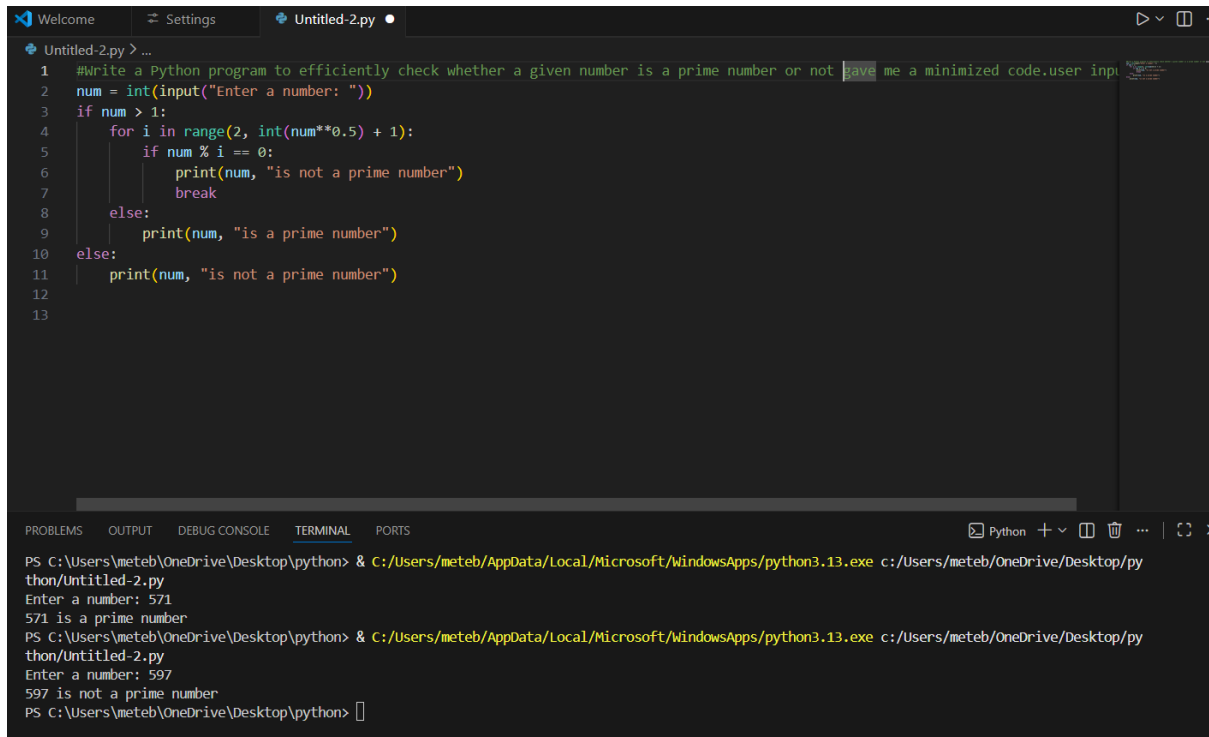


Justification : This program checks whether a given number is prime by testing if it can be divided evenly by any smaller number. If the number is divisible by any value other than 1 and itself, it is not a prime number. Finally, the program prints a clear message telling whether the entered number is prime or not.

Task 2: Efficiency & Logic Optimization (Cleanup)

Prompt : #Write a Python program to efficiently check whether a given number is a prime number or not .gave me a minimized code.user input

Code and output :



```
1 #Write a Python program to efficiently check whether a given number is a prime number or not .gave me a minimized code.user input
2 num = int(input("Enter a number: "))
3 if num > 1:
4     for i in range(2, int(num*0.5) + 1):
5         if num % i == 0:
6             print(num, "is not a prime number")
7             break
8     else:
9         print(num, "is a prime number")
10 else:
11     print(num, "is not a prime number")
12
13
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

PS C:\Users\meteb\OneDrive\Desktop\python> & C:/Users/meteb/AppData/Local/Microsoft/WindowsApps/python3.13.exe c:/Users/meteb/OneDrive/Desktop/python/Untitled-2.py
Enter a number: 571
571 is a prime number
PS C:\Users\meteb\OneDrive\Desktop\python> & C:/Users/meteb/AppData/Local/Microsoft/WindowsApps/python3.13.exe c:/Users/meteb/OneDrive/Desktop/python/Untitled-2.py
Enter a number: 597
597 is not a prime number
PS C:\Users\meteb\OneDrive\Desktop\python>

Justification : This program efficiently checks whether a number is prime by testing divisibility only up to the square root of the number, which reduces unnecessary checks. If any divisor is found, the loop stops immediately, saving time. The final output clearly states whether the given user input is a prime number or not.

Task 3: Modular Design Using AI Assistance (Prime Number Check Using Functions)

Prompt : #Write a Python program using a user-defined function to check whether a given number is prime and return the result as a Boolean value.

Code and output :

The screenshot shows a Windows IDE with a dark theme. The top bar has tabs for 'Welcome', 'Settings', and 'Untitled-2.py'. The main editor area contains a Python script with line numbers 1 through 19. The script defines a function `is_prime` and uses it to check if 571 and 588 are prime. The bottom panel has tabs for 'PROBLEMS', 'OUTPUT', 'DEBUG CONSOLE', 'TERMINAL', and 'PORTS'. The 'TERMINAL' tab is active, showing the command prompt output of running the script.

