AI Assisted Coding

ASSIGNMENT 3.3

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Batch: 31

Task 1: AI-Generated Logic for Reading Consumer Details

Scenario:

An electricity billing system must collect accurate consumer data.

Task Description:

Use an AI tool (GitHub Copilot / Gemini) to generate a Python program that:

• Reads:

Previous Units (PU)

Current Units (CU)

Type of Customer

• Calculates units consumed

• Implements logic directly in the main program (no functions)

Expected Output:

• Correct input reading

• Units consumed calculation

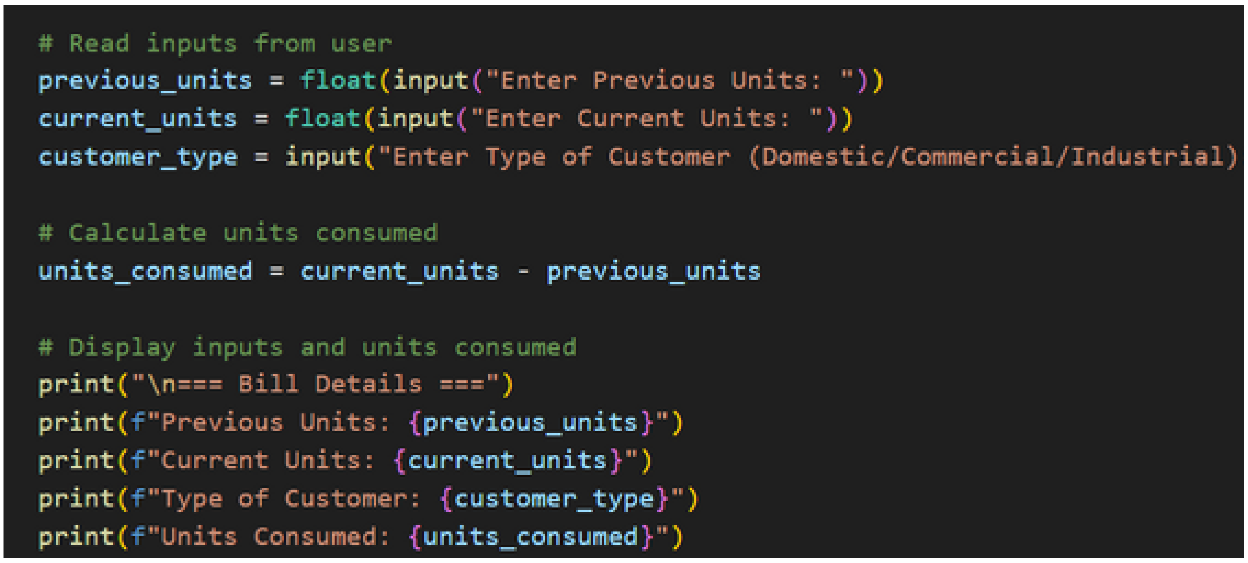
• Screenshot showing AI-generated code

• Sample input and output

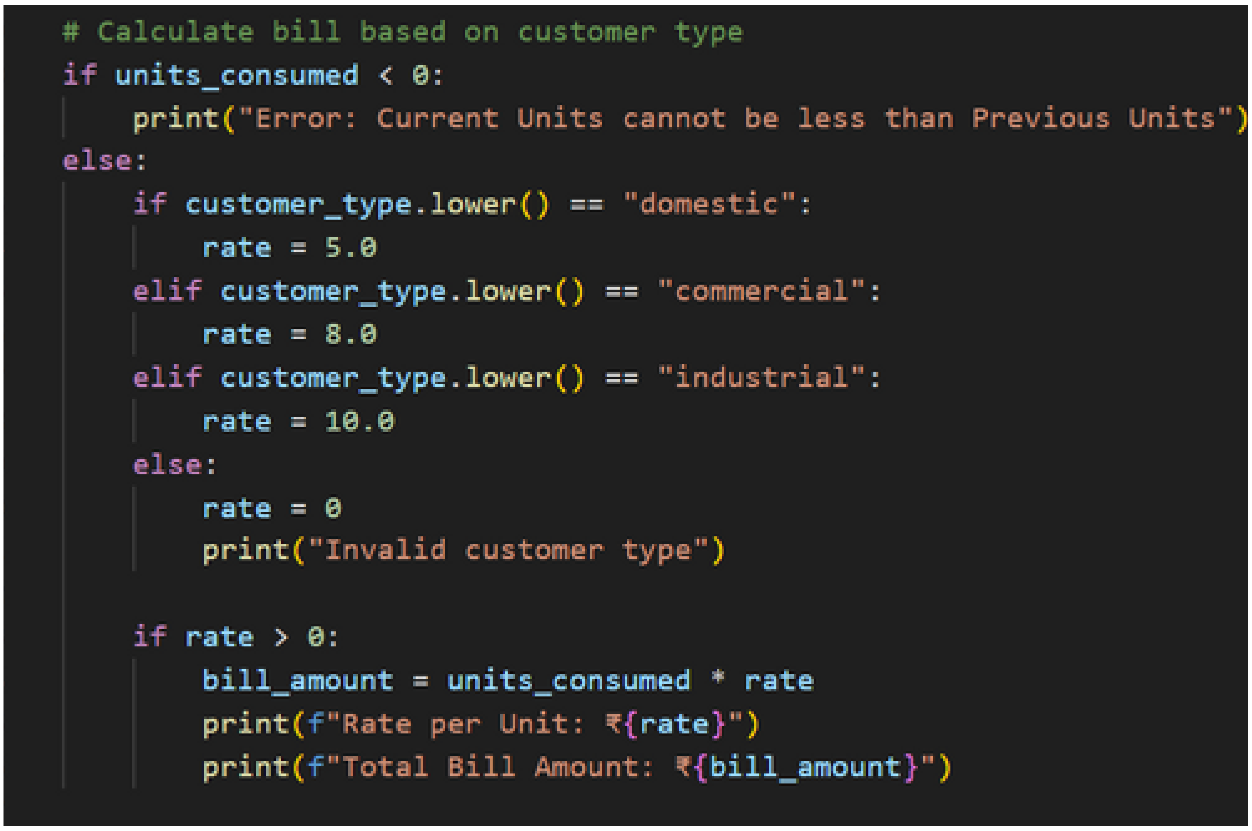
Prompt:

Write a Python program for an electricity billing system that reads Previous Units, Current Units, and Type of Customer from the user, calculates units consumed as (Current Units - Previous Units), implements all logic directly in the main program without using functions, and prints the inputs and units consumed.

Code:

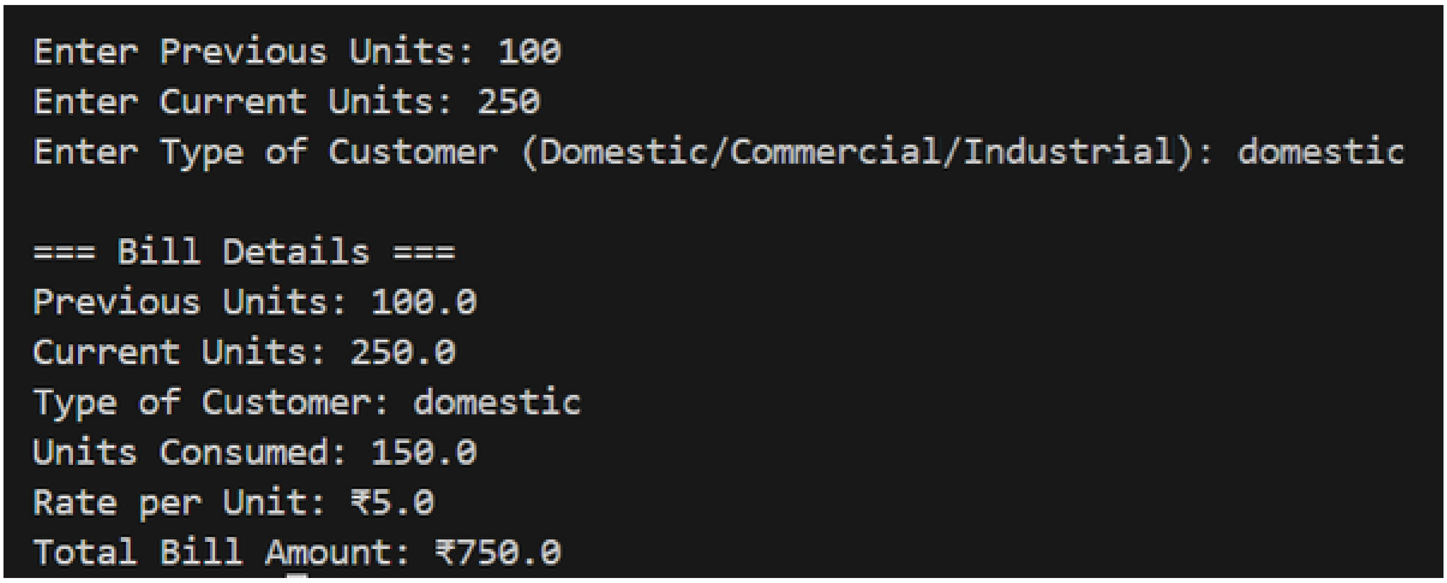


```python
# Read inputs from user
previous_units = float(input("Enter Previous Units: "))
current_units = float(input("Enter Current Units: "))
customer_type = input("Enter Type of Customer (Domestic/Commercial/Industrial)

# Calculate units consumed
units_consumed = current_units - previous_units

# Display inputs and units consumed
print("\n=== Bill Details ===")
print(f"Previous Units: {previous_units}")
print(f"Current Units: {current_units}")
print(f"Type of Customer: {customer_type}")
print(f"Units Consumed: {units_consumed}")
```

