AI Assisted Coding Lab Ass-6.1

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Task Description #1 (AI-Based Code Completion for Loops) Task:

Use an AI code completion tool to generate a loop-based

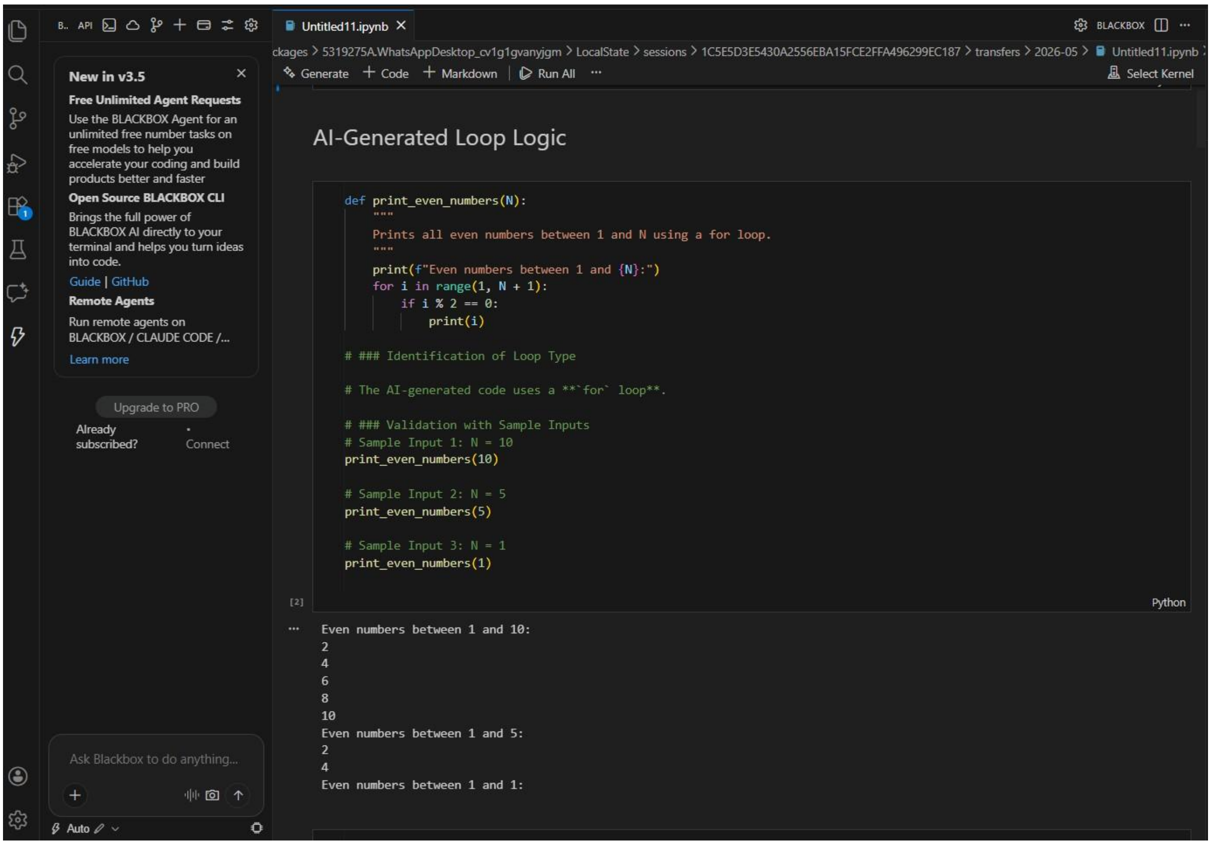
program.

Prompt:

“Generate Python code to print all even numbers between 1 and N using a loop.”

Expected Output:

- AI-generated loop logic.
- Identification of loop type used (for or while).
- Validation with sample inputs.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AI-Generated Loop Logic

```python
def print_even_numbers(N):
    """
    Prints all even numbers between 1 and N using a for loop.
    """
    print(f"Even numbers between 1 and {N}:")
    for i in range(1, N + 1):
        if i % 2 == 0:
            print(i)

# ### Identification of Loop Type

# The AI-generated code uses a **`for` loop**.

# ### Validation with Sample Inputs
# Sample Input 1: N = 10
print_even_numbers(10)

# Sample Input 2: N = 5
print_even_numbers(5)

# Sample Input 3: N = 1
print_even_numbers(1)
```

```
Even numbers between 1 and 10:
2
4
6
8
10
Even numbers between 1 and 5:
2
4
Even numbers between 1 and 1:
```

Task Description #2 (AI-Based Code Completion for Loop with

Conditionals)

