {number2} is {hcf}")
print(f"The LCM of {number1} and {number2} is {lcm}")
```

Explanation:

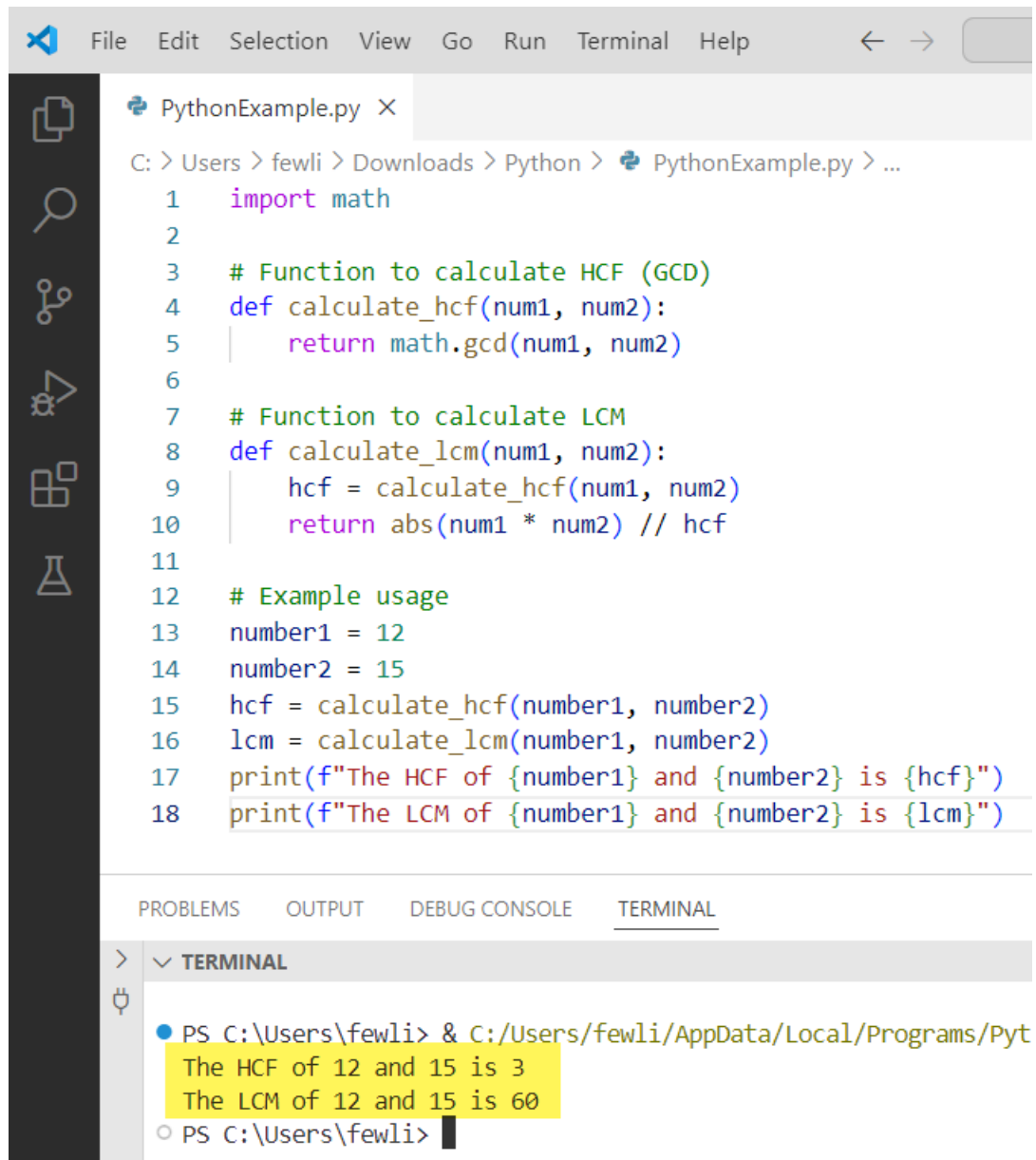
1. Import the math Module: The math module in Python provides a built-in function to calculate the GCD.
2. Calculate HCF (GCD):
 - The function `calculate_hcf` uses `math.gcd(num1, num2)` to compute the HCF of `num1` and `num2`.
3. Calculate LCM:
 - The function `calculate_lcm` first calculates the HCF using the `calculate_hcf` function.
 - The LCM is then calculated using the formula `abs(num1 * num2) // hcf`. This formula works because the product of the HCF and LCM of two numbers equals the product of the numbers themselves.
4. Example Usage:
 - For the numbers 12 and 15:
 - The HCF is calculated as `math.gcd(12, 15)`, which is 3.
 - The LCM is calculated as `abs(12 * 15) // 3`, which is 60.

Example:

For the numbers 12 and 15:

- The HCF is 3.
- The LCM is 60.

Here is the exact output in the screenshot below:



```

PythonExample.py X
C: > Users > fewli > Downloads > Python > PythonExample.py > ...
1  import math
2
3  # Function to calculate HCF (GCD)
4  def calculate_hcf(num1, num2):
5      |   return math.gcd(num1, num2)
6
7  # Function to calculate LCM
8  def calculate_lcm(num1, num2):
9      |   hcf = calculate_hcf(num1, num2)
10     |   return abs(num1 * num2) // hcf
11
12 # Example usage
13 number1 = 12
14 number2 = 15
15 hcf = calculate_hcf(number1, number2)
16 lcm = calculate_lcm(number1, number2)
17 print(f"The HCF of {number1} and {number2} is {hcf}")
18 print(f"The LCM of {number1} and {number2} is {lcm}")

PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL
>  v TERMINAL
  o PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Pyt
    The HCF of 12 and 15 is 3
    The LCM of 12 and 15 is 60
  o PS C:\Users\fewli>

```

8# PYTHON PROGRAM FOR PALINDROME NUMBER

Here is a Python program to check if a number is a palindrome.

```

# Function to check if a number is a palindrome
def is_palindrome_number(num):
    # Convert the number to a string
    str_num = str(num)
    # Compare the string with its reverse
    return str_num == str_num[::-1]

# Example usage
number = 12321
if is_palindrome_number(number):
    print(f"{number} is a palindrome number.")
else:

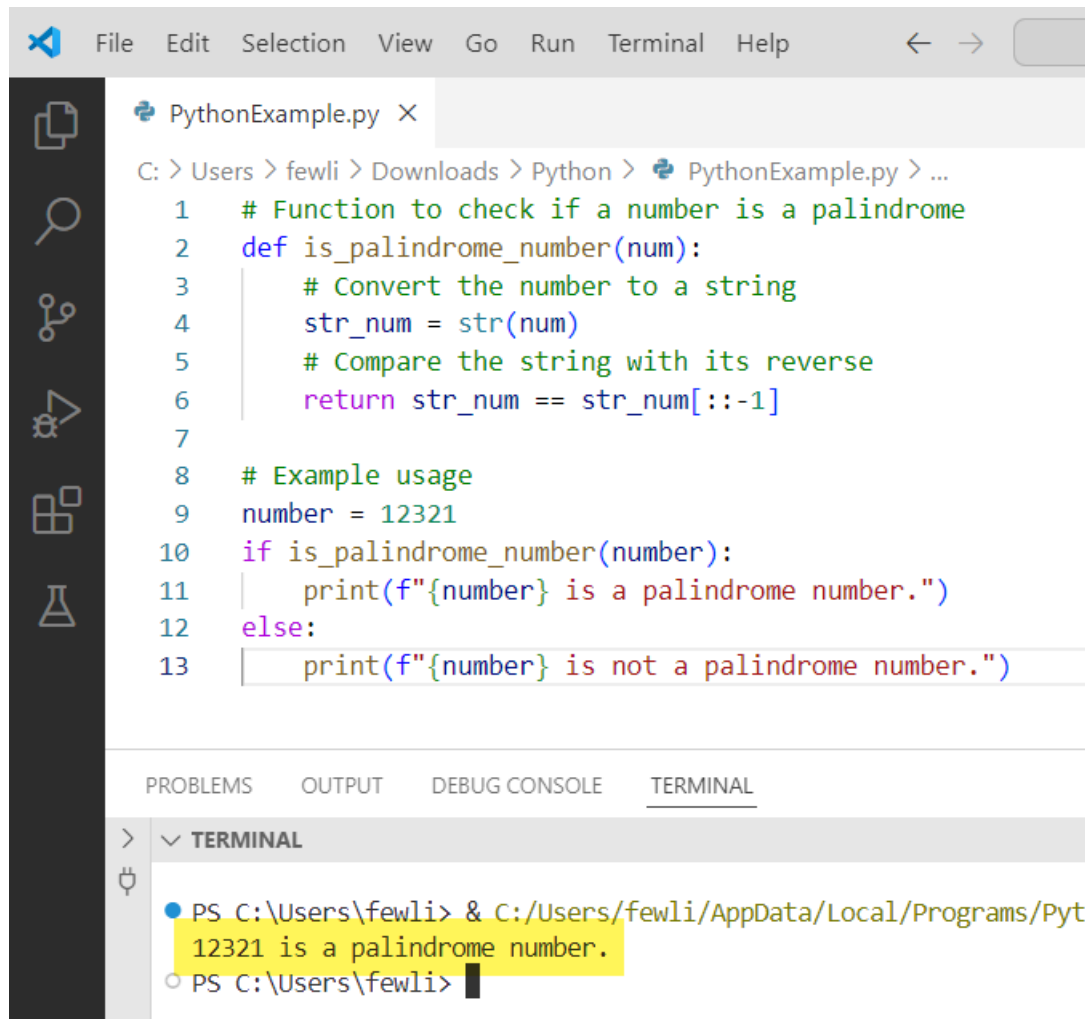
```

```
print(f"{number} is not a palindrome number.")
```

Explanation:

1. Define the Function: The function `is_palindrome_number` takes a single argument `num`, which is the number to be checked.
2. Convert Number to String:
 - `str_num = str(num)`: This converts the number to a string. This step is necessary because checking for a palindrome involves comparing the sequence of digits.
3. Check Palindrome:
 - `str_num == str_num[::-1]`: This compares the string representation of the number with its reverse. The slicing operation `str_num[::-1]` creates a reversed copy of the string.
 - If the string is equal to its reversed copy, the number is a palindrome, and the function returns `True`. Otherwise, it returns `False`.
4. Example Usage:
 - The example number 12321 is converted to the string "12321".
 - The reversed string is also "12321".
 - Since they are equal, the number is identified as a palindrome.

Here is the exact output you can see in the screenshot below:



```

PythonExample.py X
C: > Users > fewli > Downloads > Python > PythonExample.py > ...
1  # Function to check if a number is a palindrome
2  def is_palindrome_number(num):
3      # Convert the number to a string
4      str_num = str(num)
5      # Compare the string with its reverse
6      return str_num == str_num[::-1]
7
8  # Example usage
9  number = 12321
10 if is_palindrome_number(number):
11     print(f"{number} is a palindrome number.")
12 else:
13     print(f"{number} is not a palindrome number.")

PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL
>
  > TERMINAL
  ● PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Pyt
    12321 is a palindrome number.
  ○ PS C:\Users\fewli>

```

9# PYTHON PROGRAM FOR FIBONACCI SERIES

Here is a Python program to generate the Fibonacci series up to n terms.

```

# Function to generate Fibonacci series up to n terms
def fibonacci_series(n):
    # Initialize the first two terms of the series
    fib_sequence = [0, 1]
    # Generate the Fibonacci series
    for i in range(2, n):
        next_term = fib_sequence[-1] + fib_sequence[-2]
        fib_sequence.append(next_term)
    return fib_sequence[:n]

# Example usage
n_terms = 10
fib_series = fibonacci_series(n_terms)
print(f"The first {n_terms} terms of the Fibonacci series are: {fib_series}")

```

Explanation:

1. Define the Function: The function `fibonacci_series` takes a single argument `n`, which specifies the number of terms in the Fibonacci series to be generated.
2. Initialize the First Two Terms:
 - `fib_sequence = [0, 1]`: This initializes the list with the first two terms of the Fibonacci series, 0 and 1.
3. Generate the Fibonacci Series:
 - The for loop starts from 2 and runs up to `n-1`, generating the next terms of the series.
 - `next_term = fib_sequence[-1] + fib_sequence[-2]`: This calculates the next term by adding the last two terms in the current sequence.
 - `fib_sequence.append(next_term)`: This appends the newly calculated term to the sequence.
4. Return the Series:
 - `return fib_sequence[:n]`: This returns the first `n` terms of the Fibonacci series. The slicing is necessary in case `n` is less than 2, ensuring the function returns the correct number of terms.
5. Example Usage:
 - For `n_terms = 10`, the function generates the first 10 terms of the Fibonacci series.
 - The output will be: `[0, 1, 1, 2, 3, 5, 8, 13, 21, 34]`.

Example:

For `n_terms = 10`:

- The first 10 terms of the Fibonacci series are `[0, 1, 1, 2, 3, 5, 8, 13, 21, 34]`.

Here is the exact output:

```

PythonExample.py X
C: > Users > fewli > Downloads > Python > PythonExample.py > ...
1 # Function to generate Fibonacci series up to n terms
2 def fibonacci_series(n):
3     # Initialize the first two terms of the series
4     fib_sequence = [0, 1]
5     # Generate the Fibonacci series
6     for i in range(2, n):
7         next_term = fib_sequence[-1] + fib_sequence[-2]
8         fib_sequence.append(next_term)
9     return fib_sequence[:n]
10
11 # Example usage
12 n_terms = 10
13 fib_series = fibonacci_series(n_terms)
14 print(f"The first {n_terms} terms of the Fibonacci series are: {fib_series}")

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
> TERMINAL
PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python312/python.exe
The first 10 terms of the Fibonacci series are: [0, 1, 1, 2, 3, 5, 8, 13, 21, 34]
PS C:\Users\fewli>

```

10# PYTHON PROGRAM FOR ARMSTRONG NUMBER

Here is a Python program to check if a number is an Armstrong number.

```

# Function to check if a number is an Armstrong number
def is_armstrong_number(num):
    # Convert the number to a string to easily iterate over each digit
    num_str = str(num)
    # Calculate the number of digits
    num_digits = len(num_str)
    # Initialize the sum to 0
    sum_of_powers = 0
    # Calculate the sum of each digit raised to the power of the number of
    digits
    for digit in num_str:
        sum_of_powers += int(digit) ** num_digits
    # Check if the sum of powers is equal to the original number
    return sum_of_powers == num

# Example usage
number = 153
if is_armstrong_number(number):
    print(f"{number} is an Armstrong number.")
else:
    print(f"{number} is not an Armstrong number.")

```

Explanation:

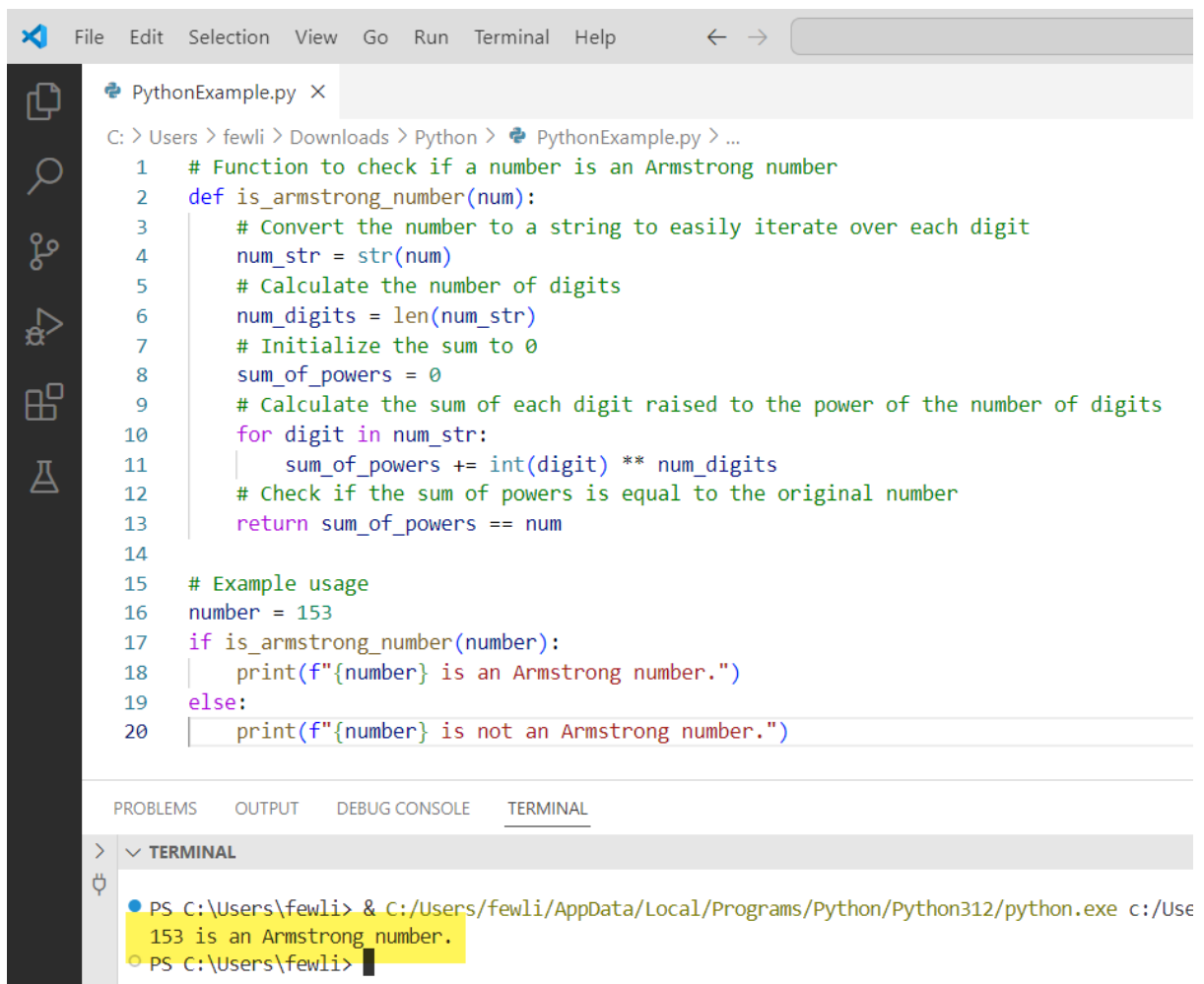
1. Define the Function: The function `is_armstrong_number` takes a single argument `num`, which is the number to be checked.
2. Convert the Number to a String:
 - `num_str = str(num)`: This converts the number to a string to easily iterate over each digit.
3. Calculate the Number of Digits:
 - `num_digits = len(num_str)`: This calculates the number of digits in the number.
4. Initialize the Sum:
 - `sum_of_powers = 0`: This initializes the sum of the digits raised to the power of the number of digits.
5. Calculate the Sum of Powers:
 - The for loop iterates over each digit in the string representation of the number.
 - `sum_of_powers += int(digit) ** num_digits`: This converts the digit back to an integer, raises it to the power of `num_digits`, and adds it to `sum_of_powers`.
6. Check if the Sum Equals the Original Number:
 - `return sum_of_powers == num`: This checks if the sum of the digits raised to the power of the number of digits is equal to the original number. If true, the number is an Armstrong number.
7. Example Usage:
 - For the number 153:
 - The number of digits is 3.
 - The sum of the digits raised to the power of 3 is $(1^3 + 5^3 + 3^3 = 1 + 125 + 27 = 153)$.
 - Since the sum equals the original number, 153 is an Armstrong number.

Example:

For the number 153:

- The sum of the digits raised to the power of the number of digits is ($1^3 + 5^3 + 3^3 = 153$).
- Since the sum equals the original number, 153 is an Armstrong number.

Here is the exact output in the screenshot below:



```

PythonExample.py X
C:\Users\fewli> Downloads > Python > PythonExample.py > ...
1 # Function to check if a number is an Armstrong number
2 def is_armstrong_number(num):
3     # Convert the number to a string to easily iterate over each digit
4     num_str = str(num)
5     # Calculate the number of digits
6     num_digits = len(num_str)
7     # Initialize the sum to 0
8     sum_of_powers = 0
9     # Calculate the sum of each digit raised to the power of the number of digits
10    for digit in num_str:
11        sum_of_powers += int(digit) ** num_digits
12    # Check if the sum of powers is equal to the original number
13    return sum_of_powers == num
14
15 # Example usage
16 number = 153
17 if is_armstrong_number(number):
18     print(f"{number} is an Armstrong number.")
19 else:
20     print(f"{number} is not an Armstrong number.")

```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL

```

> TERMINAL
● PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python312/python.exe c:/Use
153 is an Armstrong number.
○ PS C:\Users\fewli>

```

11# PYTHON PROGRAM FOR BINARY SEARCH

Here is a Python program to perform a binary search.

```

# Function to perform binary search
def binary_search(arr, target):
    left, right = 0, len(arr) - 1

    while left <= right:
        mid = (left + right) // 2

```

```
# Check if target is present at mid
if arr[mid] == target:
    return mid
# If target is greater, ignore the left half
elif arr[mid] < target:
    left = mid + 1
# If target is smaller, ignore the right half
else:
    right = mid - 1

# Target is not present in the array
return -1

# Example usage
arr = [2, 3, 4, 10, 40]
target = 10

result = binary_search(arr, target)

if result != -1:
    print(f"Element {target} is present at index {result}.")
else:
    print(f"Element {target} is not present in the array.")
```

Explanation:

1. Define the Function: The function `binary_search` takes two arguments: `arr` (the sorted list of elements) and `target` (the element to be searched).
2. Initialize Pointers:
 - `left` is initialized to 0 (the start of the array).
 - `right` is initialized to `len(arr) - 1` (the end of the array).
3. Iterate Until the Search Space is Exhausted:
 - The while loop continues as long as `left` is less than or equal to `right`.
4. Calculate the Middle Index:
 - `mid = (left + right) // 2`: This calculates the middle index of the current search space.
5. Check if the Target is at the Middle:

- If $\text{arr}[\text{mid}] == \text{target}$, the target is found, and the function returns the index mid .

6. Adjust the Search Space:

- If $\text{arr}[\text{mid}] < \text{target}$, the target must be in the right half of the current search space, so left is updated to $\text{mid} + 1$.
- If $\text{arr}[\text{mid}] > \text{target}$, the target must be in the left half of the current search space, so right is updated to $\text{mid} - 1$.

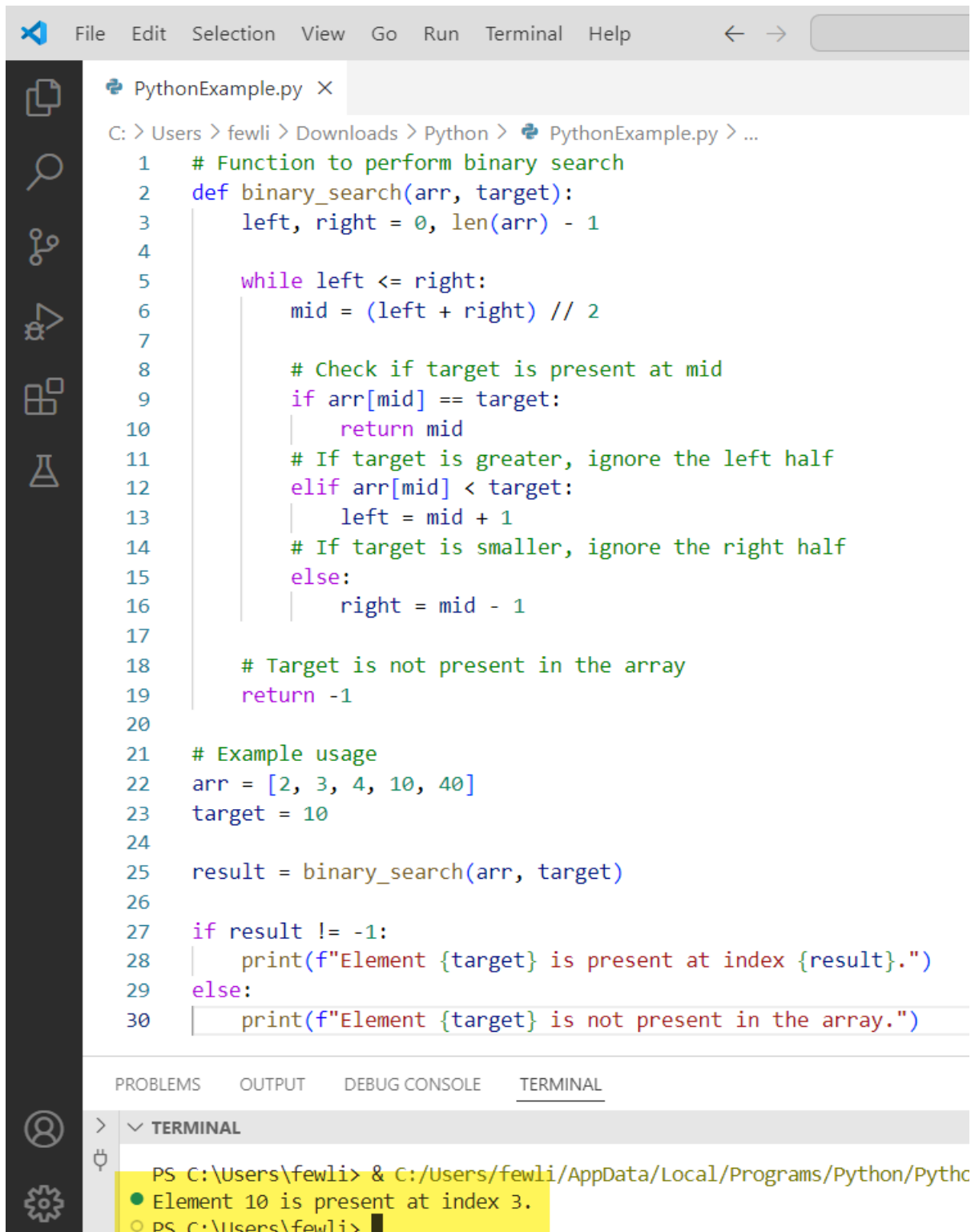
7. Return -1 if the Target is Not Found:

- If the loop exits without finding the target, the function returns -1, indicating that the target is not present in the array.

8. Example Usage:

- For the sorted array $[2, 3, 4, 10, 40]$ and target 10:
 - The middle index is calculated as $(0 + 4) // 2 = 2$, and $\text{arr}[2]$ is 4.
 - Since $4 < 10$, the search continues in the right half (left is updated to 3).
 - The new middle index is $(3 + 4) // 2 = 3$, and $\text{arr}[3]$ is 10, which matches the target.
 - The function returns the index 3.

Here is the exact output:



```
PythonExample.py X
C: > Users > fewli > Downloads > Python > PythonExample.py > ...
1 # Function to perform binary search
2 def binary_search(arr, target):
3     left, right = 0, len(arr) - 1
4
5     while left <= right:
6         mid = (left + right) // 2
7
8         # Check if target is present at mid
9         if arr[mid] == target:
10            return mid
11        # If target is greater, ignore the left half
12        elif arr[mid] < target:
13            left = mid + 1
14        # If target is smaller, ignore the right half
15        else:
16            right = mid - 1
17
18        # Target is not present in the array
19        return -1
20
21 # Example usage
22 arr = [2, 3, 4, 10, 40]
23 target = 10
24
25 result = binary_search(arr, target)
26
27 if result != -1:
28     print(f"Element {target} is present at index {result}.")
29 else:
30     print(f"Element {target} is not present in the array.")