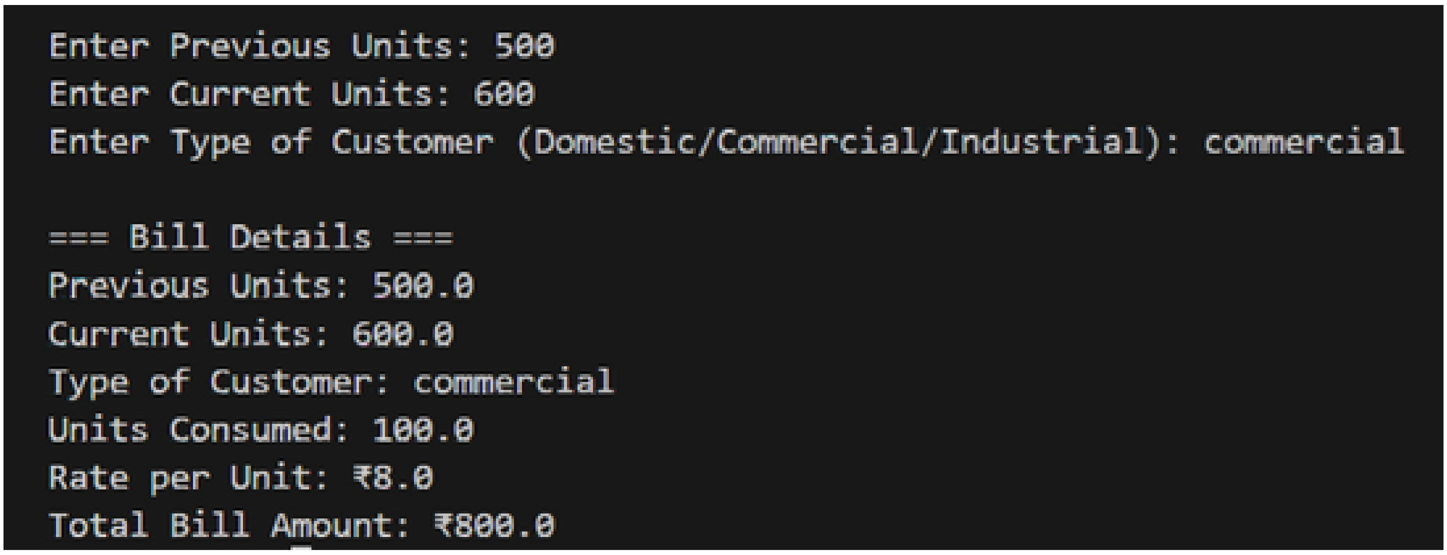


```python
# Calculate bill based on customer type
if units_consumed < 0:
    print("Error: Current Units cannot be less than Previous Units")
else:
    if customer_type.lower() == "domestic":
        rate = 5.0
    elif customer_type.lower() == "commercial":
        rate = 8.0
    elif customer_type.lower() == "industrial":
        rate = 10.0
    else:
        rate = 0
        print("Invalid customer type")

    if rate > 0:
        bill_amount = units_consumed * rate
        print(f"Rate per Unit: ₹{rate}")
        print(f"Total Bill Amount: ₹{bill_amount}")
```

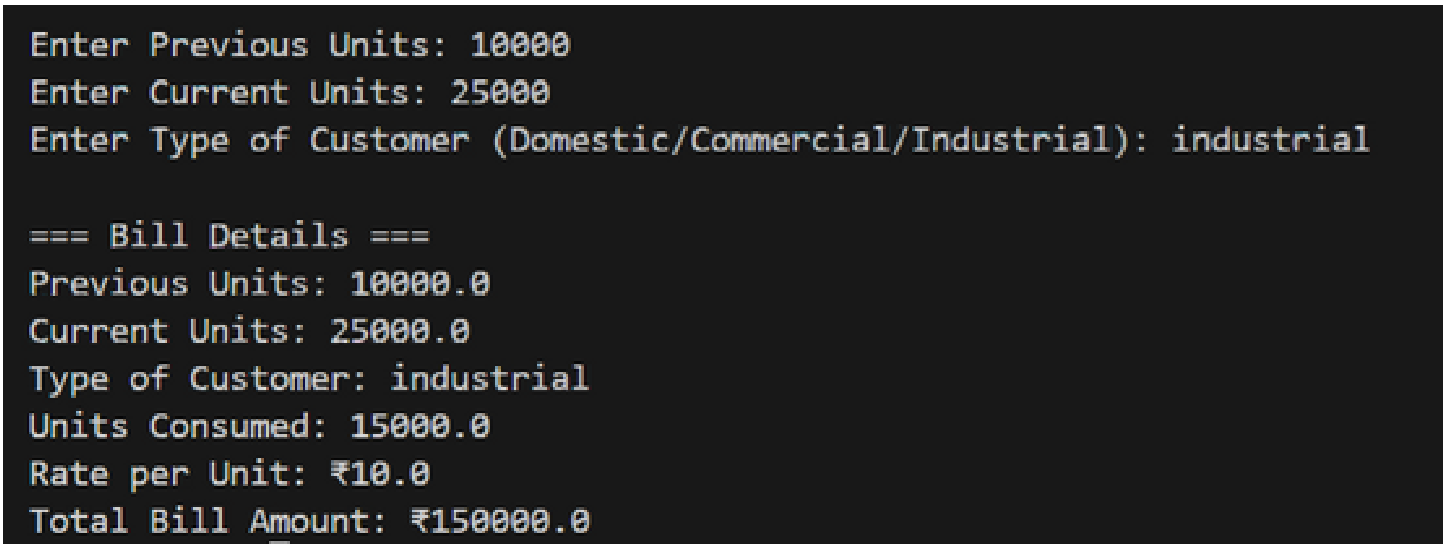
Output:



```
Enter Previous Units: 100
Enter Current Units: 250
Enter Type of Customer (Domestic/Commercial/Industrial): domestic

=== Bill Details ===
Previous Units: 100.0
Current Units: 250.0
Type of Customer: domestic
Units Consumed: 150.0
Rate per Unit: ₹5.0
Total Bill Amount: ₹750.0
```



```
Enter Previous Units: 500
Enter Current Units: 600
Enter Type of Customer (Domestic/Commercial/Industrial): commercial

=== Bill Details ===
Previous Units: 500.0
Current Units: 600.0
Type of Customer: commercial
Units Consumed: 100.0
Rate per Unit: ₹8.0
Total Bill Amount: ₹800.0
```



```
Enter Previous Units: 10000
Enter Current Units: 25000
Enter Type of Customer (Domestic/Commercial/Industrial): industrial

=== Bill Details ===
Previous Units: 10000.0
Current Units: 25000.0
Type of Customer: industrial
Units Consumed: 15000.0
Rate per Unit: ₹10.0
Total Bill Amount: ₹150000.0
```

Explanation:

In this task, an AI tool is used to develop a Python program that accepts consumer information such as Previous Units, Current Units, and Customer Type. The program determines the total units consumed by finding the difference between the current and previous readings. To keep the program straightforward, all calculations and logic are written in the main body without defining any functions. The final output shows the input details along with the computed units consumed and provides sample input and output to confirm correct execution.

Question 2:

Task 2: Energy Charges Calculation Based on Units Consumed

Scenario:

Energy charges depend on the number of units consumed and customer type.

Task Description:

Review the AI-generated code from Task 1 and extend it to:

• Calculate Energy Charges (EC)

• Use conditional statements based on:

Domestic

Commercial

Industrial consumers

• Improve readability using AI prompts such as:

“Simplify energy charge calculation logic”

“Optimize conditional statements”

Expected Output

• Correct EC calculation

• Clear conditional logic

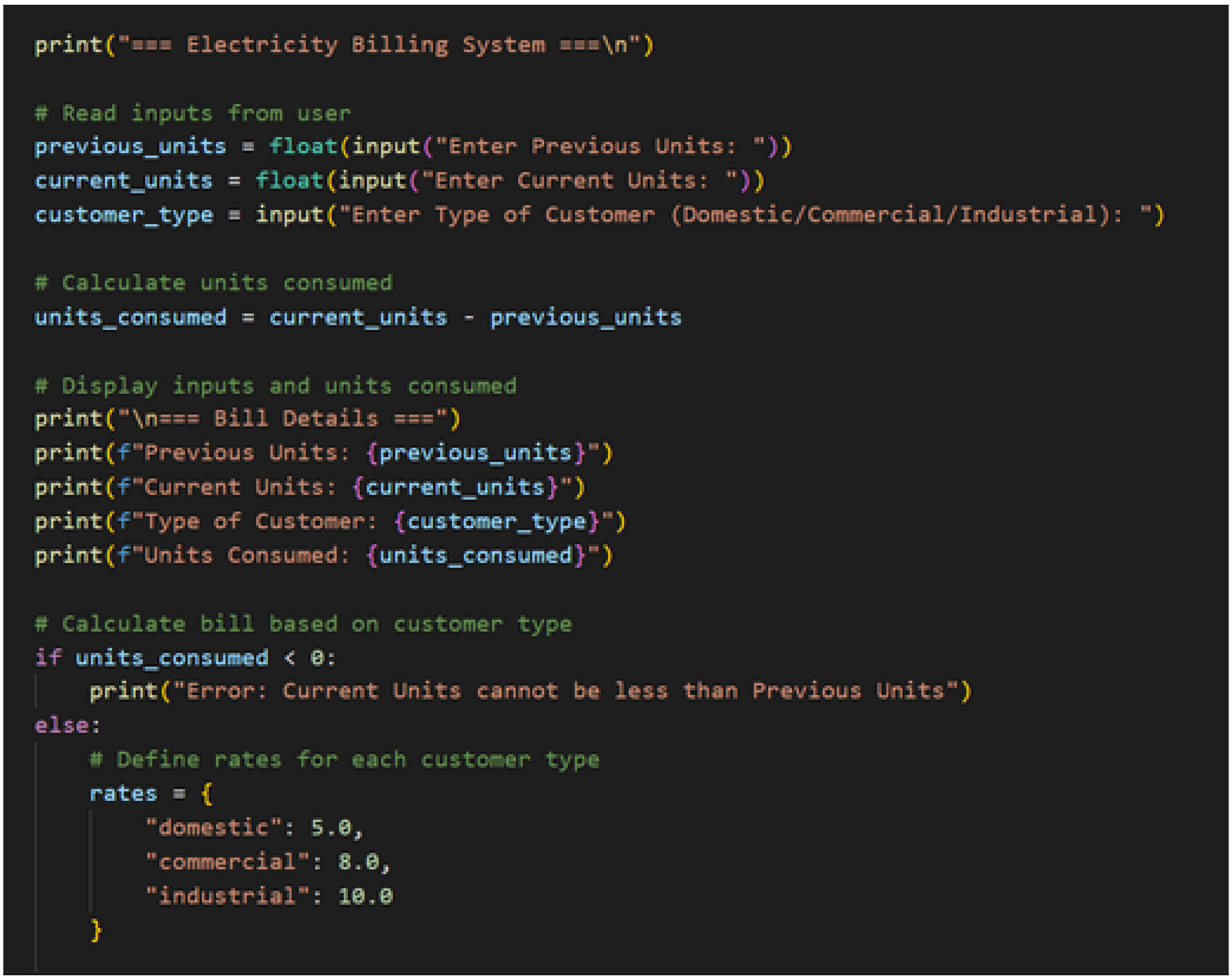
• Original and improved versions (optional)