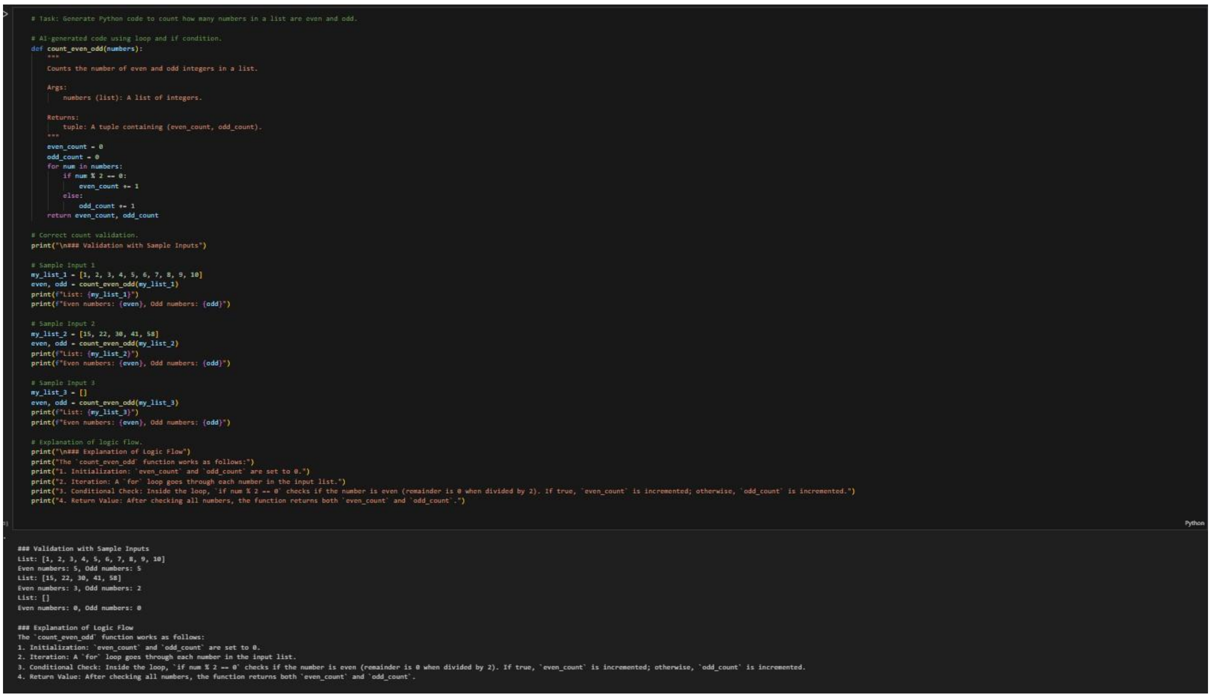
Task: Use an AI code completion tool to combine loops and conditionals.

Prompt:

“Generate Python code to count how many numbers in a list are even and odd.”

Expected Output:

- AI-generated code using loop and if condition.
- Correct count validation.
- Explanation of logic flow.



```python
# Task: Generate Python code to count how many numbers in a list are even and odd.

# AI-generated code using loop and if condition.
def count_even_odd(numbers):
    """
    Counts the number of even and odd integers in a list.

    Args:
        numbers (list): A list of integers.

    Returns:
        tuple: A tuple containing (even_count, odd_count).
    """
    even_count = 0
    odd_count = 0
    for num in numbers:
        if num % 2 == 0:
            even_count += 1
        else:
            odd_count += 1
    return even_count, odd_count

# Correct count validation.
print("\n### Validation with Sample Inputs")

# Sample Input 1
my_list_1 = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]
even, odd = count_even_odd(my_list_1)
print(f"List: {my_list_1}")
print(f"Even numbers: {even}, Odd numbers: {odd}")

# Sample Input 2
my_list_2 = [15, 22, 30, 41, 58]
even, odd = count_even_odd(my_list_2)
print(f"List: {my_list_2}")
print(f"Even numbers: {even}, Odd numbers: {odd}")

# Sample Input 3
my_list_3 = []
even, odd = count_even_odd(my_list_3)
print(f"List: {my_list_3}")
print(f"Even numbers: {even}, Odd numbers: {odd}")

# Explanation of logic flow.
print("\n### Explanation of Logic Flow")
print("The `count_even_odd` function works as follows:")
print("1. Initialization: `even_count` and `odd_count` are set to 0.")
print("2. Iteration: A `for` loop goes through each number in the input list.")
print("3. Conditional Check: Inside the loop, `if num % 2 == 0` checks if the number is even (remainder is 0 when divided by 2). If true, `even_count` is incremented; otherwise, `odd_count` is incremented.")
print("4. Return Value: After checking all numbers, the function returns both `even_count` and `odd_count`.")
```

```
### Validation with Sample Inputs
List: [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]
Even numbers: 5, Odd numbers: 5
List: [15, 22, 30, 41, 58]
Even numbers: 3, Odd numbers: 2
List: []
Even numbers: 0, Odd numbers: 0

### Explanation of Logic Flow
The `count_even_odd` function works as follows:
1. Initialization: `even_count` and `odd_count` are set to 0.
2. Iteration: A `for` loop goes through each number in the input list.
3. Conditional Check: Inside the loop, `if num % 2 == 0` checks if the number is even (remainder is 0 when divided by 2). If true, `even_count` is incremented; otherwise, `odd_count` is incremented.
4. Return Value: After checking all numbers, the function returns both `even_count` and `odd_count`.
```

Task Description #3 (AI-Based Code Completion for Class Attributes Validation)

Task: Use an AI tool to complete a Python class that validates user input.