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
> TERMINAL
PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Pythc
● Element 10 is present at index 3.
○ PS C:\Users\fewli>
```

12# PYTHON PROGRAM FOR BUBBLE SORT

Bubble Sort is a simple sorting algorithm that works by repeatedly stepping through the list to be sorted, comparing each pair of adjacent items, and swapping them if they are in the wrong order. This process is repeated until the list is sorted.

Here is a Python implementation of the Bubble Sort algorithm:

```
def bubble_sort(arr):
    n = len(arr)
    # Traverse through all array elements
    for i in range(n):
        # Last i elements are already in place
        for j in range(0, n-i-1):
            # Traverse the array from 0 to n-i-1
            # Swap if the element found is greater than the next element
            if arr[j] > arr[j+1]:
                arr[j], arr[j+1] = arr[j+1], arr[j]
    return arr

# Example usage
arr = [64, 34, 25, 12, 22, 11, 90]
sorted_arr = bubble_sort(arr)
print("Sorted array is:", sorted_arr)
```

Explanation

1. Outer Loop: The outer loop runs n times, where n is the length of the array. This ensures that all elements are sorted.
2. Inner Loop: The inner loop runs from the start of the array to $n-i-1$. This is because after each pass, the largest element moves to its correct position, so we can ignore the last i elements in the subsequent passes.
3. Comparison and Swap: During each pass, adjacent elements are compared. If the current element is greater than the next element, they are swapped.

This algorithm has a time complexity of $O(n^2)$ in the worst and average cases, making it inefficient for large lists. However, it is easy to understand and implement, which makes it useful for educational purposes.

Here is the exact output:

```

PythonExample.py X
C: > Users > fewli > Downloads > Python > PythonExample.py > ...
1  def bubble_sort(arr):
2      n = len(arr)
3      # Traverse through all array elements
4      for i in range(n):
5          # Last i elements are already in place
6          for j in range(0, n-i-1):
7              # Traverse the array from 0 to n-i-1
8              # Swap if the element found is greater than the next element
9              if arr[j] > arr[j+1]:
10                 arr[j], arr[j+1] = arr[j+1], arr[j]
11         return arr
12
13     # Example usage
14     arr = [64, 34, 25, 12, 22, 11, 90]
15     sorted_arr = bubble_sort(arr)
16     print("Sorted array is:", sorted_arr)

```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL

```

> v TERMINAL
• PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python312/python
Sorted array is: [11, 12, 22, 25, 34, 64, 90]
○ PS C:\Users\fewli>

```

13# PYTHON PROGRAM TO FIND AREA OF CIRCLE

To find the area of a circle in Python, you can use the formula:

$$[\text{Area}] = \pi r^2$$

where (r) is the radius of the circle and (π) (pi) is a constant approximately equal to 3.14159. Python's math module provides a more precise value for (π).

Here is a simple Python program to calculate the area of a circle:

```

import math

def calculate_area(radius):
    area = math.pi * (radius ** 2)
    return area

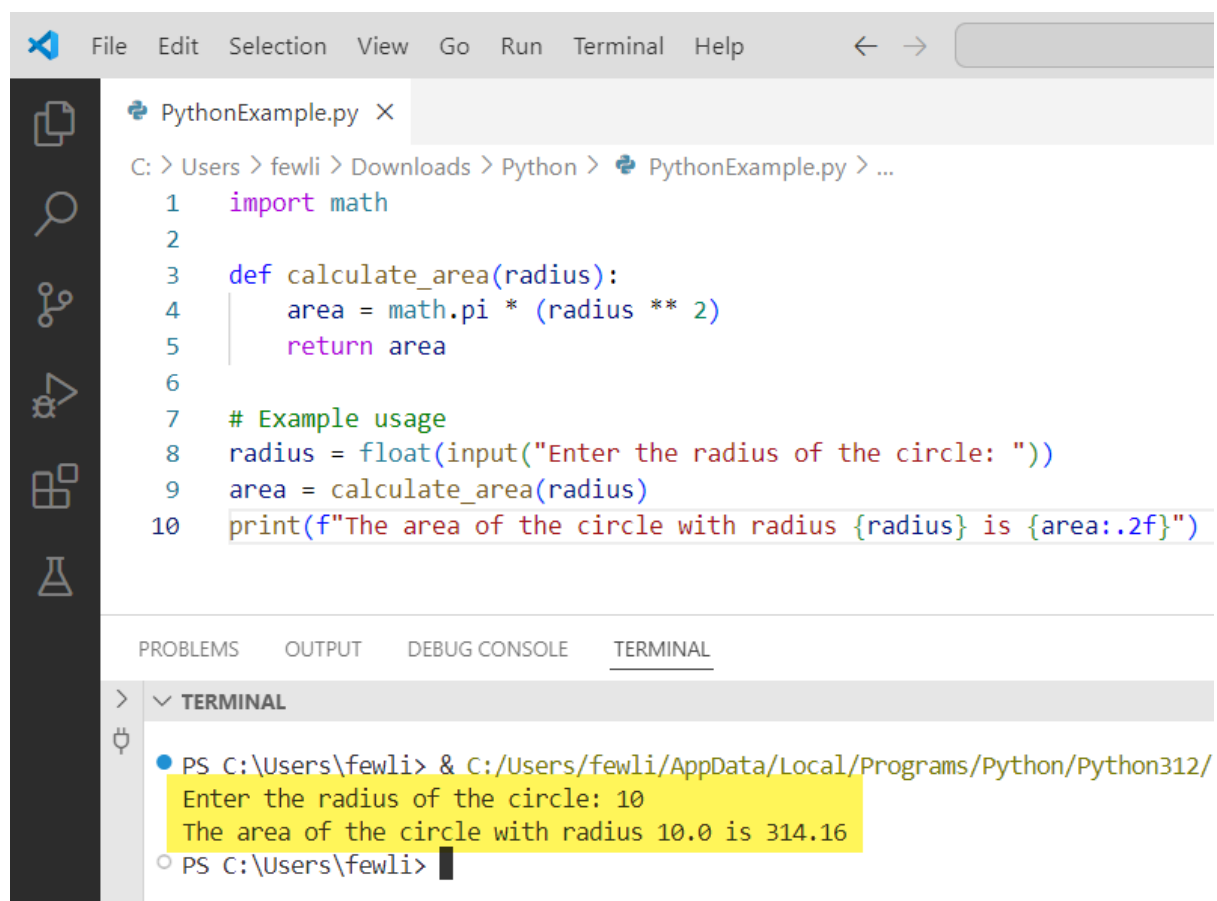
# Example usage
radius = float(input("Enter the radius of the circle: "))
area = calculate_area(radius)
print(f"The area of the circle with radius {radius} is {area:.2f}")

```

Explanation

1. Import math module: This module provides access to the mathematical constant (π) and other mathematical functions.
2. Define calculate_area function: This function takes the radius as an argument, calculates the area using the formula ($\pi \times r^2$), and returns the result.
3. User Input: The program prompts the user to enter the radius of the circle.
4. Calculate and Print Area: The program calculates the area using the calculate_area function and prints the result formatted to two decimal places.

Here is the exact output:



```
PythonExample.py X
C: > Users > fewli > Downloads > Python > PythonExample.py > ...
1  import math
2
3  def calculate_area(radius):
4      area = math.pi * (radius ** 2)
5      return area
6
7  # Example usage
8  radius = float(input("Enter the radius of the circle: "))
9  area = calculate_area(radius)
10 print(f"The area of the circle with radius {radius} is {area:.2f}")

PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL
>  v  TERMINAL
• PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python312/
  Enter the radius of the circle: 10
  The area of the circle with radius 10.0 is 314.16
○ PS C:\Users\fewli>
```

14# PYTHON PROGRAM TO FIND AREA OF TRIANGLE

The formula for the area of a triangle when the base and height are known is:

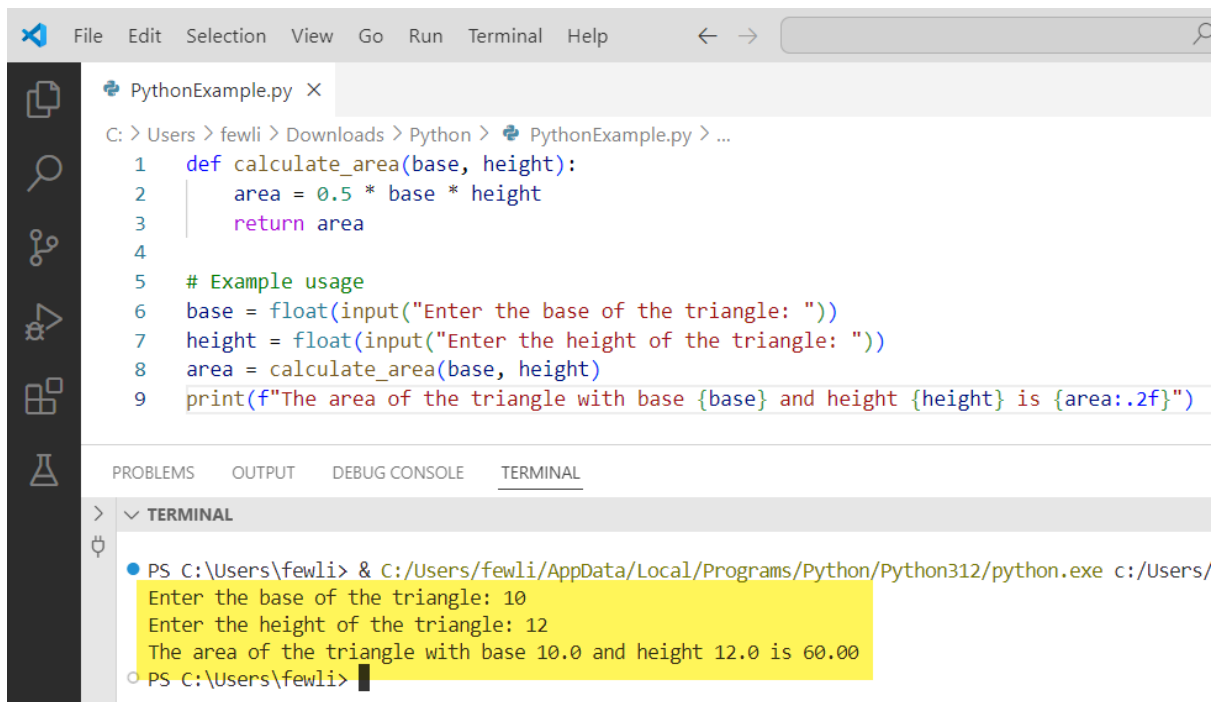
$$[\text{Area} = \frac{1}{2} \times \text{base} \times \text{height}]$$

Here's a Python program using this formula:

```
def calculate_area(base, height):
    area = 0.5 * base * height
    return area

# Example usage
base = float(input("Enter the base of the triangle: "))
height = float(input("Enter the height of the triangle: "))
area = calculate_area(base, height)
print(f"The area of the triangle with base {base} and height {height} is {area:.2f}")
```

Here is the exact output you can see in the screenshot below:



The screenshot shows a Python IDE window with the following code and output:

```
PythonExample.py X
C: > Users > fewli > Downloads > Python > PythonExample.py > ...
1 def calculate_area(base, height):
2     area = 0.5 * base * height
3     return area
4
5 # Example usage
6 base = float(input("Enter the base of the triangle: "))
7 height = float(input("Enter the height of the triangle: "))
8 area = calculate_area(base, height)
9 print(f"The area of the triangle with base {base} and height {height} is {area:.2f}")
```

TERMINAL

```
PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python312/python.exe c:/Users/
Enter the base of the triangle: 10
Enter the height of the triangle: 12
The area of the triangle with base 10.0 and height 12.0 is 60.00
PS C:\Users\fewli>
```

15# PYTHON PROGRAM TO FIND AREA OF SQUARE

To find the area of a square in Python, you can use the simple formula:

$$[\text{Area} = \text{side}^2]$$

where "side" is the length of one side of the square.

Here is a Python program to calculate the area of a square:

```
def calculate_area(side):
    area = side ** 2
    return area
```

Example usage

```
side = float(input("Enter the length of the side of the square: "))
area = calculate_area(side)
print(f"The area of the square with side length {side} is {area:.2f}")
```

Explanation

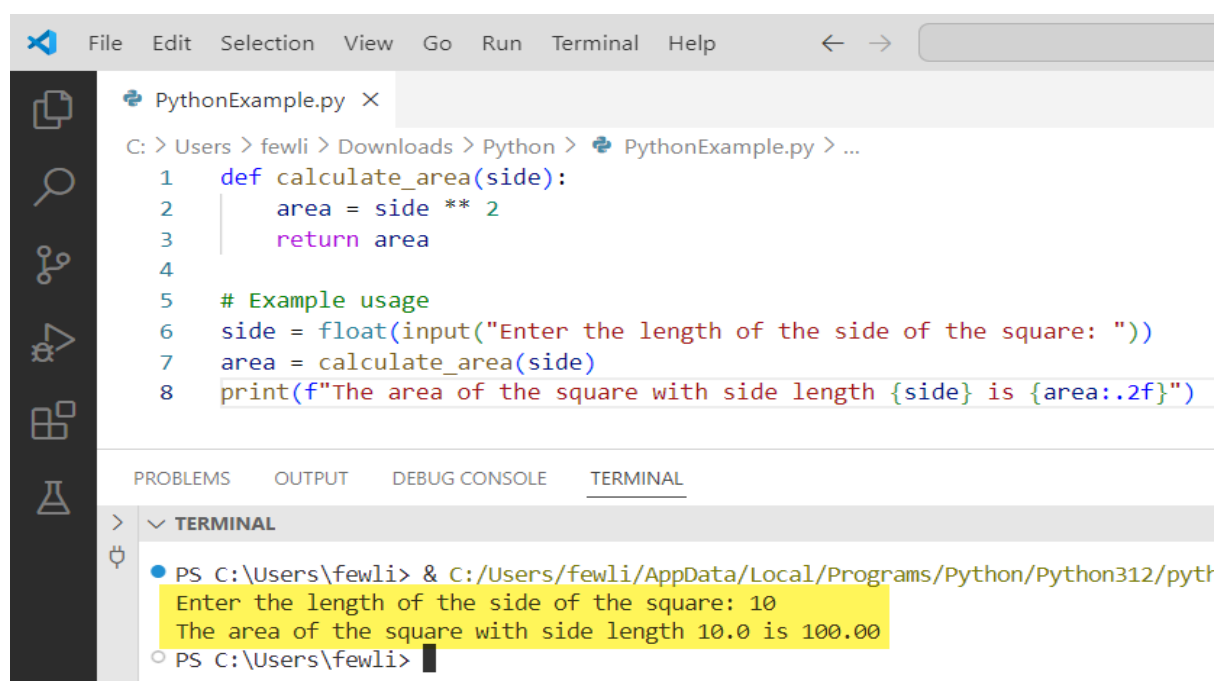
1. Define calculate_area function: This function takes the length of one side of the square as an argument, calculates the area using the formula (side^2), and returns the result.
2. User Input: The program prompts the user to enter the length of the side of the square.
3. Calculate and Print Area: The program calculates the area using the calculate_area function and prints the result formatted to two decimal places.

Example

Let's say the user inputs a side length of 5 units.

- The program will calculate the area as ($5^2 = 25$) square units.
- The output will be: "The area of the square with side length 5.0 is 25.00"

Here is the exact output in the screenshot below:



The screenshot shows a Python IDE with a file named PythonExample.py. The code in the editor is as follows:

```
1 def calculate_area(side):
2     area = side ** 2
3     return area
4
5 # Example usage
6 side = float(input("Enter the length of the side of the square: "))
7 area = calculate_area(side)
8 print(f"The area of the square with side length {side} is {area:.2f}")
```

The terminal output shows the program being executed with the following input and output:

```
PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python312/pyt
Enter the length of the side of the square: 10
The area of the square with side length 10.0 is 100.00
PS C:\Users\fewli>
```

16# PYTHON PROGRAM TO FIND EVEN OR ODD USING FUNCTION

To determine whether a number is even or odd in Python, you can use the modulus operator `%`. If a number divided by 2 has a remainder of 0, it is even; otherwise, it is odd.

Here is a Python program that uses a function to check if a number is even or odd:

```
def check_even_or_odd(number):
    if number % 2 == 0:
        return "Even"
    else:
        return "Odd"

# Example usage
number = int(input("Enter a number: "))
result = check_even_or_odd(number)
print(f"The number {number} is {result}.")
```

Explanation

1. Define `check_even_or_odd` function: This function takes a single argument `number`.
 - It uses the modulus operator `%` to check if the number is divisible by 2.
 - If `number % 2 == 0`, it returns "Even".
 - Otherwise, it returns "Odd".
2. User Input: The program prompts the user to enter a number.
 - The `input` function is used to get the user's input, which is then converted to an integer using `int()`.
3. Check and Print Result: The program calls the `check_even_or_odd` function with the user's input and prints whether the number is even or odd.

Example

Let's say the user inputs the number 7.

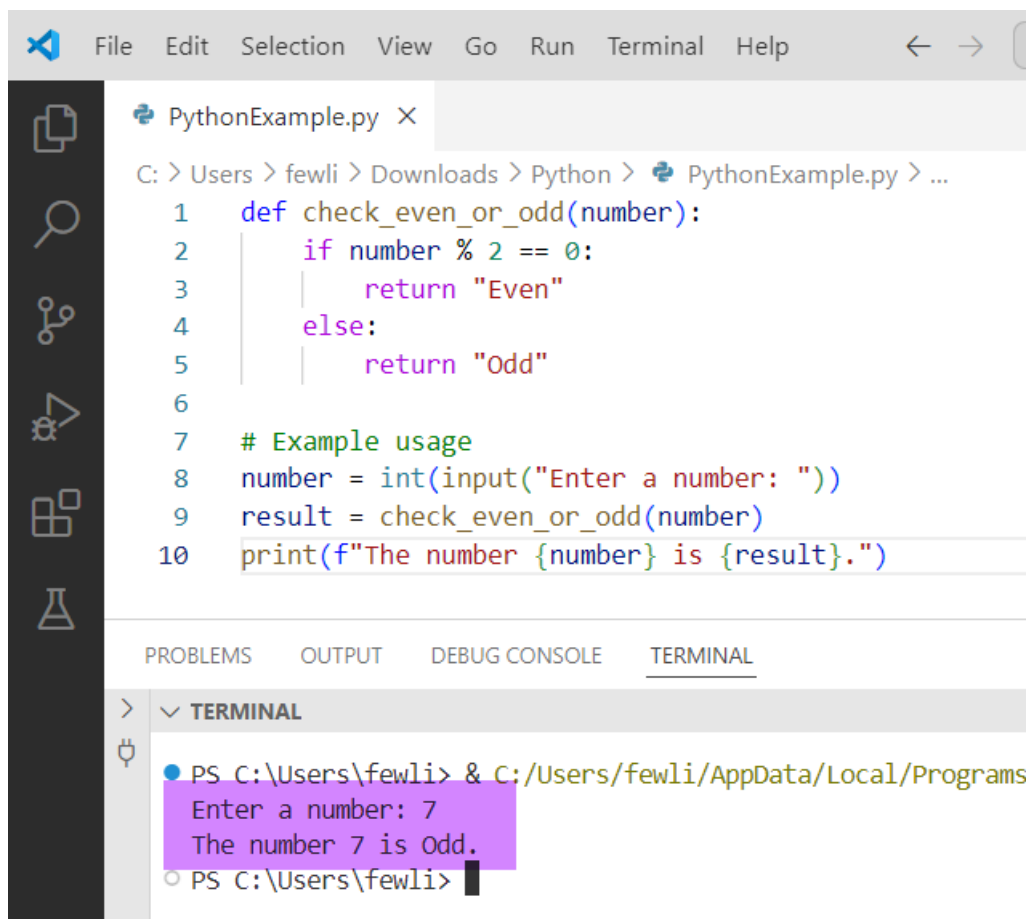
- The program will call `check_even_or_odd(7)`.

- Inside the function, it checks $7 \% 2$, which equals 1 (not 0), so it returns "Odd".
- The output will be: "The number 7 is Odd."

Similarly, if the user inputs the number 8:

- The program will call `check_even_or_odd(8)`.
- Inside the function, it checks $8 \% 2$, which equals 0, so it returns "Even".
- The output will be: "The number 8 is Even."

Here is the exact output:



The screenshot shows a code editor with a Python file named `PythonExample.py`. The code defines a function `check_even_or_odd` that checks if a number is even or odd using the modulus operator. It also includes an example usage where the user is prompted to enter a number, and the program prints the result. The terminal output shows the program being executed, the user entering '7', and the program outputting 'The number 7 is Odd.'

```
File Edit Selection View Go Run Terminal Help
PythonExample.py X
C: > Users > fewli > Downloads > Python > PythonExample.py > ...
1 def check_even_or_odd(number):
2     if number % 2 == 0:
3         return "Even"
4     else:
5         return "Odd"
6
7 # Example usage
8 number = int(input("Enter a number: "))
9 result = check_even_or_odd(number)
10 print(f"The number {number} is {result}.")

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
> TERMINAL
● PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs
  Enter a number: 7
  The number 7 is Odd.
○ PS C:\Users\fewli>
```

17# PYTHON PROGRAM TO FIND EVEN OR ODD USING FUNCTION

To determine whether a number is even or odd in Python, you can use the modulus operator `%`. If a number divided by 2 has a remainder of 0, it is even; otherwise, it is odd.

Here is a Python program that uses a function to check if a number is even or odd:

```
def check_even_or_odd(number):  
    if number % 2 == 0:  
        return "Even"  
    else:  
        return "Odd"  
  
# Example usage  
number = int(input("Enter a number: "))  
result = check_even_or_odd(number)  
print(f"The number {number} is {result}.")
```

Explanation

1. Define `check_even_or_odd` function: This function takes a single argument `number`.
 - It uses the modulus operator `%` to check if the number is divisible by 2.
 - If `number % 2 == 0`, it returns "Even".
 - Otherwise, it returns "Odd".
2. User Input: The program prompts the user to enter a number.
 - The `input` function is used to get the user's input, which is then converted to an integer using `int()`.
3. Check and Print Result: The program calls the `check_even_or_odd` function with the user's input and prints whether the number is even or odd.

Example

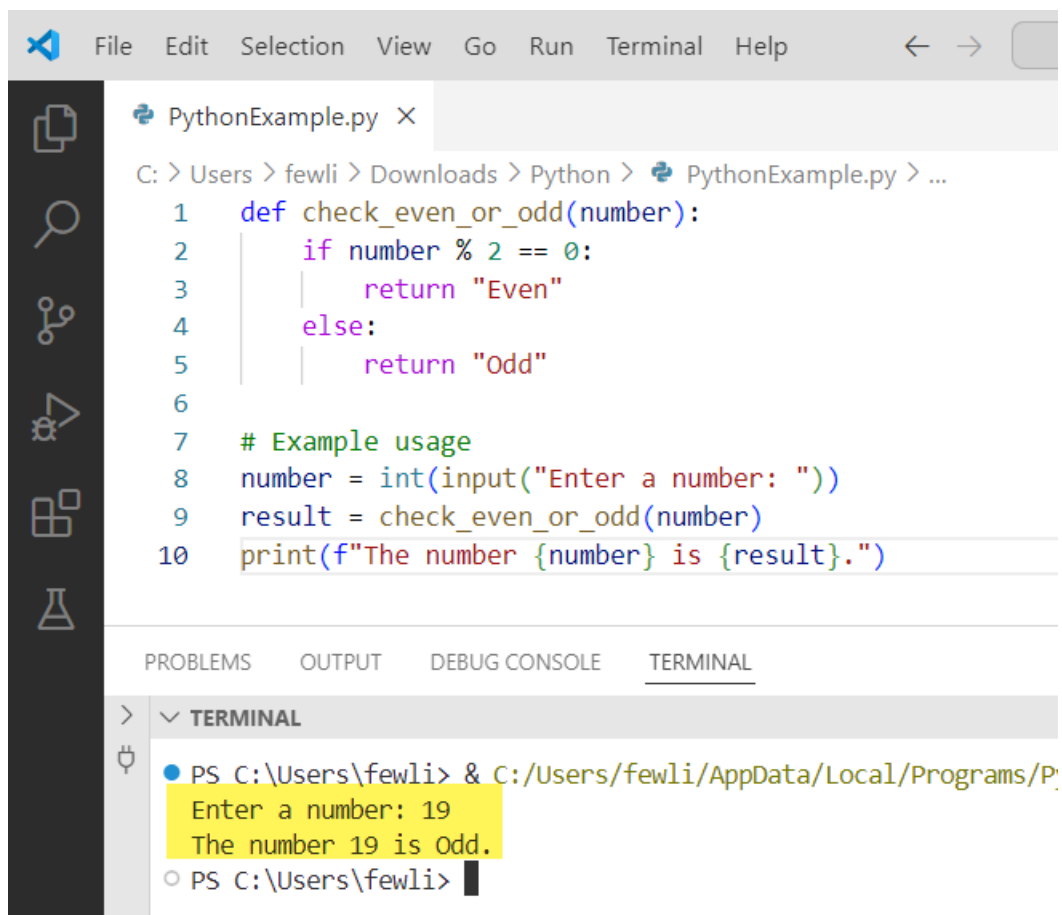
Let's say the user inputs the number 7.

- The program will call `check_even_or_odd(7)`.
- Inside the function, it checks `7 % 2`, which equals 1 (not 0), so it returns "Odd".
- The output will be: "The number 7 is Odd."

Similarly, if the user inputs the number 8:

- The program will call `check_even_or_odd(8)`.
- Inside the function, it checks `8 % 2`, which equals 0, so it returns "Even".
- The output will be: "The number 8 is Even."

Here is the exact output in the screenshot below:



The screenshot shows a code editor window with a file named `PythonExample.py`. The code defines a function `check_even_or_odd` that checks if a number is even or odd. It also includes an example usage where the user enters 19, and the program outputs "The number 19 is Odd." The terminal output is highlighted in yellow.

```
File Edit Selection View Go Run Terminal Help
PythonExample.py X
C:\Users\fewli\Downloads\Python> PythonExample.py > ...
1 def check_even_or_odd(number):
2     if number % 2 == 0:
3         return "Even"
4     else:
5         return "Odd"
6
7 # Example usage
8 number = int(input("Enter a number: "))
9 result = check_even_or_odd(number)
10 print(f"The number {number} is {result}.")