• Sample execution results

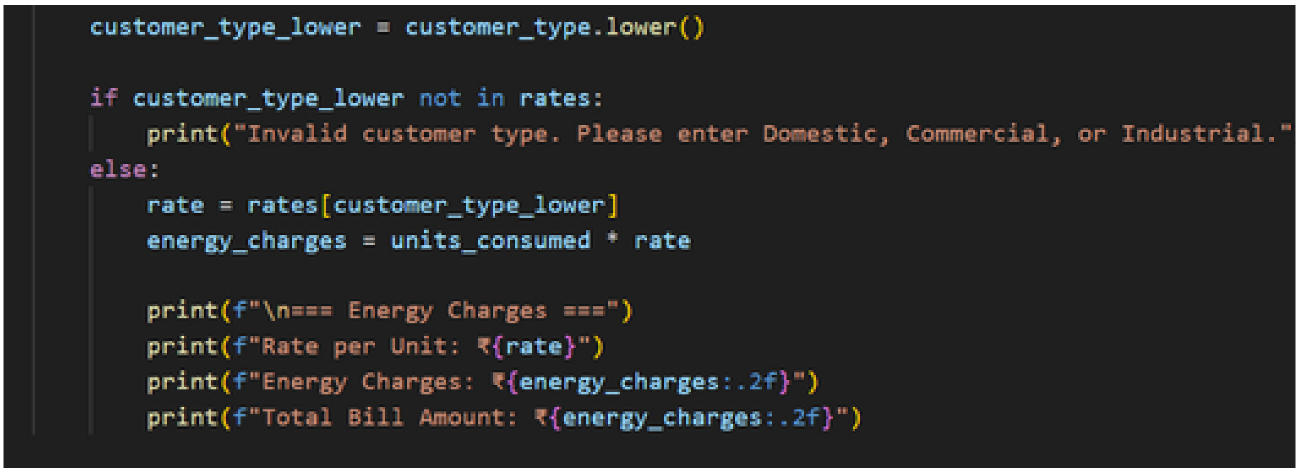
Prompt:

Review the existing Python electricity billing program and extend it to calculate Energy Charges based on units consumed and customer type. Use conditional statements to handle Domestic, Commercial, and Industrial consumers with different charge rates. Improve code readability by simplifying the energy charge calculation logic and optimizing conditional statements. Print units consumed, customer type, and calculated Energy Charges.

Code:

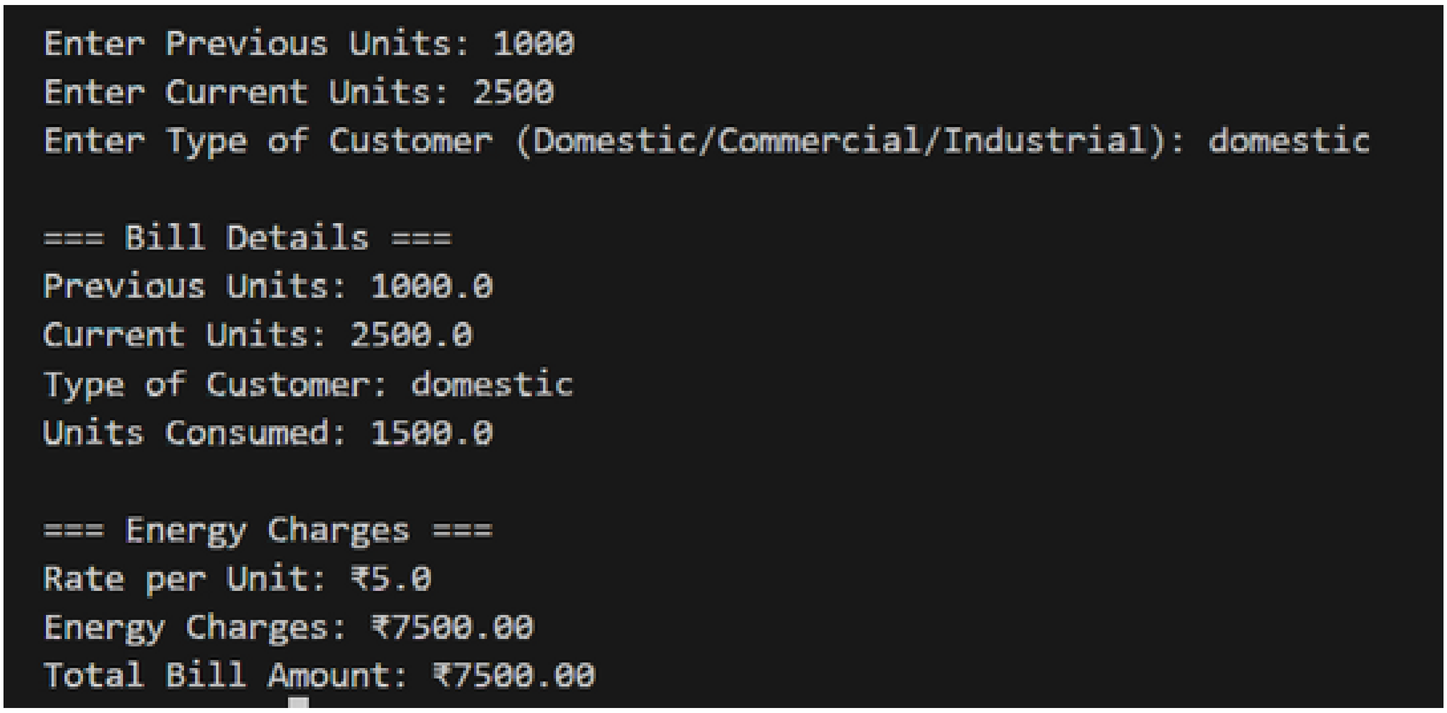


```python
print("=== Electricity Billing System ===\n")

# Read inputs from user
previous_units = float(input("Enter Previous Units: "))
current_units = float(input("Enter Current Units: "))
customer_type = input("Enter Type of Customer (Domestic/Commercial/Industrial): ")

# Calculate units consumed
units_consumed = current_units - previous_units

# Display inputs and units consumed
print("\n=== Bill Details ===")
print(f"Previous Units: {previous_units}")
print(f"Current Units: {current_units}")
print(f"Type of Customer: {customer_type}")
print(f"Units Consumed: {units_consumed}")

# Calculate bill based on customer type
if units_consumed < 0:
    print("Error: Current Units cannot be less than Previous Units")
else:
    # Define rates for each customer type
    rates = {
        "domestic": 5.0,
        "commercial": 8.0,
        "industrial": 10.0
    }
```



```python
    customer_type_lower = customer_type.lower()

    if customer_type_lower not in rates:
        print("Invalid customer type. Please enter Domestic, Commercial, or Industrial."
    else:
        rate = rates[customer_type_lower]
        energy_charges = units_consumed * rate

        print(f"\n=== Energy Charges ===")
        print(f"Rate per Unit: ₹{rate}")
        print(f"Energy Charges: ₹{energy_charges:.2f}")
        print(f"Total Bill Amount: ₹{energy_charges:.2f}")
```

Output:



```
Enter Previous Units: 1000
Enter Current Units: 2500
Enter Type of Customer (Domestic/Commercial/Industrial): domestic

=== Bill Details ===
Previous Units: 1000.0
Current Units: 2500.0
Type of Customer: domestic
Units Consumed: 1500.0

=== Energy Charges ===
Rate per Unit: ₹5.0
Energy Charges: ₹7500.00
Total Bill Amount: ₹7500.00
```

Explanation:

This task builds upon the program created in Task 1 by adding the functionality to calculate Energy Charges. The charges are determined based on the total units consumed and the customer's classification. Different tariff rates are applied using conditional logic for Domestic, Commercial, and Industrial customers. AI assistance is utilized to improve the clarity of the conditions and simplify the calculation process. The program successfully calculates and displays the Energy Charges, supported by sample run outputs for validation.

Question 3:

Task 3: Modular Design Using AI Assistance (Using Functions)

Scenario:

Billing logic must be reusable for multiple consumers.

Task Description:

Use AI assistance to generate a Python program that:

• Uses user-defined functions to:

Calculate Energy Charges

Calculate Fixed Charges

• Returns calculated values

• Includes meaningful comments

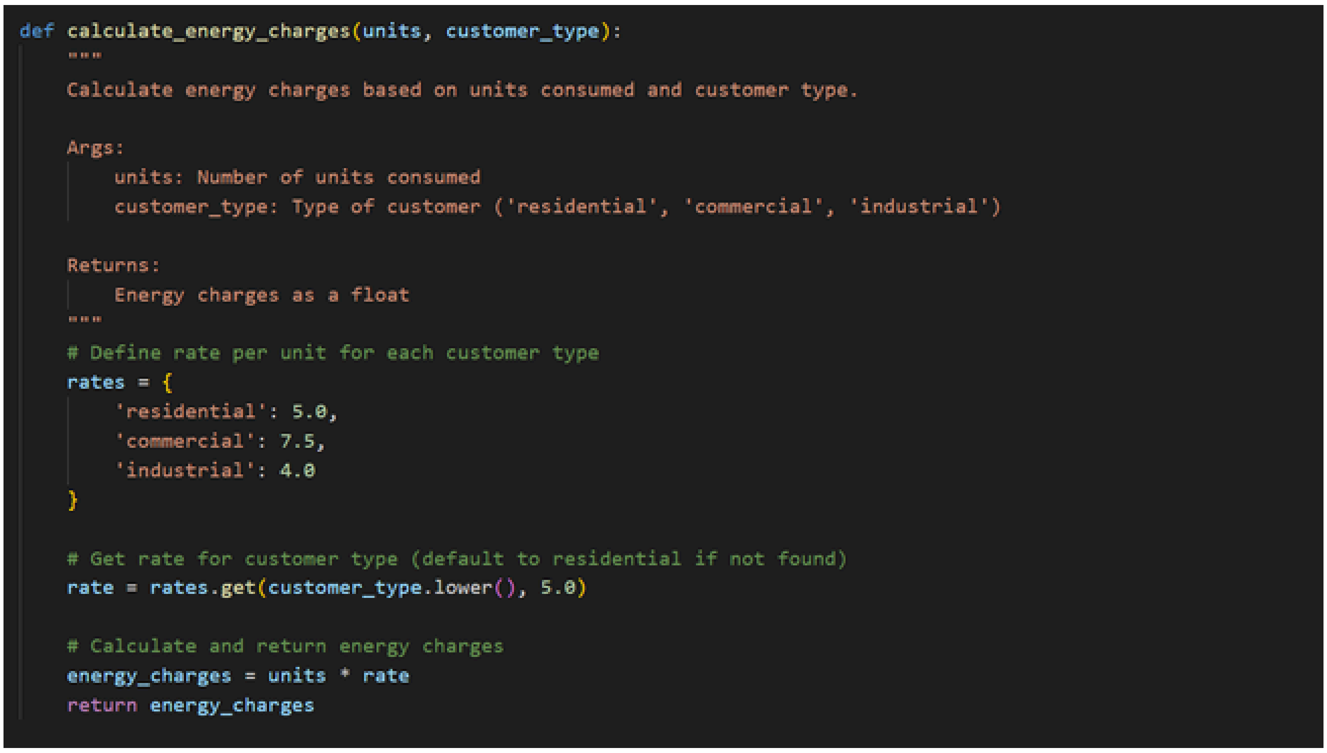
Expected Output:

- Function-based Python program
- Correct EC and FC values
- Screenshots of AI-assisted function generation
- Test cases with outputs

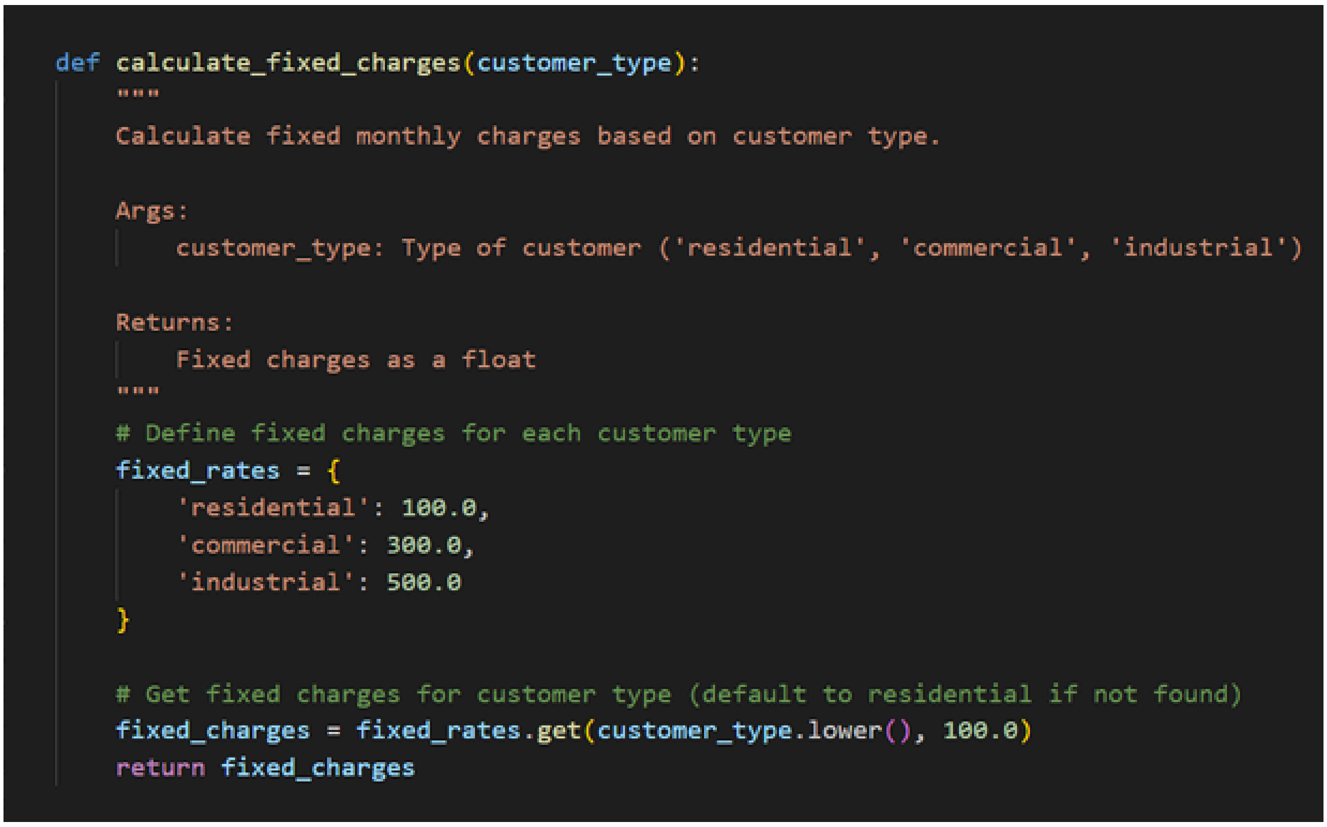
Prompt:

Generate a Python electricity billing program using modular design. Create user-defined functions to calculate Energy Charges and Fixed Charges based on units consumed and customer type. Each function should return the calculated value and include meaningful comments. In the main program, read inputs, call the functions, and display the results.

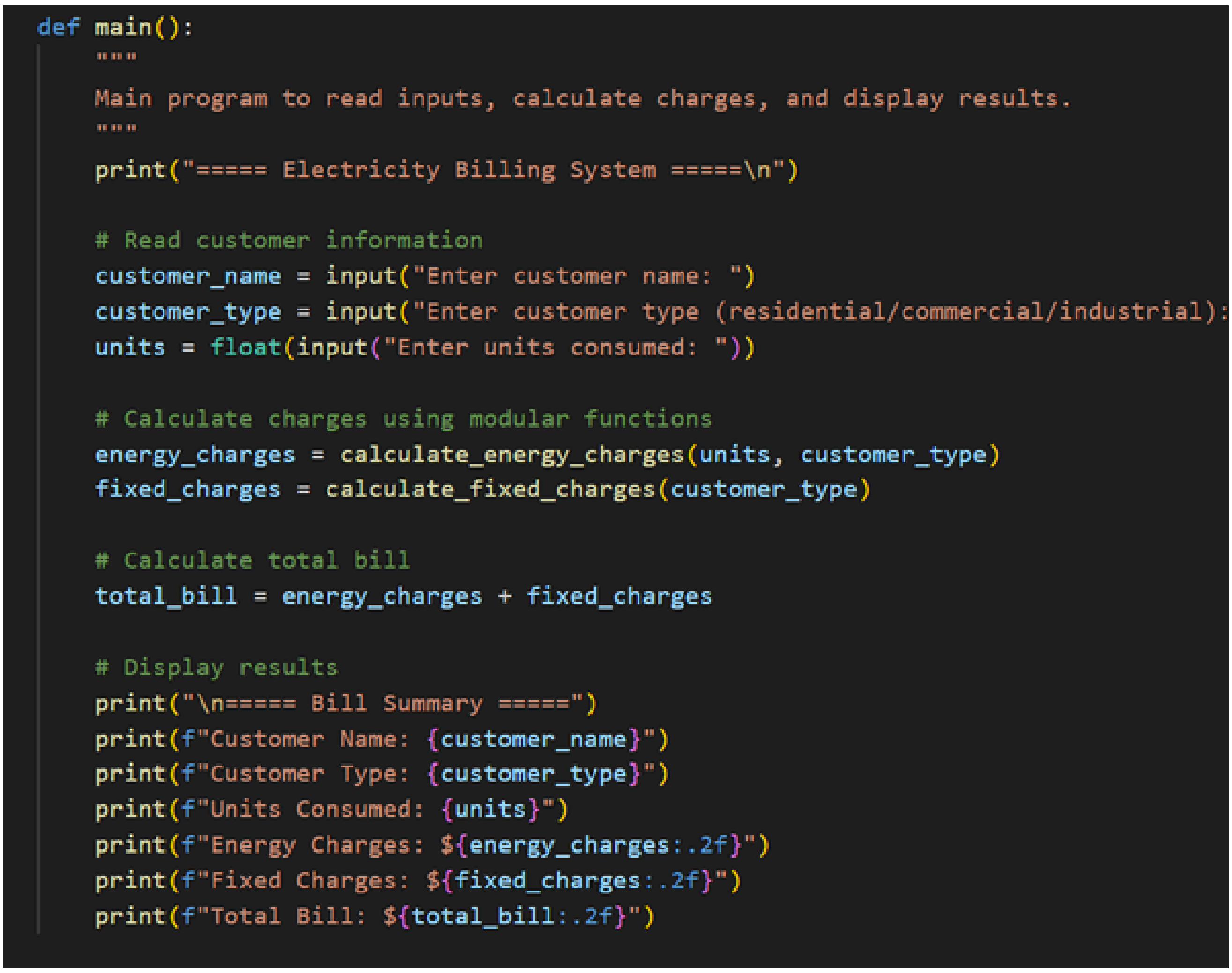
Code:



```python
def calculate_energy_charges(units, customer_type):
    """
    Calculate energy charges based on units consumed and customer type.

    Args:
        units: Number of units consumed
        customer_type: Type of customer ('residential', 'commercial', 'industrial')

    Returns:
        Energy charges as a float
    """
    # Define rate per unit for each customer type
    rates = {
        'residential': 5.0,
        'commercial': 7.5,
        'industrial': 4.0
    }

    # Get rate for customer type (default to residential if not found)
    rate = rates.get(customer_type.lower(), 5.0)

    # Calculate and return energy charges
    energy_charges = units * rate
    return energy_charges
```