Prompt:

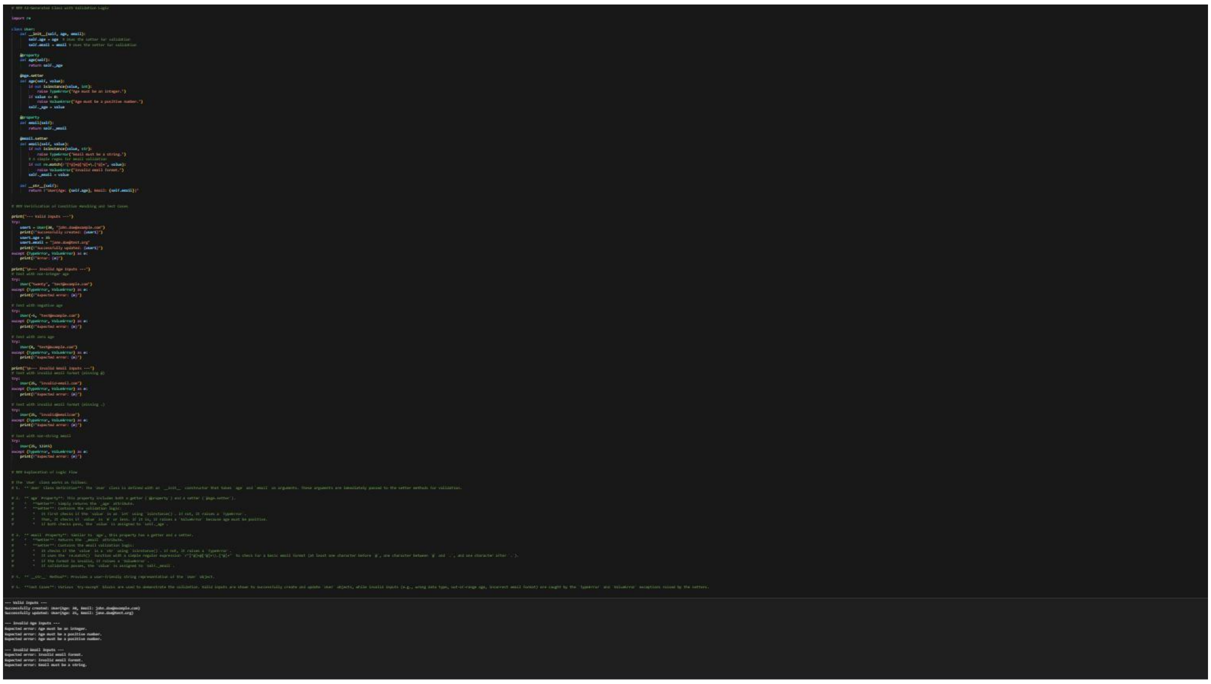
“Generate a Python class User that validates age and email using conditional statements.”

Expected Output:

- AI-generated class with validation logic.

- Verification of condition handling.

- Test cases for valid and invalid inputs.



```python
# ### AI-Generated Class with Validation Logic

import re

class User:
    def __init__(self, age, email):
        self.age = age  # Uses the setter for validation
        self.email = email # Uses the setter for validation

    @property
    def age(self):
        return self._age

    @age.setter
    def age(self, value):
        if not isinstance(value, int):
            raise TypeError("Age must be an integer.")
        if value <= 0:
            raise ValueError("Age must be a positive number.")
        self._age = value

    @property
    def email(self):
        return self._email

    @email.setter
    def email(self, value):
        if not isinstance(value, str):
            raise TypeError("Email must be a string.")
        # A simple regex for email validation
        if not re.match(r"[^@]+@[^@]+\.[^@]+", value):
            raise ValueError("Invalid email format.")
        self._email = value

    def __str__(self):
        return f"User(Age: {self.age}, Email: {self.email})"


# ### Verification of Condition Handling and Test Cases

print("--- Valid Inputs ---")
try:
    user1 = User(30, "john.doe@example.com")
    print(f"Successfully created: {user1}")
    user1.age = 35
    user1.email = "jane.doe@test.org"
    print(f"Successfully updated: {user1}")
except (TypeError, ValueError) as e:
    print(f"Error: {e}")

print("\n--- Invalid Age Inputs ---")
# Test with non-integer age
try:
    User("twenty", "test@example.com")
except (TypeError, ValueError) as e:
    print(f"Expected error: {e}")

# Test with negative age
try:
    User(-5, "test@example.com")
except (TypeError, ValueError) as e:
    print(f"Expected error: {e}")

# Test with zero age
try:
    User(0, "test@example.com")
except (TypeError, ValueError) as e:
    print(f"Expected error: {e}")

print("\n--- Invalid Email Inputs ---")
# Test with invalid email format (missing @)
try:
    User(25, "invalid-email.com")
except (TypeError, ValueError) as e:
    print(f"Expected error: {e}")

# Test with invalid email format (missing .)
try:
    User(25, "invalid@emailcom")
except (TypeError, ValueError) as e:
    print(f"Expected error: {e}")

# Test with non-string email
try:
    User(25, 12345)
except (TypeError, ValueError) as e:
    print(f"Expected error: {e}")


# ### Explanation of Logic Flow

# The `User` class works as follows:
# 1.  **`User` Class Definition**: The `User` class is defined with an `__init__` constructor that takes `age` and `email` as arguments. These arguments are immediately passed to the setter methods for validation.

# 2.  **`age` Property**: This property includes both a getter (`@property`) and a setter (`@age.setter`).
#     *   **Getter**: Simply returns the `_age` attribute.
#     *   **Setter**: Contains the validation logic:
#         *   It first checks if the `value` is an `int` using `isinstance()`. If not, it raises a `TypeError`.
#         *   Then, it checks if `value` is `0` or less. If it is, it raises a `ValueError` because age must be positive.
#         *   If both checks pass, the `value` is assigned to `self._age`.

# 3.  **`email` Property**: Similar to `age`, this property has a getter and a setter.
#     *   **Getter**: Returns the `_email` attribute.
#     *   **Setter**: Contains the email validation logic:
#         *   It checks if the `value` is a `str` using `isinstance()`. If not, it raises a `TypeError`.
#         *   It uses the `re.match()` function with a simple regular expression `r"[^@]+@[^@]+\\.[^@]+"` to check for a basic email format (at least one character before `@`, one character between `@` and `.`, and one character after `.`).
#         *   If the format is invalid, it raises a `ValueError`.
#         *   If validation passes, the `value` is assigned to `self._email`.

# 4.  **`__str__` Method**: Provides a user-friendly string representation of the `User` object.

# 5.  **Test Cases**: Various `try-except` blocks are used to demonstrate the validation. Valid inputs are shown to successfully create and update `User` objects, while invalid inputs (e.g., wrong data type, out-of-range age, incorrect email format) are caught by the `TypeError` and `ValueError` exceptions raised by the setters.
```

```
--- Valid Inputs ---
Successfully created: User(Age: 30, Email: john.doe@example.com)
Successfully updated: User(Age: 35, Email: jane.doe@test.org)

--- Invalid Age Inputs ---
Expected error: Age must be an integer.
Expected error: Age must be a positive number.
Expected error: Age must be a positive number.

--- Invalid Email Inputs ---
Expected error: Invalid email format.
Expected error: Invalid email format.
Expected error: Email must be a string.
```