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
> TERMINAL
• PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/P
Enter a number: 19
The number 19 is Odd.
○ PS C:\Users\fewli> █
```

18# PYTHON PROGRAM TO FIND REPEATED WORDS IN A STRING

To find repeated words in a string in Python, you can use a dictionary to count the occurrences of each word. This method involves splitting the string into words, counting each word's occurrences, and then identifying which words appear more than once.

Here is a Python program to find repeated words in a string:

```
def find_repeated_words(input_string):
    # Split the string into words
    words = input_string.split()

    # Create a dictionary to count occurrences of each word
    word_count = {}
```

```
for word in words:
    # Convert word to lowercase to make the count case-insensitive
    word = word.lower()
    if word in word_count:
        word_count[word] += 1
    else:
        word_count[word] = 1

# Find words that are repeated
repeated_words = {word: count for word, count in word_count.items() if
count > 1}

return repeated_words

# Example usage
input_string = "This is a test. This test is only a test."
repeated_words = find_repeated_words(input_string)
print("Repeated words and their counts:", repeated_words)
```

Explanation

1. Define `find_repeated_words` function: This function takes an `input_string` as an argument.
 - It splits the string into words using the `split()` method, which by default splits by whitespace.
2. Create a Dictionary to Count Words:
 - It initializes an empty dictionary `word_count` to store the count of each word.
 - It iterates over each word in the list of words, converts each word to lowercase (to make the counting case-insensitive), and updates the word count in the dictionary.
3. Identify Repeated Words:
 - It uses a dictionary comprehension to create a new dictionary `repeated_words` that contains only the words that have a count greater than 1.
4. Return Repeated Words: The function returns the `repeated_words` dictionary.

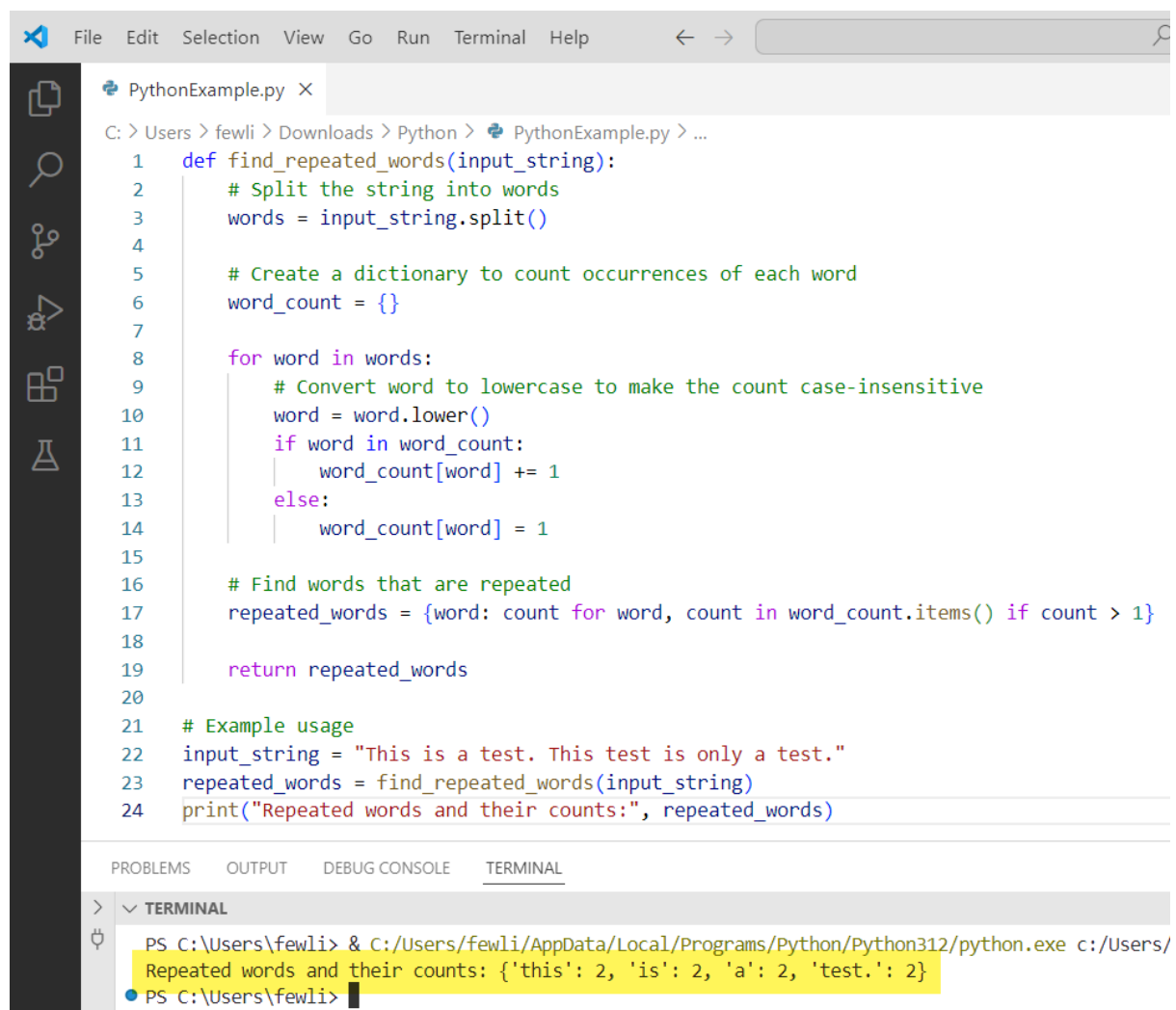
Example

Let's say the input string is:

"This is a test. This test is only a test."

- The program splits the string into words: ["This", "is", "a", "test.", "This", "test", "is", "only", "a", "test."].
- It converts each word to lowercase and counts the occurrences:
 - {'this': 2, 'is': 2, 'a': 2, 'test.': 2, 'test': 1, 'only': 1}
- The program identifies the repeated words: {'this': 2, 'is': 2, 'a': 2, 'test.': 2}.
- The output will be: Repeated words and their counts: {'this': 2, 'is': 2, 'a': 2, 'test.': 2}.

Here is the exact output in the screenshot below:



```
File Edit Selection View Go Run Terminal Help
PythonExample.py X
C:\Users\fewli> Downloads > Python > PythonExample.py > ...
1 def find_repeated_words(input_string):
2     # Split the string into words
3     words = input_string.split()
4
5     # Create a dictionary to count occurrences of each word
6     word_count = {}
7
8     for word in words:
9         # Convert word to lowercase to make the count case-insensitive
10        word = word.lower()
11        if word in word_count:
12            word_count[word] += 1
13        else:
14            word_count[word] = 1
15
16        # Find words that are repeated
17        repeated_words = {word: count for word, count in word_count.items() if count > 1}
18
19    return repeated_words
20
21 # Example usage
22 input_string = "This is a test. This test is only a test."
23 repeated_words = find_repeated_words(input_string)
24 print("Repeated words and their counts:", repeated_words)

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
> TERMINAL
PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python312/python.exe c:/Users/
Repeated words and their counts: {'this': 2, 'is': 2, 'a': 2, 'test.': 2}
PS C:\Users\fewli>
```

19# PYTHON PROGRAM FOR NUMBER GUESSING GAME

A number guessing game in Python involves the computer generating a random number within a specified range, and the user attempting to guess that number. The program provides feedback on whether the guess is too high, too low, or correct, and continues until the user guesses the number correctly.

Here is a simple implementation of a number guessing game in Python:

```
import random

def number_guessing_game():
    # Generate a random number between 1 and 100
    number_to_guess = random.randint(1, 100)

    # Initialize the number of attempts
    attempts = 0

    while True:
        # Prompt the user to enter a guess
        guess = int(input("Guess a number between 1 and 100: "))

        # Increment the number of attempts
        attempts += 1

        # Check if the guess is correct
        if guess < number_to_guess:
            print("Too low! Try again.")
        elif guess > number_to_guess:
            print("Too high! Try again.")
        else:
            print(f"Congratulations! You guessed the number in {attempts}
attempts.")
            break

# Start the game
number_guessing_game()
```

Explanation

1. Import random module: This module is used to generate a random number.
2. Define number_guessing_game function: This function contains the logic for the game.

- Generate a Random Number: `random.randint(1, 100)` generates a random integer between 1 and 100.
 - Initialize Attempts: A variable `attempts` is initialized to count the number of guesses.
3. Game Loop: A `while True` loop is used to repeatedly prompt the user for a guess until the correct number is guessed.
- User Input: The user is prompted to enter a guess, which is converted to an integer.
 - Increment Attempts: The number of attempts is incremented each time the user makes a guess.
 - Provide Feedback: The program checks if the guess is too low, too high, or correct:
 - If the guess is less than the number to guess, it prints "Too low! Try again."
 - If the guess is greater than the number to guess, it prints "Too high! Try again."
 - If the guess is correct, it prints a congratulatory message with the number of attempts and breaks out of the loop.

Example

When you run the program, it might look something like this:

Guess a number between 1 and 100: 50

Too high! Try again.

Guess a number between 1 and 100: 25

Too low! Try again.

Guess a number between 1 and 100: 37

Too high! Try again.

Guess a number between 1 and 100: 31

Congratulations! You guessed the number in 4 attempts.

20# PYTHON PROGRAM TO PRINT A STAR PATTERN

Printing star patterns is a common exercise in programming, often used to practice nested loops. There are various star patterns you can print, such as right-angled triangles, pyramids, diamonds, and more. Here, I'll explain how to print a simple right-angled triangle star pattern in Python.

Right-Angled Triangle Star Pattern

A right-angled triangle star pattern looks like this for 5 rows:

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

Here is a Python program to print this pattern:

```
def print_right_angled_triangle(rows):  
    for i in range(1, rows + 1):  
        print('*' * i)  
  
# Example usage  
rows = int(input("Enter the number of rows: "))  
print_right_angled_triangle(rows)
```

Explanation

1. Define print_right_angled_triangle Function:

- This function takes one argument, rows, which specifies the number of rows in the triangle.
- It uses a for loop to iterate from 1 to rows (inclusive).
- In each iteration, it prints a string consisting of i asterisks ('*' * i).

2. User Input:

- The program prompts the user to enter the number of rows for the triangle.

- The input is read as a string and then converted to an integer using `int()`.

3. Print the Pattern:

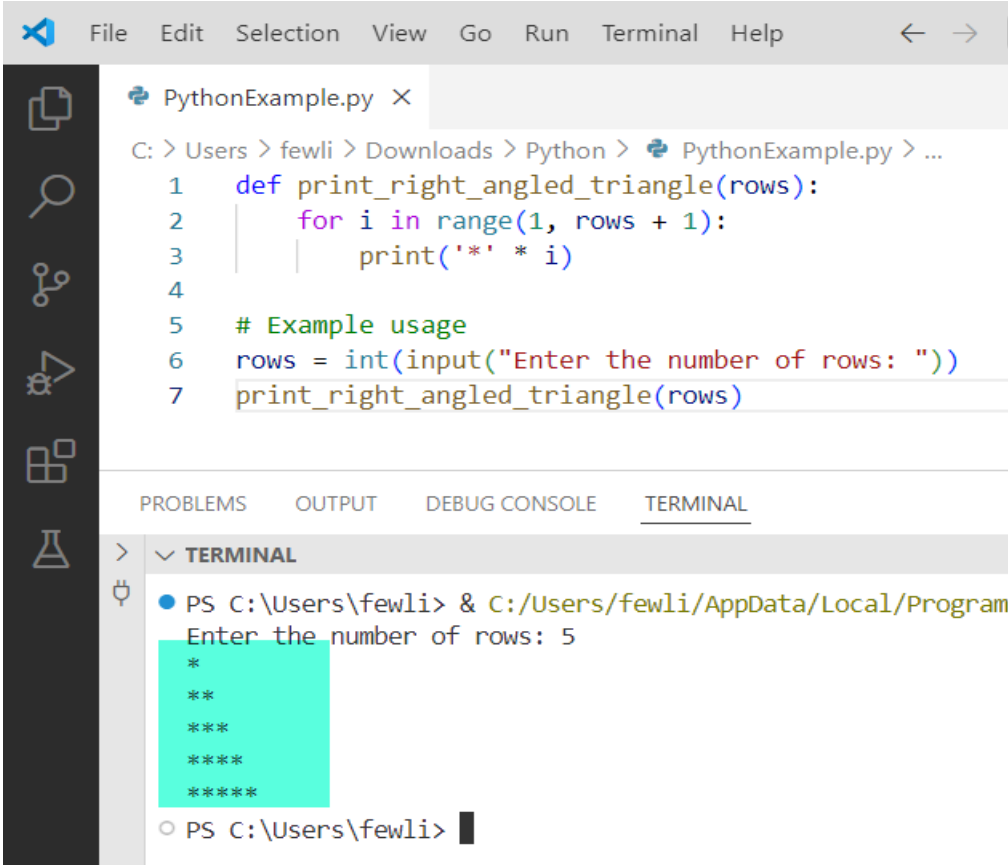
- The program calls the `print_right_angled_triangle` function with the user-provided number of rows.
- The function prints the star pattern.

Example Output

If the user inputs 5, the output will be:

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

Here is the exact output:



The screenshot shows a code editor window with a file named `PythonExample.py`. The code defines a function `print_right_angled_triangle` that takes a number of rows and prints a right-angled triangle of stars. The code also includes an example usage where it prompts the user for the number of rows and calls the function.

```
1 def print_right_angled_triangle(rows):
2     for i in range(1, rows + 1):
3         print('*' * i)
4
5 # Example usage
6 rows = int(input("Enter the number of rows: "))
7 print_right_angled_triangle(rows)
```

The terminal output shows the program running and the user entering 5, resulting in the star pattern:

```
PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Program
Enter the number of rows: 5
*
**
***
****
*****
PS C:\Users\fewli>
```

Pyramid Star Pattern

A pyramid star pattern looks like this for 5 rows:

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

Here is a Python program to print this pattern:

```
def print_pyramid(rows):  
    for i in range(1, rows + 1):  
        # Print leading spaces  
        print(' ' * (rows - i), end='')  
        # Print stars  
        print('*' * (2 * i - 1))  
  
# Example usage  
rows = int(input("Enter the number of rows: "))  
print_pyramid(rows)
```

Explanation

1. Define print_pyramid Function:

- This function takes one argument, rows, which specifies the number of rows in the pyramid.
- It uses a for loop to iterate from 1 to rows (inclusive).
- In each iteration, it prints leading spaces (' ' * (rows - i)) to center the stars.
- It then prints the stars ('*' * (2 * i - 1)), where the number of stars in each row is 2 * i - 1.

2. User Input:

- The program prompts the user to enter the number of rows for the pyramid.
- The input is read as a string and then converted to an integer using int().

3. Print the Pattern:

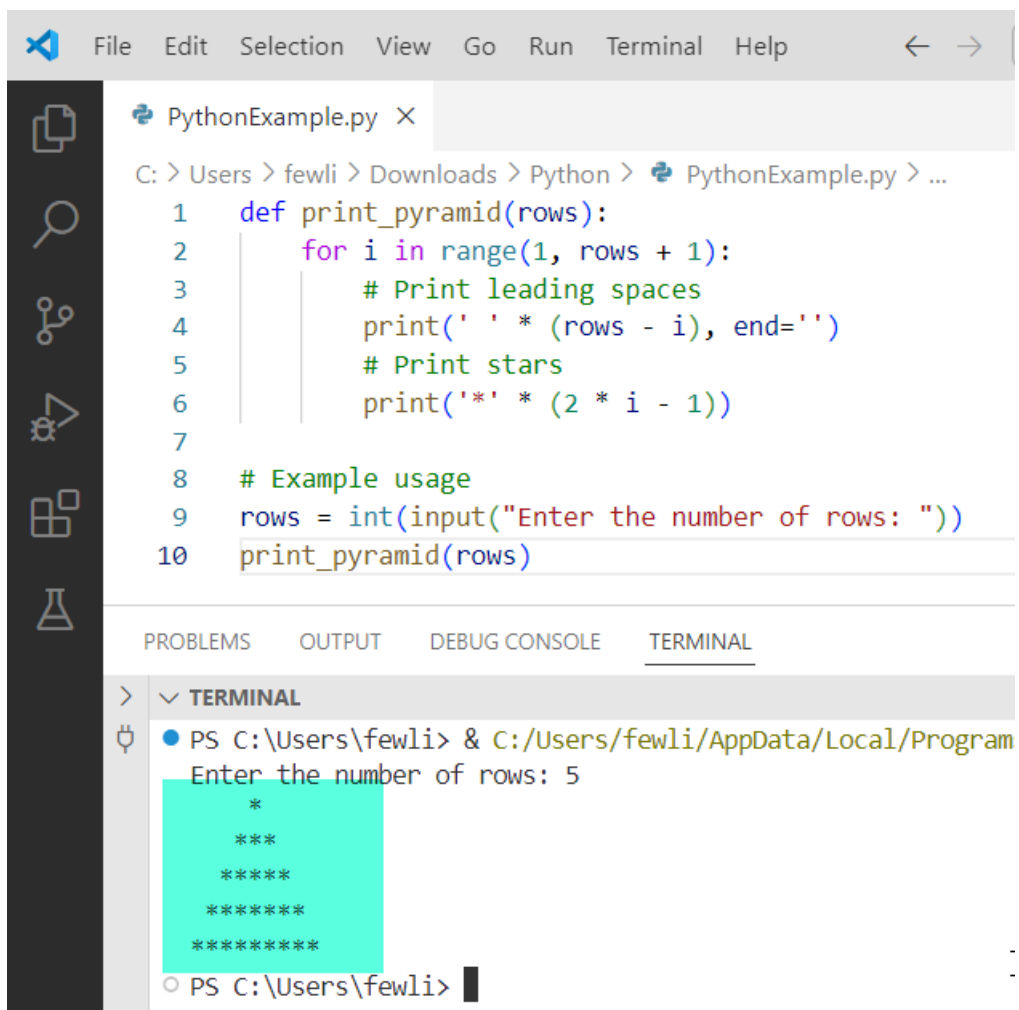
- The program calls the print_pyramid function with the user-provided number of rows.
- The function prints the star pattern.

Example Output

If the user inputs 5, the output will be:

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

Here is the exact output in the screenshot below:



The screenshot shows a code editor window with a Python file named 'PythonExample.py'. The code defines a function 'print_pyramid' that takes 'rows' as an argument. It uses a 'for' loop to iterate from 1 to 'rows'. Inside the loop, it prints leading spaces (' ' * (rows - i)) followed by stars ('*' * (2 * i - 1)). Below the function, there is an example usage where the user is prompted to enter the number of rows, and the function is called with that input. The terminal output shows the program running, the user entering '5', and the resulting star pattern being printed.

```
File Edit Selection View Go Run Terminal Help  
PythonExample.py X  
C: > Users > fewli > Downloads > Python > PythonExample.py > ...  
1 def print_pyramid(rows):  
2     for i in range(1, rows + 1):  
3         # Print leading spaces  
4         print(' ' * (rows - i), end='')  
5         # Print stars  
6         print('*' * (2 * i - 1))  
7  
8 # Example usage  
9 rows = int(input("Enter the number of rows: "))  
10 print_pyramid(rows)  
  
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL  
TERMINAL  
PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Program  
Enter the number of rows: 5  
*  
***  
*****  
*****  
*****  
PS C:\Users\fewli>
```

21# PYTHON PROGRAM TO PRINT DIAMOND PATTERN

A diamond star pattern looks like this for 5 rows (9 total rows):

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

Here is a Python program to print this pattern:

Explanation

1. Define print_diamond Function:

- This function takes one argument, rows, which specifies the number of rows in the upper half of the diamond.
- It first prints the upper pyramid using a for loop from 1 to rows (inclusive).
- It then prints the lower inverted pyramid using a for loop from rows - 1 to 1 (inclusive, in reverse order).

2. User Input:

- The program prompts the user to enter the number of rows for the diamond.
- The input is read as a string and then converted to an integer using int().

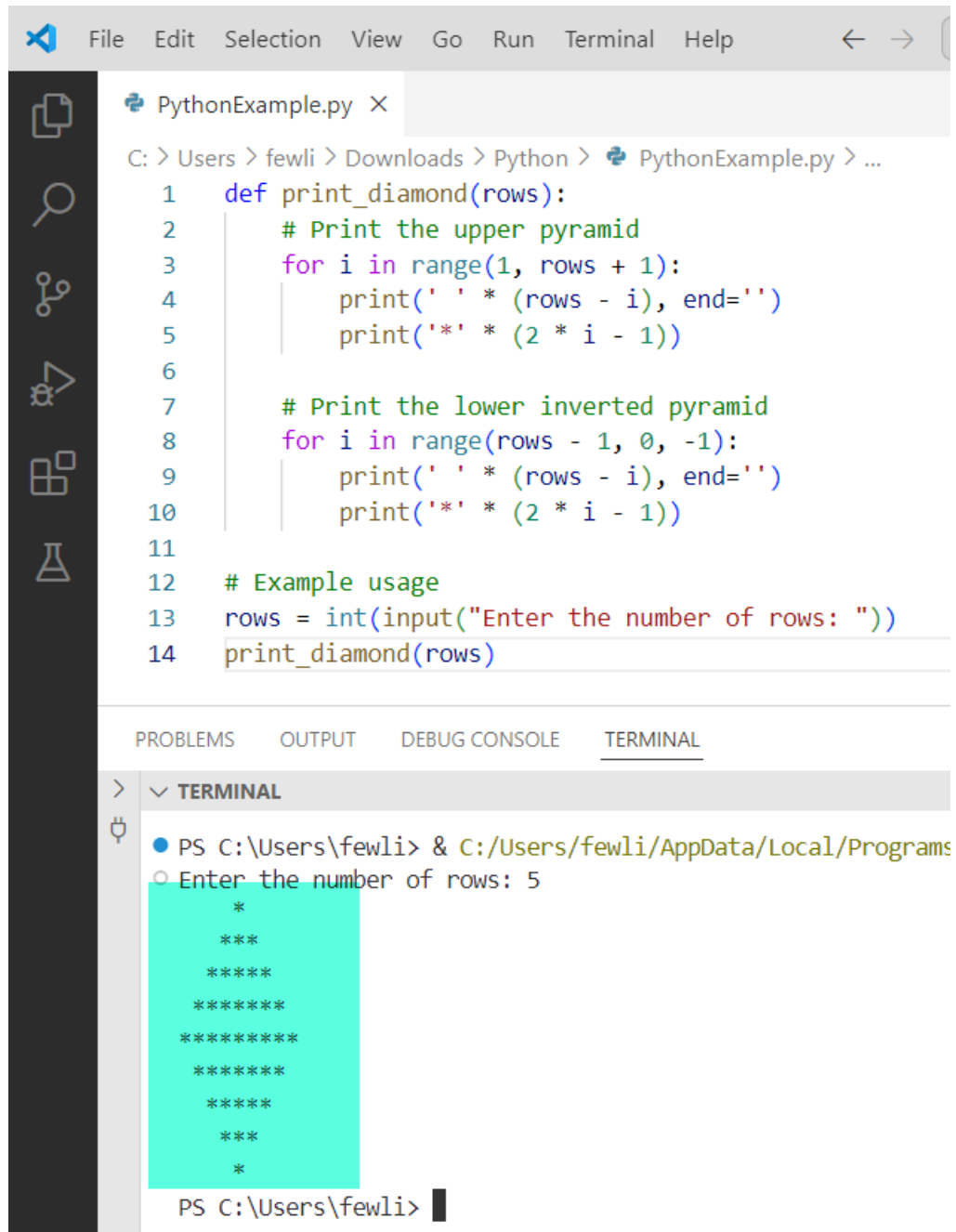
3. Print the Pattern:

- The program calls the print_diamond function with the user-provided number of rows.

- The function prints the star pattern.

Example Output

If the user inputs 5, the output will be:



The screenshot shows a Python IDE with a file named 'PythonExample.py'. The code defines a function 'print_diamond(rows)' that prints a diamond pattern of stars. The function consists of two loops: one for the upper pyramid and one for the lower inverted pyramid. An example usage is provided where the user is prompted to enter the number of rows, and the function is called with that input. The terminal output shows the diamond pattern for 5 rows, which is highlighted in cyan.

```
1 def print_diamond(rows):
2     # Print the upper pyramid
3     for i in range(1, rows + 1):
4         print(' ' * (rows - i), end='')
5         print('*' * (2 * i - 1))
6
7     # Print the lower inverted pyramid
8     for i in range(rows - 1, 0, -1):
9         print(' ' * (rows - i), end='')
10        print('*' * (2 * i - 1))
11
12 # Example usage
13 rows = int(input("Enter the number of rows: "))
14 print_diamond(rows)
```

PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs
Enter the number of rows: 5

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

PS C:\Users\fewli>

22# PYTHON PROGRAM TO PRINT MULTIPLICATION TABLE

Printing a multiplication table in Python can be done using nested loops. Here is a Python program to print the multiplication table for a given number:

```
def print_multiplication_table(number, up_to=10):
```

```
for i in range(1, up_to + 1):
    print(f"{number} x {i} = {number * i}")

# Example usage
number = int(input("Enter the number for which you want the multiplication
table: "))
print_multiplication_table(number)
```

Explanation

1. Define print_multiplication_table Function:

- This function takes two arguments: number (the number for which the multiplication table is to be printed) and up_to (the range up to which the table should be printed, default is 10).
- It uses a for loop to iterate from 1 to up_to (inclusive).
- In each iteration, it calculates the product of number and i, and prints it in the format number x i = product.

2. User Input:

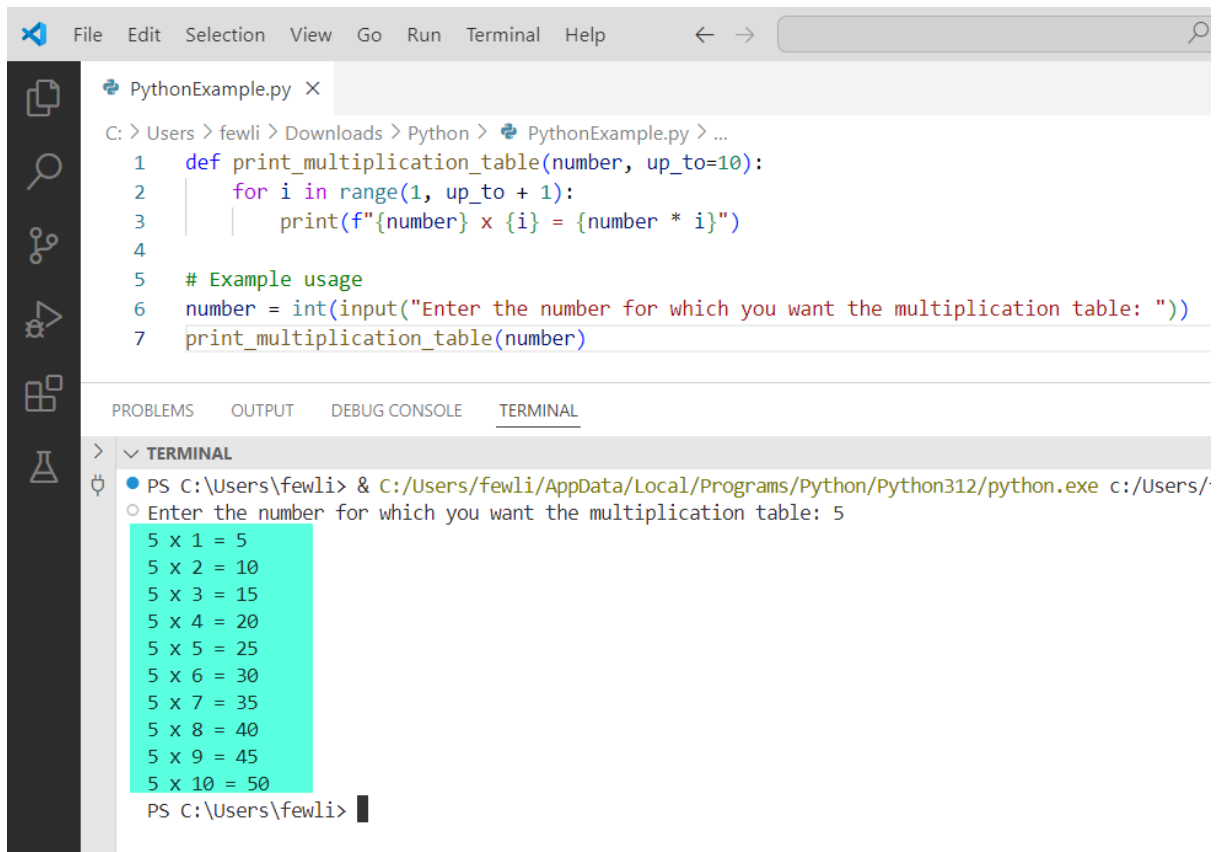
- The program prompts the user to enter the number for which they want the multiplication table.
- The input is read as a string and then converted to an integer using int().

3. Print the Multiplication Table:

- The program calls the print_multiplication_table function with the user-provided number.
- The function prints the multiplication table for the specified number.

Example Output

If the user inputs 5, the output will be:



```
PythonExample.py X
C: > Users > fewli > Downloads > Python > PythonExample.py > ...
1 def print_multiplication_table(number, up_to=10):
2     for i in range(1, up_to + 1):
3         print(f"{number} x {i} = {number * i}")
4
5 # Example usage
6 number = int(input("Enter the number for which you want the multiplication table: "))
7 print_multiplication_table(number)

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
> v TERMINAL
• PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python312/python.exe c:/Users/fewli/Downloads/PythonExample.py
o Enter the number for which you want the multiplication table: 5
5 x 1 = 5
5 x 2 = 10
5 x 3 = 15
5 x 4 = 20
5 x 5 = 25
5 x 6 = 30
5 x 7 = 35
5 x 8 = 40
5 x 9 = 45
5 x 10 = 50
PS C:\Users\fewli>
```

23# PYTHON PROGRAM FOR MULTIPLICATION TABLES FOR NUMBERS 1 THROUGH 10

Here is a Python program to print the multiplication tables for numbers 1 through 10:

```
def print_all_multiplication_tables(up_to=10):
    for number in range(1, up_to + 1):
        print(f"Multiplication Table for {number}")
        for i in range(1, up_to + 1):
            print(f"{number} x {i} = {number * i}")
        print() # Print a blank line between tables

# Example usage
print_all_multiplication_tables()
```

Explanation

1. Define print_all_multiplication_tables Function:

- This function takes one optional argument up_to (the range up to which the tables should be printed, default is 10).
- It uses a nested for loop:

- The outer loop iterates over each number from 1 to up_to (inclusive).
- The inner loop iterates from 1 to up_to (inclusive) for each number.
- In each iteration of the inner loop, it calculates the product of number and i, and prints it in the format number x i = product.
- After each table, it prints a blank line for better readability.

2. Print the Multiplication Tables:

- The program calls the print_all_multiplication_tables function.
- The function prints the multiplication tables for numbers 1 through 10.

Example Output

The output will be:

The image shows a Python IDE window with a file named 'PythonExample.py'. The code defines a function to print multiplication tables for numbers 1 through 10. The terminal output shows the execution of this function, displaying two multiplication tables: one for the number 1 and one for the number 2. The output is highlighted in a light blue box.