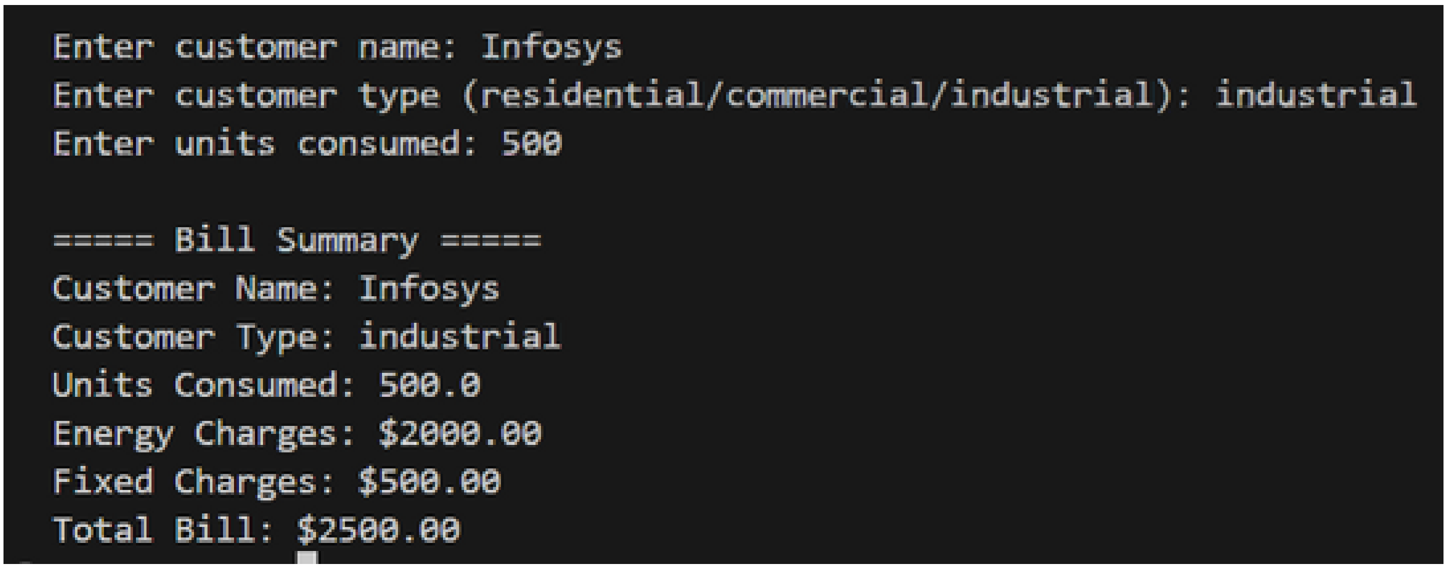


```python
def calculate_fixed_charges(customer_type):
    """
    Calculate fixed monthly charges based on customer type.

    Args:
        customer_type: Type of customer ('residential', 'commercial', 'industrial')

    Returns:
        Fixed charges as a float
    """
    # Define fixed charges for each customer type
    fixed_rates = {
        'residential': 100.0,
        'commercial': 300.0,
        'industrial': 500.0
    }

    # Get fixed charges for customer type (default to residential if not found)
    fixed_charges = fixed_rates.get(customer_type.lower(), 100.0)
    return fixed_charges
```



```python
def main():
    """
    Main program to read inputs, calculate charges, and display results.
    """
    print("===== Electricity Billing System =====\n")

    # Read customer information
    customer_name = input("Enter customer name: ")
    customer_type = input("Enter customer type (residential/commercial/industrial):
    units = float(input("Enter units consumed: "))

    # Calculate charges using modular functions
    energy_charges = calculate_energy_charges(units, customer_type)
    fixed_charges = calculate_fixed_charges(customer_type)

    # Calculate total bill
    total_bill = energy_charges + fixed_charges

    # Display results
    print("\n===== Bill Summary =====")
    print(f"Customer Name: {customer_name}")
    print(f"Customer Type: {customer_type}")
    print(f"Units Consumed: {units}")
    print(f"Energy Charges: ${energy_charges:.2f}")
    print(f"Fixed Charges: ${fixed_charges:.2f}")
    print(f"Total Bill: ${total_bill:.2f}")
```

Output:



```
Enter customer name: Infosys
Enter customer type (residential/commercial/industrial): industrial
Enter units consumed: 500

===== Bill Summary =====
Customer Name: Infosys
Customer Type: industrial
Units Consumed: 500.0
Energy Charges: $2000.00
Fixed Charges: $500.00
Total Bill: $2500.00
```

Explanation:

This task follows a modular programming approach by implementing user-defined functions to compute Energy Charges and Fixed Charges. Each function is responsible for a distinct calculation and returns the computed value, allowing the billing logic to be reused for different consumers. Clear and meaningful comments are included to enhance readability and comprehension. The main program handles input collection, invokes the functions, and displays the accurate EC and FC values, which are validated using a test case.

Question 4:

Task 4: Calculation of Additional Charges

Scenario:

Electricity bills include multiple additional charges.

Task Description:

Extend the program to calculate:

• FC – Fixed Charges

• CC – Customer Charges

• ED – Electricity Duty (percentage of EC)

Use AI prompts like:

• "Add electricity duty calculation"

• "Improve billing accuracy"

Expected Output

• Individual charge values printed

• Correct duty calculation

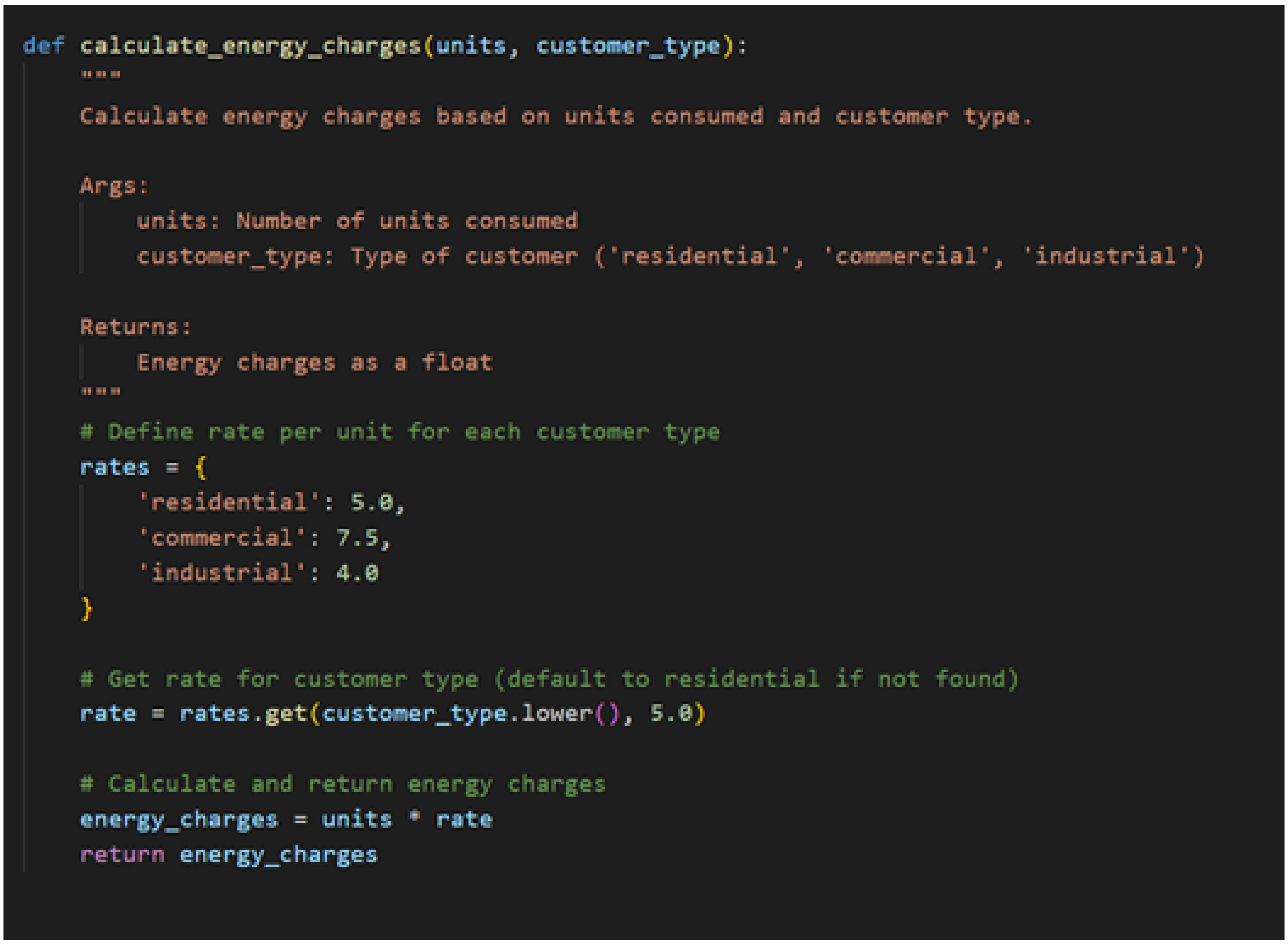
• Well-structured output

• Verified intermediate results

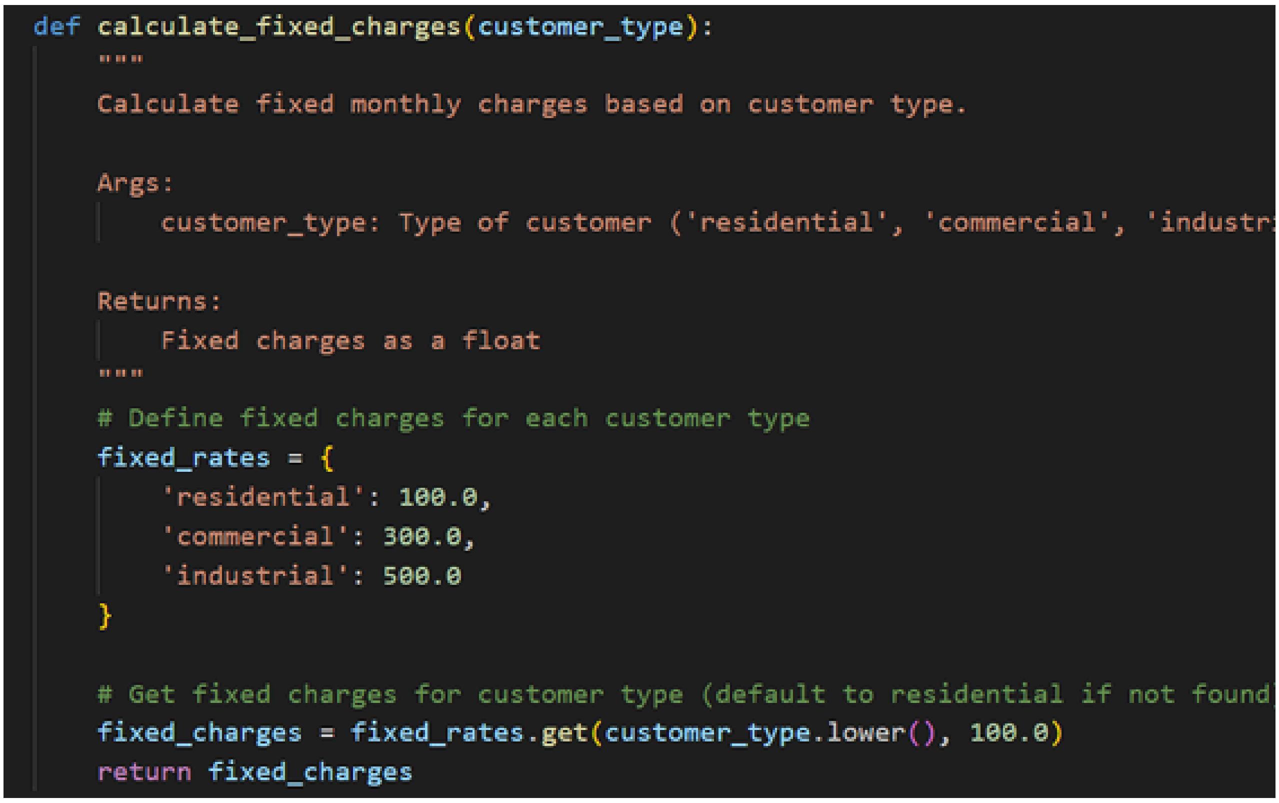
Prompt:

Extend the existing Python electricity billing program to calculate additional charges, including Fixed Charges (FC), Customer Charges (CC), and Electricity Duty (ED as a percentage of Energy Charges). Print each charge separately along with intermediate calculation results. Ensure accurate duty calculation, improved billing accuracy, and well-structured, readable output.