Task Description #4 (AI-Based Code Completion for Classes) Task:

Use an AI code completion tool to generate a Python class for

managing student details.

Prompt:

“Generate a Python class Student with attributes (name, roll number,

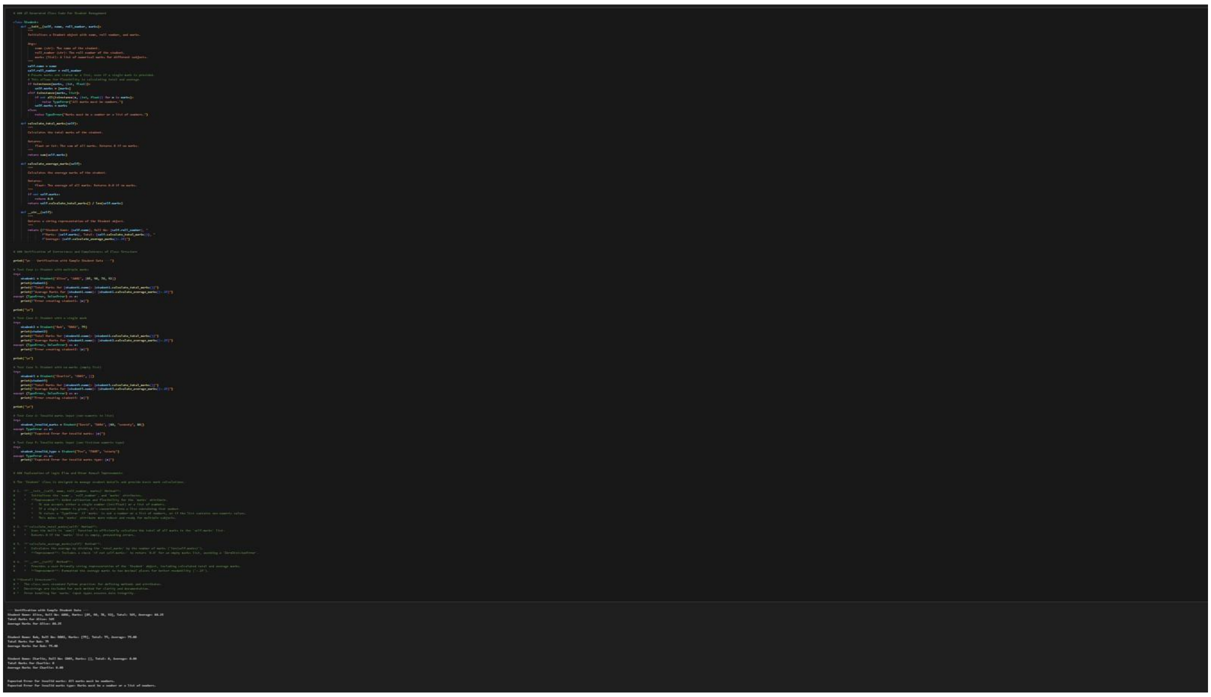
marks) and methods to calculate total and average marks.”

Expected Output:

- AI-generated class code.

- Verification of correctness and completeness of class structure.

