Lab Assignment 2.1

Task 1: Statistical Summary for Survey Data

Scenario:

- You are a data analyst intern working with survey responses stored as numerical lists.

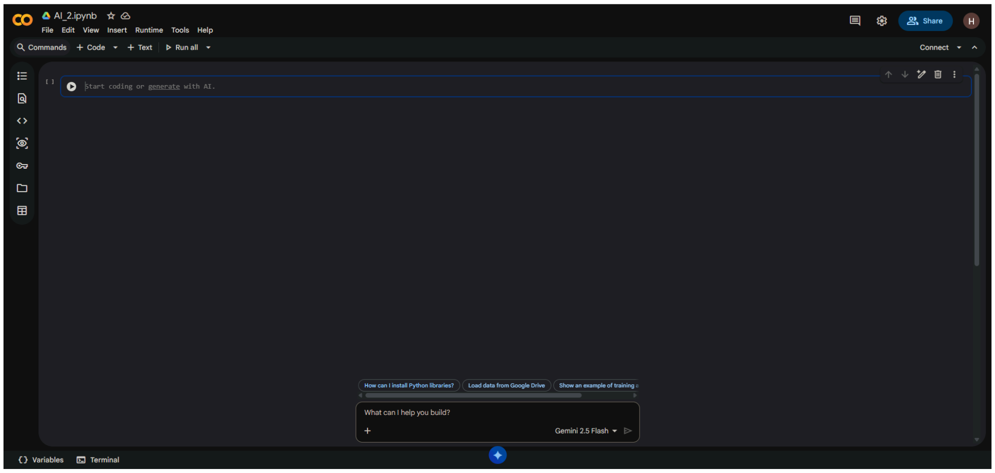
Task:

- Use Google Gemini in Colab to generate a Python function that reads a list of numbers and calculates the mean, minimum, and maximum values.

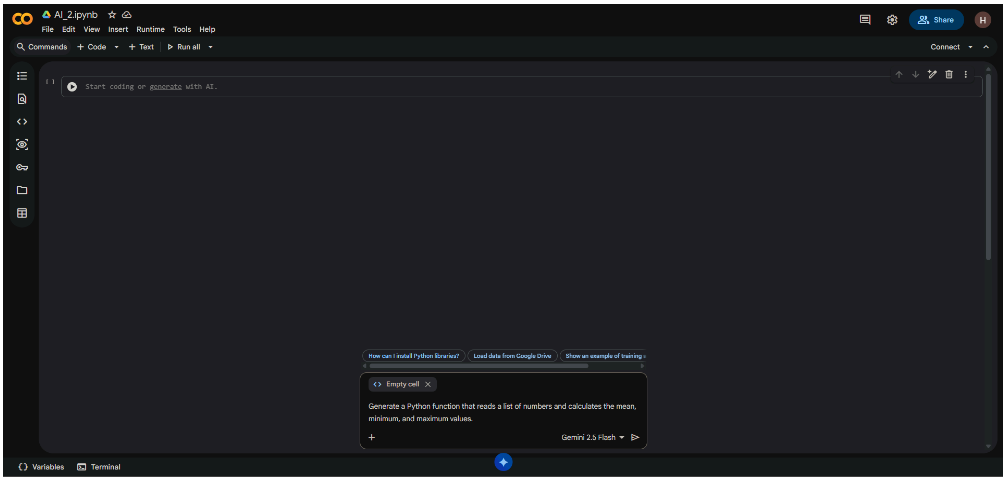
Expected Output:

- Correct Python function
- Output shown in Colab
- Screenshot of Gemini prompt and result

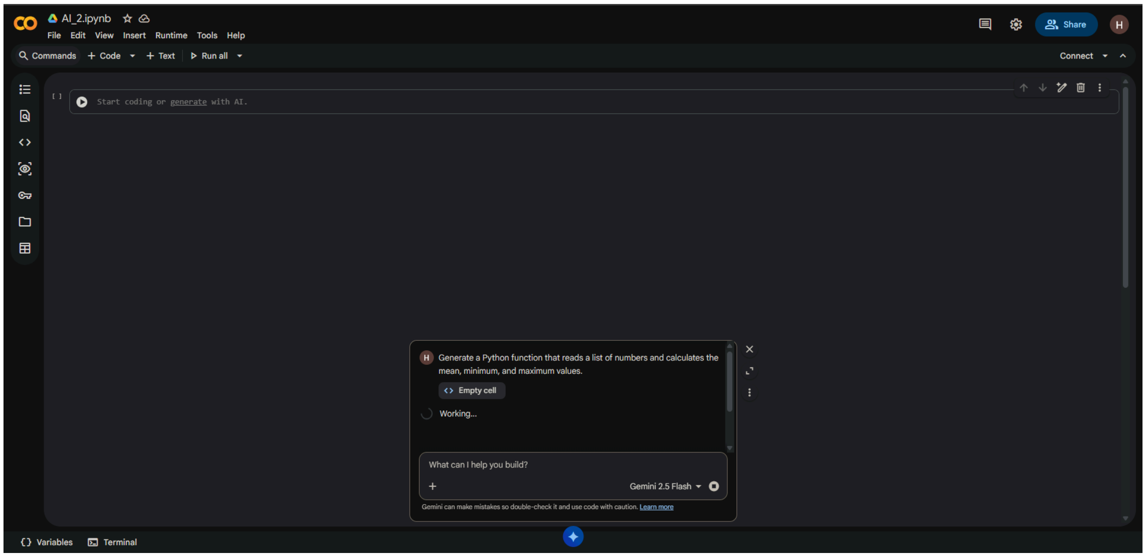
Google Colab Workspace Screenshots:


AI_2.ipynb
File
Edit
View
Insert
Runtime
Tools
Help
Share
H
Commands
+ Code
+ Text
Run all
Connect
[ ]
Start coding or generate with AI.
How can I install Python libraries?
Load data from Google Drive
Show an example of training a
What can I help you build?
+
Gemini 2.5 Flash
Variables
Terminal

```
Generate a Python function that reads a list of numbers and
calculates the mean, minimum, and maximum values.
```



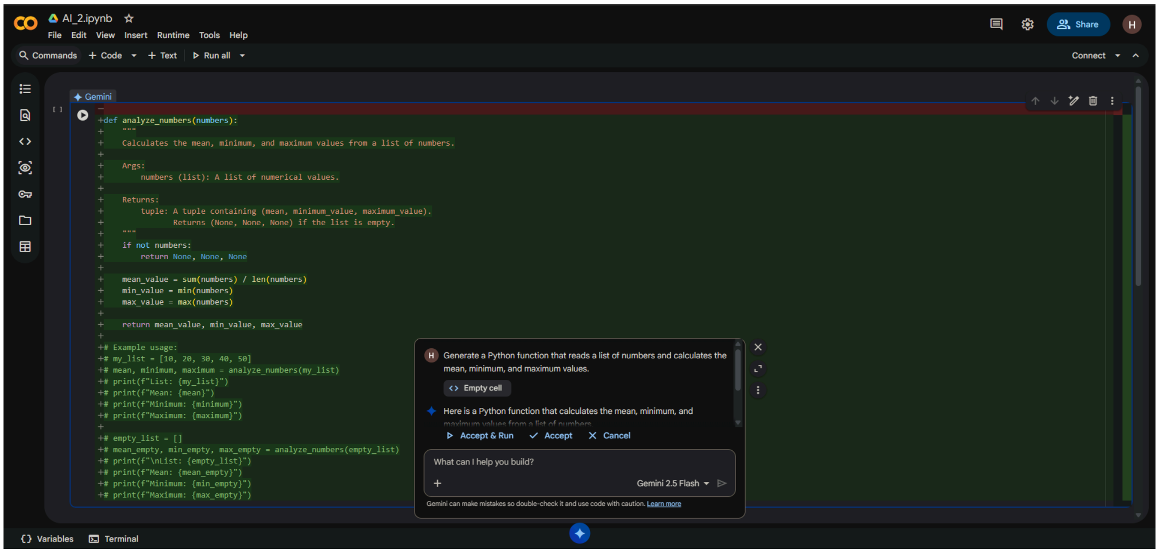
Generate a Python function that reads a list of numbers and calculates the mean, minimum, and maximum values.