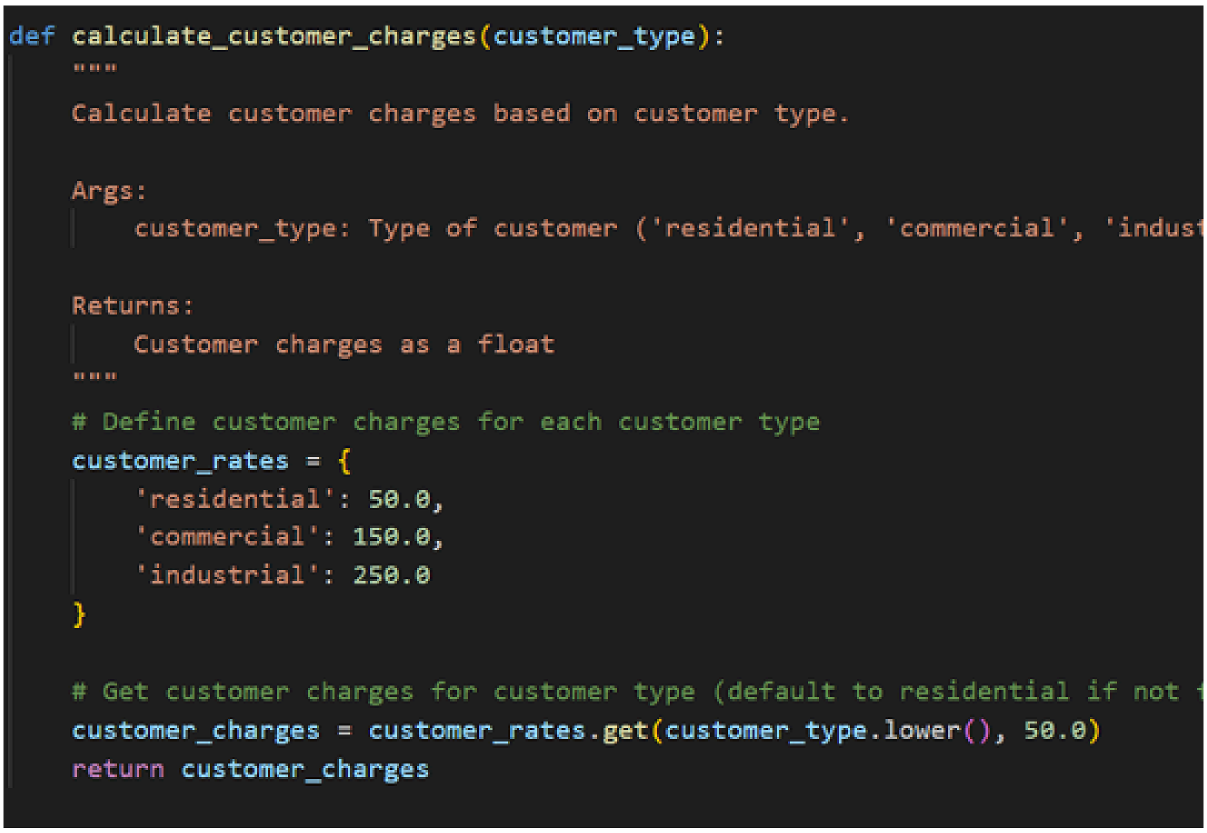
Code:



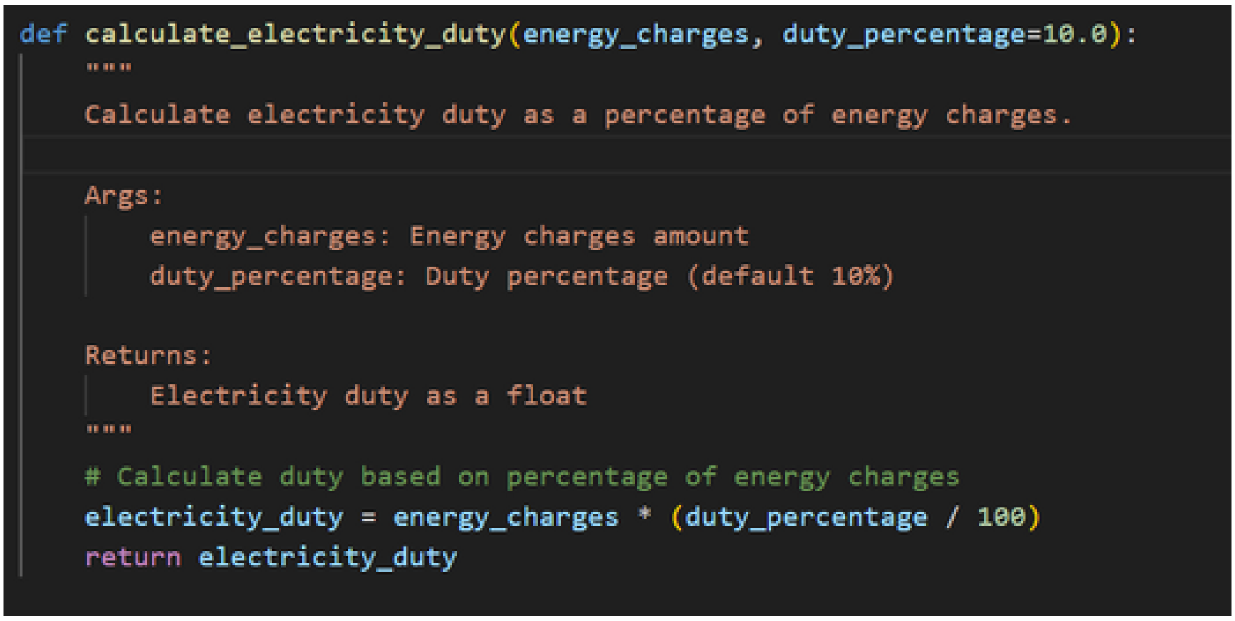
```python
def calculate_energy_charges(units, customer_type):
    """
    Calculate energy charges based on units consumed and customer type.

    Args:
        units: Number of units consumed
        customer_type: Type of customer ('residential', 'commercial', 'industrial')

    Returns:
        Energy charges as a float
    """
    # Define rate per unit for each customer type
    rates = {
        'residential': 5.0,
        'commercial': 7.5,
        'industrial': 4.0
    }

    # Get rate for customer type (default to residential if not found)
    rate = rates.get(customer_type.lower(), 5.0)

    # Calculate and return energy charges
    energy_charges = units * rate
    return energy_charges
```



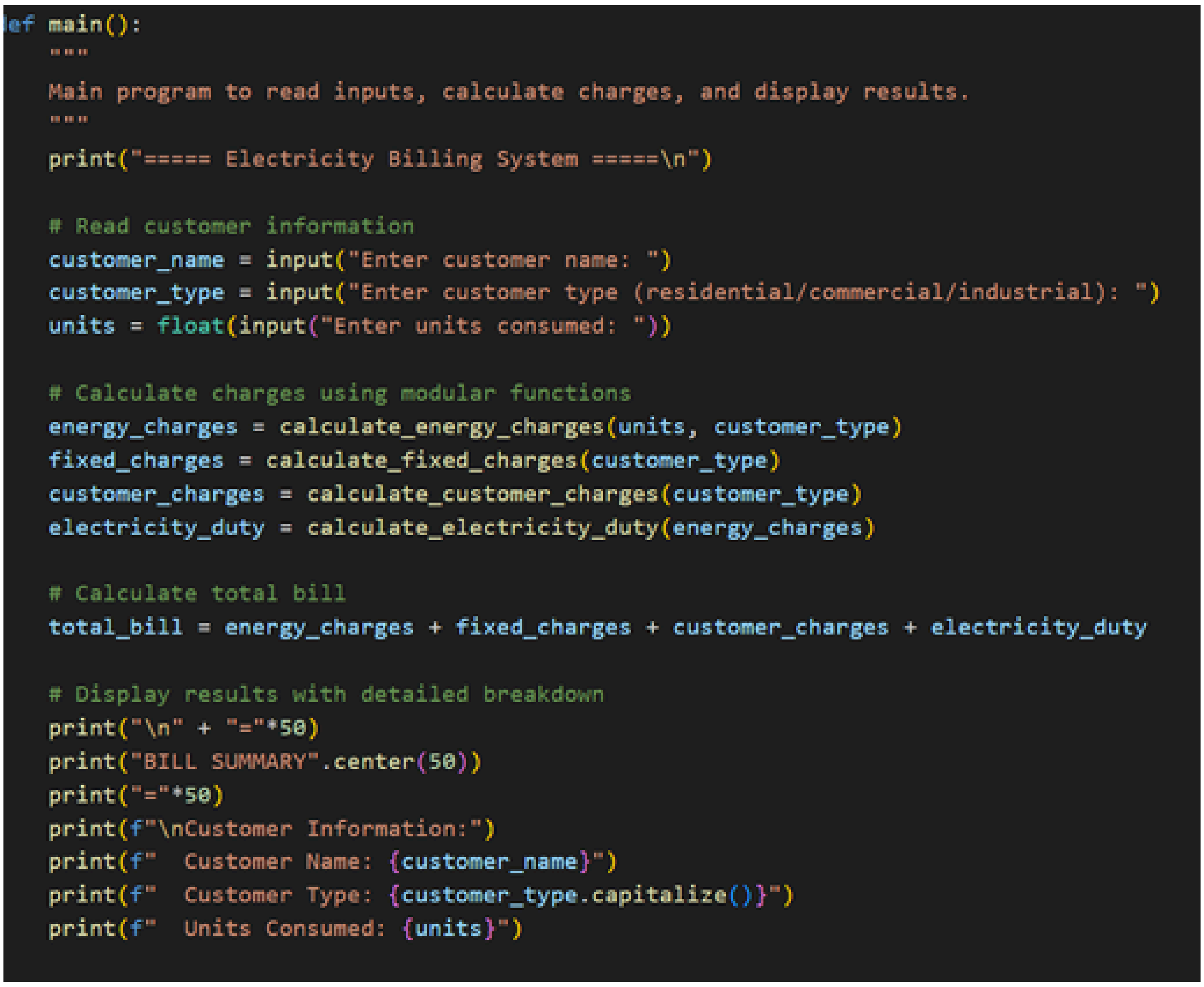
```python
def calculate_fixed_charges(customer_type):
    """
    Calculate fixed monthly charges based on customer type.

    Args:
        customer_type: Type of customer ('residential', 'commercial', 'industr

    Returns:
        Fixed charges as a float
    """
    # Define fixed charges for each customer type
    fixed_rates = {
        'residential': 100.0,
        'commercial': 300.0,
        'industrial': 500.0
    }

    # Get fixed charges for customer type (default to residential if not found
    fixed_charges = fixed_rates.get(customer_type.lower(), 100.0)
    return fixed_charges
```