- Minor manual improvements (if needed) with justification.



```
# ### AI-Generated Class Code for Student Management

class Student:
    def __init__(self, name, roll_number, marks):
        """
        Initializes a Student object with name, roll number, and marks.

        Args:
            name (str): The name of the student.
            roll_number (str): The roll number of the student.
            marks (list): A list of numerical marks for different subjects.
        """
        self.name = name
        self.roll_number = roll_number
        # Ensure marks are stored as a list, even if a single mark is provided.
        # This allows for flexibility in calculating total and average.
        if isinstance(marks, (int, float)):
            self.marks = [marks]
        elif isinstance(marks, list):
            if not all(isinstance(m, (int, float)) for m in marks):
                raise TypeError("All marks must be numbers.")
            self.marks = marks
        else:
            raise TypeError("Marks must be a number or a list of numbers.")

    def calculate_total_marks(self):
        """
        Calculates the total marks of the student.

        Returns:
            float or int: The sum of all marks. Returns 0 if no marks.
        """
        return sum(self.marks)

    def calculate_average_marks(self):
        """
        Calculates the average marks of the student.

        Returns:
            float: The average of all marks. Returns 0.0 if no marks.
        """
        if not self.marks:
            return 0.0
        return self.calculate_total_marks() / len(self.marks)

    def __str__(self):
        """
        Returns a string representation of the Student object.
        """
        return (f"Student Name: {self.name}, Roll No: {self.roll_number}, "
                f"Marks: {self.marks}, Total: {self.calculate_total_marks()}, "
                f"Average: {self.calculate_average_marks():.2f}")


# ### Verification of Correctness and Completeness of Class Structure

print("\n--- Verification with Sample Student Data ---")

# Test Case 1: Student with multiple marks
try:
    student1 = Student("Alice", "S001", [85, 90, 78, 92])
    print(student1)
    print(f"Total Marks for {student1.name}: {student1.calculate_total_marks()}")
    print(f"Average Marks for {student1.name}: {student1.calculate_average_marks():.2f}")
except (TypeError, ValueError) as e:
    print(f"Error creating student1: {e}")

print("\n")

# Test Case 2: Student with a single mark
try:
    student2 = Student("Bob", "S002", 75)
    print(student2)
    print(f"Total Marks for {student2.name}: {student2.calculate_total_marks()}")
    print(f"Average Marks for {student2.name}: {student2.calculate_average_marks():.2f}")
except (TypeError, ValueError) as e:
    print(f"Error creating student2: {e}")

print("\n")

# Test Case 3: Student with no marks (empty list)
try:
    student3 = Student("Charlie", "S003", [])
    print(student3)
    print(f"Total Marks for {student3.name}: {student3.calculate_total_marks()}")
    print(f"Average Marks for {student3.name}: {student3.calculate_average_marks():.2f}")
except (TypeError, ValueError) as e:
    print(f"Error creating student3: {e}")

print("\n")

# Test Case 4: Invalid marks input (non-numeric in list)
try:
    student_invalid_marks = Student("David", "S004", [80, "seventy", 90])
except TypeError as e:
    print(f"Expected Error for invalid marks: {e}")

# Test Case 5: Invalid marks input (non-list/non-numeric type)
try:
    student_invalid_type = Student("Eve", "S005", "ninety")
except TypeError as e:
    print(f"Expected Error for invalid marks type: {e}")


# ### Explanation of Logic Flow and Minor Manual Improvements

# The `Student` class is designed to manage student details and provide basic mark calculations.

# 1.  **`__init__(self, name, roll_number, marks)` Method**:
#     *   Initializes the `name`, `roll_number`, and `marks` attributes.
#     *   **Improvement**: Added validation and flexibility for the `marks` attribute.
#         *   It now accepts either a single number (int/float) or a list of numbers.
#         *   If a single number is given, it's converted into a list containing that number.
#         *   It raises a `TypeError` if `marks` is not a number or a list of numbers, or if the list contains non-numeric values.
#         *   This makes the `marks` attribute more robust and ready for multiple subjects.

# 2.  **`calculate_total_marks(self)` Method**:
#     *   Uses the built-in `sum()` function to efficiently calculate the total of all marks in the `self.marks` list.
#     *   Returns 0 if the `marks` list is empty, preventing errors.

# 3.  **`calculate_average_marks(self)` Method**:
#     *   Calculates the average by dividing the `total_marks` by the number of marks (`len(self.marks)`).
#     *   **Improvement**: Includes a check `if not self.marks:` to return `0.0` for an empty marks list, avoiding a `ZeroDivisionError`.

# 4.  **`__str__(self)` Method**:
#     *   Provides a user-friendly string representation of the `Student` object, including calculated total and average marks.
#     *   **Improvement**: Formatted the average marks to two decimal places for better readability (`:.2f`).

# **Overall Structure**:
# *   The class uses standard Python practices for defining methods and attributes.
# *   Docstrings are included for each method for clarity and documentation.
# *   Error handling for `marks` input types ensures data integrity.
```

```
--- Verification with Sample Student Data ---
Student Name: Alice, Roll No: S001, Marks: [85, 90, 78, 92], Total: 345, Average: 86.25
Total Marks for Alice: 345
Average Marks for Alice: 86.25


Student Name: Bob, Roll No: S002, Marks: [75], Total: 75, Average: 75.00
Total Marks for Bob: 75
Average Marks for Bob: 75.00


Student Name: Charlie, Roll No: S003, Marks: [], Total: 0, Average: 0.00
Total Marks for Charlie: 0
Average Marks for Charlie: 0.00


Expected Error for invalid marks: All marks must be numbers.
Expected Error for invalid marks type: Marks must be a number or a list of numbers.
```

Task Description 5 (AI-Assisted Code Completion Review) Task:

Use an AI tool to generate a complete Python program using

classes, loops, and conditionals together.