AI_2.ipynb
File Edit View Insert Runtime Tools Help
Commands + Code + Text Run all
Share
Connect
Start coding or generate with AI.
Empty cell
What can I help you build?
Gemini 2.5 Flash
Variables
Terminal

Generate a Python function that reads a list of numbers and calculates the mean, minimum, and maximum values.

Working...

Gemini can make mistakes so double-check it and use code with caution. Learn more

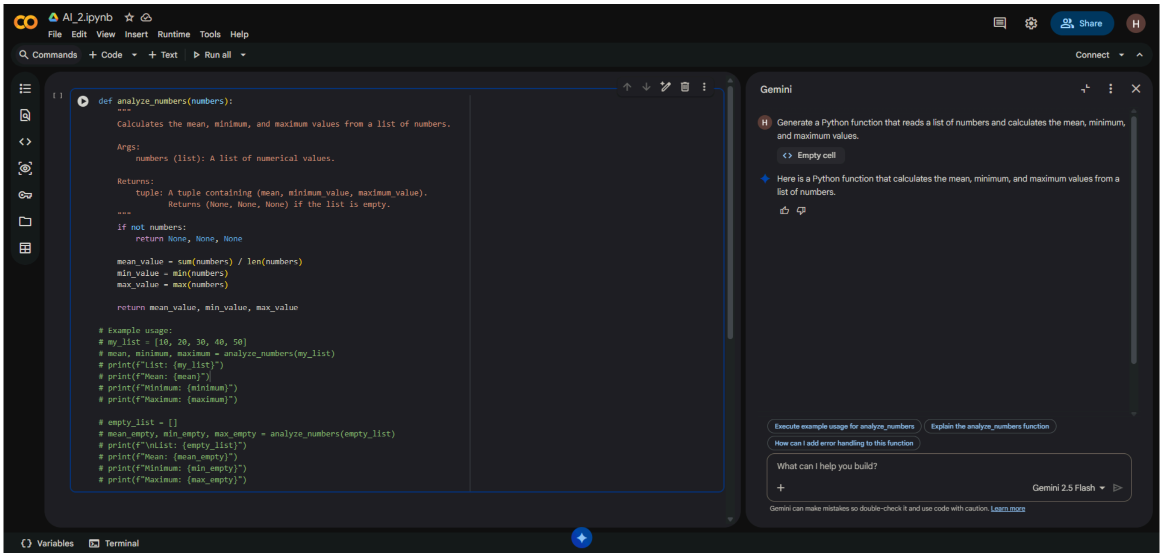

AI_2.ipynb
File Edit View Insert Runtime Tools Help
Commands + Code + Text Run all
Share
Connect
Gemini
Empty cell
Accept & Run
Accept
Cancel
What can I help you build?
Gemini 2.5 Flash
Variables
Terminal

```
-
+def analyze_numbers(numbers):
+    """
+    Calculates the mean, minimum, and maximum values from a list of numbers.
+
+    Args:
+        numbers (list): A list of numerical values.
+
+    Returns:
+        tuple: A tuple containing (mean, minimum_value, maximum_value).
+               Returns (None, None, None) if the list is empty.
+    """
+    if not numbers:
+        return None, None, None
+
+    mean_value = sum(numbers) / len(numbers)
+    min_value = min(numbers)
+    max_value = max(numbers)
+
+    return mean_value, min_value, max_value
+
+# Example usage:
+# my_list = [10, 20, 30, 40, 50]
+# mean, minimum, maximum = analyze_numbers(my_list)
+# print(f"List: {my_list}")
+# print(f"Mean: {mean}")
+# print(f"Minimum: {minimum}")
+# print(f"Maximum: {maximum}")
+
+# empty_list = []
+# mean_empty, min_empty, max_empty = analyze_numbers(empty_list)
+# print(f"\nList: {empty_list}")
+# print(f"Mean: {mean_empty}")
+# print(f"Minimum: {min_empty}")
+# print(f"Maximum: {max_empty}")
```

Generate a Python function that reads a list of numbers and calculates the mean, minimum, and maximum values.

Here is a Python function that calculates the mean, minimum, and maximum values from a list of numbers.

Gemini can make mistakes so double-check it and use code with caution. Learn more