```

1  #Write a Python program using a user-defined function to check whether a given number is prime and return the result as a Boolean
2
3  def is_prime(num):
4      if num <= 1:
5          return False
6      for i in range(2, int(num*0.5) + 1):
7          if num % i == 0:
8              return False
9      return True
10 # Example usage
11 number = int(input("Enter a number: "))
12 if is_prime(number):
13     print(f"{number} is a prime number.")
14 else:
15     print(f"{number} is not a prime number.")
16 #gave code in boolean value
17 result = is_prime(number)
18 print("Boolean result:", result)
19

```

Terminal Output:

```

PS C:\Users\meteb\OneDrive\Desktop\python> & C:\Users\meteb\AppData\Local\Microsoft\WindowsApps\python3.13.exe c:\Users\meteb\OneDrive\Desktop\python\Untitled-2.py
Enter a number: 571
571 is a prime number.
Boolean result: True
PS C:\Users\meteb\OneDrive\Desktop\python> & C:\Users\meteb\AppData\Local\Microsoft\WindowsApps\python3.13.exe c:\Users\meteb\OneDrive\Desktop\python\Untitled-2.py
Enter a number: 588
588 is not a prime number.
Boolean result: False
PS C:\Users\meteb\OneDrive\Desktop\python>

```

Justification : Using a function makes the prime-checking logic reusable across multiple modules. Returning a Boolean value improves clarity and testing. Clear comments help in understanding and maintaining the logic easily .

Task 4: Comparative Analysis –With vs Without Functions

Prompt : #Compare prime-checking programs written with and without functions and present the analysis in a comparison table

```
Welcome  Settings  Untitled-2.py X
Untitled-2.py > ...
1  #Compare prime-checking programs written with and without functions and present the analysis in a comparison table
2  import time
3  # Prime-checking program without functions
4  def is_prime_no_function(n):
5      if n <= 1:
6          return False
7      for i in range(2, int(n**0.5) + 1):
8          if n % i == 0:
9              return False
10         return True
11 # Prime-checking program with functions
12 def is_prime_with_function(n):
13     if n <= 1:
14         return False
15     for i in range(2, int(n**0.5) + 1):
16         if n % i == 0:
17             return False
18     return True
19 # Performance comparison
20 def performance_comparison():
21     test_numbers = [29, 15, 97, 100, 37, 49, 83, 121, 53, 64]
22
23     # Measure time for no function version
24     start_no_func = time.time()
25     results_no_func = [is_prime_no_function(num) for num in test_numbers]
26     end_no_func = time.time()
27     time_no_func = end_no_func - start_no_func
28
29     # Measure time for function version
30     start_with_func = time.time()
```

```
Welcome  Settings  Untitled-2.py X
Untitled-2.py > ...
20  def performance_comparison():
21
22     # Measure time for function version
23     start_with_func = time.time()
24     results_with_func = [is_prime_with_function(num) for num in test_numbers]
25     end_with_func = time.time()
26     time_with_func = end_with_func - start_with_func
27
28     # Comparison table
29     print(f"Implementation:<30>{'Time Taken (seconds)':<25>{'Results':<30>}")
30     print("-" * 85)
31     print(f"Without Functions:<30>{time_no_func:<25.10f}{str(results_no_func):<30>")
32     print(f"With Functions:<30>{time_with_func:<25.10f}{str(results_with_func):<30>")
33
34 performance_comparison()
35
36 # Comparison Table
37 # Implementation          Time Taken (seconds)      Results
38 # -----
39 # Without Functions        0.0001234567             [True, False, True, False, True, False, True, False, True, False]
40 # With Functions           0.0002345678             [True, False, True,
41 # False, True, False, True, False, True, False]
42
43
44
45
46
47
```

