

NAME:G.BHAGATH H.NO: 2303A51807 BATCH:26

## ASSIGNMENT-3.3

| SCHOOL OF COMPUTER SCIENCE AND ARTIFICIAL INTELLIGENCE                                   |                    | DEPARTMENT OF COMPUTER SCIENCE ENGINEERING  |                        |
|--|--------------------|---|------------------------|
| <b>Program Name:</b> B. Tech   |                    | <b>Assignment Type:</b> Lab   |                        |
| <b>Course Coordinator Name</b>   |                    | Dr. Rishabh Mittal  |                        |
| <b>Instructor(s) Name</b>  |                    | Mr. S Naresh Kumar<br>Ms. B. Swathi<br>Dr. Sasanko Shekhar Gantayat<br>Mr. Md Sallauddin<br>Dr. Mathivanan<br>Mr. Y Srikanth<br>Ms. N Shilpa<br>Dr. Rishabh Mittal (Coordinator)<br>Dr. R. Prashant Kumar<br>Mr. Ankushavali MD<br>Mr. B Viswanath<br>Ms. Sujitha Reddy<br>Ms. A. Anitha<br>Ms. M.Madhuri<br>Ms. Katherashala Swetha<br>Ms. Velpula sumalatha<br>Mr. Bingi Raju |                        |
| <b>Course Code</b>   | 23CS002PC304       | <b>Course Title</b>   | AI Assisted Coding     |
| <b>Year/Sem</b>  | III/I              | <b>Regulation</b>   | R23                    |
| <b>Date and Day of Assignment</b>  | Week 2 - Wednesday | <b>Time(s)</b>  | 23CSBTB01 To 23CSBTB52 |
| <b>Duration</b>  | 2 Hours            | <b>Applicable to Batches</b>  | All batches            |
| <b>Assignment Number:</b> 3.3(Present assignment number)/24(Total number of assignments) |                    |   |                        |

| Q.No. | Question  | Expected Time to complete |
|-------|---|---------------------------|
| 1     | <p><b>Lab 3: Application for TGNPDCL – Electricity Bill Generation Using Python &amp; AI Tools</b></p> <p><b>Lab Objectives</b></p> <ul style="list-style-type: none"> <li>• To design a real-world electricity billing application using Python</li> <li>• To use AI-assisted coding tools for logic generation and optimization</li> <li>• To understand conditional logic and arithmetic operations</li> <li>• To generate structured billing output similar to utility bills</li> </ul> <p><b>Lab Outcomes (LOs)</b><br/>After completing this lab, students will be able to:</p> | Week2 - Wednesday         |

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- Read and validate user input in Python
- Apply conditional logic for tariff-based billing
- Use AI tools to assist in program development
- Calculate and display electricity bill components
- Build a complete real-time application

### 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

```

C:\Users\shash> AAC A (3.3).py > ...
1 # Simple electricity consumer data reader and units calculator
2
3 # Read inputs
4 previous_units = float(input("Enter Previous Units (PU): "))
5 current_units = float(input("Enter Current Units (CU): "))
6 customer_type = input("Enter Type of Customer (Domestic/Commercial/Industrial): ")
7
8 # Calculate units consumed
9 units_consumed = current_units - previous_units
10
11 # Output the result
12 print(f"Units Consumed: {units_consumed}")

```

The terminal window also shows a command-line error for 'conda' and a successful execution of the script 'AAC A (3.3).py' with sample input and output.

### 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:

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- "Simplify energy charge calculation logic"
- "Optimize conditional statements"

**Expected Output**

- Correct EC calculation
- Clear conditional logic
- Original and improved versions (optional)
- Sample execution results

```

1 #!/usr/bin/python
2
3 previous_units = float(input("Enter Previous Units (PU): "))
4 current_units = float(input("Enter Current Units (CU): "))
5 customer_type = input("Enter Type of Customer (Domestic/Commercial/Industrial): ")
6
7 # Calculate units consumed
8 units_consumed = current_units - previous_units
9
10
11 # Calculate Energy Charges (EC) based on type and slabs
12 if customer_type == "Domestic":
13     if units_consumed <= 100:
14         ec = units_consumed * 1.0
15     elif units_consumed <= 200:
16         ec = 100 * 1.0 + (units_consumed - 100) * 2.0
17     else:
18         ec = 100 * 1.0 + 100 * 2.0 + (units_consumed - 200) * 3.0
19 elif customer_type == "Commercial":
20     if units_consumed <= 100:
21         ec = units_consumed * 1.5
22     elif units_consumed <= 200:
23         ec = 100 * 1.5 + (units_consumed - 100) * 2.5
24     else:
25         ec = 100 * 1.5 + 100 * 2.5 + (units_consumed - 200) * 4.0
26 elif customer_type == "Industrial":
27     if units_consumed <= 100:
28         ec = units_consumed * 2.0
29     elif units_consumed <= 200:
30         ec = 100 * 2.0 + (units_consumed - 100) * 3.0
31     else:
32         ec = 100 * 2.0 + 100 * 3.0 + (units_consumed - 200) * 5.0
33 else:
34     ec = 0 # Invalid type
35     print("Invalid customer type!")
36
37 # Output
38 print("Units Consumed: {units_consumed}")
39 print("Energy Charges (EC): ${ec:.2f}")

```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

```

Enter Previous Units (PU): 150
Enter Current Units (CU): 200
Enter Type of Customer (Domestic/Commercial/Industrial): Domestic
Units Consumed: 150.0
PS C:\Users\shash> c:\Users\shash\anaconda3\envs\Shashidhar\python.exe "c:\Users\shash\AAAC A (3.3).py"
Enter Previous Units (PU): 150
Enter Current Units (CU): 200
Enter Type of Customer (Domestic/Commercial/Industrial): Domestic
Units Consumed: 150.0
Energy Charges (EC): $100.00
PS C:\Users\shash>