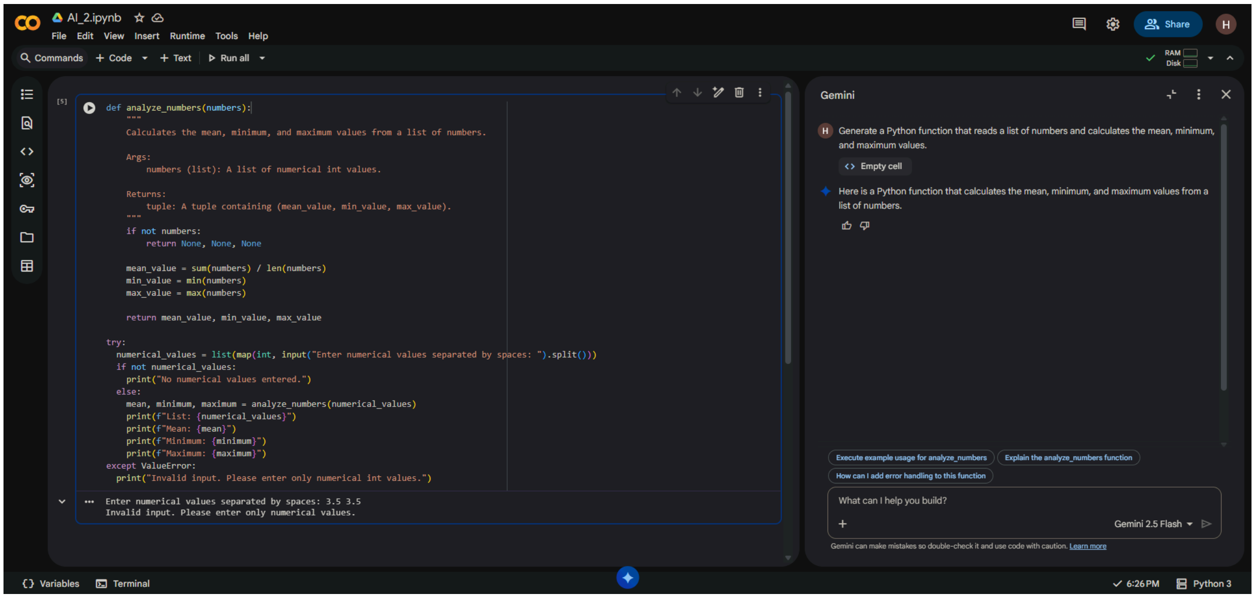

AI_2.ipynb
File Edit View Insert Runtime Tools Help
Commands + Code + Text Run all
Share
Connect
Gemini
Empty cell
Execute example usage for analyze_numbers
Explain the analyze_numbers function
How can I add error handling to this function
What can I help you build?
Gemini 2.5 Flash
Variables
Terminal

```
def analyze_numbers(numbers):
    """
    Calculates the mean, minimum, and maximum values from a list of numbers.

    Args:
        numbers (list): A list of numerical values.

    Returns:
        tuple: A tuple containing (mean, minimum_value, maximum_value).
               Returns (None, None, None) if the list is empty.
    """
    if not numbers:
        return None, None, None

    mean_value = sum(numbers) / len(numbers)
    min_value = min(numbers)
    max_value = max(numbers)

    return mean_value, min_value, max_value

# Example usage:
# my_list = [10, 20, 30, 40, 50]
# mean, minimum, maximum = analyze_numbers(my_list)
# print(f"List: {my_list}")
# print(f"Mean: {mean}")
# print(f"Minimum: {minimum}")
# print(f"Maximum: {maximum}")

# empty_list = []
# mean_empty, min_empty, max_empty = analyze_numbers(empty_list)
# print(f"\nList: {empty_list}")
# print(f"Mean: {mean_empty}")
# print(f"Minimum: {min_empty}")
# print(f"Maximum: {max_empty}")
```

Generate a Python function that reads a list of numbers and calculates the mean, minimum, and maximum values.

Here is a Python function that calculates the mean, minimum, and maximum values from a list of numbers.

Gemini can make mistakes so double-check it and use code with caution. Learn more


AI_2.ipynb
File
Edit
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Help
Commands
+ Code
+ Text
Run all
Share
RAM
Disk
Gemini
Empty cell
Execute example usage for analyze_numbers
Explain the analyze_numbers function
How can I add error handling to this function
What can I help you build?
Gemini 2.5 Flash
Variables
Terminal
6:26 PM
Python 3

[5]

```
def analyze_numbers(numbers):
    """
    Calculates the mean, minimum, and maximum values from a list of numbers.

    Args:
        numbers (list): A list of numerical int values.

    Returns:
        tuple: A tuple containing (mean_value, min_value, max_value).
    """
    if not numbers:
        return None, None, None

    mean_value = sum(numbers) / len(numbers)
    min_value = min(numbers)
    max_value = max(numbers)

    return mean_value, min_value, max_value

try:
  numerical_values = list(map(int, input("Enter numerical values separated by spaces: ").split()))
  if not numerical_values:
    print("No numerical values entered.")
  else:
    mean, minimum, maximum = analyze_numbers(numerical_values)
    print(f"List: {numerical_values}")
    print(f"Mean: {mean}")
    print(f"Minimum: {minimum}")
    print(f"Maximum: {maximum}")
except ValueError:
  print("Invalid input. Please enter only numerical int values.")
```

```
Enter numerical values separated by spaces: 3.5 3.5
Invalid input. Please enter only numerical values.
```

Generate a Python function that reads a list of numbers and calculates the mean, minimum, and maximum values.

Here is a Python function that calculates the mean, minimum, and maximum values from a list of numbers.

Gemini can make mistakes so double-check it and use code with caution. Learn more

Final Code:

```
def analyze_numbers(numbers):
    """
    Calculates the mean, minimum, and maximum values from a list of numbers.

    Args:
        numbers (list): A list of numerical int values.

    Returns:
        tuple: A tuple containing (mean_value, min_value, max_value).
    """
    if not numbers:
        return None, None, None

    mean_value = sum(numbers) / len(numbers)
    min_value = min(numbers)
    max_value = max(numbers)

    return mean_value, min_value, max_value

try:
  numerical_values = list(map(int, input("Enter numerical values separated by spaces: ").split()))
  if not numerical_values:
    print("No numerical values entered.")
  else:
    mean, minimum, maximum = analyze_numbers(numerical_values)
    print(f"List: {numerical_values}")
    print(f"Mean: {mean}")
    print(f"Minimum: {minimum}")
    print(f"Maximum: {maximum}")
except ValueError:
  print("Invalid input. Please enter only numerical int values.")
```

Task 2: Armstrong Number – AI Comparison

Scenario:

- You are evaluating AI tools for numeric validation logic.

Task:

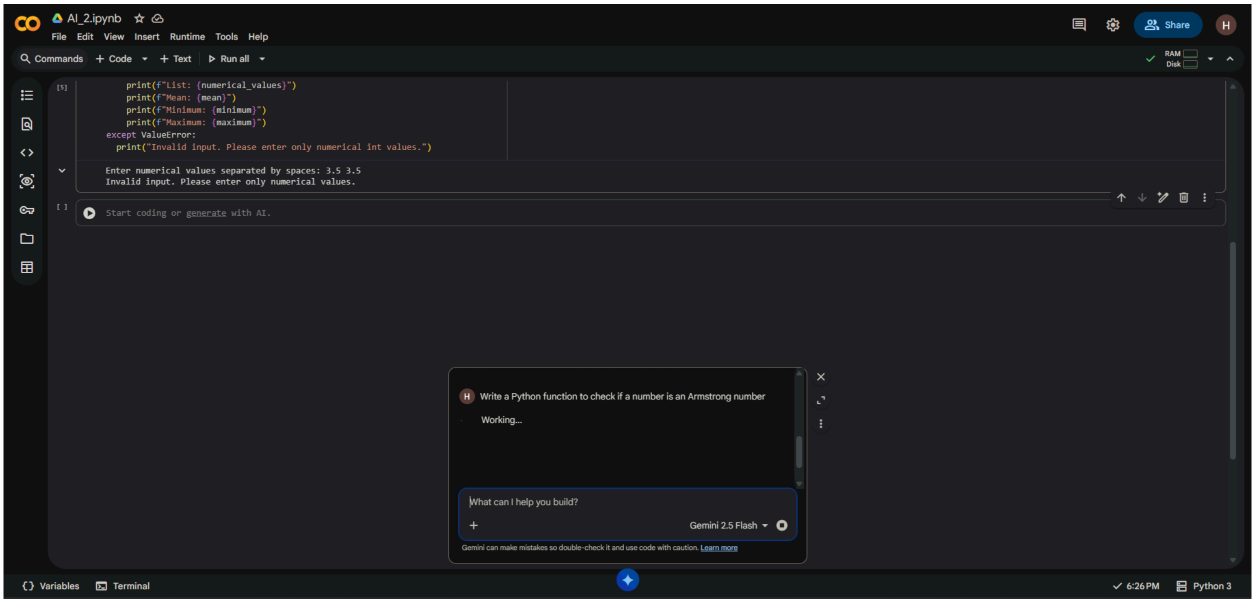
- Generate an Armstrong number checker using Gemini and GitHub Copilot.
- Compare their outputs, logic style, and clarity.

Expected Output:

- Side-by-side comparison table
- Screenshots of prompts and generated code

Google Colab Workspace Screenshots:

```
Write a Python function to check if a number is an Armstrong number
```



```
[5]     print(f"List: {numerical_values}")
        print(f"Mean: {mean}")
        print(f"Minimum: {minimum}")
        print(f"Maximum: {maximum}")
    except ValueError:
      print("Invalid input. Please enter only numerical int values.")
```

```
Enter numerical values separated by spaces: 3.5 3.5
Invalid input. Please enter only numerical values.
```

Start coding or generate with AI.