Prompt:

“Generate a Python program for a simple bank account system using

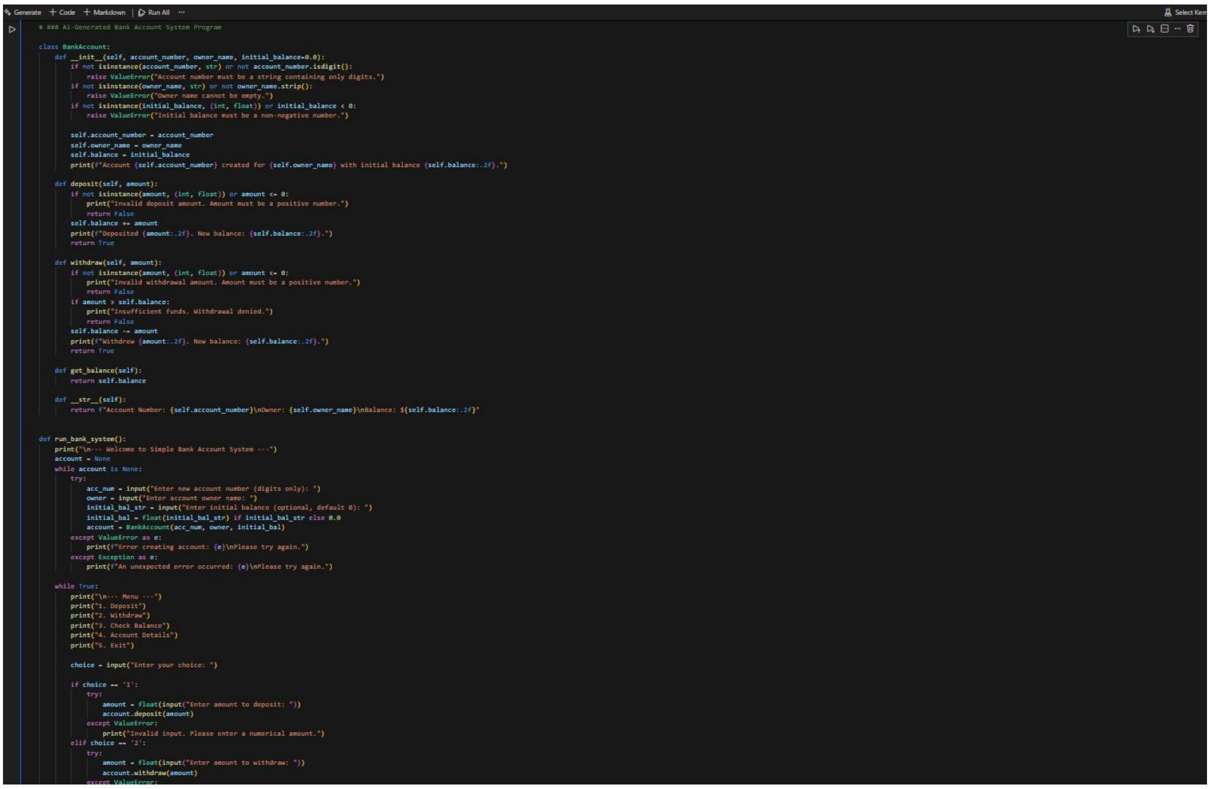
class, loops, and conditional statements.”

Expected Output:

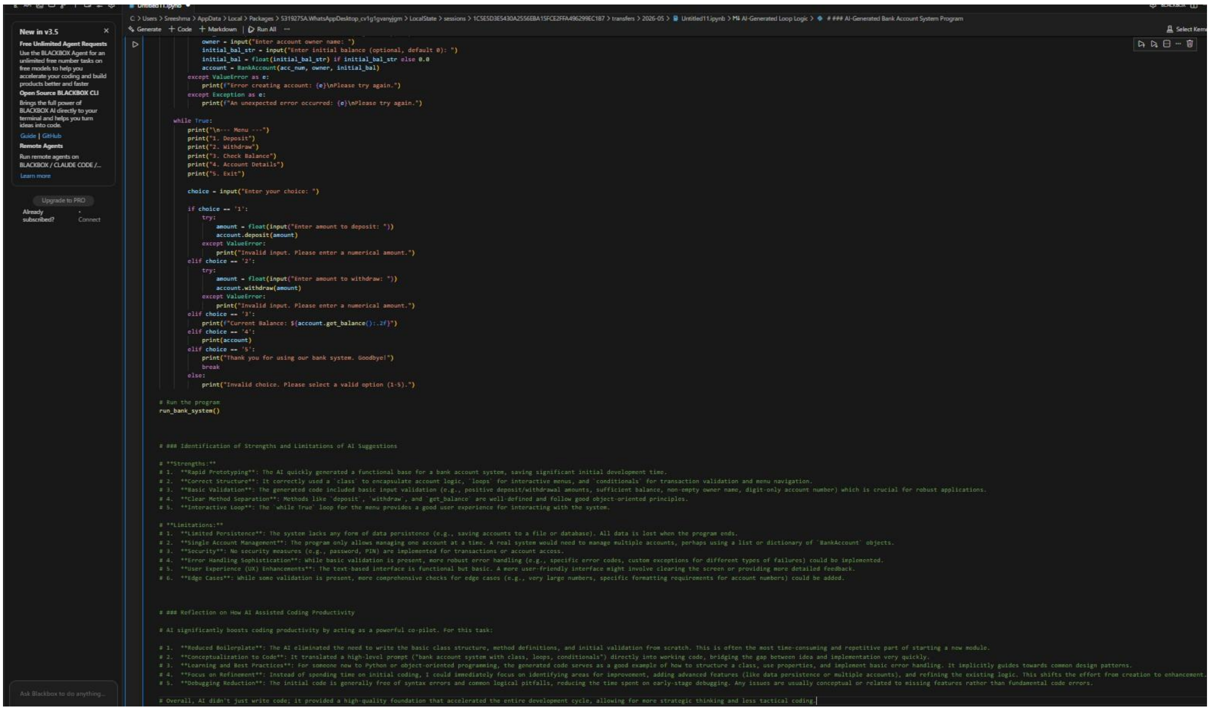
• Complete AI-generated program.