```

PythonExample.py X
C: > Users > fewli > Downloads > Python > PythonExample.py > ...
1 def print_all_multiplication_tables(up_to=10):
2     for number in range(1, up_to + 1):
3         print(f"Multiplication Table for {number}")
4         for i in range(1, up_to + 1):
5             print(f"{number} x {i} = {number * i}")
6         print() # Print a blank line between tables
7
8 # Example usage
9 print_all_multiplication_tables()

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
> ▼ TERMINAL
• PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Pytho
Multiplication Table for 1
1 x 1 = 1
1 x 2 = 2
1 x 3 = 3
1 x 4 = 4
1 x 5 = 5
1 x 6 = 6
1 x 7 = 7
1 x 8 = 8
1 x 9 = 9
1 x 10 = 10

Multiplication Table for 2
2 x 1 = 2
2 x 2 = 4
2 x 3 = 6
2 x 4 = 8
2 x 5 = 10
2 x 6 = 12
2 x 7 = 14
2 x 8 = 16
2 x 9 = 18
2 x 10 = 20

```

24# PYTHON PROGRAM FOR COMPOUND INTEREST

To calculate compound interest in Python, you need to use the compound interest formula. The formula for compound interest is:

$$[A = P \left(1 + \frac{r}{n} \right)^{nt}]$$

Where:

- (A) is the amount of money accumulated after n years, including interest.
- (P) is the principal amount (the initial amount of money).
- (r) is the annual interest rate (in decimal form).
- (n) is the number of times that interest is compounded per year.
- (t) is the time the money is invested for, in years.

The compound interest (CI) can be calculated as:

$$[CI = A - P]$$

Here is a Python program to calculate compound interest:

```
def calculate_compound_interest(principal, rate, times_compounded, years):
    # Calculate the amount after the given number of years
    amount = principal * (1 + rate / times_compounded) ** (times_compounded *
years)

    # Calculate the compound interest
    compound_interest = amount - principal

    return amount, compound_interest

# Example usage
principal = float(input("Enter the principal amount: "))
rate = float(input("Enter the annual interest rate (as a percentage): ")) /
100
times_compounded = int(input("Enter the number of times interest is compounded
per year: "))
years = float(input("Enter the number of years the money is invested for: "))

amount, compound_interest = calculate_compound_interest(principal, rate,
times_compounded, years)
print(f"The amount after {years} years is: {amount:.2f}")
print(f"The compound interest is: {compound_interest:.2f}")
```

Explanation

1. Define calculate_compound_interest Function:

- This function takes four arguments:
 - principal: The initial amount of money (P).

- rate: The annual interest rate as a decimal (r).
- times_compounded: The number of times interest is compounded per year (n).
- years: The time the money is invested for, in years (t).
- It calculates the amount after the given number of years using the compound interest formula: $[A = P \left(1 + \frac{r}{n}\right)^{nt}]$
- It calculates the compound interest by subtracting the principal from the amount: $[CI = A - P]$
- It returns both the amount and the compound interest.

2. User Input:

- The program prompts the user to enter the principal amount.
- The input is read as a string and then converted to a floating-point number using `float()`.
- The program prompts the user to enter the annual interest rate as a percentage.
- The input is read as a string, converted to a floating-point number, and then divided by 100 to convert it to a decimal.
- The program prompts the user to enter the number of times interest is compounded per year.
- The input is read as a string and then converted to an integer using `int()`.
- The program prompts the user to enter the number of years the money is invested for.
- The input is read as a string and then converted to a floating-point number using `float()`.

3. Calculate and Print:

- The program calls the `calculate_compound_interest` function with the user-provided values.

- It prints the amount after the given number of years, formatted to two decimal places.
- It prints the compound interest, formatted to two decimal places.

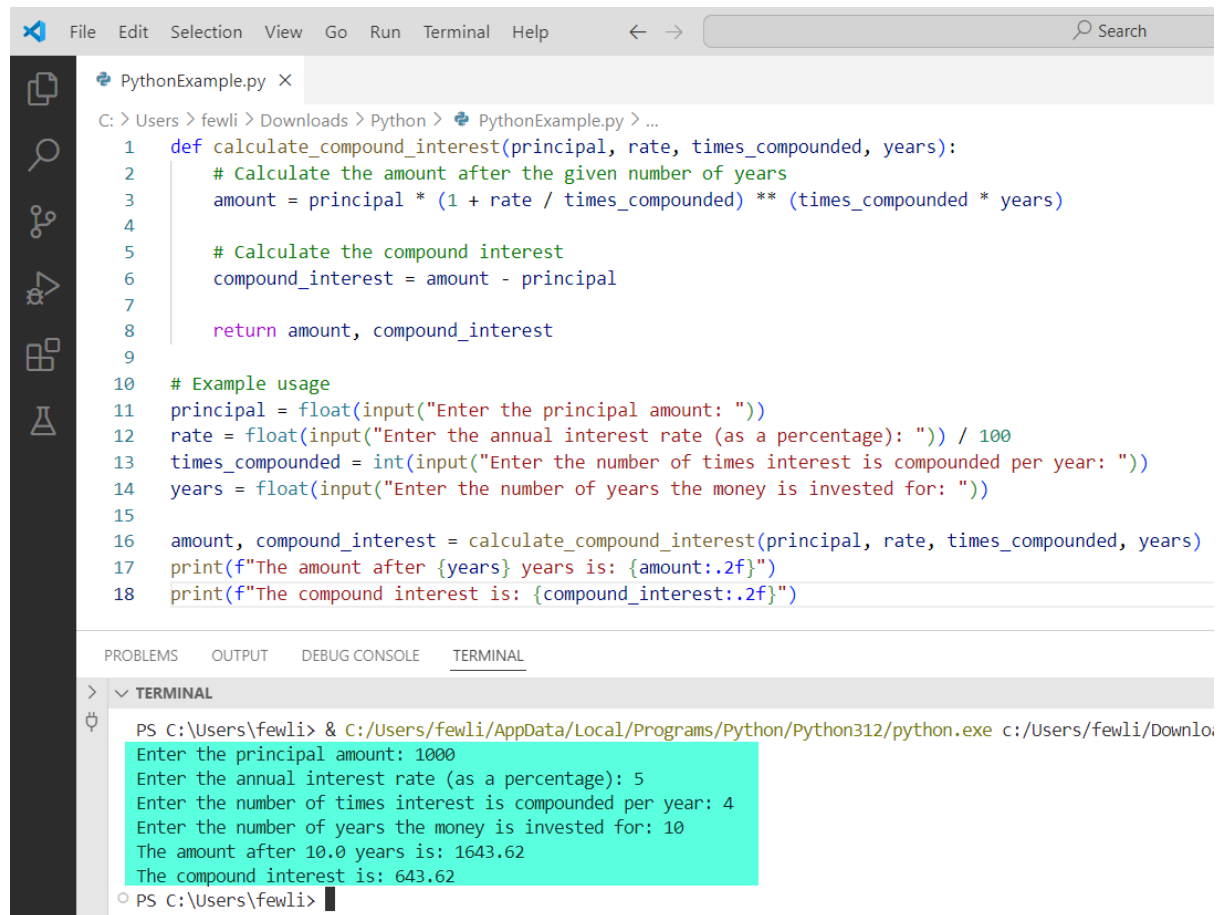
Example

Let's say the user inputs the following values:

- Principal amount: \$1000
- Annual interest rate: 5%
- Times compounded per year: 4
- Number of years: 10
- The program will call `calculate_compound_interest(1000, 0.05, 4, 10)`.
- Inside the function:
 - It calculates the amount: [$A = 1000 \left(1 + \frac{0.05}{4}\right)^{4 \times 10} = 1000 \left(1 + 0.0125\right)^{40} \approx 1647.01$]
 - It calculates the compound interest: [$CI = 1647.01 - 1000 = 647.01$]
- The output will be:
- The amount after 10.0 years is: 1647.01

The compound interest is: 647.01

Here is the exact output:



```

PythonExample.py X
C: > Users > fewli > Downloads > Python > PythonExample.py > ...
1  def calculate_compound_interest(principal, rate, times_compounded, years):
2      # Calculate the amount after the given number of years
3      amount = principal * (1 + rate / times_compounded) ** (times_compounded * years)
4
5      # Calculate the compound interest
6      compound_interest = amount - principal
7
8      return amount, compound_interest
9
10 # Example usage
11 principal = float(input("Enter the principal amount: "))
12 rate = float(input("Enter the annual interest rate (as a percentage): ") / 100)
13 times_compounded = int(input("Enter the number of times interest is compounded per year: "))
14 years = float(input("Enter the number of years the money is invested for: "))
15
16 amount, compound_interest = calculate_compound_interest(principal, rate, times_compounded, years)
17 print(f"The amount after {years} years is: {amount:.2f}")
18 print(f"The compound interest is: {compound_interest:.2f}")

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
> TERMINAL
PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python312/python.exe c:/Users/fewli/Downlo
Enter the principal amount: 1000
Enter the annual interest rate (as a percentage): 5
Enter the number of times interest is compounded per year: 4
Enter the number of years the money is invested for: 10
The amount after 10.0 years is: 1643.62
The compound interest is: 643.62
PS C:\Users\fewli>

```

25# PYTHON PROGRAM TO CONVERT CELSIUS TO FAHRENHEIT

To convert a temperature from Celsius to Fahrenheit, you can use the following formula:

$$[\text{Fahrenheit}] = (\text{Celsius}) \times \frac{9}{5} + 32$$

Here is a Python program to perform this conversion:

```

def celsius_to_fahrenheit(celsius):
    fahrenheit = (celsius * 9/5) + 32
    return fahrenheit

# Example usage
celsius = float(input("Enter temperature in Celsius: "))
fahrenheit = celsius_to_fahrenheit(celsius)
print(f"{celsius} degrees Celsius is equal to {fahrenheit:.2f} degrees Fahrenheit.")

```

Explanation

1. Define celsius_to_fahrenheit Function:

- This function takes a temperature in Celsius as an argument.

- It applies the conversion formula ($(\text{Celsius} \times \frac{9}{5}) + 32$) to calculate the equivalent temperature in Fahrenheit.
- It returns the calculated Fahrenheit temperature.

2. User Input:

- The program prompts the user to enter a temperature in Celsius.
- The input is read as a string and then converted to a floating-point number using `float()`.

3. Convert and Print:

- The program calls the `celsius_to_fahrenheit` function with the user-provided Celsius temperature.
- It prints the result, formatted to two decimal places.

Example

Let's say the user inputs a temperature of 25 degrees Celsius.

- The program will call `celsius_to_fahrenheit(25)`.
- Inside the function, it calculates $(25 \times \frac{9}{5}) + 32 = 77$ degrees Fahrenheit.
- The output will be: "25.0 degrees Celsius is equal to 77.00 degrees Fahrenheit."

Here is the exact output you can see in the screenshot below:

```

PythonExample.py X
C: > Users > fewli > Downloads > Python > PythonExample.py > ...
1 def celsius_to_fahrenheit(celsius):
2     fahrenheit = (celsius * 9/5) + 32
3     return fahrenheit
4
5 # Example usage
6 celsius = float(input("Enter temperature in Celsius: "))
7 fahrenheit = celsius_to_fahrenheit(celsius)
8 print(f"{celsius} degrees Celsius is equal to {fahrenheit:.2f} degrees Fahrenheit.")

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
> v TERMINAL
• PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python312/python.exe c:/Users,
Enter temperature in Celsius: 25
25.0 degrees Celsius is equal to 77.00 degrees Fahrenheit.
○ PS C:\Users\fewli>

```

26# PYTHON PROGRAM TO CONVERT FAHRENHEIT INTO CELSIUS

To convert a temperature from Fahrenheit to Celsius, you can use the following formula:

$$[\text{Celsius}] = (\text{Fahrenheit} - 32) \times \frac{5}{9}]$$

Here is a Python program to perform this conversion:

```

def fahrenheit_to_celsius(fahrenheit):
    celsius = (fahrenheit - 32) * 5/9
    return celsius

# Example usage
fahrenheit = float(input("Enter temperature in Fahrenheit: "))
celsius = fahrenheit_to_celsius(fahrenheit)
print(f"{fahrenheit} degrees Fahrenheit is equal to {celsius:.2f} degrees Celsius.")

```

Explanation

1. Define fahrenheit_to_celsius Function:

- This function takes a temperature in Fahrenheit as an argument.
- It applies the conversion formula $(\text{Fahrenheit} - 32) \times \frac{5}{9}$ to calculate the equivalent temperature in Celsius.

- It returns the calculated Celsius temperature.

2. User Input:

- The program prompts the user to enter a temperature in Fahrenheit.
- The input is read as a string and then converted to a floating-point number using `float()`.

3. Convert and Print:

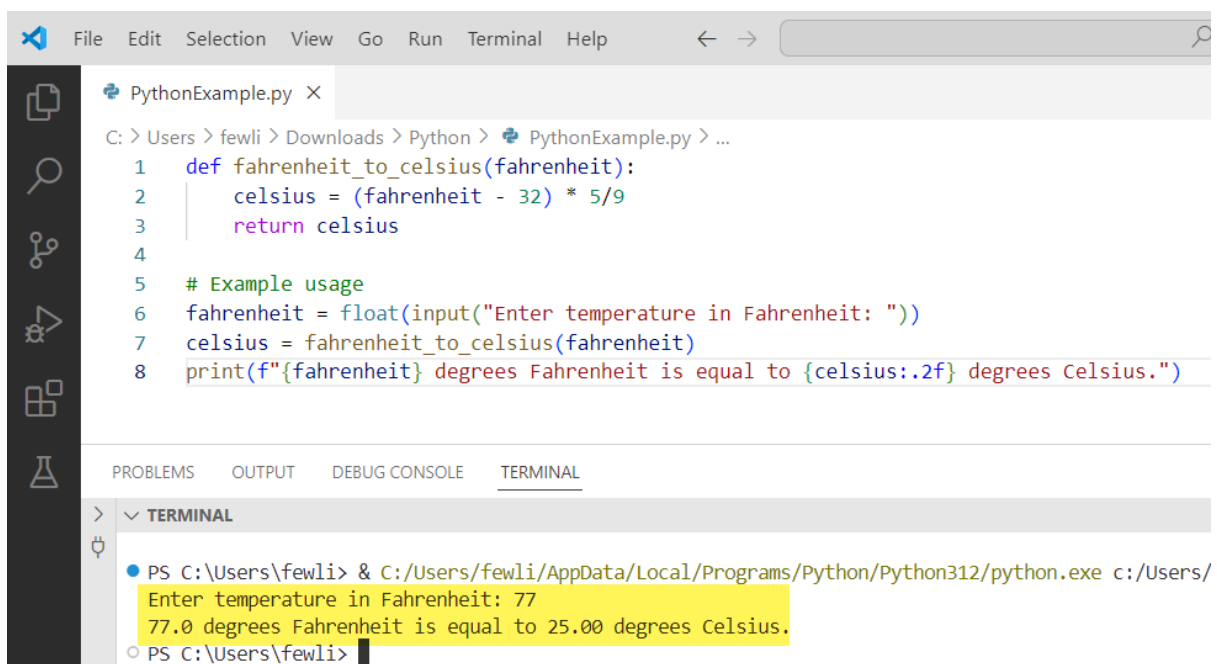
- The program calls the `fahrenheit_to_celsius` function with the user-provided Fahrenheit temperature.
- It prints the result, formatted to two decimal places.

Example

Let's say the user inputs a temperature of 77 degrees Fahrenheit.

- The program will call `fahrenheit_to_celsius(77)`.
- Inside the function, it calculates $(77 - 32) \times \frac{5}{9} = 25$ degrees Celsius.
- The output will be: "77.0 degrees Fahrenheit is equal to 25.00 degrees Celsius."

Here is the exact output:



```
File Edit Selection View Go Run Terminal Help
PythonExample.py X
C:\Users\fewli\Downloads\Python> PythonExample.py ...
1 def fahrenheit_to_celsius(fahrenheit):
2     celsius = (fahrenheit - 32) * 5/9
3     return celsius
4
5 # Example usage
6 fahrenheit = float(input("Enter temperature in Fahrenheit: "))
7 celsius = fahrenheit_to_celsius(fahrenheit)
8 print(f"{fahrenheit} degrees Fahrenheit is equal to {celsius:.2f} degrees Celsius.")

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
> TERMINAL
PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python312/python.exe c:/Users/
Enter temperature in Fahrenheit: 77
77.0 degrees Fahrenheit is equal to 25.00 degrees Celsius.
PS C:\Users\fewli>
```

27# PYTHON PROGRAM TO CONVERT KILOMETERS TO MILES

To convert a distance from kilometers to miles, you can use the following conversion factor:

$$[\text{Miles}] = [\text{Kilometers}] \times 0.621371$$

Here is a Python program to perform this conversion:

```
def kilometers_to_miles(kilometers):
    miles = kilometers * 0.621371
    return miles

# Example usage
kilometers = float(input("Enter distance in kilometers: "))
miles = kilometers_to_miles(kilometers)
print(f"{kilometers} kilometers is equal to {miles:.2f} miles.")
```

Explanation

1. Define kilometers_to_miles Function:

- This function takes a distance in kilometers as an argument.
- It applies the conversion factor ($[\text{Kilometers}] \times 0.621371$) to calculate the equivalent distance in miles.
- It returns the calculated distance in miles.

2. User Input:

- The program prompts the user to enter a distance in kilometers.
- The input is read as a string and then converted to a floating-point number using `float()`.

3. Convert and Print:

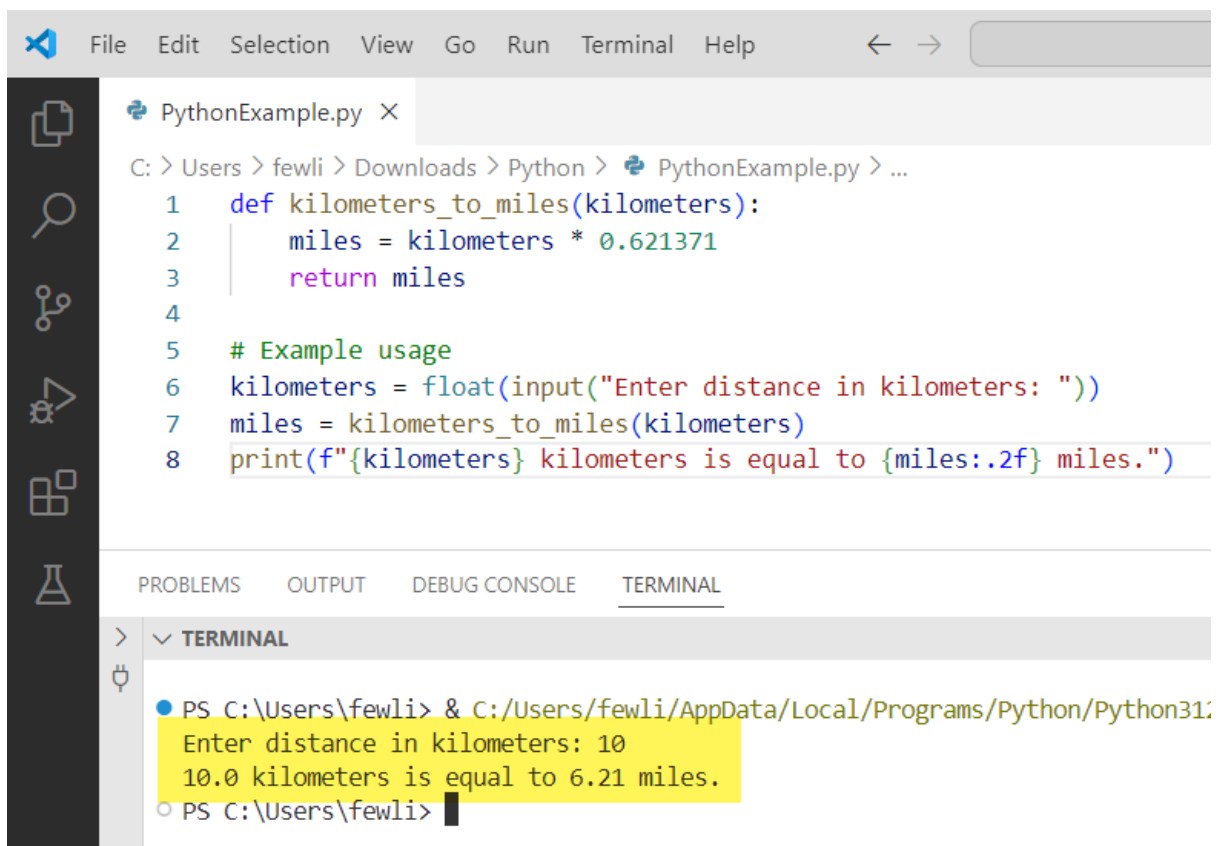
- The program calls the `kilometers_to_miles` function with the user-provided distance in kilometers.
- It prints the result, formatted to two decimal places.

Example

Let's say the user inputs a distance of 10 kilometers.

- The program will call kilometers_to_miles(10).
- Inside the function, it calculates (10 \times 0.621371 = 6.21371) miles.
- The output will be: "10.0 kilometers is equal to 6.21 miles."

Here is the exact output in the screenshot below:



```

PythonExample.py X
C: > Users > fewli > Downloads > Python > PythonExample.py > ...
1 def kilometers_to_miles(kilometers):
2     miles = kilometers * 0.621371
3     return miles
4
5 # Example usage
6 kilometers = float(input("Enter distance in kilometers: "))
7 miles = kilometers_to_miles(kilometers)
8 print(f"{kilometers} kilometers is equal to {miles:.2f} miles.")

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
> ▼ TERMINAL
• PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python31:
  Enter distance in kilometers: 10
  10.0 kilometers is equal to 6.21 miles.
○ PS C:\Users\fewli>

```

28# PYTHON PROGRAM TO CONVERT MILES TO KILOMETERS

To convert a distance from miles to kilometers, you can use the following conversion factor:

$$[\text{Kilometers}] = [\text{Miles}] \times 1.60934$$

Here is a Python program to perform this conversion:

```

def miles_to_kilometers(miles):
    kilometers = miles * 1.60934
    return kilometers

# Example usage
miles = float(input("Enter distance in miles: "))
kilometers = miles_to_kilometers(miles)
print(f"{miles} miles is equal to {kilometers:.2f} kilometers.")

```

Explanation

1. Define miles_to_kilometers Function:

- This function takes a distance in miles as an argument.
- It applies the conversion factor ($\text{Miles} \times 1.60934$) to calculate the equivalent distance in kilometers.
- It returns the calculated distance in kilometers.

2. User Input:

- The program prompts the user to enter a distance in miles.
- The input is read as a string and then converted to a floating-point number using `float()`.

3. Convert and Print:

- The program calls the `miles_to_kilometers` function with the user-provided distance in miles.
- It prints the result, formatted to two decimal places.

Example

Let's say the user inputs a distance of 5 miles.

- The program will call `miles_to_kilometers(5)`.
- Inside the function, it calculates ($5 \times 1.60934 = 8.0467$) kilometers.
- The output will be: "5.0 miles is equal to 8.05 kilometers."

Here is the exact output:

```

PythonExample.py X
C: > Users > fewli > Downloads > Python > PythonExample.py > ...
1  def miles_to_kilometers(miles):
2      kilometers = miles * 1.60934
3      return kilometers
4
5  # Example usage
6  miles = float(input("Enter distance in miles: "))
7  kilometers = miles_to_kilometers(miles)
8  print(f"{miles} miles is equal to {kilometers:.2f} kilometers.")

PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL
>
>
• PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python31
  Enter distance in miles: 5
  5.0 miles is equal to 8.05 kilometers.
○ PS C:\Users\fewli>

```

29# PYTHON PROGRAM TO CONVERT BITS TO MEGABYTES GIGABYTES AND TERABYTES

To convert bits to megabytes, gigabytes, and terabytes, you need to understand the following relationships:

1. Bits to Bytes: [$\text{Bytes} = \frac{\text{Bits}}{8}$]
2. Bytes to Kilobytes: [$\text{Kilobytes} = \frac{\text{Bytes}}{1024}$]
3. Kilobytes to Megabytes: [$\text{Megabytes} = \frac{\text{Kilobytes}}{1024}$]
4. Megabytes to Gigabytes: [$\text{Gigabytes} = \frac{\text{Megabytes}}{1024}$]
5. Gigabytes to Terabytes: [$\text{Terabytes} = \frac{\text{Gigabytes}}{1024}$]

Here is a Python program that performs these conversions:

```

def bits_to_other_units(bits):
    # Convert bits to bytes
    bytes = bits / 8

```

```
# Convert bytes to kilobytes
kilobytes = bytes / 1024

# Convert kilobytes to megabytes
megabytes = kilobytes / 1024

# Convert megabytes to gigabytes
gigabytes = megabytes / 1024

# Convert gigabytes to terabytes
terabytes = gigabytes / 1024

return megabytes, gigabytes, terabytes

# Example usage
bits = float(input("Enter the number of bits: "))
megabytes, gigabytes, terabytes = bits_to_other_units(bits)
print(f"{bits} bits is equal to {megabytes:.6f} megabytes, {gigabytes:.6f}
gigabytes, and {terabytes:.6f} terabytes.")
```

Explanation

1. Define bits_to_other_units Function:

- This function takes the number of bits as an argument.
- It converts bits to bytes by dividing by 8.
- It converts bytes to kilobytes by dividing by 1024.
- It converts kilobytes to megabytes by dividing by 1024.
- It converts megabytes to gigabytes by dividing by 1024.
- It converts gigabytes to terabytes by dividing by 1024.
- It returns the values in megabytes, gigabytes, and terabytes.

2. User Input:

- The program prompts the user to enter a number of bits.
- The input is read as a string and then converted to a floating-point number using float().

3. Convert and Print:

- The program calls the bits_to_other_units function with the user-provided number of bits.

- It prints the results, formatted to six decimal places.

Example

Let's say the user inputs 8000000000 bits.

- The program will call `bits_to_other_units(8000000000)`.
- Inside the function, it performs the following conversions:
 - ($\text{Bytes} = \frac{8000000000}{8} = 1000000000$)
 - ($\text{Kilobytes} = \frac{1000000000}{1024} \approx 976562.5$)
 - ($\text{Megabytes} = \frac{976562.5}{1024} \approx 953.674316$)
 - ($\text{Gigabytes} = \frac{953.674316}{1024} \approx 0.931323$)
 - ($\text{Terabytes} = \frac{0.931323}{1024} \approx 0.000909$)
- The output will be: "8000000000 bits is equal to 953.674316 megabytes, 0.931323 gigabytes, and 0.000909 terabytes."

Here is the exact output:

```

PythonExample.py X
C:\Users\fewli> Downloads\Python> PythonExample.py > ...
1 def bits_to_other_units(bits):
2     # Convert bits to bytes
3     bytes = bits / 8
4
5     # Convert bytes to kilobytes
6     kilobytes = bytes / 1024
7
8     # Convert kilobytes to megabytes
9     megabytes = kilobytes / 1024
10
11    # Convert megabytes to gigabytes
12    gigabytes = megabytes / 1024
13
14    # Convert gigabytes to terabytes
15    terabytes = gigabytes / 1024
16
17    return megabytes, gigabytes, terabytes
18
19 # Example usage
20 bits = float(input("Enter the number of bits: "))
21 megabytes, gigabytes, terabytes = bits_to_other_units(bits)
22 print(f"{bits} bits is equal to {megabytes:.6f} megabytes, {gigabytes:.6f} gigabytes, and {terabytes:.6f} terabytes.")

```

```

> TERMINAL
PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python312/python.exe c:/Users/fewli/Downloads/Python/PythonExample.py
Enter the number of bits: 8000000000
8000000000.0 bits is equal to 953.674316 megabytes, 0.931323 gigabytes, and 0.000909 terabytes.
PS C:\Users\fewli>

```

30# PYTHON PROGRAM TO CONVERT CENTIMETERS TO INCHES

To convert a length from centimeters to inches, you can use the following conversion factor:

$$[\text{Inches}] = [\text{Centimeters}] \times 0.393701]$$

Here is a Python program to perform this conversion:

```
def centimeters_to_inches(centimeters):
    inches = centimeters * 0.393701
    return inches

# Example usage
centimeters = float(input("Enter length in centimeters: "))
inches = centimeters_to_inches(centimeters)
print(f"{centimeters} centimeters is equal to {inches:.2f} inches.")
```

Explanation

1. Define centimeters_to_inches Function:

- This function takes a length in centimeters as an argument.
- It applies the conversion factor ($[\text{Centimeters}] \times 0.393701$) to calculate the equivalent length in inches.
- It returns the calculated length in inches.

2. User Input:

- The program prompts the user to enter a length in centimeters.
- The input is read as a string and then converted to a floating-point number using `float()`.

3. Convert and Print:

- The program calls the `centimeters_to_inches` function with the user-provided length in centimeters.
- It prints the result, formatted to two decimal places.

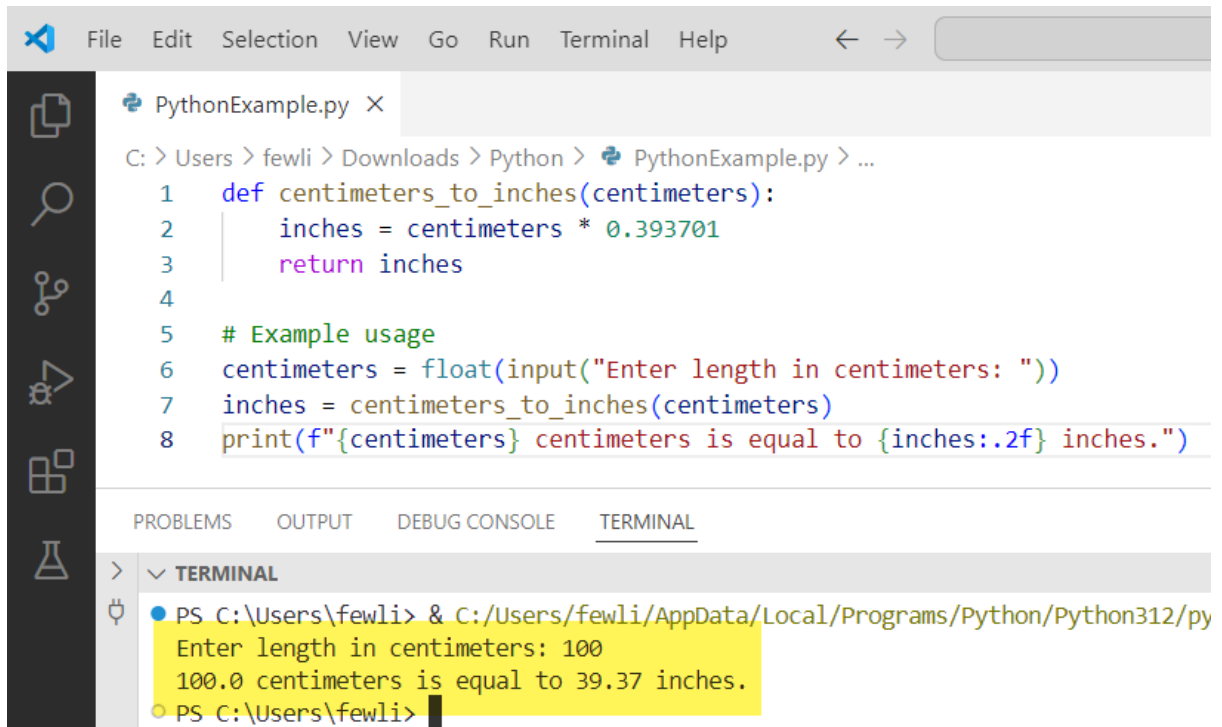
Example

Let's say the user inputs a length of 100 centimeters.

- The program will call `centimeters_to_inches(100)`.

- Inside the function, it calculates ($100 \times 0.393701 = 39.3701$) inches.
- The output will be: "100.0 centimeters is equal to 39.37 inches."

Here is the exact output:



```
File Edit Selection View Go Run Terminal Help
PythonExample.py X
C: > Users > fewli > Downloads > Python > PythonExample.py > ...
1 def centimeters_to_inches(centimeters):
2     inches = centimeters * 0.393701
3     return inches
4
5 # Example usage
6 centimeters = float(input("Enter length in centimeters: "))
7 inches = centimeters_to_inches(centimeters)
8 print(f"{centimeters} centimeters is equal to {inches:.2f} inches.")