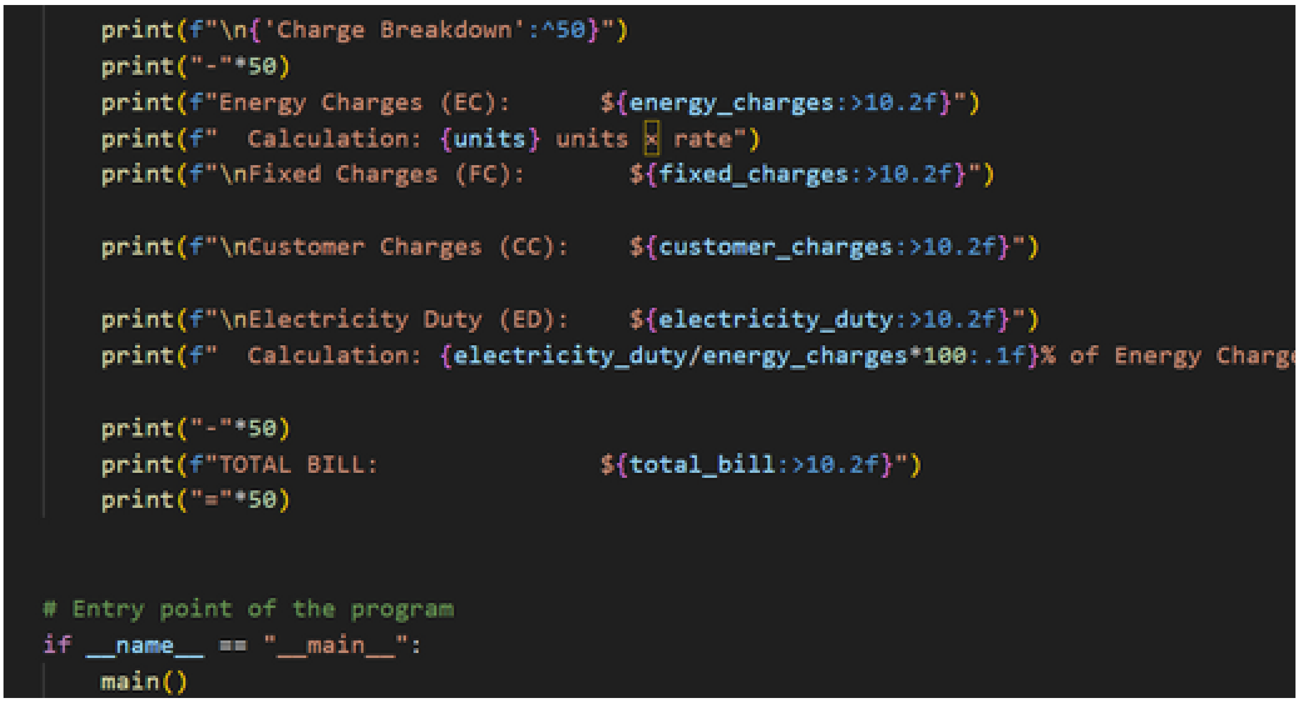
```python
def calculate_customer_charges(customer_type):
    """
    Calculate customer charges based on customer type.

    Args:
        customer_type: Type of customer ('residential', 'commercial', 'indust

    Returns:
        Customer charges as a float
    """
    # Define customer charges for each customer type
    customer_rates = {
        'residential': 50.0,
        'commercial': 150.0,
        'industrial': 250.0
    }

    # Get customer charges for customer type (default to residential if not f
    customer_charges = customer_rates.get(customer_type.lower(), 50.0)
    return customer_charges
```



```python
def calculate_electricity_duty(energy_charges, duty_percentage=10.0):
    """
    Calculate electricity duty as a percentage of energy charges.

    Args:
        energy_charges: Energy charges amount
        duty_percentage: Duty percentage (default 10%)

    Returns:
        Electricity duty as a float
    """
    # Calculate duty based on percentage of energy charges
    electricity_duty = energy_charges * (duty_percentage / 100)
    return electricity_duty
```

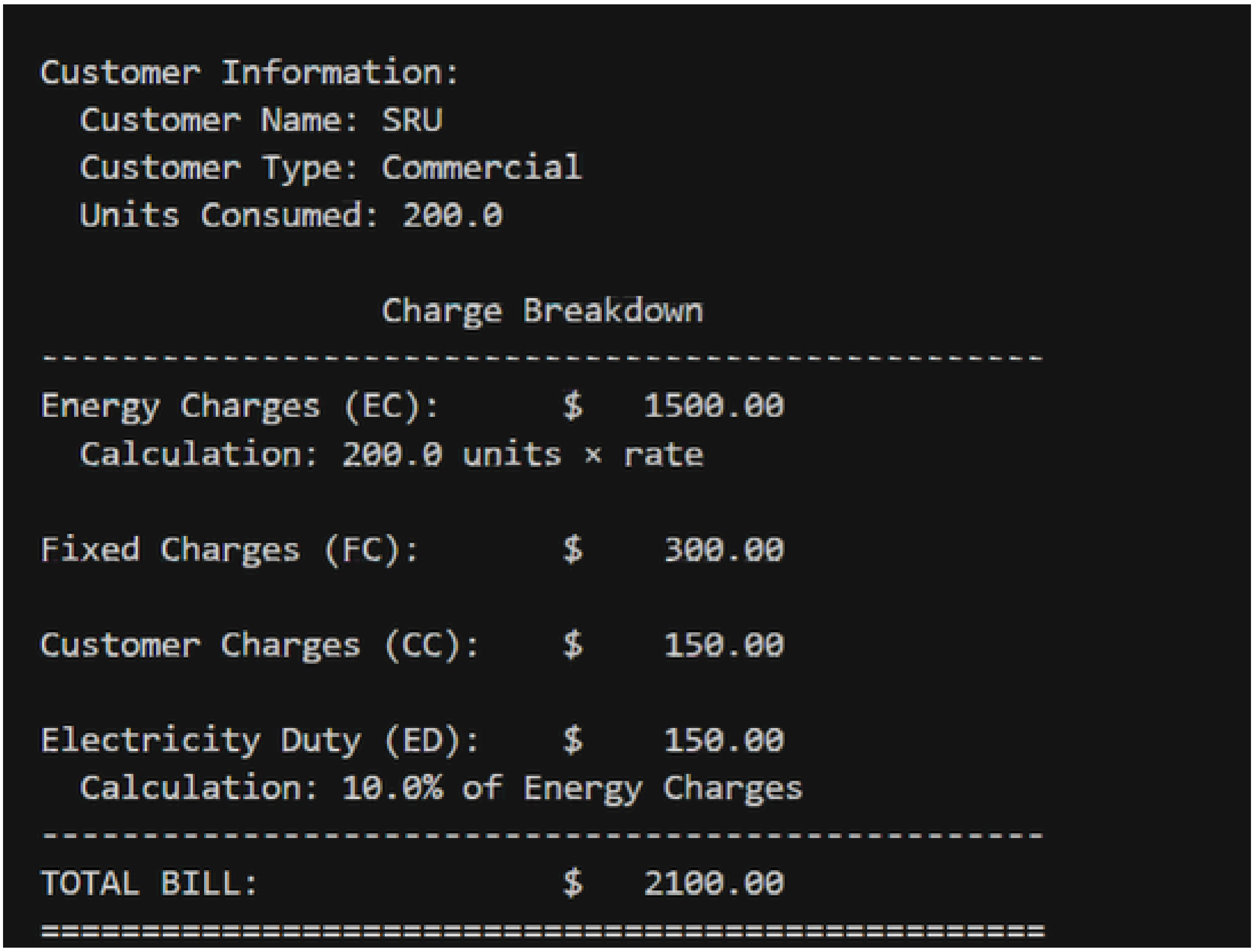


```python
ef main():
    """
    Main program to read inputs, calculate charges, and display results.
    """
    print("===== Electricity Billing System =====\n")

    # Read customer information
    customer_name = input("Enter customer name: ")
    customer_type = input("Enter customer type (residential/commercial/industrial): ")
    units = float(input("Enter units consumed: "))

    # Calculate charges using modular functions
    energy_charges = calculate_energy_charges(units, customer_type)
    fixed_charges = calculate_fixed_charges(customer_type)
    customer_charges = calculate_customer_charges(customer_type)
    electricity_duty = calculate_electricity_duty(energy_charges)

    # Calculate total bill
    total_bill = energy_charges + fixed_charges + customer_charges + electricity_duty

    # Display results with detailed breakdown
    print("\n" + "="*50)
    print("BILL SUMMARY".center(50))
    print("="*50)
    print(f"\nCustomer Information:")
    print(f"  Customer Name: {customer_name}")
    print(f"  Customer Type: {customer_type.capitalize()}")
    print(f"  Units Consumed: {units}")
```



```python
    print(f"\n{'Charge Breakdown':^50}")
    print("-"*50)
    print(f"Energy Charges (EC):      ${energy_charges:>10.2f}")
    print(f"  Calculation: {units} units × rate")
    print(f"\nFixed Charges (FC):       ${fixed_charges:>10.2f}")

    print(f"\nCustomer Charges (CC):    ${customer_charges:>10.2f}")

    print(f"\nElectricity Duty (ED):    ${electricity_duty:>10.2f}")
    print(f"  Calculation: {electricity_duty/energy_charges*100:.1f}% of Energy Charg

    print("-"*50)
    print(f"TOTAL BILL:               ${total_bill:>10.2f}")
    print("="*50)


# Entry point of the program
if __name__ == "__main__":
    main()
```

Output:



```
Customer Information:
  Customer Name: SRU
  Customer Type: Commercial
  Units Consumed: 200.0

                 Charge Breakdown
--------------------------------------------------
Energy Charges (EC):       $   1500.00
  Calculation: 200.0 units × rate

Fixed Charges (FC):        $    300.00

Customer Charges (CC):     $    150.00

Electricity Duty (ED):     $    150.00
  Calculation: 10.0% of Energy Charges
--------------------------------------------------
TOTAL BILL:                $   2100.00
==================================================
```

Explanation:

In this task, the electricity billing program is further enhanced to include additional components such as Fixed Charges, Customer Charges, and Electricity Duty, which is calculated as a percentage of the Energy Charges. AI support is used to refine the billing calculations and organize the output more effectively. The program displays each charge individually and validates intermediate values, ensuring both accuracy and clarity in the final bill computation.