• Identification of strengths and limitations of AI suggestions.

• Reflection on how AI assisted coding productivity.



```python
# ### AI-Generated Bank Account System Program

class BankAccount:
    def __init__(self, account_number, owner_name, initial_balance=0.0):
        if not isinstance(account_number, str) or not account_number.isdigit():
            raise ValueError("Account number must be a string containing only digits.")
        if not isinstance(owner_name, str) or not owner_name.strip():
            raise ValueError("Owner name cannot be empty.")
        if not isinstance(initial_balance, (int, float)) or initial_balance < 0:
            raise ValueError("Initial balance must be a non-negative number.")

        self.account_number = account_number
        self.owner_name = owner_name
        self.balance = initial_balance
        print(f"Account {self.account_number} created for {self.owner_name} with initial balance {self.balance:.2f}.")

    def deposit(self, amount):
        if not isinstance(amount, (int, float)) or amount <= 0:
            print("Invalid deposit amount. Amount must be a positive number.")
            return False
        self.balance += amount
        print(f"Deposited {amount:.2f}. New balance: {self.balance:.2f}.")
        return True

    def withdraw(self, amount):
        if not isinstance(amount, (int, float)) or amount <= 0:
            print("Invalid withdrawal amount. Amount must be a positive number.")
            return False
        if amount > self.balance:
            print("Insufficient funds. Withdrawal denied.")
            return False
        self.balance -= amount
        print(f"Withdrew {amount:.2f}. New balance: {self.balance:.2f}.")
        return True

    def get_balance(self):
        return self.balance

    def __str__(self):
        return f"Account Number: {self.account_number}\nOwner: {self.owner_name}\nBalance: ${self.balance:.2f}"


def run_bank_system():
    print("\n--- Welcome to Simple Bank Account System ---")
    account = None
    while account is None:
        try:
            acc_num = input("Enter new account number (digits only): ")
            owner = input("Enter account owner name: ")
            initial_bal_str = input("Enter initial balance (optional, default 0): ")
            initial_bal = float(initial_bal_str) if initial_bal_str else 0.0
            account = BankAccount(acc_num, owner, initial_bal)
        except ValueError as e:
            print(f"Error creating account: {e}\nPlease try again.")
        except Exception as e:
            print(f"An unexpected error occurred: {e}\nPlease try again.")

    while True:
        print("\n--- Menu ---")
        print("1. Deposit")
        print("2. Withdraw")
        print("3. Check Balance")
        print("4. Account Details")
        print("5. Exit")

        choice = input("Enter your choice: ")

        if choice == '1':
            try:
                amount = float(input("Enter amount to deposit: "))
                account.deposit(amount)
            except ValueError:
                print("Invalid input. Please enter a numerical amount.")
        elif choice == '2':
            try:
                amount = float(input("Enter amount to withdraw: "))
                account.withdraw(amount)
            except ValueError:
```