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
> v TERMINAL
PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python312/py
Enter length in centimeters: 100
100.0 centimeters is equal to 39.37 inches.
PS C:\Users\fewli>
```

31# PYTHON PROGRAM TO CONVERT DAYS INTO YEARS WEEKS AND DAYS

To convert a given number of days into years, weeks, and remaining days, you need to understand the following relationships:

1. Days to Years:
 - 1 year = 365 days (assuming a non-leap year for simplicity)
2. Days to Weeks:
 - 1 week = 7 days

Here is a Python program to perform this conversion:

```
def convert_days(days):
    # Calculate the number of years
    years = days // 365
    remaining_days = days % 365
```

```
# Calculate the number of weeks from the remaining days
weeks = remaining_days // 7
days_left = remaining_days % 7

return years, weeks, days_left

# Example usage
total_days = int(input("Enter the number of days: "))
years, weeks, days_left = convert_days(total_days)
print(f"{total_days} days is equal to {years} years, {weeks} weeks, and
{days_left} days.")
```

Explanation

1. Define convert_days Function:

- This function takes a total number of days as an argument.
- It calculates the number of years by performing integer division of the total days by 365.
- It calculates the remaining days after extracting the years using the modulus operator %.
- It calculates the number of weeks from the remaining days by performing integer division by 7.
- It calculates the remaining days after extracting the weeks using the modulus operator %.
- It returns the number of years, weeks, and remaining days.

2. User Input:

- The program prompts the user to enter the total number of days.
- The input is read as a string and then converted to an integer using int().

3. Convert and Print:

- The program calls the convert_days function with the user-provided number of days.
- It prints the result, showing the equivalent number of years, weeks, and days.

Example

Let's say the user inputs 400 days.

- The program will call `convert_days(400)`.
- Inside the function, it performs the following calculations:
 - ($\text{Years} = 400 // 365 = 1$)
 - ($\text{Remaining Days} = 400 \% 365 = 35$)
 - ($\text{Weeks} = 35 // 7 = 5$)
 - ($\text{Days Left} = 35 \% 7 = 0$)
- The output will be: "400 days is equal to 1 years, 5 weeks, and 0 days."

Here is the exact output:

```

PythonExample.py X
C: > Users > fewli > Downloads > Python > PythonExample.py > ...
1  def convert_days(days):
2      # Calculate the number of years
3      years = days // 365
4      remaining_days = days % 365
5
6      # Calculate the number of weeks from the remaining days
7      weeks = remaining_days // 7
8      days_left = remaining_days % 7
9
10     return years, weeks, days_left
11
12 # Example usage
13 total_days = int(input("Enter the number of days: "))
14 years, weeks, days_left = convert_days(total_days)
15 print(f"{total_days} days is equal to {years} years, {weeks} weeks, and {days_left} days.")

PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL
>  TERMINAL
• PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python312/python.exe c:/Users/fewli/t
  Enter the number of days: 400
  400 days is equal to 1 years, 5 weeks, and 0 days.
• PS C:\Users\fewli>

```

32# PYTHON PROGRAM TO CONVERT DEGREE TO RADIAN

To convert an angle from degrees to radians, you can use the following conversion formula:

$$[\text{Radians}] = \text{Degrees} \times \frac{\pi}{180}$$

In Python, you can use the math module which provides the constant `math.pi` for the value of (π).

Here is a Python program to perform this conversion:

```
import math

def degrees_to_radians(degrees):
    radians = degrees * (math.pi / 180)
    return radians

# Example usage
degrees = float(input("Enter angle in degrees: "))
radians = degrees_to_radians(degrees)
print(f"{degrees} degrees is equal to {radians:.6f} radians.")
```

Explanation

1. Import math Module:

- The math module provides mathematical functions and constants, including `math.pi`.

2. Define degrees_to_radians Function:

- This function takes an angle in degrees as an argument.
- It applies the conversion formula ($\text{Degrees} \times \frac{\pi}{180}$) to calculate the equivalent angle in radians.
- It returns the calculated angle in radians.

3. User Input:

- The program prompts the user to enter an angle in degrees.
- The input is read as a string and then converted to a floating-point number using `float()`.

4. Convert and Print:

- The program calls the `degrees_to_radians` function with the user-provided angle in degrees.
- It prints the result, formatted to six decimal places.

Example

Let's say the user inputs an angle of 180 degrees.

- The program will call `degrees_to_radians(180)`.
- Inside the function, it calculates $(180 \times \frac{\pi}{180}) = \pi \approx 3.141593$ radians.
- The output will be: "180.0 degrees is equal to 3.141593 radians."

Here is the output in the screenshot:

```

PythonExample.py X
C: > Users > fewli > Downloads > Python > PythonExample.py > ...
1  import math
2
3  def degrees_to_radians(degrees):
4      radians = degrees * (math.pi / 180)
5      return radians
6
7  # Example usage
8  degrees = float(input("Enter angle in degrees: "))
9  radians = degrees_to_radians(degrees)
10 print(f"{degrees} degrees is equal to {radians:.6f} radians.")

PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL
>  ▾ TERMINAL
  ● PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python3
    Enter angle in degrees: 180
    180.0 degrees is equal to 3.141593 radians.
  ○ PS C:\Users\fewli>

```

33# PYTHON PROGRAM TO CONVERT POUNDS TO KILOGRAMS

To convert a weight from pounds to kilograms, you can use the following conversion factor:

$$[\text{Kilograms}] = \text{Pounds} \times 0.453592]$$

Here is a Python program to perform this conversion:

```

def pounds_to_kilograms(pounds):
    kilograms = pounds * 0.453592
    return kilograms

# Example usage
pounds = float(input("Enter weight in pounds: "))
kilograms = pounds_to_kilograms(pounds)

```

```
print(f"{pounds} pounds is equal to {kilograms:.2f} kilograms.")
```

Explanation

1. Define pounds_to_kilograms Function:

- This function takes a weight in pounds as an argument.
- It applies the conversion factor ($\text{Pounds} \times 0.453592$) to calculate the equivalent weight in kilograms.
- It returns the calculated weight in kilograms.

2. User Input:

- The program prompts the user to enter a weight in pounds.
- The input is read as a string and then converted to a floating-point number using `float()`.

3. Convert and Print:

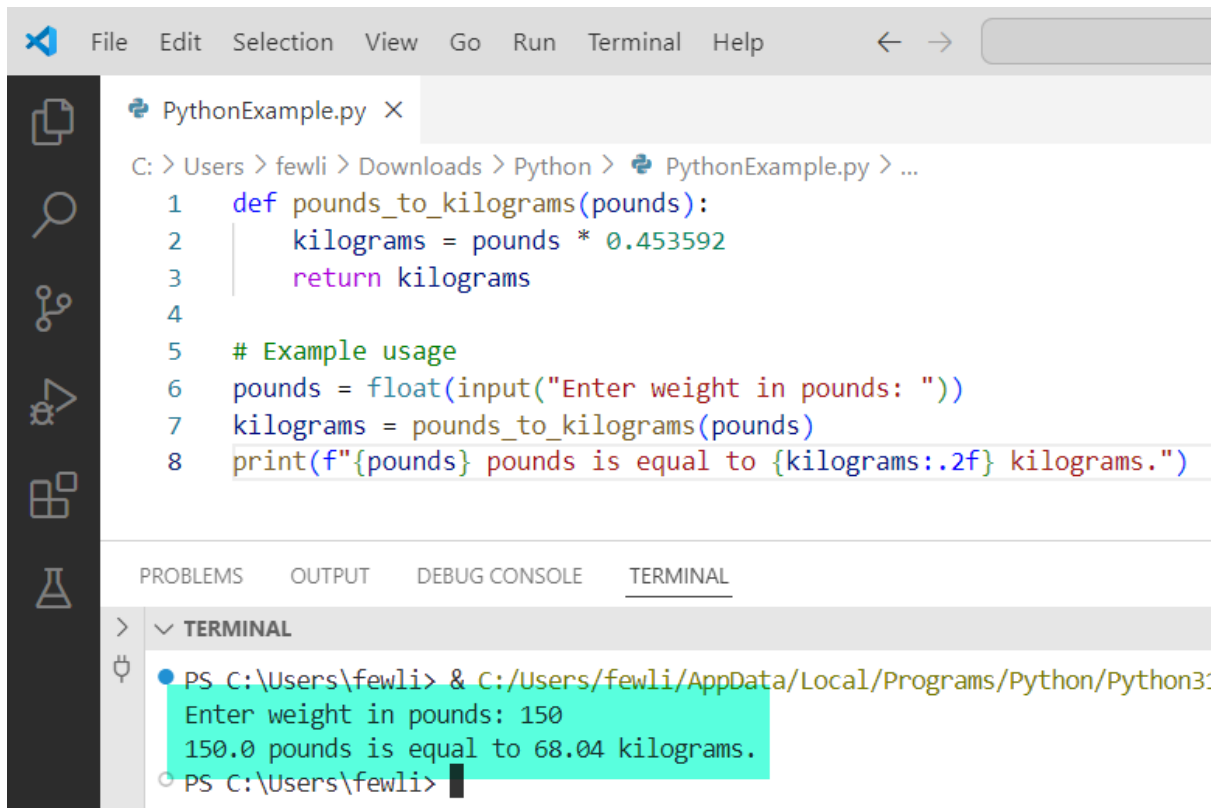
- The program calls the `pounds_to_kilograms` function with the user-provided weight in pounds.
- It prints the result, formatted to two decimal places.

Example

Let's say the user inputs a weight of 150 pounds.

- The program will call `pounds_to_kilograms(150)`.
- Inside the function, it calculates ($150 \times 0.453592 = 68.0388$) kilograms.
- The output will be: "150.0 pounds is equal to 68.04 kilograms."

Here is the exact output in the screenshot below:



```

PythonExample.py X
C: > Users > fewli > Downloads > Python > PythonExample.py > ...
1  def pounds_to_kilograms(pounds):
2      kilograms = pounds * 0.453592
3      return kilograms
4
5  # Example usage
6  pounds = float(input("Enter weight in pounds: "))
7  kilograms = pounds_to_kilograms(pounds)
8  print(f"{pounds} pounds is equal to {kilograms:.2f} kilograms.")

PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL
> v TERMINAL
• PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python3:
  Enter weight in pounds: 150
  150.0 pounds is equal to 68.04 kilograms.
○ PS C:\Users\fewli>

```

34# PYTHON PROGRAM TO CONVERT LOWER CASE TO UPPER CASE

To convert a string from lowercase to uppercase in Python, you can use the built-in `upper()` method of string objects. This method returns a new string with all the characters converted to uppercase.

Here is a Python program to perform this conversion:

```

def convert_to_uppercase(input_string):
    # Convert the string to uppercase using the upper() method
    uppercase_string = input_string.upper()
    return uppercase_string

# Example usage
input_string = input("Enter a string in lowercase: ")
uppercase_string = convert_to_uppercase(input_string)
print(f"The string in uppercase is: {uppercase_string}")

```

Explanation

1. Define `convert_to_uppercase` Function:
 - This function takes a string `input_string` as an argument.

- It uses the upper() method to convert all characters in the string to uppercase.
- It returns the converted string.

2. User Input:

- The program prompts the user to enter a string in lowercase.
- The input is read as a string using the input() function.

3. Convert and Print:

- The program calls the convert_to_uppercase function with the user-provided string.
- It prints the result, showing the string converted to uppercase.

Example

Let's say the user inputs the string "hello world".

- The program will call convert_to_uppercase("hello world").
- Inside the function, it converts the string to uppercase using the upper() method: "hello world".upper() results in "HELLO WORLD".
- The output will be: "The string in uppercase is: HELLO WORLD".

35# PYTHON PROGRAM TO CONVERT UPPER CASE TO LOWER CASE

To convert a string from uppercase to lowercase in Python, you can use the built-in lower() method of string objects. This method returns a new string with all the characters converted to lowercase.

Here is a Python program to perform this conversion:

```
def convert_to_lowercase(input_string):
    # Convert the string to lowercase using the lower() method
    lowercase_string = input_string.lower()
    return lowercase_string

# Example usage
input_string = input("Enter a string in uppercase: ")
lowercase_string = convert_to_lowercase(input_string)
print(f"The string in lowercase is: {lowercase_string}")
```

Explanation

1. Define `convert_to_lowercase` Function:
 - This function takes a string `input_string` as an argument.
 - It uses the `lower()` method to convert all characters in the string to lowercase.
 - It returns the converted string.
2. User Input:
 - The program prompts the user to enter a string in uppercase.
 - The input is read as a string using the `input()` function.
3. Convert and Print:
 - The program calls the `convert_to_lowercase` function with the user-provided string.
 - It prints the result, showing the string converted to lowercase.

Example

Let's say the user inputs the string "HELLO WORLD".

- The program will call `convert_to_lowercase("HELLO WORLD")`.
- Inside the function, it converts the string to lowercase using the `lower()` method: `"HELLO WORLD".lower()` results in `"hello world"`.
- The output will be: `"The string in lowercase is: hello world"`.

Here is the exact screenshot:

The screenshot shows a Python IDE with a file named 'PythonExample.py'. The code defines a function 'convert_to_lowercase' that takes an 'input_string' and returns its lowercase version using the 'lower()' method. It includes an example usage section where it prompts the user to enter a string in uppercase, reads the input, and prints the lowercase result. The terminal output shows the program being run, the user entering 'HELLO WORLD', and the program outputting 'The string in lowercase is: hello world'.

```

PythonExample.py X
C:\Users\fewli\Downloads\Python> PythonExample.py > ...
1  def convert_to_lowercase(input_string):
2      # Convert the string to lowercase using the lower() method
3      lowercase_string = input_string.lower()
4      return lowercase_string
5
6  # Example usage
7  input_string = input("Enter a string in uppercase: ")
8  lowercase_string = convert_to_lowercase(input_string)
9  print(f"The string in lowercase is: {lowercase_string}")

PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL
>  TERMINAL
● PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python
Enter a string in uppercase: HELLO WORLD
The string in lowercase is: hello world
○ PS C:\Users\fewli>

```

36# PYTHON PROGRAM TO FIND NUMBER OF VOWELS IN A STRING

To find the number of vowels in a string in Python, you can iterate through each character in the string and check if it is a vowel. You can use a set to store the vowels for quick lookup.

Here is a Python program to count the number of vowels in a string:

```

def count_vowels(input_string):
    # Define a set of vowels
    vowels = set("aeiouAEIOU")

    # Initialize a counter for vowels
    vowel_count = 0

    # Iterate through each character in the string
    for char in input_string:
        if char in vowels:
            vowel_count += 1

    return vowel_count

# Example usage
input_string = input("Enter a string: ")
vowel_count = count_vowels(input_string)
print(f"The number of vowels in the string is: {vowel_count}")

```

Explanation

1. Define count_vowels Function:
 - This function takes a string input_string as an argument.
 - It defines a set of vowels vowels = set("aeiouAEIOU") to include both lowercase and uppercase vowels.
 - It initializes a counter vowel_count to zero.
2. Iterate Through the String:
 - The function iterates through each character in the string using a for loop.
 - For each character, it checks if the character is in the set of vowels.
 - If the character is a vowel, it increments the vowel_count by 1.
3. Return the Count:
 - After iterating through the entire string, the function returns the total count of vowels.
4. User Input:
 - The program prompts the user to enter a string.
 - The input is read as a string using the input() function.
5. Count and Print:
 - The program calls the count_vowels function with the user-provided string.
 - It prints the result, showing the number of vowels in the string.

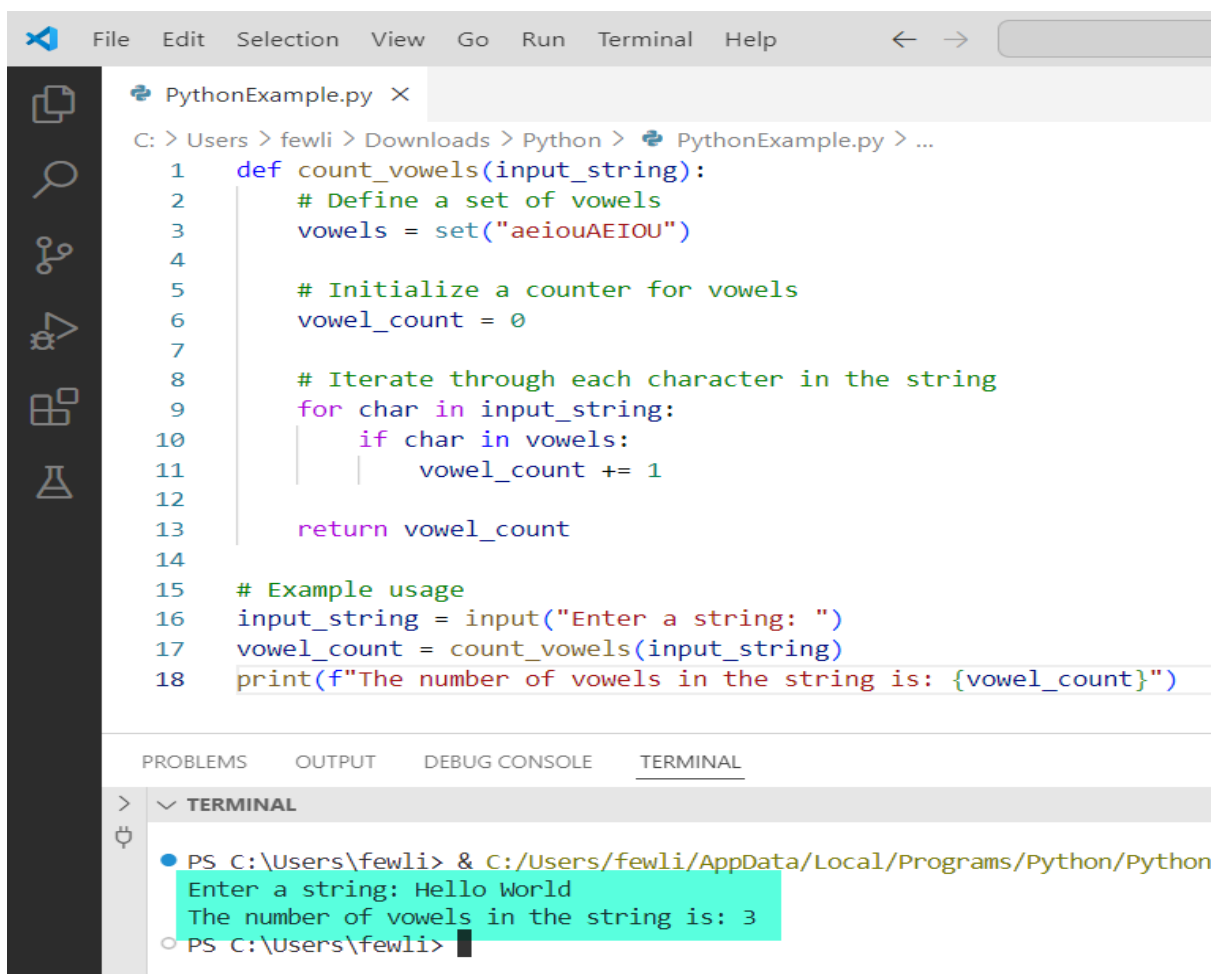
Example

Let's say the user inputs the string "Hello World".

- The program will call count_vowels("Hello World").
- Inside the function, it iterates through each character:
 - 'H' (not a vowel)

- 'e' (vowel, count becomes 1)
 - 'l' (not a vowel)
 - 'l' (not a vowel)
 - 'o' (vowel, count becomes 2)
 - '' (not a vowel)
 - 'W' (not a vowel)
 - 'o' (vowel, count becomes 3)
 - 'r' (not a vowel)
 - 'l' (not a vowel)
 - 'd' (not a vowel)
- The output will be: "The number of vowels in the string is: 3".

Here is the exact output in the screenshot below:



The screenshot shows a Python IDE window with a file named 'PythonExample.py'. The code defines a function 'count_vowels' that iterates through each character in a string and counts vowels. The output terminal shows the program being run, the user entering 'Hello World', and the program outputting 'The number of vowels in the string is: 3'.

```
File Edit Selection View Go Run Terminal Help
PythonExample.py x
C: > Users > fewli > Downloads > Python > PythonExample.py > ...
1 def count_vowels(input_string):
2     # Define a set of vowels
3     vowels = set("aeiouAEIOU")
4
5     # Initialize a counter for vowels
6     vowel_count = 0
7
8     # Iterate through each character in the string
9     for char in input_string:
10        if char in vowels:
11            vowel_count += 1
12
13    return vowel_count
14
15 # Example usage
16 input_string = input("Enter a string: ")
17 vowel_count = count_vowels(input_string)
18 print(f"The number of vowels in the string is: {vowel_count}")

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
> TERMINAL
• PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python
  Enter a string: Hello World
  The number of vowels in the string is: 3
○ PS C:\Users\fewli>
```

37# PYTHON PROGRAM FOR BINARY TO DECIMAL CONVERSION

To convert a binary number to a decimal number in Python, you can use the built-in `int` function with the base parameter set to 2. This method simplifies the conversion process.

```
def binary_to_decimal(binary_str):
    # Convert binary string to decimal using int function
    decimal_number = int(binary_str, 2)
    return decimal_number

# Example usage
binary_str = input("Enter a binary number: ")
decimal_number = binary_to_decimal(binary_str)
print(f"The decimal equivalent of binary {binary_str} is {decimal_number}.")
```

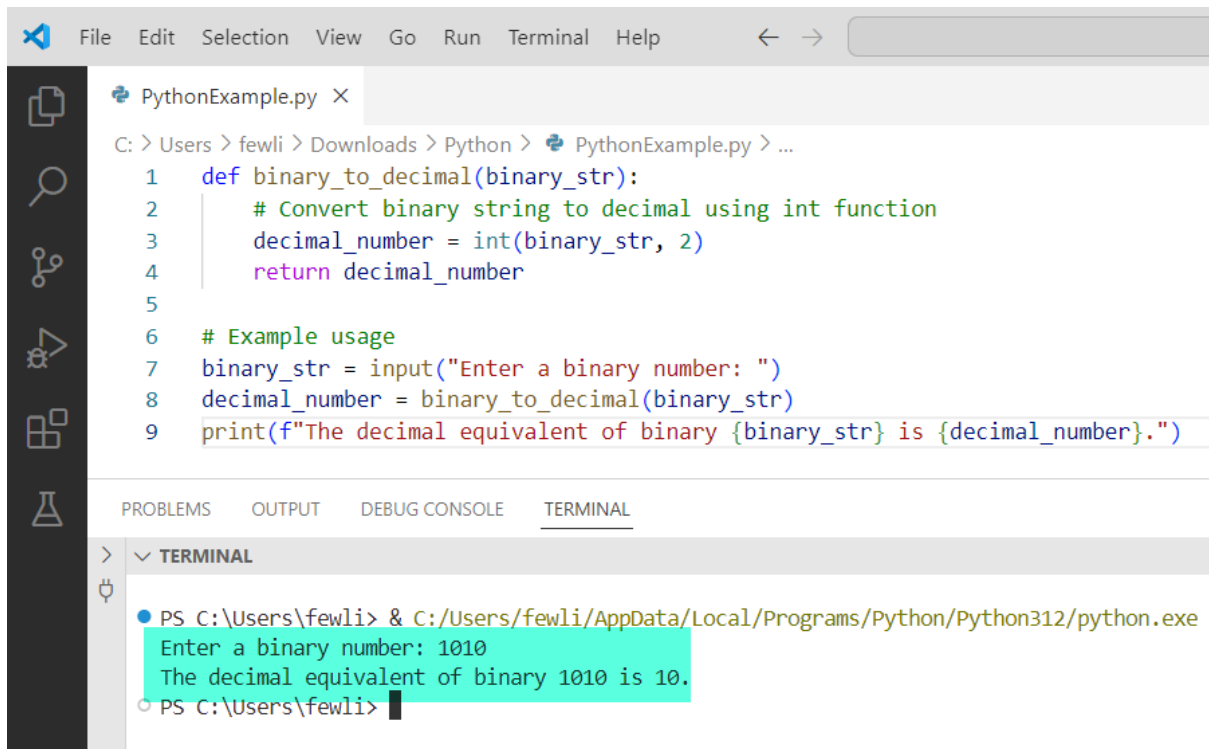
Explanation

- The `int` function can convert a binary string to a decimal number by specifying the base as 2.
- `int(binary_str, 2)` converts the binary string `binary_str` to its decimal equivalent.
- The function `binary_to_decimal` takes a binary string as an argument, uses the `int` function to perform the conversion, and returns the decimal number.

Let's say the user inputs the binary number "1010".

- Using the `int` Function:
 - The program calls `binary_to_decimal("1010")`.
 - Inside the function, `int("1010", 2)` converts "1010" to 10.
 - The output will be: "The decimal equivalent of binary 1010 is 10."

Here is the exact output in the screenshot below:



```
PythonExample.py X
C:\Users\fewli\Downloads\Python> PythonExample.py > ...
1 def binary_to_decimal(binary_str):
2     # Convert binary string to decimal using int function
3     decimal_number = int(binary_str, 2)
4     return decimal_number
5
6 # Example usage
7 binary_str = input("Enter a binary number: ")
8 decimal_number = binary_to_decimal(binary_str)
9 print(f"The decimal equivalent of binary {binary_str} is {decimal_number}.")