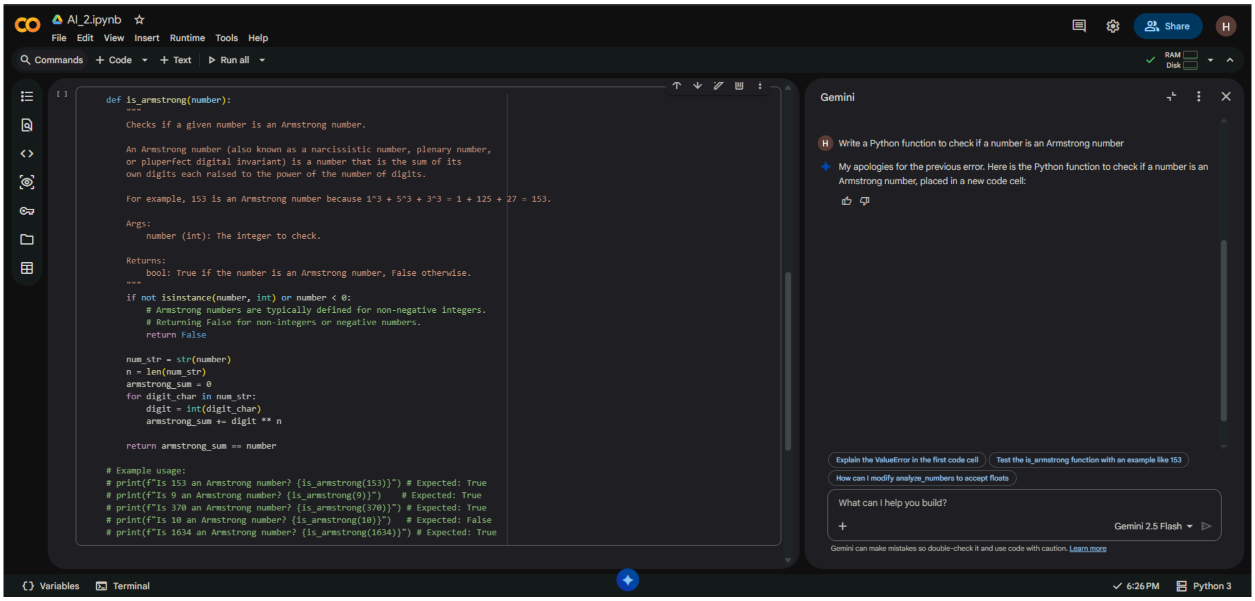
H Write a Python function to check if a number is an Armstrong number

Working...

What can I help you build?

Gemini 2.5 Flash

Gemini can make mistakes so double-check it and use code with caution. Learn more


AI_2.ipynb
File Edit View Insert Runtime Tools Help
Commands + Code + Text ▷ Run all
Share
RAM Disk
Gemini
Variables Terminal
6:26 PM Python 3

```python
def is_armstrong(number):
    """
    Checks if a given number is an Armstrong number.

    An Armstrong number (also known as a narcissistic number, plenary number,
    or pluperfect digital invariant) is a number that is the sum of its
    own digits each raised to the power of the number of digits.

    For example, 153 is an Armstrong number because 1^3 + 5^3 + 3^3 = 1 + 125 + 27 = 153.

    Args:
        number (int): The integer to check.

    Returns:
        bool: True if the number is an Armstrong number, False otherwise.
    """
    if not isinstance(number, int) or number < 0:
        # Armstrong numbers are typically defined for non-negative integers.
        # Returning False for non-integers or negative numbers.
        return False

    num_str = str(number)
    n = len(num_str)
    armstrong_sum = 0
    for digit_char in num_str:
        digit = int(digit_char)
        armstrong_sum += digit ** n

    return armstrong_sum == number

# Example usage:
# print(f"Is 153 an Armstrong number? {is_armstrong(153)}") # Expected: True
# print(f"Is 9 an Armstrong number? {is_armstrong(9)}")    # Expected: True
# print(f"Is 370 an Armstrong number? {is_armstrong(370)}") # Expected: True
# print(f"Is 10 an Armstrong number? {is_armstrong(10)}")   # Expected: False
# print(f"Is 1634 an Armstrong number? {is_armstrong(1634)}") # Expected: True
```

H Write a Python function to check if a number is an Armstrong number

My apologies for the previous error. Here is the Python function to check if a number is an Armstrong number, placed in a new code cell:

Explain the ValueError in the first code cell

Test the is_armstrong function with an example like 153

How can I modify analyze_numbers to accept floats

What can I help you build?

Gemini 2.5 Flash

Gemini can make mistakes so double-check it and use code with caution. Learn more