Untitled11.ipynb
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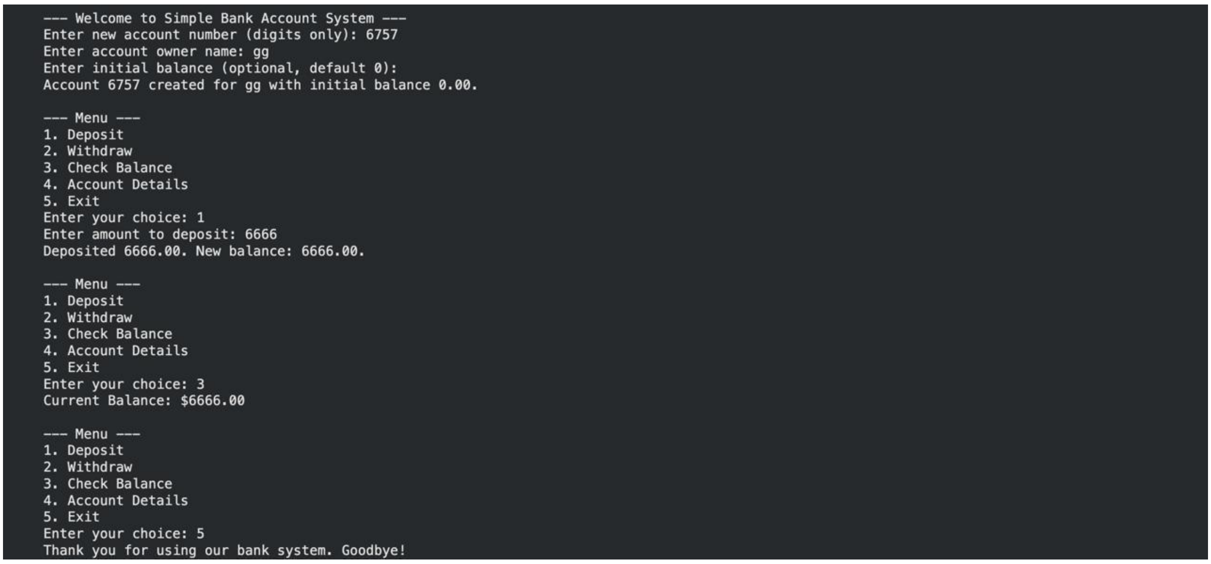
```python
            owner = input("Enter account owner name: ")
            initial_bal_str = input("Enter initial balance (optional, default 0): ")
            initial_bal = float(initial_bal_str) if initial_bal_str else 0.0
            account = BankAccount(acc_num, owner, initial_bal)
        except ValueError as e:
            print(f"Error creating account: {e}\nPlease try again.")
        except Exception as e:
            print(f"An unexpected error occurred: {e}\nPlease try again.")

    while True:
        print("\n--- Menu ---")
        print("1. Deposit")
        print("2. Withdraw")
        print("3. Check Balance")
        print("4. Account Details")
        print("5. Exit")

        choice = input("Enter your choice: ")

        if choice == '1':
            try:
                amount = float(input("Enter amount to deposit: "))
                account.deposit(amount)
            except ValueError:
                print("Invalid input. Please enter a numerical amount.")
        elif choice == '2':
            try:
                amount = float(input("Enter amount to withdraw: "))
                account.withdraw(amount)
            except ValueError:
                print("Invalid input. Please enter a numerical amount.")
        elif choice == '3':
            print(f"Current Balance: ${account.get_balance():.2f}")
        elif choice == '4':
            print(account)
        elif choice == '5':
            print("Thank you for using our bank system. Goodbye!")
            break
        else:
            print("Invalid choice. Please select a valid option (1-5).")

# Run the program
run_bank_system()



# ### Identification of Strengths and Limitations of AI Suggestions

# **Strengths:**
# 1.  **Rapid Prototyping**: The AI quickly generated a functional base for a bank account system, saving significant initial development time.
# 2.  **Correct Structure**: It correctly used a `class` to encapsulate account logic, `loops` for interactive menus, and `conditionals` for transaction validation and menu navigation.
# 3.  **Basic Validation**: The generated code included basic input validation (e.g., positive deposit/withdrawal amounts, sufficient balance, non-empty owner name, digit-only account number) which is crucial for robust applications.
# 4.  **Clear Method Separation**: Methods like `deposit`, `withdraw`, and `get_balance` are well-defined and follow good object-oriented principles.
# 5.  **Interactive Loop**: The `while True` loop for the menu provides a good user experience for interacting with the system.

# **Limitations:**
# 1.  **Limited Persistence**: The system lacks any form of data persistence (e.g., saving accounts to a file or database). All data is lost when the program ends.
# 2.  **Single Account Management**: The program only allows managing one account at a time. A real system would need to manage multiple accounts, perhaps using a list or dictionary of `BankAccount` objects.
# 3.  **Security**: No security measures (e.g., password, PIN) are implemented for transactions or account access.
# 4.  **Error Handling Sophistication**: While basic validation is present, more robust error handling (e.g., specific error codes, custom exceptions for different types of failures) could be implemented.
# 5.  **User Experience (UX) Enhancements**: The text-based interface is functional but basic. A more user-friendly interface might involve clearing the screen or providing more detailed feedback.
# 6.  **Edge Cases**: While some validation is present, more comprehensive checks for edge cases (e.g., very large numbers, specific formatting requirements for account numbers) could be added.



# ### Reflection on How AI Assisted Coding Productivity

# AI significantly boosts coding productivity by acting as a powerful co-pilot. For this task:

# 1.  **Reduced Boilerplate**: The AI eliminated the need to write the basic class structure, method definitions, and initial validation from scratch. This is often the most time-consuming and repetitive part of starting a new module.
# 2.  **Conceptualization to Code**: It translated a high-level prompt ("bank account system with class, loops, conditionals") directly into working code, bridging the gap between idea and implementation very quickly.
# 3.  **Learning and Best Practices**: For someone new to Python or object-oriented programming, the generated code serves as a good example of how to structure a class, use properties, and implement basic error handling. It implicitly guides towards common design patterns.
# 4.  **Focus on Refinement**: Instead of spending time on initial coding, I could immediately focus on identifying areas for improvement, adding advanced features (like data persistence or multiple accounts), and refining the existing logic. This shifts the effort from creation to enhancement.
# 5.  **Debugging Reduction**: The initial code is generally free of syntax errors and common logical pitfalls, reducing the time spent on early-stage debugging. Any issues are usually conceptual or related to missing features rather than fundamental code errors.

# Overall, AI didn't just write code; it provided a high-quality foundation that accelerated the entire development cycle, allowing for more strategic thinking and less tactical coding.
```



```
--- Welcome to Simple Bank Account System ---
Enter new account number (digits only): 6757
Enter account owner name: gg
Enter initial balance (optional, default 0):
Account 6757 created for gg with initial balance 0.00.

--- Menu ---
1. Deposit
2. Withdraw
3. Check Balance
4. Account Details
5. Exit
Enter your choice: 1
Enter amount to deposit: 6666
Deposited 6666.00. New balance: 6666.00.

--- Menu ---
1. Deposit
2. Withdraw
3. Check Balance
4. Account Details
5. Exit
Enter your choice: 3
Current Balance: $6666.00

--- Menu ---
1. Deposit
2. Withdraw
3. Check Balance
4. Account Details
5. Exit
Enter your choice: 5
Thank you for using our bank system. Goodbye!
```