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
> TERMINAL
PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python312/python.exe
Enter a binary number: 1010
The decimal equivalent of binary 1010 is 10.
PS C:\Users\fewli>
```

38# PYTHON PROGRAM TO CALCULATE DISCOUNTED AMOUNT WITH DISCOUNT

To calculate the discounted amount with a given discount percentage in Python, you can follow these steps:

1. Get the original price of the item.
2. Get the discount percentage.
3. Calculate the discount amount.
4. Subtract the discount amount from the original price to get the discounted price.

Here is a Python program to perform this calculation:

```
def calculate_discounted_amount(original_price, discount_percentage):
    # Calculate the discount amount
    discount_amount = (original_price * discount_percentage) / 100

    # Calculate the discounted price
    discounted_price = original_price - discount_amount

    return discounted_price, discount_amount

# Example usage
original_price = float(input("Enter the original price: "))
```

```
discount_percentage = float(input("Enter the discount percentage: "))
discounted_price, discount_amount =
calculate_discounted_amount(original_price, discount_percentage)
print(f"The discount amount is: {discount_amount:.2f}")
print(f"The discounted price is: {discounted_price:.2f}")
```

Explanation

1. Define calculate_discounted_amount Function:

- This function takes two arguments: original_price and discount_percentage.
- It calculates the discount amount using the formula: [$\text{Discount Amount} = \left(\frac{\text{Original Price}}{100} \times \text{Discount Percentage} \right)$]
- It calculates the discounted price by subtracting the discount amount from the original price: [$\text{Discounted Price} = \text{Original Price} - \text{Discount Amount}$]
- It returns both the discounted price and the discount amount.

2. User Input:

- The program prompts the user to enter the original price of the item.
- The input is read as a string and then converted to a floating-point number using float().
- The program prompts the user to enter the discount percentage.
- The input is read as a string and then converted to a floating-point number using float().

3. Calculate and Print:

- The program calls the calculate_discounted_amount function with the user-provided original price and discount percentage.
- It prints the discount amount and the discounted price, formatted to two decimal places.

Example

Let's say the user inputs an original price of \$100 and a discount percentage of 20%.

- The program will call `calculate_discounted_amount(100, 20)`.
- Inside the function:
 - It calculates the discount amount: $\left[\text{Discount Amount} = \left(\frac{100 \times 20}{100} \right) = 20 \right]$
 - It calculates the discounted price: $\left[\text{Discounted Price} = 100 - 20 = 80 \right]$
- The output will be:
- The discount amount is: 20.00

The discounted price is: 80.00

Here is exact output in the screenshot below:

```

PythonExample.py X
C: > Users > fewli > Downloads > Python > PythonExample.py > ...
1  def calculate_discounted_amount(original_price, discount_percentage):
2      # Calculate the discount amount
3      discount_amount = (original_price * discount_percentage) / 100
4
5      # Calculate the discounted price
6      discounted_price = original_price - discount_amount
7
8      return discounted_price, discount_amount
9
10 # Example usage
11 original_price = float(input("Enter the original price: "))
12 discount_percentage = float(input("Enter the discount percentage: "))
13 discounted_price, discount_amount = calculate_discounted_amount(original_price, discount_percentage)
14 print(f"The discount amount is: {discount_amount:.2f}")
15 print(f"The discounted price is: {discounted_price:.2f}")

PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL
>  TERMINAL
• PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python312/python.exe c:/Users/fewli/Downloads/P
  Enter the original price: 100
  Enter the discount percentage: 20
  The discount amount is: 20.00
  The discounted price is: 80.00
○ PS C:\Users\fewli>

```

39# PYTHON PROGRAM TO CALCULATE DEPRECIATION

Depreciation is the reduction in the value of an asset over time. There are several methods to calculate depreciation, but one of the most commonly used methods is the Straight-Line Depreciation method. This method spreads the cost of the asset evenly over its useful life.

Straight-Line Depreciation Formula

The formula for calculating straight-line depreciation is:

$$[\text{Depreciation Expense}] = \frac{\text{Cost of Asset} - \text{Salvage Value}}{\text{Useful Life}}$$

- Cost of Asset: The initial cost of the asset.
- Salvage Value: The value of the asset at the end of its useful life.
- Useful Life: The expected time period over which the asset will be used.

Here is a Python program to calculate depreciation using the straight-line method:

```
def calculate_depreciation(cost, salvage_value, useful_life):
    # Calculate the annual depreciation expense
    depreciation_expense = (cost - salvage_value) / useful_life
    return depreciation_expense

# Example usage
cost = float(input("Enter the cost of the asset: "))
salvage_value = float(input("Enter the salvage value of the asset: "))
useful_life = float(input("Enter the useful life of the asset (in years): "))

annual_depreciation = calculate_depreciation(cost, salvage_value, useful_life)
print(f"The annual depreciation expense is: {annual_depreciation:.2f}")
```

Explanation

1. Define calculate_depreciation Function:
 - This function takes three arguments: cost, salvage_value, and useful_life.
 - It calculates the annual depreciation expense using the formula: $[\text{Depreciation Expense}] = \frac{\text{Cost of Asset} - \text{Salvage Value}}{\text{Useful Life}}$
 - It returns the calculated annual depreciation expense.
2. User Input:
 - The program prompts the user to enter the cost of the asset.

- The input is read as a string and then converted to a floating-point number using `float()`.
- The program prompts the user to enter the salvage value of the asset.
- The input is read as a string and then converted to a floating-point number using `float()`.
- The program prompts the user to enter the useful life of the asset in years.
- The input is read as a string and then converted to a floating-point number using `float()`.

3. Calculate and Print:

- The program calls the `calculate_depreciation` function with the user-provided cost, salvage value, and useful life.
- It prints the annual depreciation expense, formatted to two decimal places.

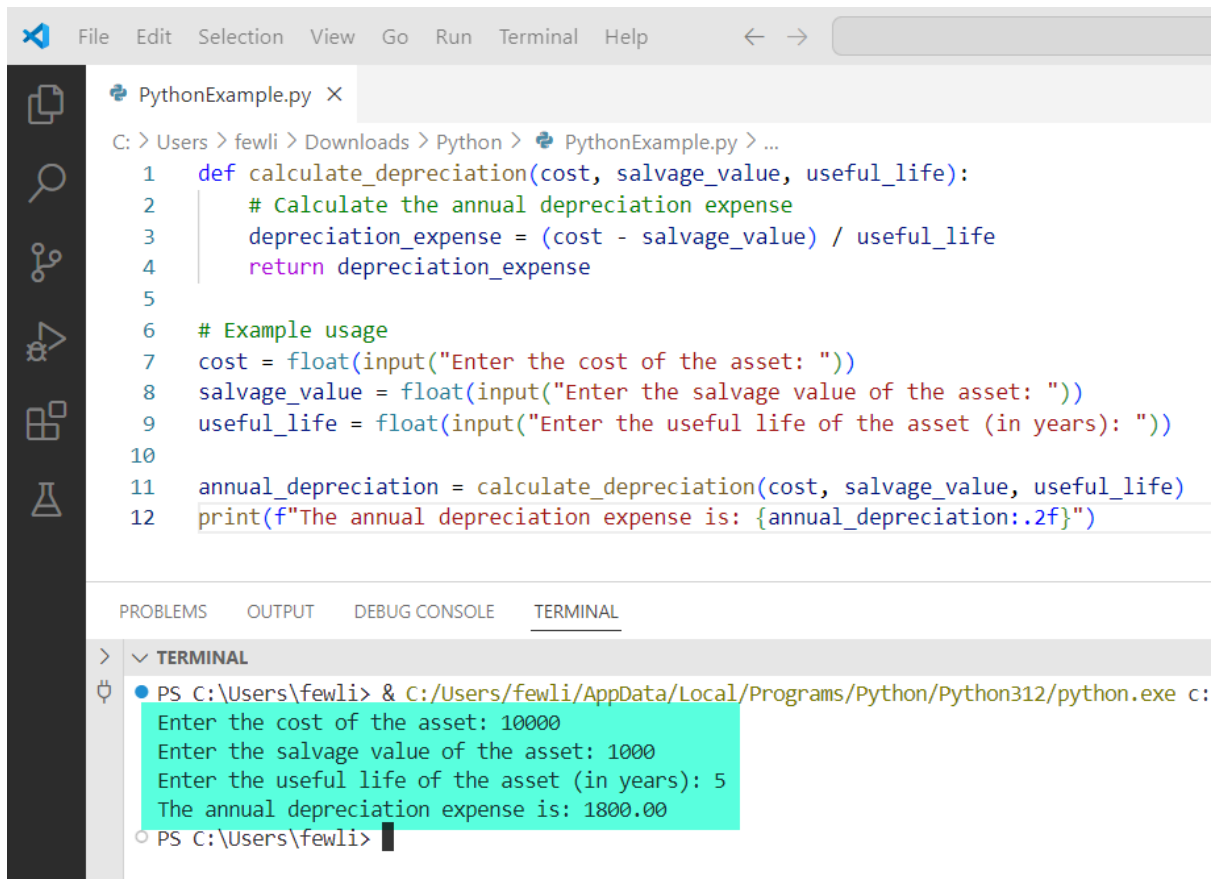
Example

Let's say the user inputs the following values:

- Cost of the asset: \$10,000
- Salvage value: \$1,000
- Useful life: 5 years
- The program will call `calculate_depreciation(10000, 1000, 5)`.
- Inside the function:
 - It calculates the annual depreciation expense: [
$$\text{Depreciation Expense} = \frac{10000 - 1000}{5} = 1800$$
]
- The output will be:

The annual depreciation expense is: 1800.00

Here is the exact output:



```

PythonExample.py X
C:\Users\fewli> Downloads\Python> PythonExample.py > ...
1 def calculate_depreciation(cost, salvage_value, useful_life):
2     # Calculate the annual depreciation expense
3     depreciation_expense = (cost - salvage_value) / useful_life
4     return depreciation_expense
5
6 # Example usage
7 cost = float(input("Enter the cost of the asset: "))
8 salvage_value = float(input("Enter the salvage value of the asset: "))
9 useful_life = float(input("Enter the useful life of the asset (in years): "))
10
11 annual_depreciation = calculate_depreciation(cost, salvage_value, useful_life)
12 print(f"The annual depreciation expense is: {annual_depreciation:.2f}")

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
> TERMINAL
PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python312/python.exe c:
Enter the cost of the asset: 10000
Enter the salvage value of the asset: 1000
Enter the useful life of the asset (in years): 5
The annual depreciation expense is: 1800.00
PS C:\Users\fewli>

```

40# PYTHON PROGRAM TO CALCULATE BODY MASS INDEX

Body Mass Index (BMI) is a measure that uses a person's weight and height to estimate whether they have a healthy body weight. The formula to calculate BMI is:

$$[\text{BMI}] = \frac{\text{weight (kg)}}{\text{height (m)}^2}$$

Here is a Python program to calculate BMI:

```

def calculate_bmi(weight, height):
    # Calculate BMI using the formula
    bmi = weight / (height ** 2)
    return bmi

# Example usage
weight = float(input("Enter your weight in kilograms: "))
height = float(input("Enter your height in meters: "))

bmi = calculate_bmi(weight, height)
print(f"Your BMI is: {bmi:.2f}")

# Optional: Categorize the BMI result
def categorize_bmi(bmi):
    if bmi < 18.5:

```

```
        return "Underweight"
    elif 18.5 <= bmi < 24.9:
        return "Normal weight"
    elif 25 <= bmi < 29.9:
        return "Overweight"
    else:
        return "Obesity"

category = categorize_bmi(bmi)
print(f"Your BMI category is: {category}")
```

Explanation

1. Define calculate_bmi Function:

- This function takes two arguments: weight (in kilograms) and height (in meters).
- It calculates BMI using the formula:
$$\text{BMI} = \frac{\text{weight}}{\text{height}^2}$$
- It returns the calculated BMI.

2. User Input:

- The program prompts the user to enter their weight in kilograms.
- The input is read as a string and then converted to a floating-point number using `float()`.
- The program prompts the user to enter their height in meters.
- The input is read as a string and then converted to a floating-point number using `float()`.

3. Calculate and Print:

- The program calls the `calculate_bmi` function with the user-provided weight and height.
- It prints the BMI, formatted to two decimal places.

4. Optional: Categorize the BMI Result:

- The `categorize_bmi` function takes the BMI value as an argument.

- It categorizes the BMI based on standard BMI ranges:
 - BMI < 18.5: Underweight
 - 18.5 <= BMI < 24.9: Normal weight
 - 25 <= BMI < 29.9: Overweight
 - BMI >= 30: Obesity
- It returns the category as a string.
- The program prints the BMI category.

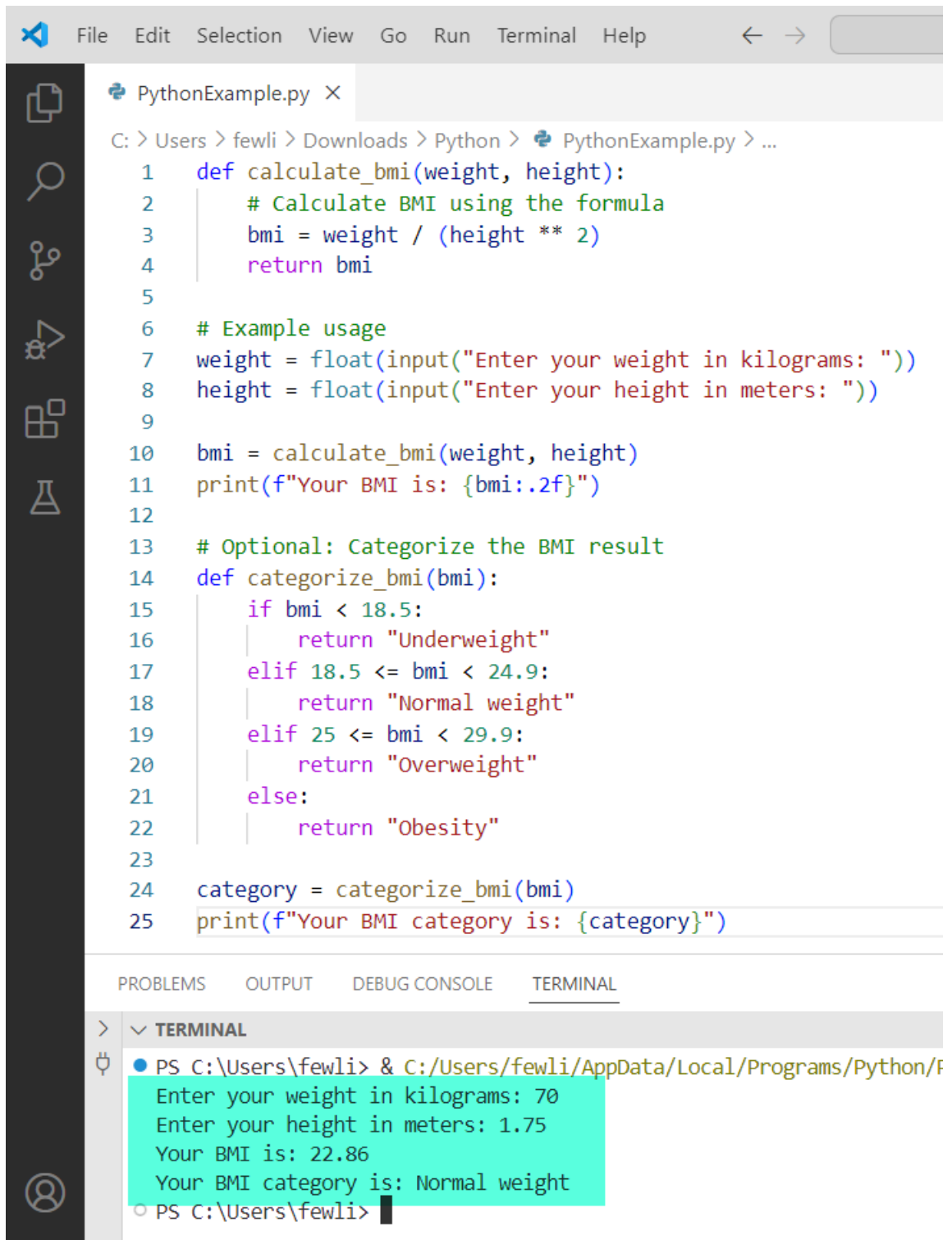
Example

Let's say the user inputs the following values:

- Weight: 70 kg
- Height: 1.75 m
- The program will call `calculate_bmi(70, 1.75)`.
- Inside the function:
 - It calculates the BMI: [$\text{BMI} = \frac{70}{1.75^2} \approx 22.86$]
- The output will be:
- Your BMI is: 22.86
- The program will call `categorize_bmi(22.86)`.
- Inside the function:
 - It determines that 22.86 falls within the "Normal weight" range.
- The output will be:

Your BMI category is: Normal weight

Here is the exact output:



```
PythonExample.py X
C: > Users > fewli > Downloads > Python > PythonExample.py > ...
1  def calculate_bmi(weight, height):
2      # Calculate BMI using the formula
3      bmi = weight / (height ** 2)
4      return bmi
5
6  # Example usage
7  weight = float(input("Enter your weight in kilograms: "))
8  height = float(input("Enter your height in meters: "))
9
10 bmi = calculate_bmi(weight, height)
11 print(f"Your BMI is: {bmi:.2f}")
12
13 # Optional: Categorize the BMI result
14 def categorize_bmi(bmi):
15     if bmi < 18.5:
16         return "Underweight"
17     elif 18.5 <= bmi < 24.9:
18         return "Normal weight"
19     elif 25 <= bmi < 29.9:
20         return "Overweight"
21     else:
22         return "Obesity"
23
24 category = categorize_bmi(bmi)
25 print(f"Your BMI category is: {category}")

PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL
>  ✓ TERMINAL
• PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/F
Enter your weight in kilograms: 70
Enter your height in meters: 1.75
Your BMI is: 22.86
Your BMI category is: Normal weight
○ PS C:\Users\fewli>
```

41# PYTHON PROGRAM TO CALCULATE DISTANCE BETWEEN TWO POINTS

To calculate the distance between two points in a 2D plane, you can use the Euclidean distance formula. The formula for the distance (d) between two points $((x_1, y_1))$ and $((x_2, y_2))$ is:

$$[d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}]$$

Here is a Python program to calculate the distance between two points using this formula:

```
import math

def calculate_distance(x1, y1, x2, y2):
    # Calculate the distance using the Euclidean distance formula
    distance = math.sqrt((x2 - x1) ** 2 + (y2 - y1) ** 2)
    return distance

# Example usage
x1 = float(input("Enter the x-coordinate of the first point: "))
y1 = float(input("Enter the y-coordinate of the first point: "))
x2 = float(input("Enter the x-coordinate of the second point: "))
y2 = float(input("Enter the y-coordinate of the second point: "))

distance = calculate_distance(x1, y1, x2, y2)
print(f"The distance between the points ({x1}, {y1}) and ({x2}, {y2}) is {distance:.2f}")
```

Explanation

1. Import math Module:

- The math module provides access to mathematical functions, including `math.sqrt` for square root calculation.

2. Define calculate_distance Function:

- This function takes four arguments: the (x) and (y) coordinates of the first point ((x1, y1)) and the (x) and (y) coordinates of the second point ((x2, y2)).
- It calculates the distance using the Euclidean distance formula: $[d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}]$
- It returns the calculated distance.

3. User Input:

- The program prompts the user to enter the (x) and (y) coordinates of the first point.
- The inputs are read as strings and then converted to floating-point numbers using `float()`.

- The program prompts the user to enter the (x) and (y) coordinates of the second point.
- The inputs are read as strings and then converted to floating-point numbers using `float()`.

4. Calculate and Print:

- The program calls the `calculate_distance` function with the user-provided coordinates.
- It prints the distance, formatted to two decimal places.

Example

Let's say the user inputs the following coordinates:

- First point: ((3, 4))
- Second point: ((6, 8))
- The program will call `calculate_distance(3, 4, 6, 8)`.
- Inside the function:
 - It calculates the distance: $[d = \sqrt{(6 - 3)^2 + (8 - 4)^2} = \sqrt{3^2 + 4^2} = \sqrt{9 + 16} = \sqrt{25} = 5]$
- The output will be:

The distance between the points (3.0, 4.0) and (6.0, 8.0) is 5.00

42# PYTHON PROGRAM TO FIND DAY OF THE WEEK FOR A GIVEN DATE

To find the day of the week for a given date in Python, you can use the `datetime` module, which provides classes for manipulating dates and times. Specifically, the `datetime.date` class and its `weekday()` or `strftime()` methods can be used to determine the day of the week.

Here is a Python program to find the day of the week for a given date:

```
import datetime

def find_day_of_week(year, month, day):
    # Create a date object for the given date
    date = datetime.date(year, month, day)
```

```
# Get the day of the week (0=Monday, 6=Sunday)
day_of_week_index = date.weekday()

# List of days of the week
days_of_week = ["Monday", "Tuesday", "Wednesday", "Thursday", "Friday",
"Saturday", "Sunday"]

# Get the name of the day
day_of_week = days_of_week[day_of_week_index]

return day_of_week

# Example usage
year = int(input("Enter year (e.g., 2024): "))
month = int(input("Enter month (1-12): "))
day = int(input("Enter day (1-31): "))

day_of_week = find_day_of_week(year, month, day)
print(f"The day of the week for {year}-{month:02d}-{day:02d} is
{day_of_week}.")
```

Explanation

1. Import datetime Module:

- The datetime module provides classes for manipulating dates and times.

2. Define find_day_of_week Function:

- This function takes three arguments: year, month, and day.
- It creates a date object for the given date using `datetime.date(year, month, day)`.
- It uses the `weekday()` method of the date object to get the day of the week as an index (0 for Monday, 6 for Sunday).
- It defines a list `days_of_week` containing the names of the days of the week.
- It retrieves the name of the day corresponding to the index using `days_of_week[day_of_week_index]`.
- It returns the name of the day.

3. User Input:

- The program prompts the user to enter the year, month, and day.
- The inputs are read as strings and then converted to integers using `int()`.

4. Find and Print:

- The program calls the `find_day_of_week` function with the user-provided year, month, and day.
- It prints the day of the week for the given date.

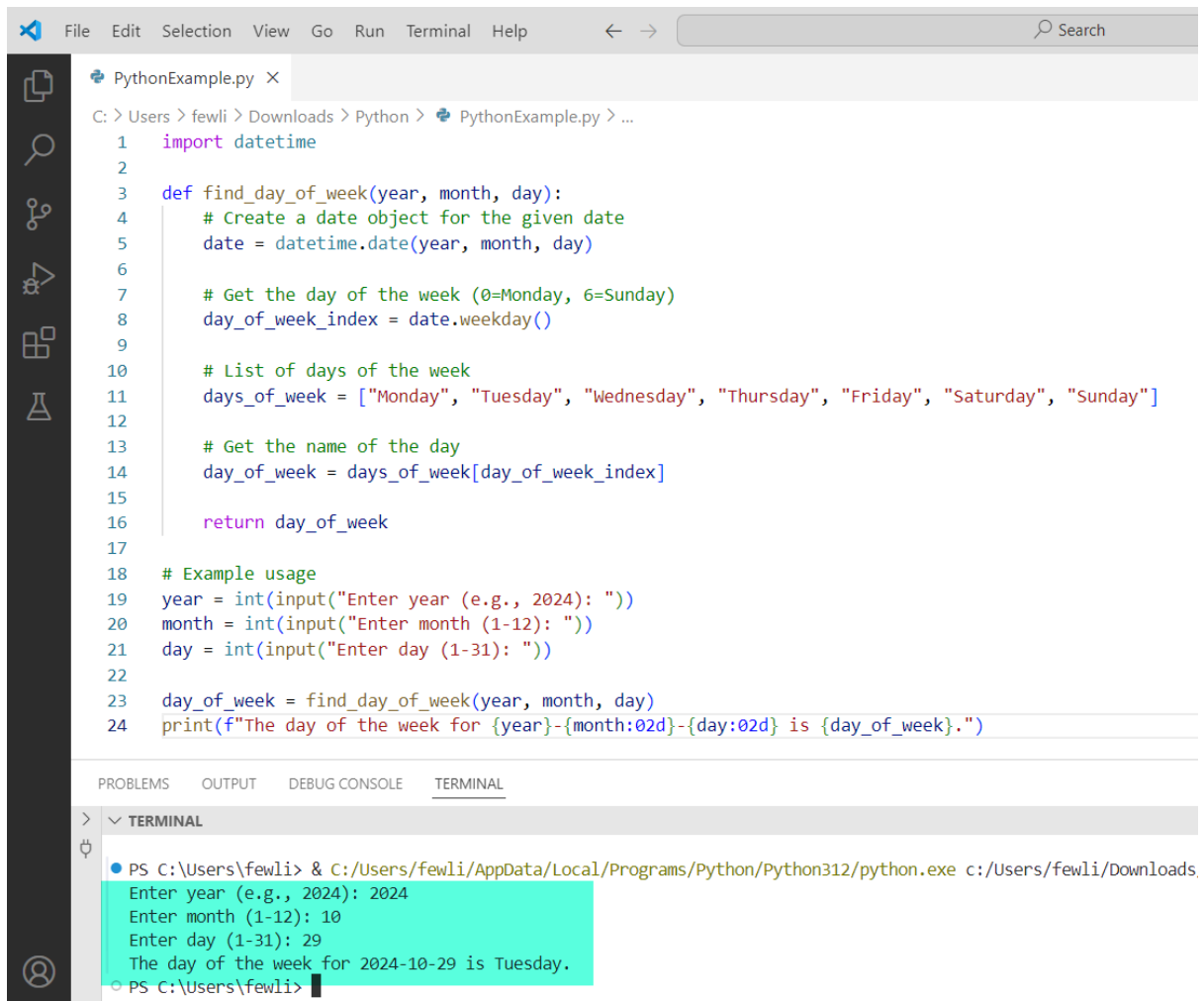
Example

Let's say the user inputs the following date:

- Year: 2024
- Month: 10
- Day: 29
- The program will call `find_day_of_week(2024, 10, 29)`.
- Inside the function:
 - It creates a date object for 2024-10-29.
 - It uses the `weekday()` method to get the day of the week index, which is 1 (Tuesday).
 - It retrieves the name "Tuesday" from the `days_of_week` list.
- The output will be:

The day of the week for 2024-10-29 is Tuesday.

Here is the exact output:



```

PythonExample.py X
C: > Users > fewli > Downloads > Python > PythonExample.py > ...
1  import datetime
2
3  def find_day_of_week(year, month, day):
4      # Create a date object for the given date
5      date = datetime.date(year, month, day)
6
7      # Get the day of the week (0=Monday, 6=Sunday)
8      day_of_week_index = date.weekday()
9
10     # List of days of the week
11     days_of_week = ["Monday", "Tuesday", "Wednesday", "Thursday", "Friday", "Saturday", "Sunday"]
12
13     # Get the name of the day
14     day_of_week = days_of_week[day_of_week_index]
15
16     return day_of_week
17
18     # Example usage
19     year = int(input("Enter year (e.g., 2024): "))
20     month = int(input("Enter month (1-12): "))
21     day = int(input("Enter day (1-31): "))
22
23     day_of_week = find_day_of_week(year, month, day)
24     print(f"The day of the week for {year}-{month:02d}-{day:02d} is {day_of_week}.")

```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL

```

> TERMINAL
• PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python312/python.exe c:/Users/fewli/Downloads
  Enter year (e.g., 2024): 2024
  Enter month (1-12): 10
  Enter day (1-31): 29
  The day of the week for 2024-10-29 is Tuesday.
○ PS C:\Users\fewli>

```

43# PYTHON PROGRAM TO FIND PERCENTAGE OF 5 SUBJECTS

To calculate the percentage of marks obtained in five subjects, you need to follow these steps:

1. Get the marks for each of the five subjects.
2. Calculate the total marks obtained.
3. Calculate the maximum possible marks.
4. Calculate the percentage using the formula:

$$\left[\text{Percentage} = \left(\frac{\text{Total Marks Obtained}}{\text{Maximum Possible Marks}} \right) \times 100 \right]$$

Here is a Python program to perform this calculation:

```

def calculate_percentage(marks):
    # Calculate the total marks obtained
    total_marks = sum(marks)

```

```
# Calculate the maximum possible marks
max_marks = len(marks) * 100 # Assuming each subject is out of 100 marks