Google Colab Gemini Code:

```python
def is_armstrong(number):
    """
    Checks if a given number is an Armstrong number.

    An Armstrong number (also known as a narcissistic number, plenary number,
    or pluperfect digital invariant) is a number that is the sum of its
    own digits each raised to the power of the number of digits.

    For example, 153 is an Armstrong number because 1^3 + 5^3 + 3^3 = 1 + 125 + 27 = 153.

    Args:
        number (int): The integer to check.

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    if not isinstance(number, int) or number < 0:
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        return False

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    for digit_char in num_str:
        digit = int(digit_char)
        armstrong_sum += digit ** n

    return armstrong_sum == number

# Example usage:
# print(f"Is 153 an Armstrong number? {is_armstrong(153)}") # Expected: True
# print(f"Is 9 an Armstrong number? {is_armstrong(9)}")    # Expected: True
# print(f"Is 370 an Armstrong number? {is_armstrong(370)}") # Expected: True
# print(f"Is 10 an Armstrong number? {is_armstrong(10)}")   # Expected: False
# print(f"Is 1634 an Armstrong number? {is_armstrong(1634)}") # Expected: True
```
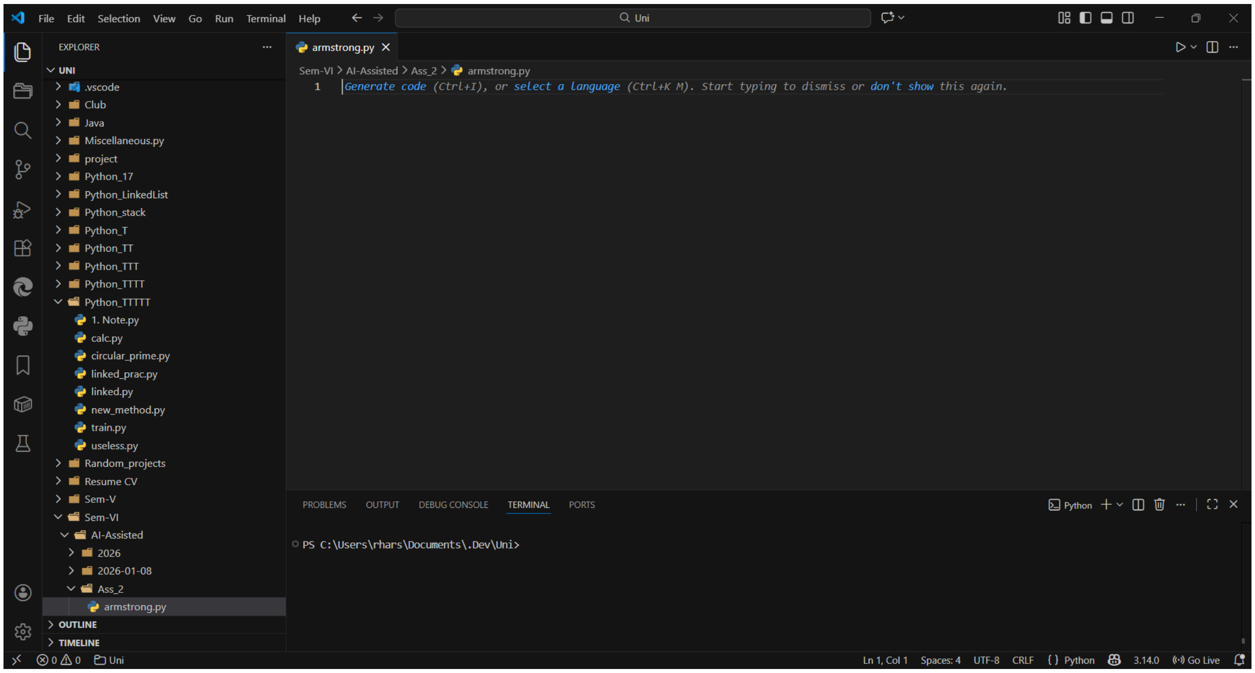
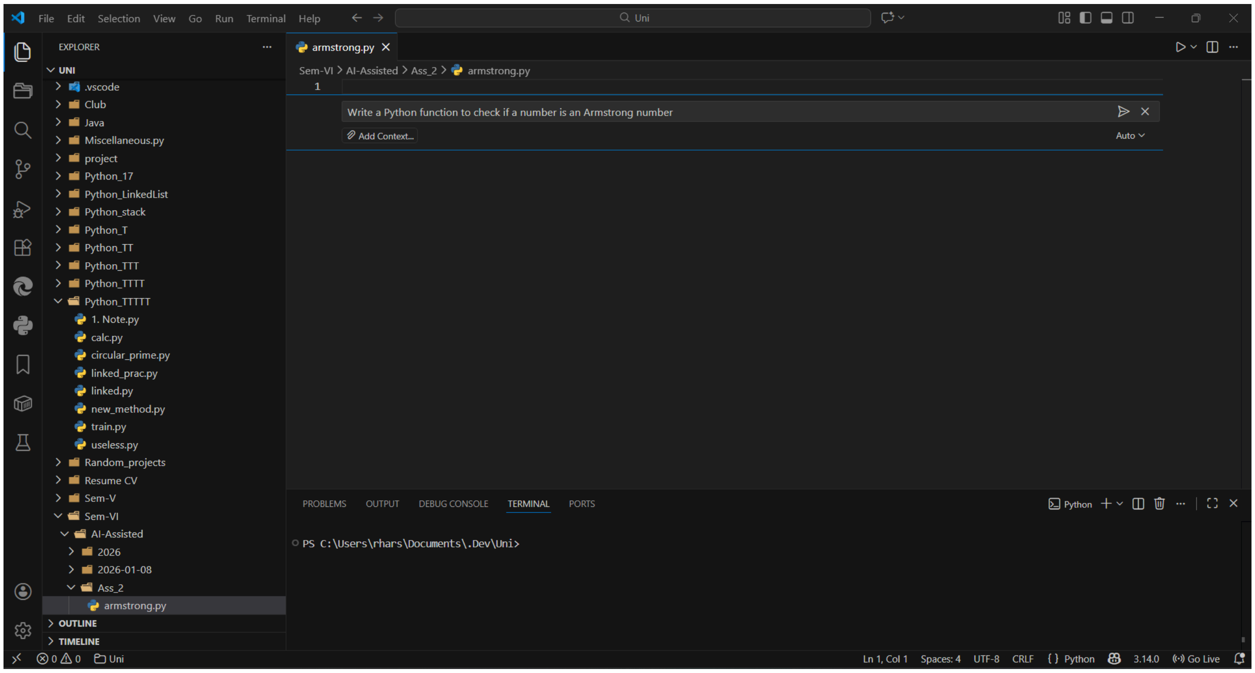



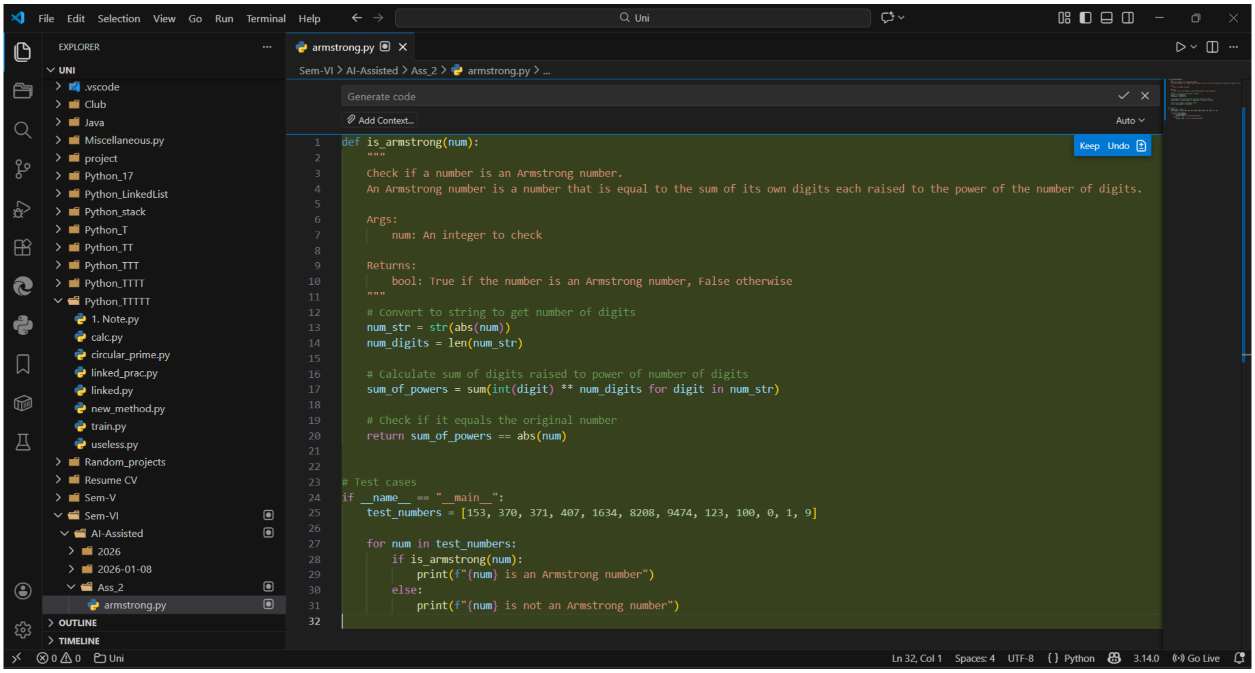
```
1 Generate code (Ctrl+I), or select a language (Ctrl+K M). Start typing to dismiss or don't show this again.
```

```
PS C:\Users\rhars\Documents\.Dev\Uni>
```