Question 5:

Task 5: Final Bill Generation and Output Analysis

Scenario:

The final electricity bill must present all values clearly.

Task Description:

Develop the final Python application to:

• Calculate total bill:

• Total Bill = EC + FC + CC + ED

• Display:

Energy Charges (EC)

Fixed Charges (FC)

Customer Charges (CC)

Electricity Duty (ED)

Total Bill Amount

• Analyze the program based on:

Accuracy

Readability

Real-world applicability

Expected Output

• Complete electricity bill output

• Neatly formatted display

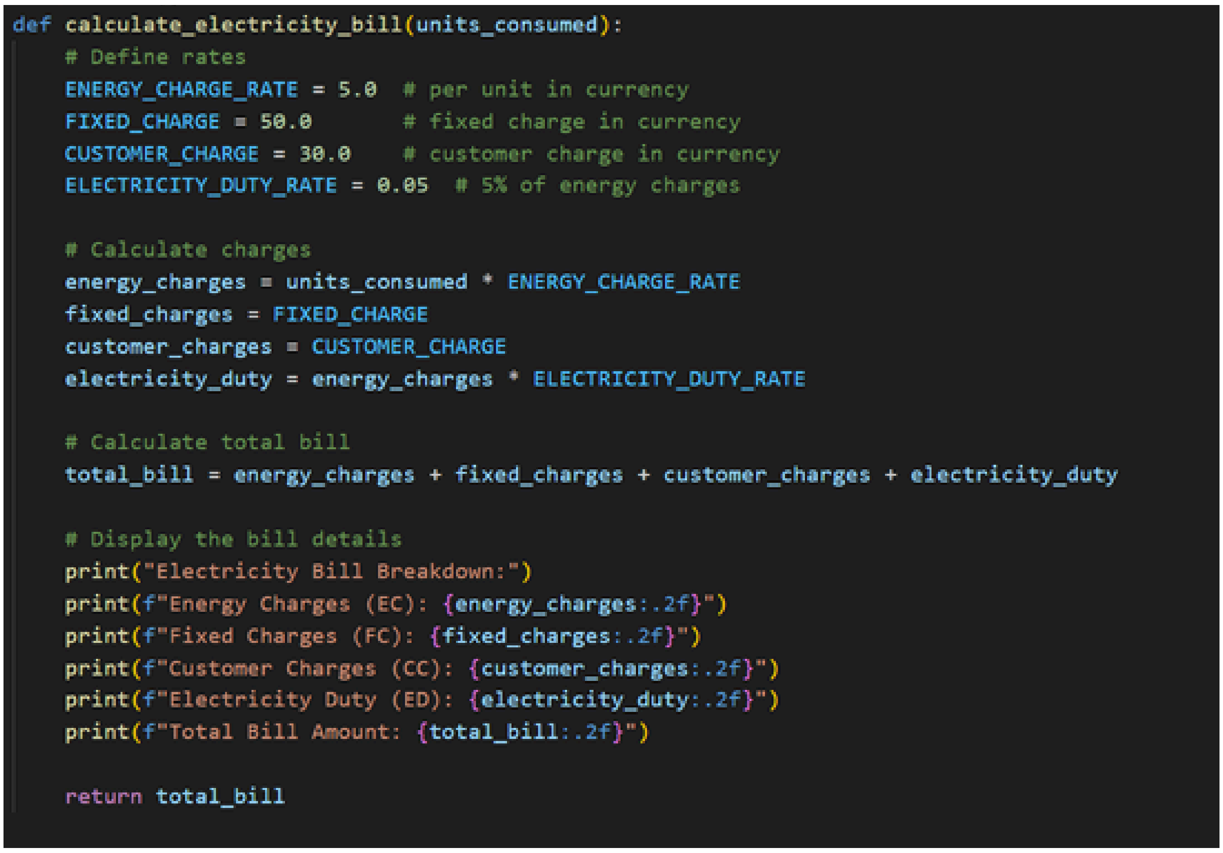
• Sample input/output

• Short analysis paragraph

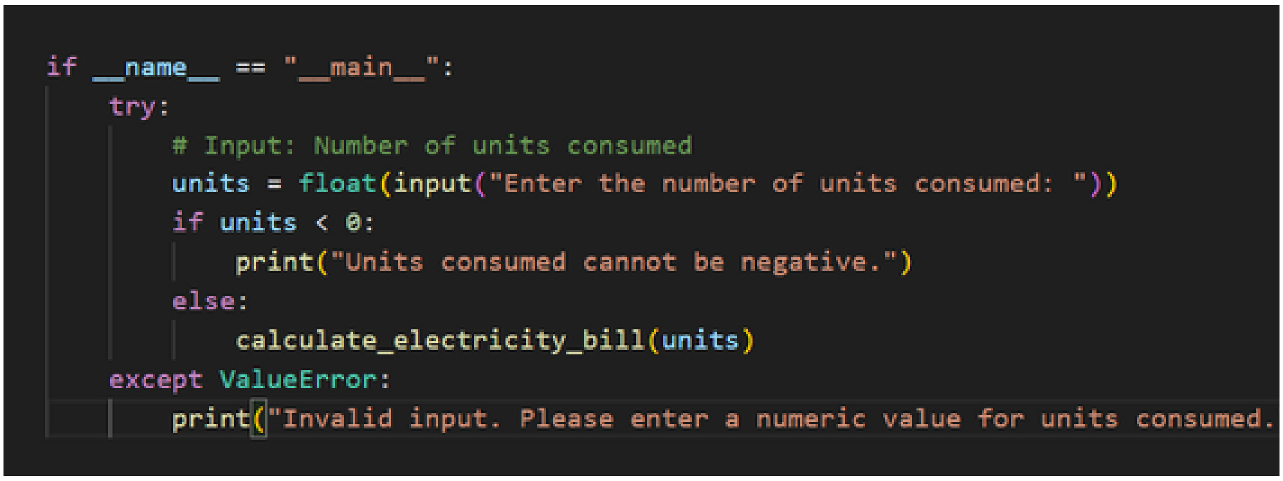
Prompt:

Develop the final Python electricity billing application that calculates Energy Charges, Fixed Charges, Customer Charges, and Electricity Duty, then computes the Total Bill as EC + FC + CC + ED. Display each charge clearly along with the total bill amount in a neatly formatted output.

Code:

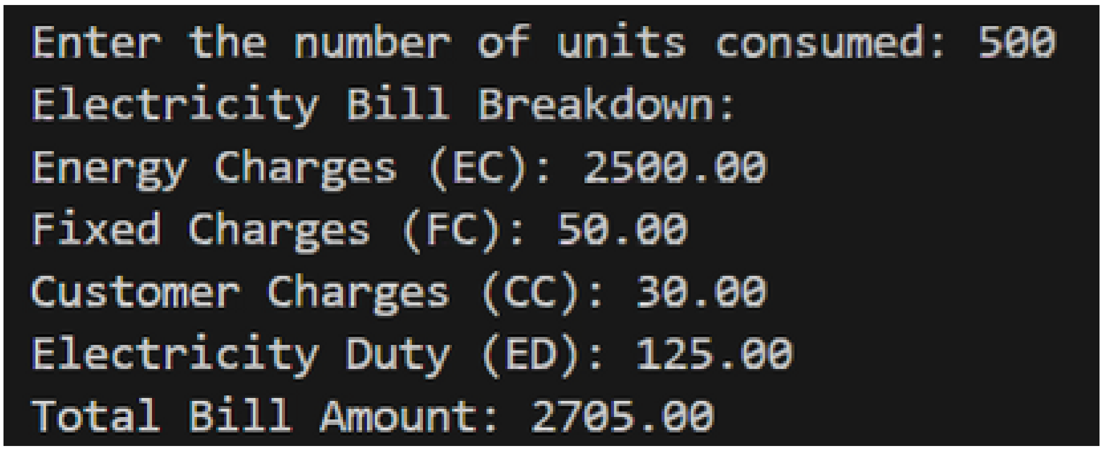


```python
def calculate_electricity_bill(units_consumed):
    # Define rates
    ENERGY_CHARGE_RATE = 5.0  # per unit in currency
    FIXED_CHARGE = 50.0       # fixed charge in currency
    CUSTOMER_CHARGE = 30.0    # customer charge in currency
    ELECTRICITY_DUTY_RATE = 0.05  # 5% of energy charges

    # Calculate charges
    energy_charges = units_consumed * ENERGY_CHARGE_RATE
    fixed_charges = FIXED_CHARGE
    customer_charges = CUSTOMER_CHARGE
    electricity_duty = energy_charges * ELECTRICITY_DUTY_RATE

    # Calculate total bill
    total_bill = energy_charges + fixed_charges + customer_charges + electricity_duty

    # Display the bill details
    print("Electricity Bill Breakdown:")
    print(f"Energy Charges (EC): {energy_charges:.2f}")
    print(f"Fixed Charges (FC): {fixed_charges:.2f}")
    print(f"Customer Charges (CC): {customer_charges:.2f}")
    print(f"Electricity Duty (ED): {electricity_duty:.2f}")
    print(f"Total Bill Amount: {total_bill:.2f}")

    return total_bill
```



```python
if __name__ == "__main__":
    try:
        # Input: Number of units consumed
        units = float(input("Enter the number of units consumed: "))
        if units < 0:
            print("Units consumed cannot be negative.")
        else:
            calculate_electricity_bill(units)
    except ValueError:
        print("Invalid input. Please enter a numeric value for units consumed.
```

Output:



```
Enter the number of units consumed: 500
Electricity Bill Breakdown:
Energy Charges (EC): 2500.00
Fixed Charges (FC): 50.00
Customer Charges (CC): 30.00
Electricity Duty (ED): 125.00
Total Bill Amount: 2705.00
```

Explanation:

The program correctly computes every part of the electricity bill, including Energy Charges, Fixed Charges, Customer Charges, and Electricity Duty, and accurately determines the final payable amount. The use of clear variable names, well-organized calculations, and neatly formatted output makes the code easy to read and understand. The billing logic reflects real-world electricity billing practices, allowing the program to be practical and easily adaptable for various customer categories or tariff structures.