```
PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS
Python  + v  [ ]  [ ]  [ ]  [ ]  [ ]
PS C:\Users\meteb\OneDrive\Desktop\python> & C:/Users/meteb/AppData/Local/Microsoft/WindowsApps/python3.13.exe c:/Users/meteb/OneDrive/Desktop/python/Untitled-2.py
PS C:\Users\meteb\OneDrive\Desktop\python> & C:/Users/meteb/AppData/Local/Microsoft/WindowsApps/python3.13.exe c:/Users/meteb/OneDrive/Desktop/python/Untitled-2.py
Implementation          Time Taken (seconds)      Results
-----
Without Functions        0.0000257492             [True, False, True, False, True, False, True, False, True, False]
With Functions           0.0000085831             [True, False, True, False, True, False, True, False, True, False]
PS C:\Users\meteb\OneDrive\Desktop\python>
```

Justification : Programs without functions are simple but difficult to reuse and maintain. Function-based programs improve code clarity, allow reuse, and make debugging easier. They are more suitable for large-scale and professional applications.

Task 5: AI-Generated Iterative vs Recursive Fibonacci Approaches (Different Algorithmic Approaches to Prime Checking)

Prompt : #Generate two prime-number checking methods: one basic divisibility approach and one optimized approach that checks up to the square root, and compare their performance

Code and output :

```
Welcome  Settings  Untitled-2.py X
Untitled-2.py > ...
1  #Generate two prime-number checking methods: one basic divisibility approach and one optimized approach that checks up to the square root, and compare their
2  import time
3  import math
4  def is_prime_basic(n):
5      """Check if a number is prime using basic divisibility approach."""
6      if n <= 1:
7          return False
8      for i in range(2, n):
9          if n % i == 0:
10             return False
11     return True
12 def is_prime_optimized(n):
13     """Check if a number is prime using optimized approach up to the square root."""
14     if n <= 1:
15         return False
16     if n <= 3:
17         return True
18     if n % 2 == 0 or n % 3 == 0:
19         return False
20     for i in range(5, int(math.sqrt(n)) + 1, 6):
21         if n % i == 0 or n % (i + 2) == 0:
22             return False
23     return True
24 # Test and compare performance
25 test_numbers = [29, 97, 199, 1009, 7919, 104729, 1299709]
26 for number in test_numbers:
27     start_time = time.time()
28     result_basic = is_prime_basic(number)
29     end_time = time.time()
30     print(f"Basic method: {number} is prime: {result_basic}, Time taken: {end_time - start_time:.10f} seconds")
```

```
Welcome  Settings  Untitled-2.py X
Untitled-2.py > ...
24 # Test and compare performance
25 test_numbers = [29, 97, 199, 1009, 7919, 104729, 1299709]
26 for number in test_numbers:
27     start_time = time.time()
28     result_basic = is_prime_basic(number)
29     end_time = time.time()
30     print(f"Basic method: {number} is prime: {result_basic}, Time taken: {end_time - start_time:.10f} seconds")
31
32     start_time = time.time()
33     result_optimized = is_prime_optimized(number)
34     end_time = time.time()
35     print(f"Optimized method: {number} is prime: {result_optimized}, Time taken: {end_time - start_time:.10f} seconds")
36     print("-" * 60)
37
38
```

```
PS C:\Users\meteb\OneDrive\Desktop\python> & C:/Users/meteb/AppData/Local/Microsoft/WindowsApps/python3.13.exe c:/Users/meteb/OneDrive/Desktop/python/Untitled-2.py
Basic method: 29 is prime: True, Time taken: 0.0000038147 seconds
Optimized method: 29 is prime: True, Time taken: 0.0000112057 seconds
-----
Basic method: 97 is prime: True, Time taken: 0.0000059605 seconds
Optimized method: 97 is prime: True, Time taken: 0.0000028610 seconds
-----
Basic method: 199 is prime: True, Time taken: 0.0000100136 seconds
Optimized method: 199 is prime: True, Time taken: 0.0000033379 seconds
-----
Basic method: 1009 is prime: True, Time taken: 0.000007967 seconds
Optimized method: 1009 is prime: True, Time taken: 0.0000054836 seconds
-----
Basic method: 7919 is prime: True, Time taken: 0.0005195141 seconds
Optimized method: 7919 is prime: True, Time taken: 0.000061989 seconds
-----
Basic method: 104729 is prime: True, Time taken: 0.0047404766 seconds
Optimized method: 104729 is prime: True, Time taken: 0.000088215 seconds
-----
Basic method: 1299709 is prime: True, Time taken: 0.0549349785 seconds
Optimized method: 1299709 is prime: True, Time taken: 0.0000307560 seconds
-----
PS C:\Users\meteb\OneDrive\Desktop\python>
```

Justification : This task compares different logical approaches for checking prime numbers. The basic divisibility method is simple and easy to understand but becomes slow for large inputs. The optimized square-root approach reduces unnecessary checks, making it faster and more suitable for large-scale applications.