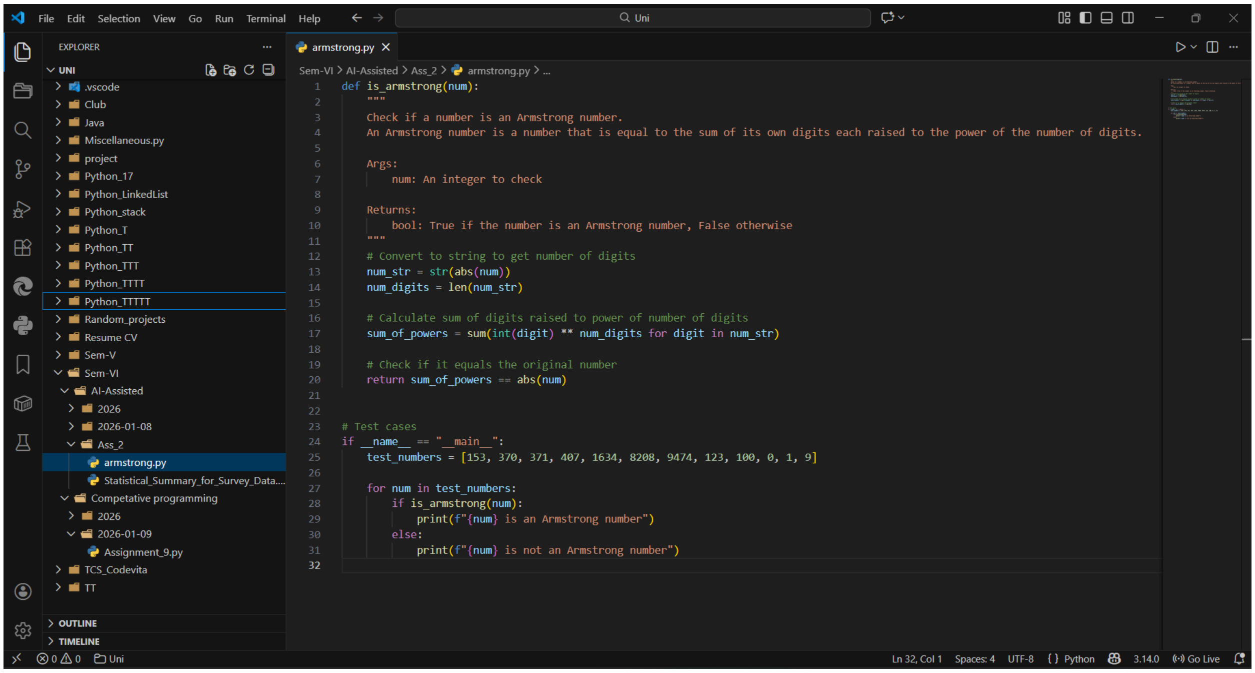


Write a Python function to check if a number is an Armstrong number

```
PS C:\Users\rhars\Documents\.Dev\Uni>
```



```python
def is_armstrong(num):
    """
    Check if a number is an Armstrong number.
    An Armstrong number is a number that is equal to the sum of its own digits each raised to the power of the number of digits.

    Args:
        num: An integer to check

    Returns:
        bool: True if the number is an Armstrong number, False otherwise
    """
    # Convert to string to get number of digits
    num_str = str(abs(num))
    num_digits = len(num_str)

    # Calculate sum of digits raised to power of number of digits
    sum_of_powers = sum(int(digit) ** num_digits for digit in num_str)

    # Check if it equals the original number
    return sum_of_powers == abs(num)


# Test cases
if __name__ == "__main__":
    test_numbers = [153, 370, 371, 407, 1634, 8208, 9474, 123, 100, 0, 1, 9]

    for num in test_numbers:
        if is_armstrong(num):
            print(f"{num} is an Armstrong number")
        else:
            print(f"{num} is not an Armstrong number")

```



```python
def is_armstrong(num):
    """
    Check if a number is an Armstrong number.
    An Armstrong number is a number that is equal to the sum of its own digits each raised to the power of the number of digits.

    Args:
        num: An integer to check

    Returns:
        bool: True if the number is an Armstrong number, False otherwise
    """
    # Convert to string to get number of digits
    num_str = str(abs(num))
    num_digits = len(num_str)

    # Calculate sum of digits raised to power of number of digits
    sum_of_powers = sum(int(digit) ** num_digits for digit in num_str)

    # Check if it equals the original number
    return sum_of_powers == abs(num)


# Test cases
if __name__ == "__main__":
    test_numbers = [153, 370, 371, 407, 1634, 8208, 9474, 123, 100, 0, 1, 9]

    for num in test_numbers:
        if is_armstrong(num):
            print(f"{num} is an Armstrong number")
        else:
            print(f"{num} is not an Armstrong number")

```

Co-pilot Code:

```python
def is_armstrong(num):
    """
    Check if a number is an Armstrong number.
    An Armstrong number is a number that is equal to the sum of its own digits each raised to the power of the number of digits.

    Args:
        num: An integer to check

    Returns:
        bool: True if the number is an Armstrong number, False otherwise
    """
    # Convert to string to get number of digits
    num_str = str(abs(num))
    num_digits = len(num_str)

    # Calculate sum of digits raised to power of number of digits
    sum_of_powers = sum(int(digit) ** num_digits for digit in num_str)

    # Check if it equals the original number
    return sum_of_powers == abs(num)
```

```
# Test cases
if __name__ == "__main__":
    test_numbers = [153, 370, 371, 407, 1634, 8208, 9474, 123, 100, 0, 1,
9]

    for num in test_numbers:
        if is_armstrong(num):
            print(f"{num} is an Armstrong number")
        else:
            print(f"{num} is not an Armstrong number")
```

Task 3: Leap Year Validation Using Cursor AI

Scenario:

- You are validating a calendar module for a backend system.

Task:

- Use Cursor AI to generate a Python program that checks whether a given year is a leap year.
- Use at least two different prompts and observe changes in code.

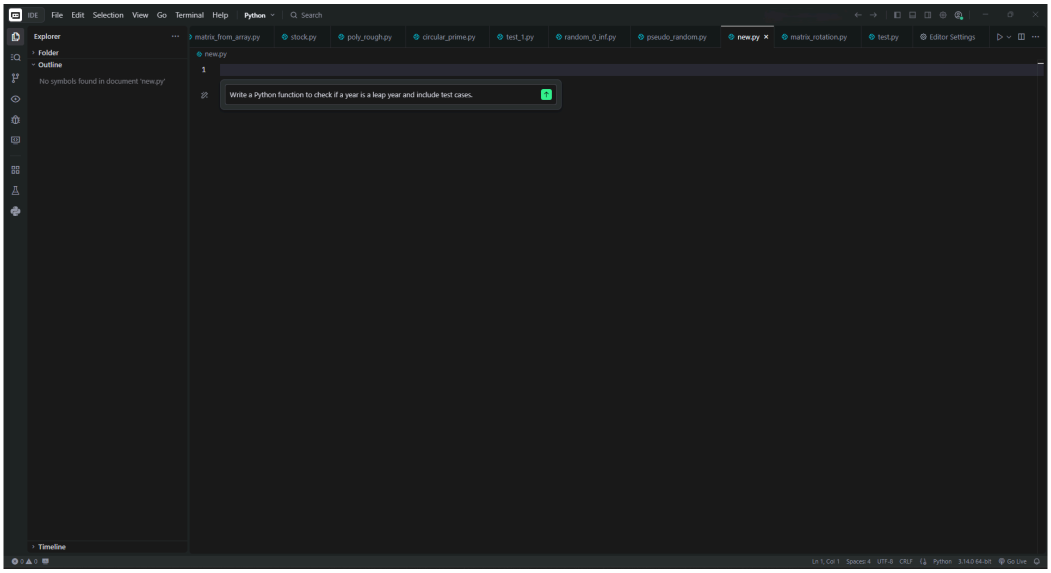
Expected Output:

- Two versions of code
- Sample inputs/outputs
- Brief comparison

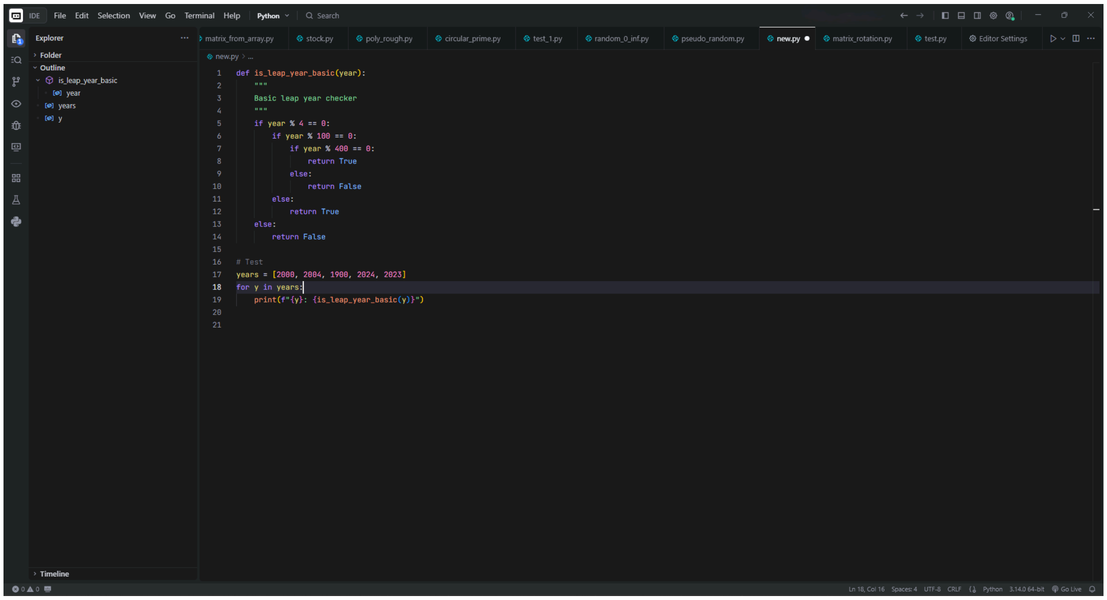
Version - 1:

Instruction Given:

```
Write a Python function to check if a year is a leap year and include test cases.
```



Write a Python function to check if a year is a leap year and include test cases.



```python
def is_leap_year_basic(year):
    """
    Basic leap year checker
    """
    if year % 4 == 0:
        if year % 100 == 0:
            if year % 400 == 0:
                return True
            else:
                return False
        else:
            return True
    else:
        return False

# Test
years = [2000, 2004, 1900, 2024, 2023]
for y in years:
    print(f"{y}: {is_leap_year_basic(y)}")
```

Code:

```python
def is_leap_year_basic(year):
    """
    Basic leap year checker
    """
    if year % 4 == 0:
        if year % 100 == 0:
            if year % 400 == 0:
                return True
            else:
                return False
        else:
            return True
    else:
        return False

# Test
years = [2000, 2004, 1900, 2024, 2023]
for y in years:
    print(f"{y}: {is_leap_year_basic(y)}")
```

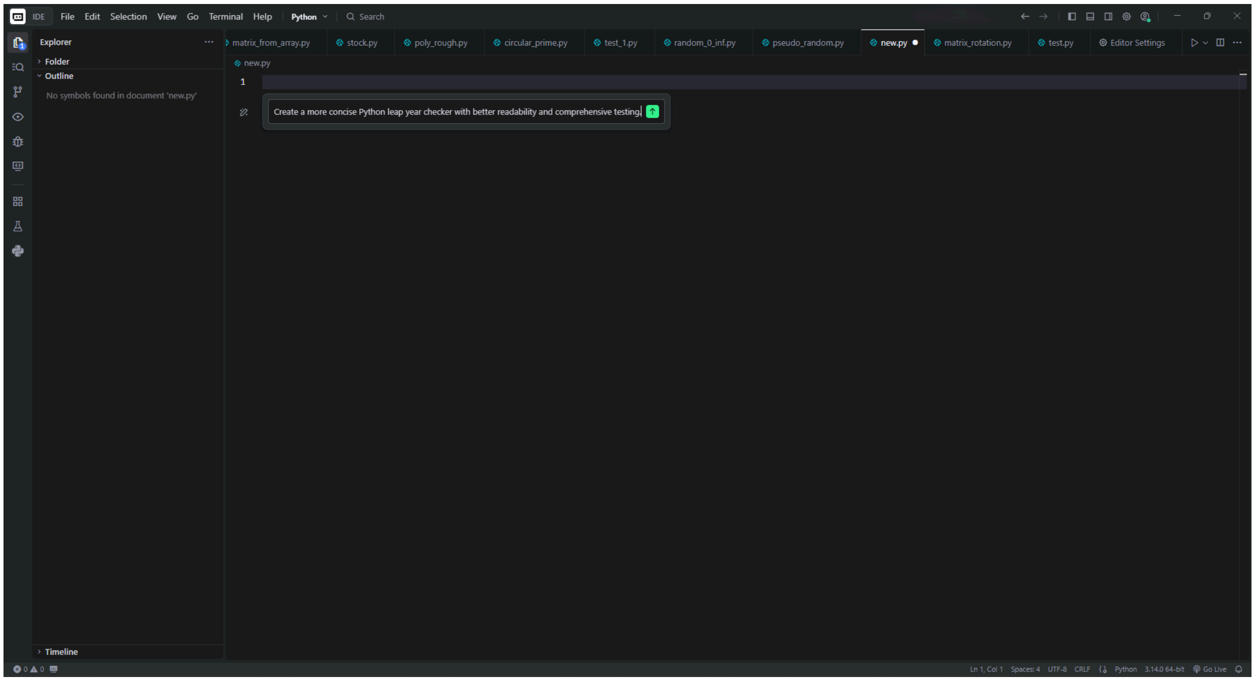
Code Output:

```
2000: True
2004: True
1900: False
2024: True
2023: False
```