# Calculate the percentage
percentage = (total_marks / max_marks) * 100

return percentage

# Example usage
marks = []
for i in range(1, 6):
    mark = float(input(f"Enter marks for subject {i} (out of 100): "))
    marks.append(mark)

percentage = calculate_percentage(marks)
print(f"The percentage of marks obtained is: {percentage:.2f}%")
```

Explanation

1. Define calculate_percentage Function:

- This function takes a list of marks for the five subjects.
- It calculates the total marks obtained using the `sum()` function.
- It calculates the maximum possible marks by multiplying the number of subjects by 100 (assuming each subject is out of 100 marks).
- It calculates the percentage using the formula: [
$$\text{Percentage} = \left(\frac{\text{Total Marks Obtained}}{\text{Maximum Possible Marks}} \right) \times 100$$
]
- It returns the calculated percentage.

2. User Input:

- The program prompts the user to enter the marks for each of the five subjects.
- The inputs are read as strings and then converted to floating-point numbers using `float()`.
- The marks are stored in a list called `marks`.

3. Calculate and Print:

- The program calls the `calculate_percentage` function with the list of marks.
- It prints the percentage of marks obtained, formatted to two decimal places.

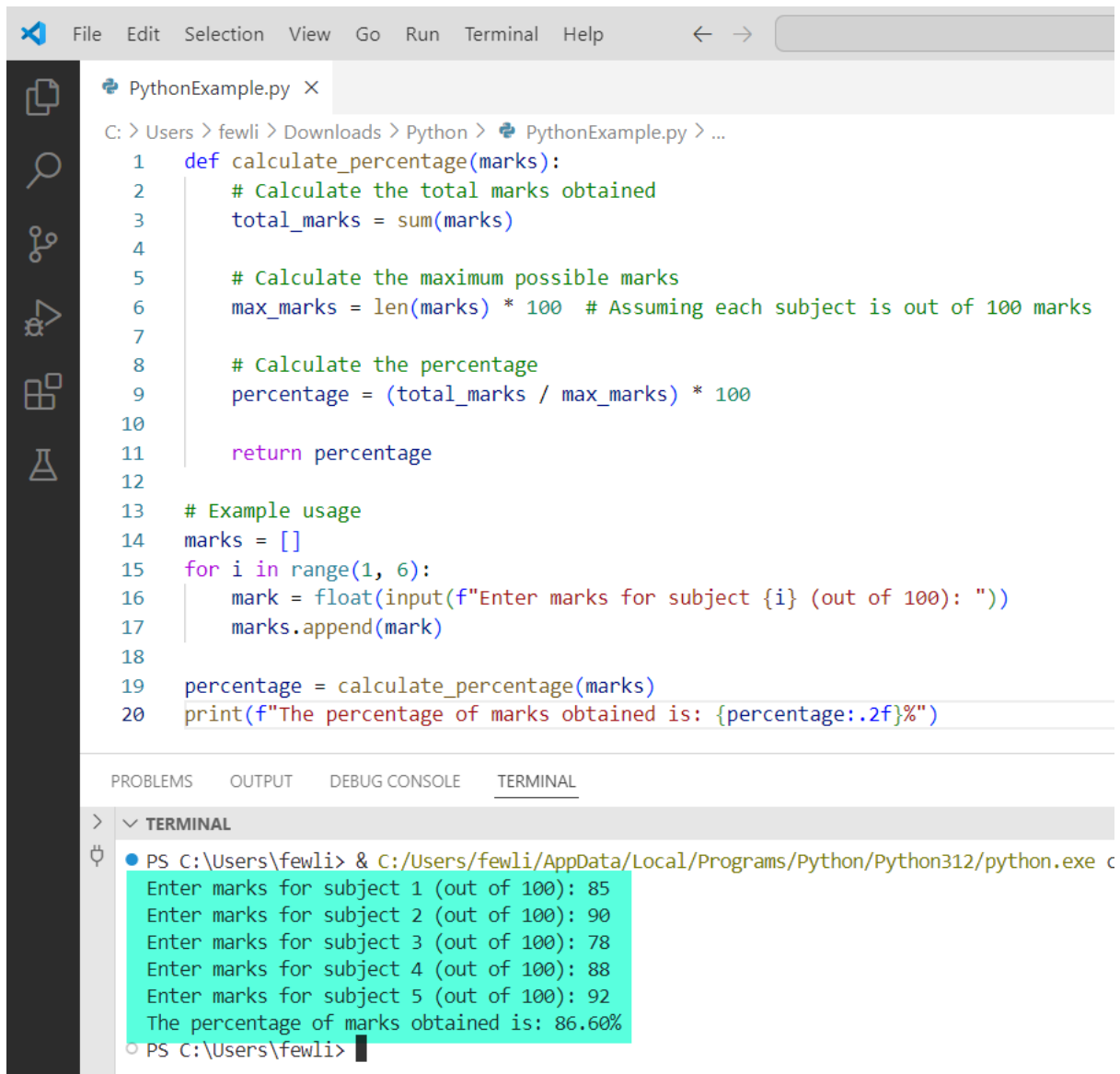
Example

Let's say the user inputs the following marks:

- Subject 1: 85
- Subject 2: 90
- Subject 3: 78
- Subject 4: 88
- Subject 5: 92
- The program will call `calculate_percentage([85, 90, 78, 88, 92])`.
- Inside the function:
 - It calculates the total marks obtained: [$\text{Total Marks} = 85 + 90 + 78 + 88 + 92 = 433$]
 - It calculates the maximum possible marks: [$\text{Max Marks} = 5 \times 100 = 500$]
 - It calculates the percentage: [$\text{Percentage} = \left(\frac{433}{500} \right) \times 100 = 86.60$]
- The output will be:

The percentage of marks obtained is: 86.60%

Here is the exact output in the screenshot below:



```

PythonExample.py X
C:\Users\fewli\Downloads\Python> PythonExample.py > ...
1  def calculate_percentage(marks):
2      # Calculate the total marks obtained
3      total_marks = sum(marks)
4
5      # Calculate the maximum possible marks
6      max_marks = len(marks) * 100 # Assuming each subject is out of 100 marks
7
8      # Calculate the percentage
9      percentage = (total_marks / max_marks) * 100
10
11     return percentage
12
13     # Example usage
14     marks = []
15     for i in range(1, 6):
16         mark = float(input(f"Enter marks for subject {i} (out of 100): "))
17         marks.append(mark)
18
19     percentage = calculate_percentage(marks)
20     print(f"The percentage of marks obtained is: {percentage:.2f}%")

```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL

TERMINAL

```

PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python312/python.exe c
Enter marks for subject 1 (out of 100): 85
Enter marks for subject 2 (out of 100): 90
Enter marks for subject 3 (out of 100): 78
Enter marks for subject 4 (out of 100): 88
Enter marks for subject 5 (out of 100): 92
The percentage of marks obtained is: 86.60%
PS C:\Users\fewli>

```

44# PYTHON PROGRAM TO FIND POWER OF A NUMBER

To find the power of a number in Python, you can use several methods, including the built-in `**` operator, the `pow()` function, or the `math.pow()` function from the `math` module. Here, I'll explain a simple Python program using the `**` operator to calculate the power of a number.

The formula to calculate the power of a number (a) raised to the power of (b) is:

$$[\text{result}] = a^b$$

Here is a Python program to perform this calculation:

```

def power(base, exponent):
    # Calculate the power using the ** operator
    result = base ** exponent

```

```
        return result

# Example usage
base = float(input("Enter the base number: "))
exponent = float(input("Enter the exponent: "))

result = power(base, exponent)
print(f"{base} raised to the power of {exponent} is {result:.2f}")
```

Explanation

1. Define power Function:

- This function takes two arguments: base (the base number) and exponent (the exponent to which the base number is raised).
- It calculates the power using the `**` operator: $[\text{result} = \text{base} ** \text{exponent}]$
- It returns the calculated result.

2. User Input:

- The program prompts the user to enter the base number.
- The input is read as a string and then converted to a floating-point number using `float()`.
- The program prompts the user to enter the exponent.
- The input is read as a string and then converted to a floating-point number using `float()`.

3. Calculate and Print:

- The program calls the power function with the user-provided base and exponent.
- It prints the result, formatted to two decimal places.

Example

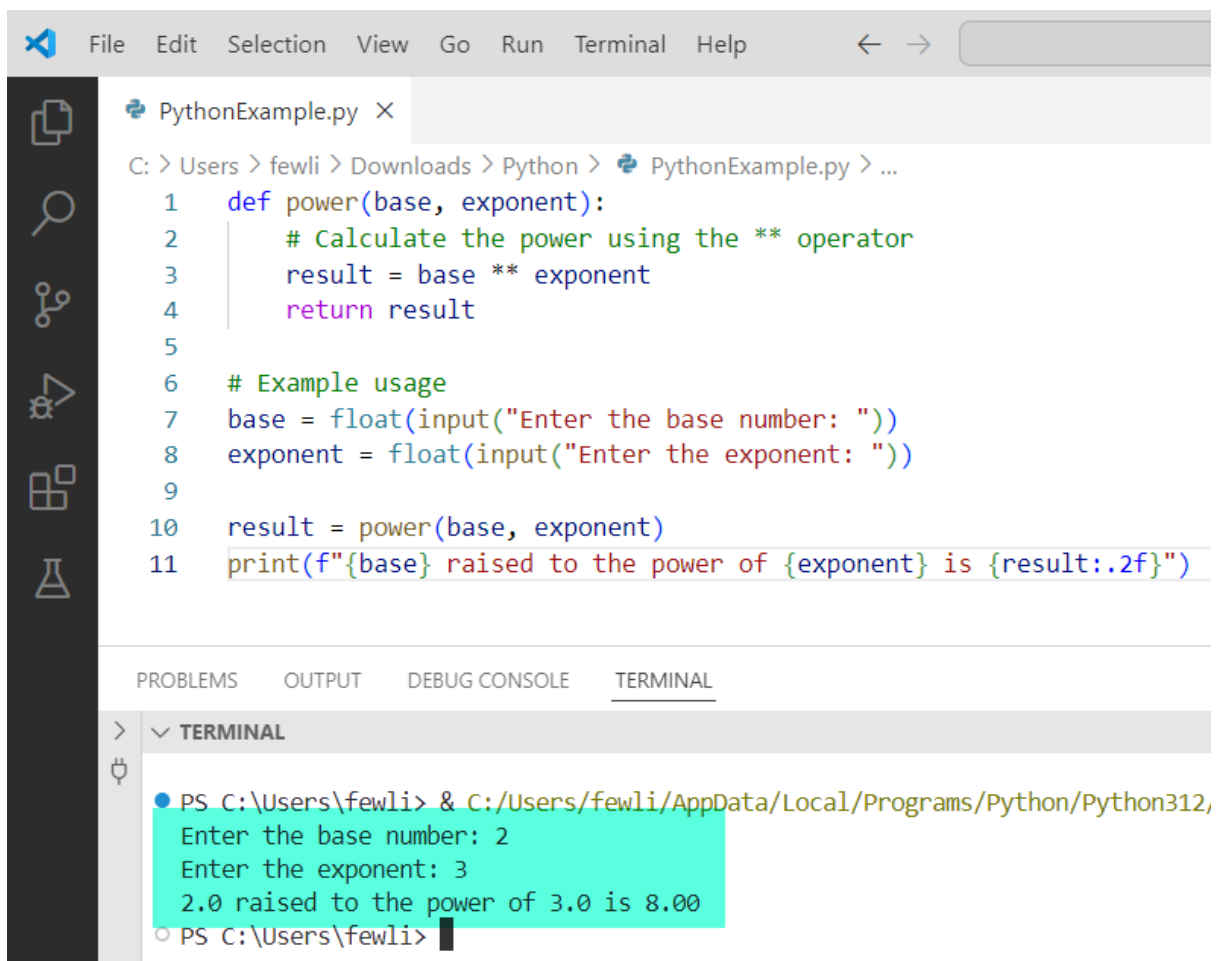
Let's say the user inputs the following values:

- Base number: 2
- Exponent: 3

- The program will call `power(2, 3)`.
- Inside the function:
 - It calculates the power: [$\text{result} = 2 ** 3 = 8$]
- The output will be:

2.0 raised to the power of 3.0 is 8.00

Here is the exact output:



The screenshot shows a Python IDE with a file named `PythonExample.py`. The code defines a `power` function that takes `base` and `exponent` as arguments and returns `base ** exponent`. It includes example usage code that prompts the user for a base and exponent, calculates the power, and prints the result. The terminal output shows the program being run, the user entering 2 for the base and 3 for the exponent, and the program outputting "2.0 raised to the power of 3.0 is 8.00".

```
File Edit Selection View Go Run Terminal Help
PythonExample.py X
C: > Users > fewli > Downloads > Python > PythonExample.py > ...
1 def power(base, exponent):
2     # Calculate the power using the ** operator
3     result = base ** exponent
4     return result
5
6 # Example usage
7 base = float(input("Enter the base number: "))
8 exponent = float(input("Enter the exponent: "))
9
10 result = power(base, exponent)
11 print(f"{base} raised to the power of {exponent} is {result:.2f}")

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
> v TERMINAL
• PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python312,
Enter the base number: 2
Enter the exponent: 3
2.0 raised to the power of 3.0 is 8.00
○ PS C:\Users\fewli>
```

45# PYTHON PROGRAM TO FIND QUOTIENT AND REMAINDER

To find the quotient and remainder of two numbers in Python, you can use the `//` operator for integer division (quotient) and the `%` operator for the modulus (remainder). These operators are straightforward and provide an efficient way to perform the required calculations.

Here is a Python program to find the quotient and remainder of two numbers:

```
def find_quotient_and_remainder(dividend, divisor):
```

```
# Calculate the quotient using integer division
quotient = dividend // divisor

# Calculate the remainder using the modulus operator
remainder = dividend % divisor

return quotient, remainder

# Example usage
dividend = int(input("Enter the dividend: "))
divisor = int(input("Enter the divisor: "))

quotient, remainder = find_quotient_and_remainder(dividend, divisor)
print(f"The quotient of {dividend} divided by {divisor} is {quotient}")
print(f"The remainder of {dividend} divided by {divisor} is {remainder}")
```

Explanation

1. Define find_quotient_and_remainder Function:

- This function takes two arguments: dividend (the number to be divided) and divisor (the number by which to divide).
- It calculates the quotient using the // operator (integer division):
$$\text{quotient} = \text{dividend} // \text{divisor}$$
- It calculates the remainder using the % operator (modulus):
$$\text{remainder} = \text{dividend} \% \text{divisor}$$
- It returns both the quotient and the remainder.

2. User Input:

- The program prompts the user to enter the dividend.
- The input is read as a string and then converted to an integer using int().
- The program prompts the user to enter the divisor.
- The input is read as a string and then converted to an integer using int().

3. Calculate and Print:

- The program calls the find_quotient_and_remainder function with the user-provided dividend and divisor.

- It prints the quotient and the remainder.

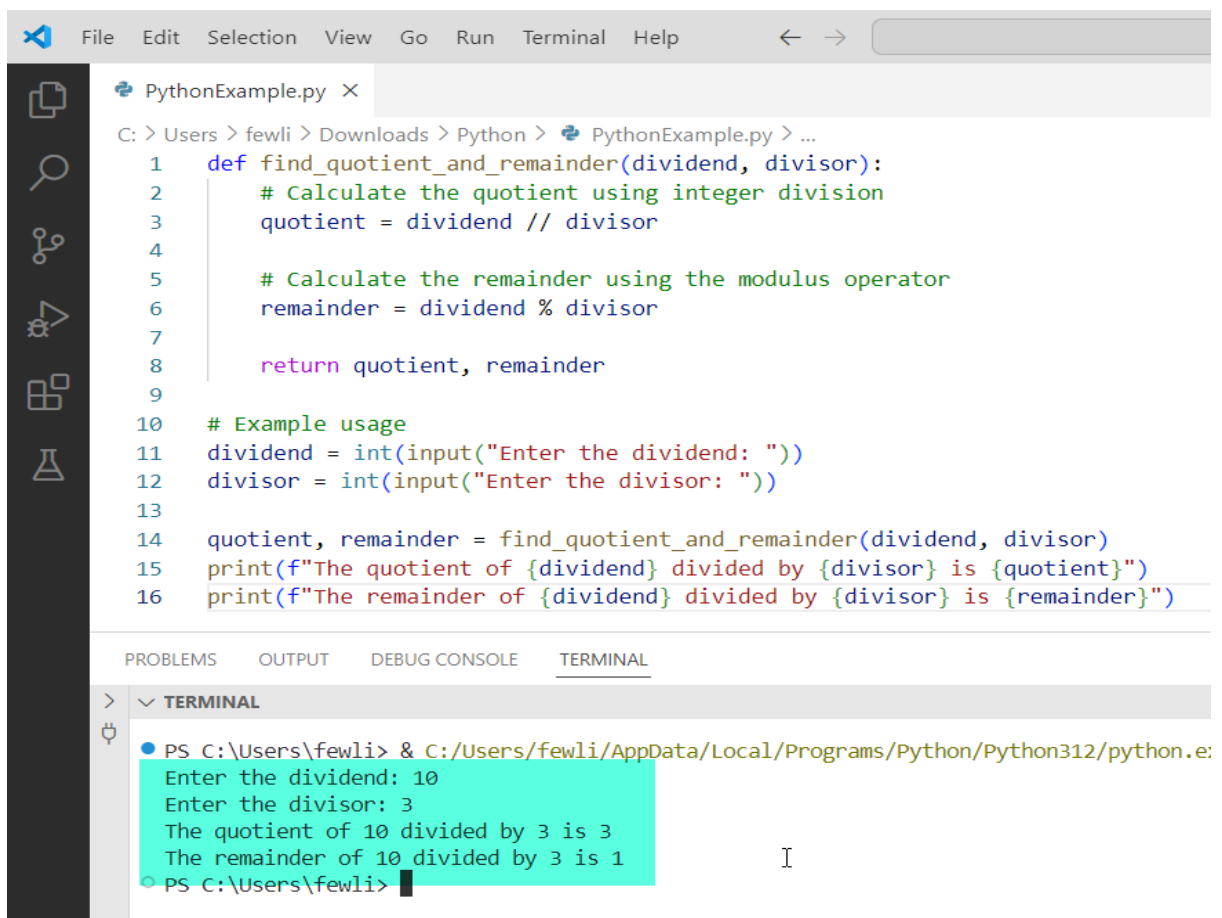
Example

Let's say the user inputs the following values:

- Dividend: 10
- Divisor: 3
- The program will call `find_quotient_and_remainder(10, 3)`.
- Inside the function:
 - It calculates the quotient: [$\text{quotient} = 10 // 3 = 3$]
 - It calculates the remainder: [$\text{remainder} = 10 \% 3 = 1$]
- The output will be:
- The quotient of 10 divided by 3 is 3

The remainder of 10 divided by 3 is 1

Here is the exact output:



The screenshot shows a Python IDE with a file named `PythonExample.py` open. The code defines a function `find_quotient_and_remainder` that takes a dividend and a divisor as arguments. It calculates the quotient using integer division (`//`) and the remainder using the modulus operator (`%`). The function returns both values. Below the function definition, there is an example usage section that prompts the user for a dividend and a divisor, calls the function, and prints the results. The terminal output shows the program running, with the user entering 10 for the dividend and 3 for the divisor. The program outputs: "The quotient of 10 divided by 3 is 3" and "The remainder of 10 divided by 3 is 1".

```
File Edit Selection View Go Run Terminal Help
PythonExample.py x
C: > Users > fewli > Downloads > Python > PythonExample.py > ...
1 def find_quotient_and_remainder(dividend, divisor):
2     # Calculate the quotient using integer division
3     quotient = dividend // divisor
4
5     # Calculate the remainder using the modulus operator
6     remainder = dividend % divisor
7
8     return quotient, remainder
9
10 # Example usage
11 dividend = int(input("Enter the dividend: "))
12 divisor = int(input("Enter the divisor: "))
13
14 quotient, remainder = find_quotient_and_remainder(dividend, divisor)
15 print(f"The quotient of {dividend} divided by {divisor} is {quotient}")
16 print(f"The remainder of {dividend} divided by {divisor} is {remainder}")

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
> v TERMINAL
• PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python312/python.e:
Enter the dividend: 10
Enter the divisor: 3
The quotient of 10 divided by 3 is 3
The remainder of 10 divided by 3 is 1
• PS C:\Users\fewli> █
```

46# PYTHON PROGRAM TO FIND OUT LEAP YEAR

To determine whether a given year is a leap year in Python, you need to follow these rules:

1. A year is a leap year if it is divisible by 4.
2. However, if the year is also divisible by 100, it is not a leap year unless it is also divisible by 400.

These rules can be summarized as:

- A year is a leap year if it is divisible by 4 and not divisible by 100, or it is divisible by 400.

Here is a Python program to check if a given year is a leap year:

```
def is_leap_year(year):
    # Check if the year is divisible by 4 but not by 100, or it is divisible
    # by 400
    if (year % 4 == 0 and year % 100 != 0) or (year % 400 == 0):
        return True
    else:
        return False

# Example usage
year = int(input("Enter a year: "))

if is_leap_year(year):
    print(f"{year} is a leap year.")
else:
    print(f"{year} is not a leap year.")
```

Explanation

1. Define is_leap_year Function:
 - This function takes one argument: year.
 - It checks if the year is a leap year using the conditions:
 - The year is divisible by 4 and not divisible by 100, or
 - The year is divisible by 400.
 - If either condition is met, the function returns True, indicating it is a leap year.
 - Otherwise, it returns False.

2. User Input:

- The program prompts the user to enter a year.
- The input is read as a string and then converted to an integer using `int()`.

3. Check and Print:

- The program calls the `is_leap_year` function with the user-provided year.
- It prints whether the year is a leap year or not based on the function's return value.

Example

Let's say the user inputs the year 2024.

- The program will call `is_leap_year(2024)`.
- Inside the function:
 - It checks the conditions:
 - 2024 is divisible by 4 (`2024 % 4 == 0` is True).
 - 2024 is not divisible by 100 (`2024 % 100 != 0` is True).
 - Since both conditions are met, the function returns True.
- The output will be:
- 2024 is a leap year.

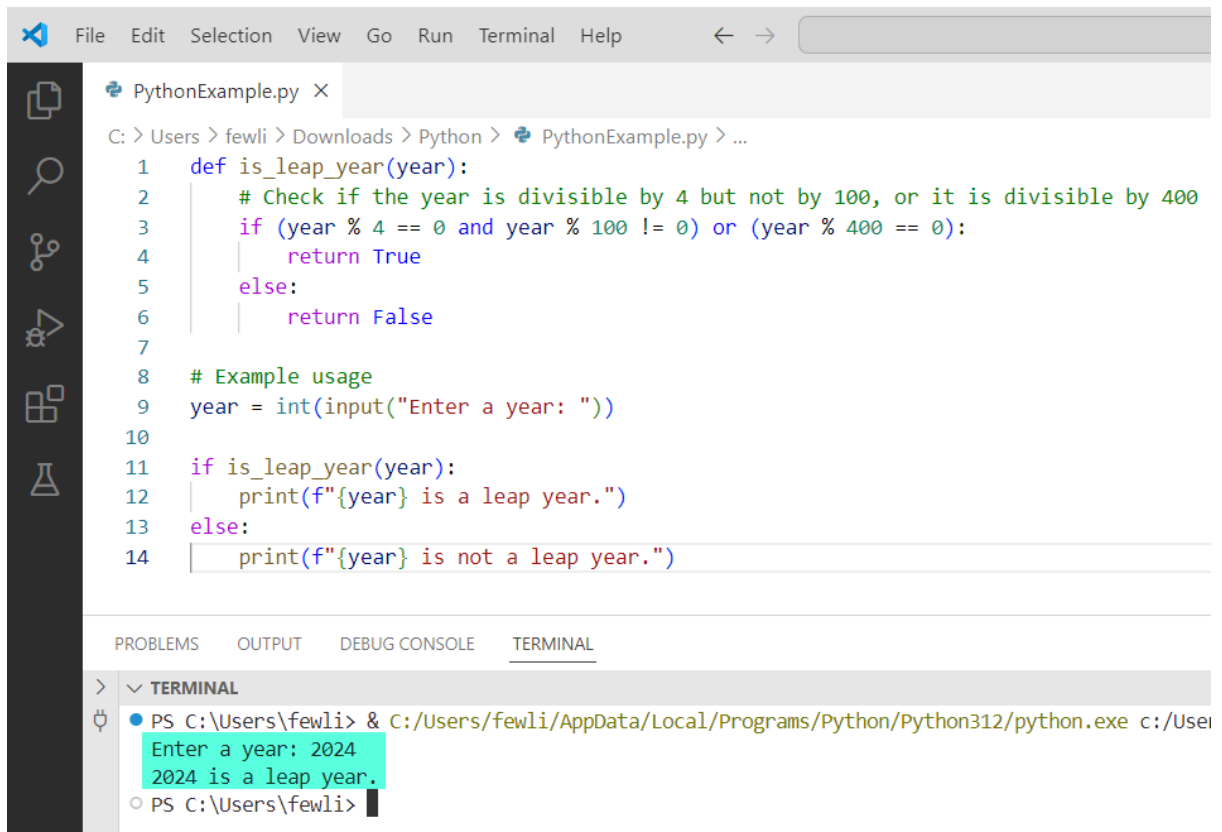
Let's consider another example where the user inputs the year 1900.

- The program will call `is_leap_year(1900)`.
- Inside the function:
 - It checks the conditions:
 - 1900 is divisible by 4 (`1900 % 4 == 0` is True).
 - 1900 is divisible by 100 (`1900 % 100 == 0` is True).
 - 1900 is not divisible by 400 (`1900 % 400 != 0` is True).

- Since 1900 is divisible by 100 but not by 400, the function returns False.
- The output will be:

1900 is not a leap year.

Here is the output:



The screenshot shows a Python IDE with a file named 'PythonExample.py'. The code defines a function 'is_leap_year' that checks if a year is a leap year based on the rules: divisible by 4 but not by 100, or divisible by 400. It includes an example usage where the user enters '2024', and the program outputs '2024 is a leap year.' The terminal window at the bottom shows the command execution and the resulting output.

```
File Edit Selection View Go Run Terminal Help
PythonExample.py x
C: > Users > fewli > Downloads > Python > PythonExample.py > ...
1 def is_leap_year(year):
2     # Check if the year is divisible by 4 but not by 100, or it is divisible by 400
3     if (year % 4 == 0 and year % 100 != 0) or (year % 400 == 0):
4         return True
5     else:
6         return False
7
8 # Example usage
9 year = int(input("Enter a year: "))
10
11 if is_leap_year(year):
12     print(f"{year} is a leap year.")
13 else:
14     print(f"{year} is not a leap year.")
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
> TERMINAL
PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python312/python.exe c:/User
Enter a year: 2024
2024 is a leap year.
PS C:\Users\fewli>
```

47# PYTHON PROGRAM TO FIND CURRENT DATE AND TIME

To find the current date and time in Python, you can use the `datetime` module, which provides various classes to manipulate dates and times. The `datetime.datetime` class includes methods to get the current date and time.

Here is a Python program to find and display the current date and time:

```
from datetime import datetime

def get_current_date_time():
    # Get the current date and time
    now = datetime.now()

    # Format the date and time as a string
    current_date_time = now.strftime("%Y-%m-%d %H:%M:%S")
```

```
    return current_date_time

# Example usage
current_date_time = get_current_date_time()
print(f"The current date and time is: {current_date_time}")
```

Explanation

1. Import datetime Module:

- The datetime module provides classes for manipulating dates and times.
- Specifically, `datetime.now()` returns the current local date and time.

2. Define `get_current_date_time` Function:

- This function gets the current date and time using `datetime.now()`.
- It formats the date and time as a string using the `strftime` method, which formats a datetime object to a string according to the specified format codes.
- The format `"%Y-%m-%d %H:%M:%S"` represents:
 - `%Y`: Year with century (e.g., 2024)
 - `%m`: Month as a zero-padded decimal number (e.g., 01 for January)
 - `%d`: Day of the month as a zero-padded decimal number (e.g., 01)
 - `%H`: Hour (24-hour clock) as a zero-padded decimal number (e.g., 14 for 2 PM)
 - `%M`: Minute as a zero-padded decimal number (e.g., 30)
 - `%S`: Second as a zero-padded decimal number (e.g., 59)
- It returns the formatted current date and time as a string.

3. Get and Print Current Date and Time:

- The program calls the `get_current_date_time` function to get the current date and time.
- It prints the result.

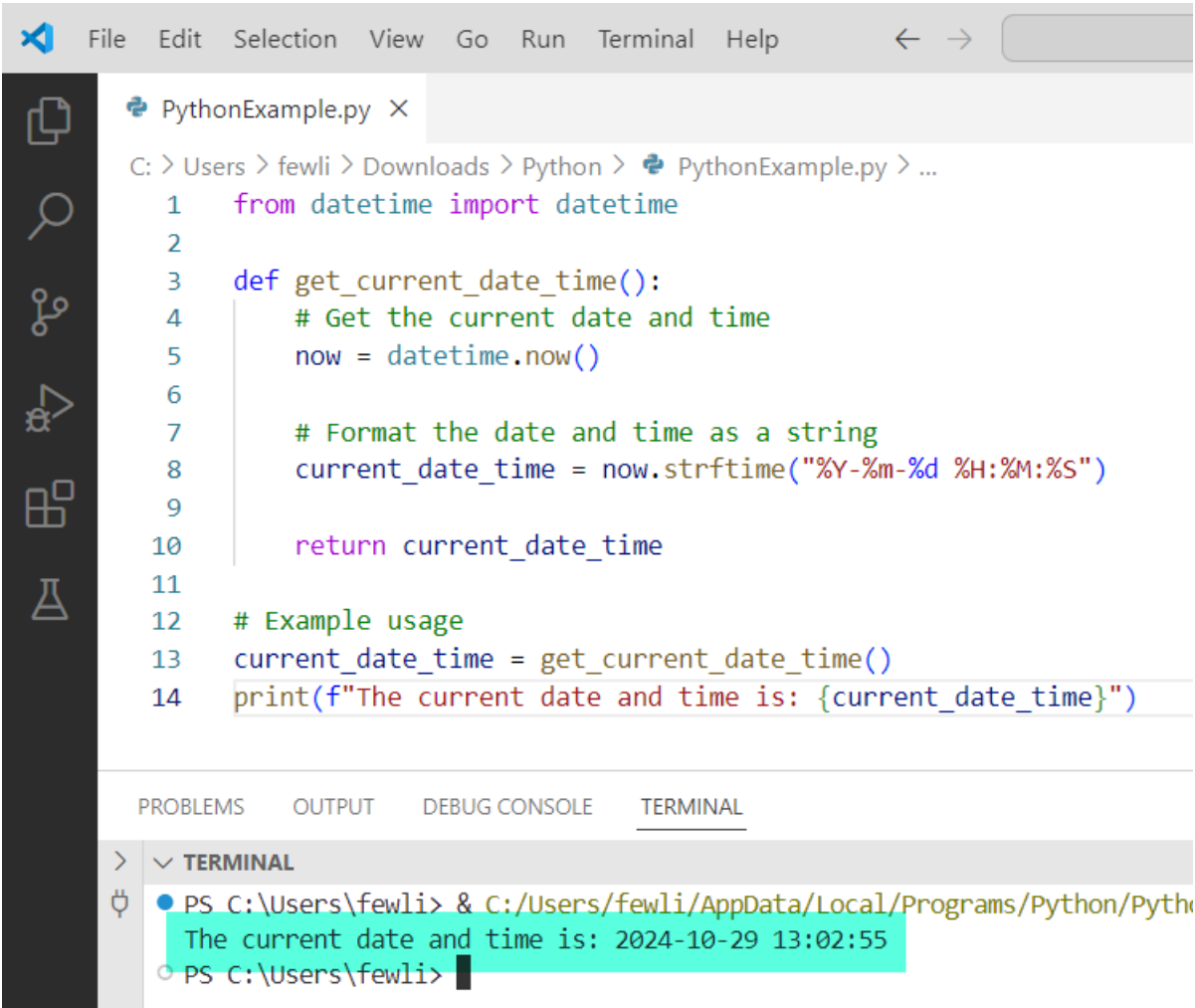
Example

When you run the program, it will output the current date and time formatted as specified. For example:

The current date and time is: 2024-10-29 14:30:45

This output will vary depending on the exact moment you run the program.

Here is the exact output:



```
PythonExample.py X
C: > Users > fewli > Downloads > Python > PythonExample.py > ...
1  from datetime import datetime
2
3  def get_current_date_time():
4      # Get the current date and time
5      now = datetime.now()
6
7      # Format the date and time as a string
8      current_date_time = now.strftime("%Y-%m-%d %H:%M:%S")
9
10     return current_date_time
11
12     # Example usage
13     current_date_time = get_current_date_time()
14     print(f"The current date and time is: {current_date_time}")

PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL
>  v  TERMINAL
• PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python
  The current date and time is: 2024-10-29 13:02:55
• PS C:\Users\fewli>
```

48# PYTHON PROGRAM TO GET DAYS BETWEEN TWO DATES

To calculate the number of days between two dates in Python, you can use the `datetime` module, which provides classes for manipulating dates and times. Specifically, you can create `datetime.date` objects for the two dates

and then subtract them to get a `datetime.timedelta` object, which represents the difference between the two dates.

Here is a Python program to calculate the number of days between two dates:

```
from datetime import date

def days_between_dates(date1, date2):
    # Convert the input strings to date objects
    date1 = date(*map(int, date1.split('-')))
    date2 = date(*map(int, date2.split('-')))

    # Calculate the difference between the two dates
    delta = date2 - date1

    # Return the difference in days
    return abs(delta.days)

# Example usage
date1 = input("Enter the first date (YYYY-MM-DD): ")
date2 = input("Enter the second date (YYYY-MM-DD): ")

days_difference = days_between_dates(date1, date2)
print(f"The number of days between {date1} and {date2} is {days_difference} days.")
```

Explanation

1. Import date Class from datetime Module:
 - The date class is used to create date objects.
2. Define days_between_dates Function:
 - This function takes two arguments: date1 and date2, which are strings representing the dates in the format YYYY-MM-DD.
 - It converts the input strings to date objects using the date class:
 - `date(*map(int, date1.split('-')))` splits the string by the hyphen, maps each part to an integer, and unpacks the integers as arguments to the date constructor.

- It calculates the difference between the two dates by subtracting one date object from the other, resulting in a `datetime.timedelta` object.
- It returns the absolute value of the difference in days using `abs(delta.days)` to ensure the result is always positive.

3. User Input:

- The program prompts the user to enter the first date in the format `YYYY-MM-DD`.
- The input is read as a string.
- The program prompts the user to enter the second date in the same format.
- The input is read as a string.

4. Calculate and Print:

- The program calls the `days_between_dates` function with the user-provided dates.
- It prints the number of days between the two dates.

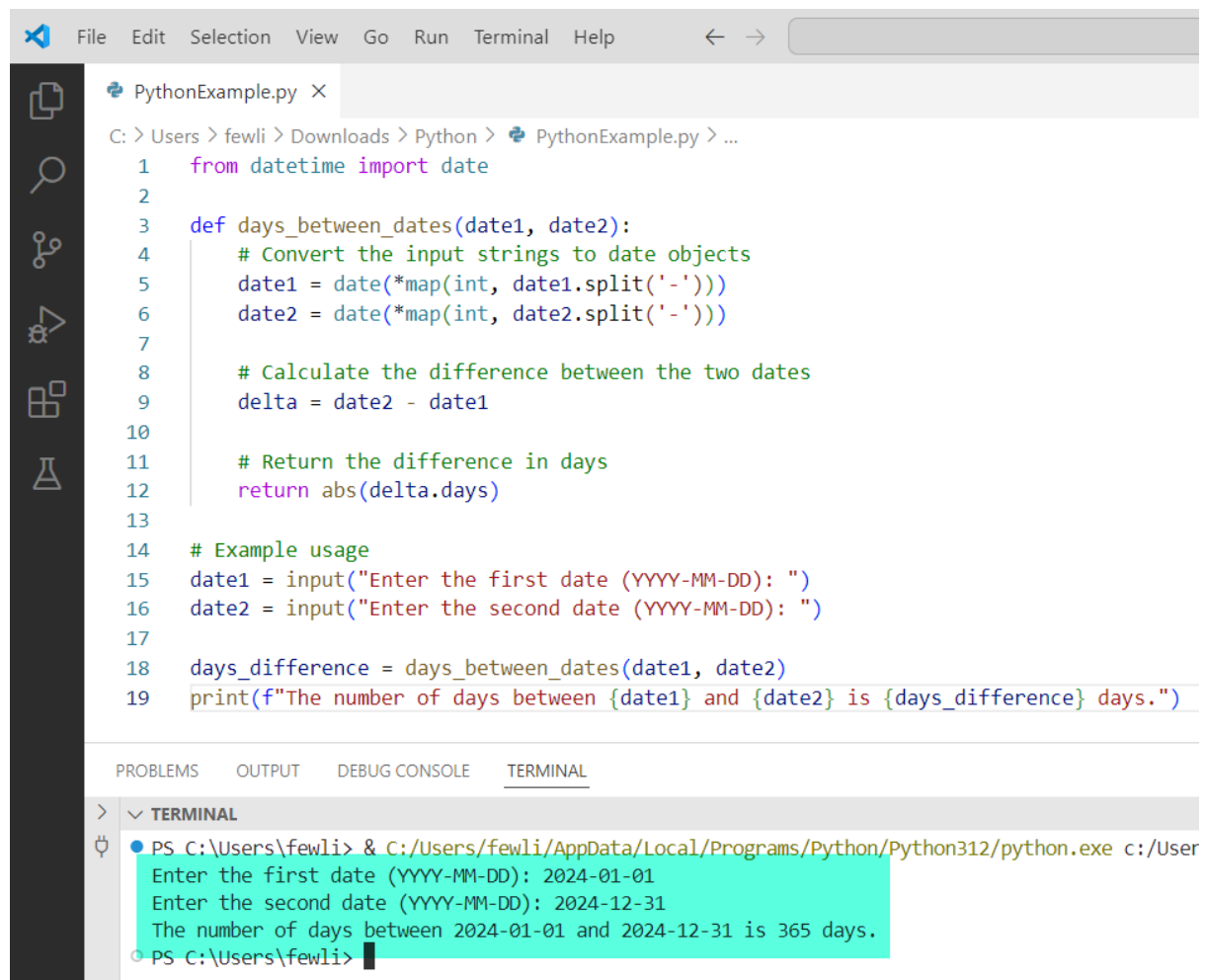
Example

Let's say the user inputs the following dates:

- First date: `2024-01-01`
- Second date: `2024-12-31`
- The program will call `days_between_dates("2024-01-01", "2024-12-31")`.
- Inside the function:
 - It converts the strings to date objects: `[\text{date}(2024, 1, 1)] [\text{date}(2024, 12, 31)]`
 - It calculates the difference between the two dates: `[\text{delta} = \text{date}(2024, 12, 31) - \text{date}(2024, 1, 1)] [\text{delta.days} = 364]`
- The output will be:

The number of days between 2024-01-01 and 2024-12-31 is 364 days.

Here is the exact output in the screenshot below:



```
PythonExample.py x
C: > Users > fewli > Downloads > Python > PythonExample.py > ...
1  from datetime import date
2
3  def days_between_dates(date1, date2):
4      # Convert the input strings to date objects
5      date1 = date(*map(int, date1.split('-')))
6      date2 = date(*map(int, date2.split('-')))
7
8      # Calculate the difference between the two dates
9      delta = date2 - date1
10
11     # Return the difference in days
12     return abs(delta.days)
13
14 # Example usage
15 date1 = input("Enter the first date (YYYY-MM-DD): ")
16 date2 = input("Enter the second date (YYYY-MM-DD): ")
17
18 days_difference = days_between_dates(date1, date2)
19 print(f"The number of days between {date1} and {date2} is {days_difference} days.")

PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL
> v TERMINAL
• PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python312/python.exe c:/User
Enter the first date (YYYY-MM-DD): 2024-01-01
Enter the second date (YYYY-MM-DD): 2024-12-31
The number of days between 2024-01-01 and 2024-12-31 is 365 days.
• PS C:\Users\fewli>
```

49# PYTHON PROGRAM TO CALCULATE AGE FROM DATE OF BIRTH

To calculate a person's age from their date of birth in Python, you can use the datetime module. This module provides classes for manipulating dates and times, making it easy to calculate the difference between the current date and the date of birth.

Here is a Python program to calculate age from a date of birth:

```
from datetime import date

def calculate_age(birthdate):
    # Get today's date
    today = date.today()

    # Calculate the difference in years
    age = today.year - birthdate.year
```

```
# Adjust the age if the birthdate has not occurred yet this year
if (today.month, today.day) < (birthdate.month, birthdate.day):
    age -= 1

return age

# Example usage
birth_year = int(input("Enter your birth year (e.g., 1990): "))
birth_month = int(input("Enter your birth month (1-12): "))
birth_day = int(input("Enter your birth day (1-31): "))

birthdate = date(birth_year, birth_month, birth_day)
age = calculate_age(birthdate)
print(f"Your age is: {age} years")
```

Explanation

1. Import date Class from datetime Module:
 - The date class is used to create date objects.
2. Define calculate_age Function:
 - This function takes one argument: birthdate, which is a date object representing the person's date of birth.
 - It gets today's date using date.today().
 - It calculates the initial age by subtracting the birth year from the current year: [$\text{age} = \text{today.year} - \text{birthdate.year}$]
 - It adjusts the age if the birthdate has not occurred yet this year by checking if today's month and day are less than the birthdate's month and day: [$\text{if (today.month, today.day) < (birthdate.month, birthdate.day):}$] [$\text{age} -= 1$]
 - It returns the calculated age.
3. User Input:
 - The program prompts the user to enter their birth year, month, and day.
 - The inputs are read as strings and then converted to integers using int().

4. Create birthdate Object:

- The program creates a date object for the birthdate using the provided year, month, and day: [`\text{birthdate} = \text{date}(birth_year, birth_month, birth_day)`]

5. Calculate and Print Age:

- The program calls the `calculate_age` function with the birthdate object.
- It prints the calculated age.

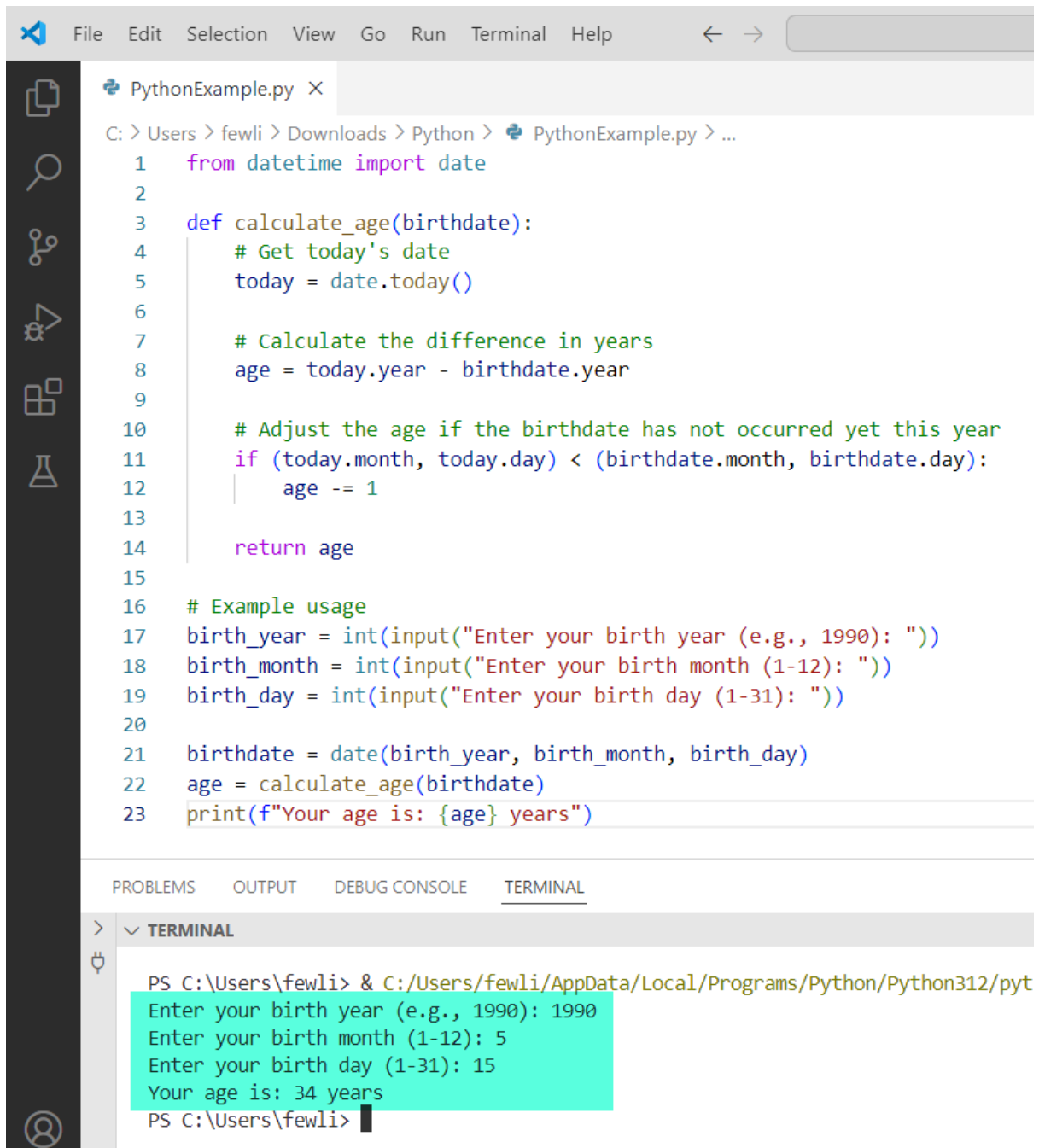
Example

Let's say the user inputs the following birthdate:

- Birth year: 1990
- Birth month: 5
- Birth day: 15
- The program will call `calculate_age(date(1990, 5, 15))`.
- Inside the function:
 - It gets today's date, for example, `date(2024, 10, 29)`.
 - It calculates the initial age: [`\text{age} = 2024 - 1990 = 34`]
 - It checks if the birthdate has occurred yet this year: [`\text{if} (10, 29) < (5, 15): \quad \text{(False)}`]
 - Since the condition is false, the age remains 34.
- The output will be:

Your age is: 34 years

Here is the exact output:



```
PythonExample.py X
C: > Users > fewli > Downloads > Python > PythonExample.py > ...
1  from datetime import date
2
3  def calculate_age(birthdate):
4      # Get today's date
5      today = date.today()
6
7      # Calculate the difference in years
8      age = today.year - birthdate.year
9
10     # Adjust the age if the birthdate has not occurred yet this year
11     if (today.month, today.day) < (birthdate.month, birthdate.day):
12         age -= 1
13
14     return age
15
16 # Example usage
17 birth_year = int(input("Enter your birth year (e.g., 1990): "))
18 birth_month = int(input("Enter your birth month (1-12): "))
19 birth_day = int(input("Enter your birth day (1-31): "))
20
21 birthdate = date(birth_year, birth_month, birth_day)
22 age = calculate_age(birthdate)
23 print(f"Your age is: {age} years")

PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL
>  TERMINAL
PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python312/pyt
Enter your birth year (e.g., 1990): 1990
Enter your birth month (1-12): 5
Enter your birth day (1-31): 15
Your age is: 34 years
PS C:\Users\fewli>
```

50# PYTHON PROGRAM TO PRINT YESTERDAY TODAY TOMORROW

To print the dates for yesterday, today, and tomorrow in Python, you can use the datetime module, which provides classes for manipulating dates and times. Specifically, you can use the datetime.date class and the timedelta class to perform date arithmetic.

Here is a Python program to print the dates for yesterday, today, and tomorrow:

```
from datetime import date, timedelta

def print_yesterday_today_tomorrow():
    # Get today's date
    today = date.today()

    # Calculate yesterday's date
    yesterday = today - timedelta(days=1)

    # Calculate tomorrow's date
    tomorrow = today + timedelta(days=1)

    # Print the dates
    print(f"Yesterday's date was: {yesterday}")
    print(f"Today's date is: {today}")
    print(f"Tomorrow's date will be: {tomorrow}")

# Example usage
print_yesterday_today_tomorrow()
```

Explanation

1. Import date and timedelta Classes from datetime Module:

- The date class is used to create date objects representing specific dates.
- The timedelta class is used to represent the difference between two dates or to perform date arithmetic.

2. Define print_yesterday_today_tomorrow Function:

- This function calculates and prints the dates for yesterday, today, and tomorrow.
- It gets today's date using date.today().
- It calculates yesterday's date by subtracting one day from today's date using timedelta(days=1): [\text{yesterday} = \text{today} - \text{timedelta(days=1)}]
- It calculates tomorrow's date by adding one day to today's date using timedelta(days=1): [\text{tomorrow} = \text{today} + \text{timedelta(days=1)}]
- It prints the calculated dates.

3. Example Usage:

- The program calls the `print_yesterday_today_tomorrow` function to print the dates for yesterday, today, and tomorrow.

Example Output

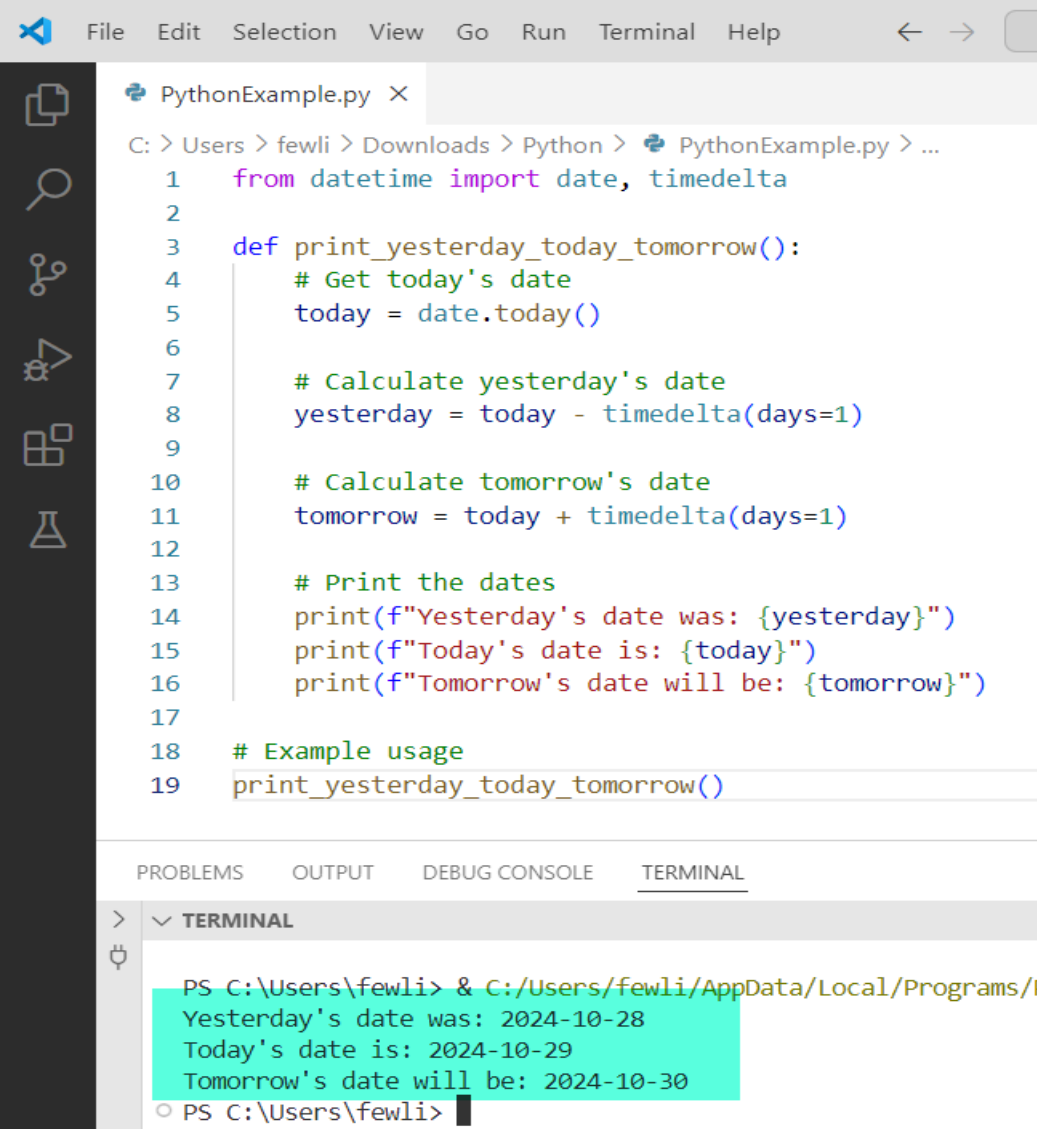
When you run the program, it will output the dates for yesterday, today, and tomorrow. For example, if today is October 29, 2024, the output will be:

Yesterday's date was: 2024-10-28

Today's date is: 2024-10-29

Tomorrow's date will be: 2024-10-30

Here is the exact output:



```
File Edit Selection View Go Run Terminal Help
PythonExample.py x
C: > Users > fewli > Downloads > Python > PythonExample.py > ...
1  from datetime import date, timedelta
2
3  def print_yesterday_today_tomorrow():
4      # Get today's date
5      today = date.today()
6
7      # Calculate yesterday's date
8      yesterday = today - timedelta(days=1)
9
10     # Calculate tomorrow's date
11     tomorrow = today + timedelta(days=1)
12
13     # Print the dates
14     print(f"Yesterday's date was: {yesterday}")
15     print(f"Today's date is: {today}")
16     print(f"Tomorrow's date will be: {tomorrow}")
17
18     # Example usage
19     print_yesterday_today_tomorrow()

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
> v TERMINAL
PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/Python/Python312/python.exe C:/Users/fewli/Downloads/Python/PythonExample.py
Yesterday's date was: 2024-10-28
Today's date is: 2024-10-29
Tomorrow's date will be: 2024-10-30
PS C:\Users\fewli>
```

51# PYTHON PROGRAM TO PRINT DAYS OF THE WEEK

To print the days of the week in Python, use the calendar module, which provides useful functions for working with dates and times. The calendar module has a `day_name` attribute that contains the names of the days of the week.

Here is a Python program using the calendar module:

```
import calendar

def print_days_of_the_week():
    # Get the day names from the calendar module
    days_of_week = list(calendar.day_name)

    # Iterate over the list and print each day
    for day in days_of_week:
        print(day)

# Example usage
print_days_of_the_week()
```

Explanation

1. Import calendar Module:

- The calendar module provides functions and classes for working with dates and calendars.

2. Define `print_days_of_the_week` Function:

- This function retrieves the names of the days of the week from `calendar.day_name`, which is an iterable containing the names of the days of the week.
- It converts `calendar.day_name` to a list called `days_of_week`.
- It uses a for loop to iterate over each element in the `days_of_week` list.
- Inside the loop, it prints each day.

3. Example Usage:

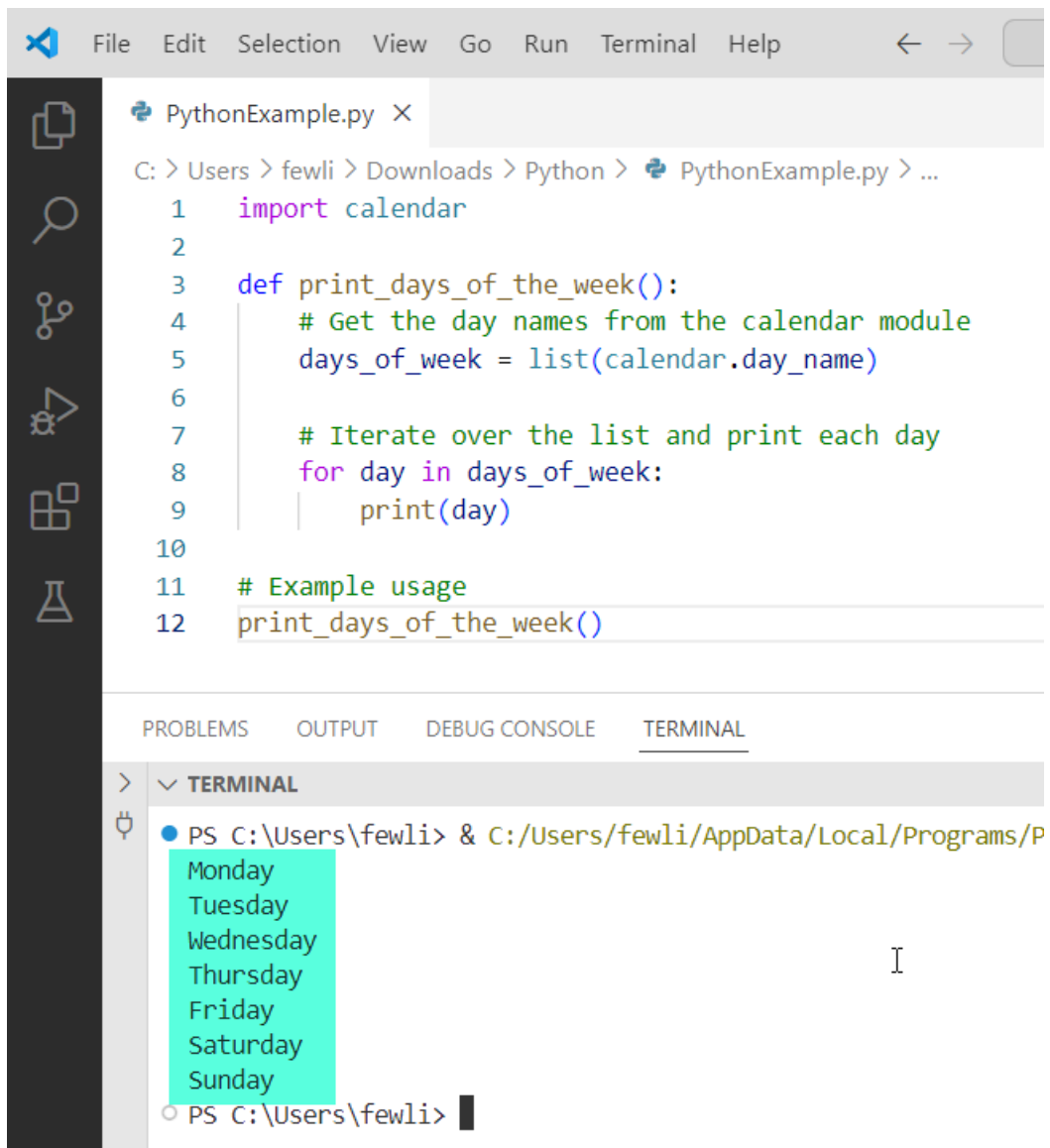
- The program calls the `print_days_of_the_week` function to print the days of the week.

Example Output

When you run the program, it will output the same result as the previous method:

- Monday
- Tuesday
- Wednesday
- Thursday
- Friday
- Saturday
- Sunday

You can see the exact output:



The screenshot shows a code editor window with a menu bar (File, Edit, Selection, View, Go, Run, Terminal, Help) and a sidebar with icons. The main editor area displays the following Python code:

```
1 import calendar
2
3 def print_days_of_the_week():
4     # Get the day names from the calendar module
5     days_of_week = list(calendar.day_name)
6
7     # Iterate over the list and print each day
8     for day in days_of_week:
9         print(day)
10
11 # Example usage
12 print_days_of_the_week()
```

Below the code editor is a terminal window with tabs for PROBLEMS, OUTPUT, DEBUG CONSOLE, and TERMINAL. The terminal shows the execution of the program:

```
PS C:\Users\fewli> & C:/Users/fewli/AppData/Local/Programs/P
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
PS C:\Users\fewli> █
```

CONCLUSION

I hope you liked all these Python programs. Do check out more Python tutorials on our website: <https://pythonguides.com>