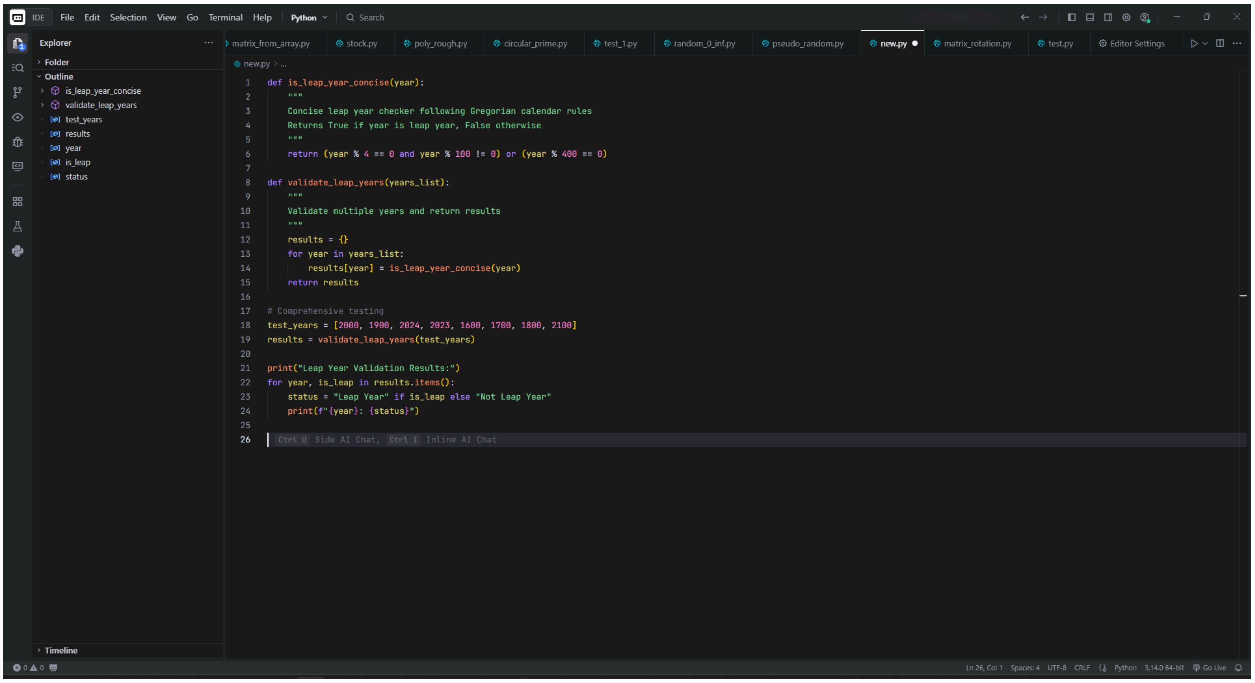
Version - 2:

Instruction Given:

```
Create a more concise Python leap year checker with better readability and comprehensive testing.
```



Create a more concise Python leap year checker with better readability and comprehensive testing.

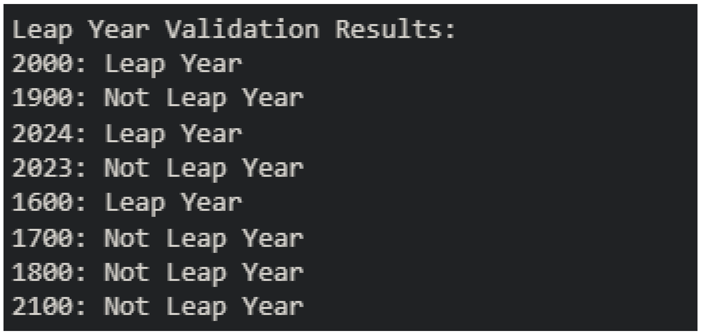


```python
def is_leap_year_concise(year):
    """
    Concise leap year checker following Gregorian calendar rules
    Returns True if year is leap year, False otherwise
    """
    return (year % 4 == 0 and year % 100 != 0) or (year % 400 == 0)

def validate_leap_years(years_list):
    """
    Validate multiple years and return results
    """
    results = {}
    for year in years_list:
        results[year] = is_leap_year_concise(year)
    return results

# Comprehensive testing
test_years = [2000, 1900, 2024, 2023, 1600, 1700, 1800, 2100]
results = validate_leap_years(test_years)

print("Leap Year Validation Results:")
for year, is_leap in results.items():
    status = "Leap Year" if is_leap else "Not Leap Year"
    print(f"{year}: {status}")
```

Code:

```python
def is_leap_year_concise(year):
    """
    Concise leap year checker following Gregorian calendar rules
    Returns True if year is leap year, False otherwise
    """
    return (year % 4 == 0 and year % 100 != 0) or (year % 400 == 0)

def validate_leap_years(years_list):
    """
    Validate multiple years and return results
    """
    results = {}
    for year in years_list:
        results[year] = is_leap_year_concise(year)
    return results

# Comprehensive testing
test_years = [2000, 1900, 2024, 2023, 1600, 1700, 1800, 2100]
results = validate_leap_years(test_years)

print("Leap Year Validation Results:")
for year, is_leap in results.items():
    status = "Leap Year" if is_leap else "Not Leap Year"
    print(f"{year}: {status}")
```

Code Output:



```
Leap Year Validation Results:
2000: Leap Year
1900: Not Leap Year
2024: Leap Year
2023: Not Leap Year
1600: Leap Year
1700: Not Leap Year
1800: Not Leap Year
2100: Not Leap Year
```

Brief comparison:

Version 1 (Basic)	Version 2 (Concise)
Uses nested if-else statements	Single return statement with logical operators

More lines of code (12 lines)	Fewer lines (5 lines for main function)
Easier for beginners to understand	Follows Python style guide
Step-by-step logic	Combined logical conditions
Includes basic testing	Includes comprehensive testing function

Task 4: Student Logic + AI Refactoring (Odd/Even Sum)

Scenario:

- Company policy requires developers to write logic before using AI.

Task:

- Write a Python program that calculates the sum of odd and even numbers in a tuple, then refactor it using any AI tool.

Expected Output:

- Original code
- Refactored code
- Explanation of improvements

Original Code written by me:

```python
def even_odd_sum_tuple(num):
    even_sum = 0
    odd_sum = 0

    for i in range(1, num+1):
      if i%2 == 0:
        even_sum += i
      else:
        odd_sum += i

    return even_sum, odd_sum

user_input = int(input("Enter a number: "))

even, odd = even_odd_sum_tuple(user_input)
print(f"Sum of even numbers: {even}")
print(f"Sum of odd numbers: {odd}")
```

Refactored code:

```
Instructions given:
Refactor the code in order to make it handle input validation,
readability and handle edge cases.
```

```
def even_odd_sum_tuple(n: int) -> tuple[int, int]:
    """
    Calculate the sum of even and odd numbers from 1 to n.

    Parameters:
        n (int): The upper limit (must be a positive integer).

    Returns:
        tuple[int, int]: (sum_of_even_numbers, sum_of_odd_numbers)
    """
    if n < 1:
        return (0, 0)  # No positive range to sum

    even_sum, odd_sum = 0, 0

    for i in range(1, n + 1):
        if i % 2 == 0:
            even_sum += i
        else:
            odd_sum += i

    return even_sum, odd_sum

try:
    user_input = int(input("Enter a positive integer: "))
    if user_input < 1:
        print("Please enter a positive integer greater than 0.")
    else:
        even, odd = even_odd_sum_tuple(user_input)
        print(f"Sum of even numbers: {even}")
        print(f"Sum of odd numbers: {odd}")

except ValueError:
    print("Invalid input! Please enter a valid integer.")
```

Explanation of improvements:

Input validation

- Making sure the user enters a valid integer.
- Handling negative numbers gracefully (return (0,0) or raise an error).

Readability

- Using clear variable names.
- Adding docstrings and comments.

Edge cases

- If input is 0, both sums should be 0.
- If input is negative, we can either reject it or compute sums up to that number (here I'll reject it for clarity).