```

**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

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```

c:\> Users > shash > AAC A (3.3).py > ...
1 # Modular Electricity Billing System
2
3 def calculate_energy_charges(customer_type, units_consumed):
4 """
5 Calculate Energy Charges based on customer type and units consumed.
6 Slabs: Domestic (1/2/3), Commercial (1.5/2.5/4), Industrial (2/3/5) per unit tiers.
7 """
8 if customer_type == "Domestic":
9     if units_consumed <= 100:
10         return units_consumed * 1.0
11     elif units_consumed <= 200:
12         return 100 * 1.0 + (units_consumed - 100) * 2.0
13     else:
14         return 100 * 1.0 + 100 * 2.0 + (units_consumed - 200) * 3.0
15 elif customer_type == "Commercial":
16     if units_consumed <= 100:
17         return units_consumed * 1.5
18     elif units_consumed <= 200:
19         return 100 * 1.5 + (units_consumed - 100) * 2.5
20     else:
21         return 100 * 1.5 + 100 * 2.5 + (units_consumed - 200) * 4.0
22 elif customer_type == "Industrial":
23     if units_consumed <= 100:
24         return units_consumed * 2.0
25     elif units_consumed <= 200:
26         return 100 * 2.0 + (units_consumed - 100) * 3.0
27     else:
28         return 100 * 2.0 + 100 * 3.0 + (units_consumed - 200) * 5.0
29
30 return 0 # Invalid type
31
32 def calculate_fixed_charges(customer_type):
33 """
34 Calculate Fixed Charges based on customer type.
35 Domestic: $100, Commercial: $200, Industrial: $300.
36 """
37 if customer_type == "Domestic":
38     return 100.0
39 elif customer_type == "Commercial":
40     return 200.0
41 elif customer_type == "Industrial":
42     return 300.0
43 return 0 # Invalid type
44
45 PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
shVAC A (3.3).py'
Units Consumed: 130.0
Energy Charges (EC): $160.00
PS C:\Users\shash> c; cd 'c:\Users\shash'; & 'c:\Users\shash\anaconda3\envs\Shashidhar\python.exe' 'c:\Users\shash\shVAC A (3.3).py'
Enter Previous Units (PU): 150
Enter Current Units (CU): 280
Enter Type of Customer (Domestic/Commercial/Industrial): Domestic
Units Consumed: 130.0
Energy Charges (EC): $160.00
Fixed Charges (FC): $100.00
PS C:\Users\shash>

```

---

```

c:\> Welcome J SubSetSum.java lab - 2.html # lab - 2.cs JS lab - 2.js resume dev
C:\> Users > shash > AAC A (3.3).py > ...
3 def calculate_energy_charges(customer_type, units_consumed):
4 """
5 Calculate Energy Charges based on customer type.
6 Domestic: $100, Commercial: $200, Industrial: $300.
7 """
8 if customer_type == "Domestic":
9     if units_consumed <= 200:
10         return 100 * 2.0 + (units_consumed - 100) * 3.0
11     else:
12         return 100 * 2.0 + 100 * 3.0 + (units_consumed - 200) * 5.0
13
14 return 0 # Invalid type
15
16 def calculate_fixed_charges(customer_type):
17 """
18 Calculate Fixed Charges based on customer type.
19 Domestic: $100, Commercial: $200, Industrial: $300.
20 """
21 if customer_type == "Domestic":
22     return 100.0
23 elif customer_type == "Commercial":
24     return 200.0
25 elif customer_type == "Industrial":
26     return 300.0
27
28 return 0 # Invalid type
29
30
31 # Main program
32 previous_units = float(input("Enter Previous Units (PU): "))
33 current_units = float(input("Enter Current Units (CU): "))
34 customer_type = input("Enter Type of Customer (Domestic/Commercial/Industrial): ")
35
36 units_consumed = current_units - previous_units
37 ec = calculate_energy_charges(customer_type, units_consumed)
38 fc = calculate_fixed_charges(customer_type)
39
40 print(f"Units Consumed: {units_consumed}")
41 print(f"Energy Charges (EC): ${ec:.2f}")
42 print(f"Fixed Charges (FC): ${fc:.2f}")
43
44
45 PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
shVAC A (3.3).py'
Fixed Charges (FC): $100.00
PS C:\Users\shash> c; cd 'c:\Users\shash'; & 'c:\Users\shash\anaconda3\envs\Shashidhar\python.exe' 'c:\Users\shash\shVAC A (3.3).py'
shVAC A (3.3).py'
Enter Previous Units (PU): 0
Enter Current Units (CU): 250
Enter Type of Customer (Domestic/Commercial/Industrial): Commercial
Units Consumed: 250.0
Energy Charges (EC): $600.00
Fixed Charges (FC): $200.00
PS C:\Users\shash>

```

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**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

```
C:\> Users> shash > AAC A (3).py > ...
1 # Extended Electricity Billing with Additional Charges
2
3 def calculate_energy_charges(customer_type, units_consumed):
4 """
5 Calculate Energy Charges based on customer type and units consumed.
6 Slabs: Domestic (1/2/3), Commercial (1.5/2.5/4), Industrial (2/3/5) per unit tiers.
7 """
8 if customer_type == "Domestic":
9     if units_consumed <= 100:
10         return units_consumed * 1.0
11     elif units_consumed <= 200:
12         return 100 * 1.0 + (units_consumed - 100) * 2.0
13     else:
14         return 100 * 1.0 + 100 * 2.0 + (units_consumed - 200) * 3.0
15 elif customer_type == "Commercial":
16     if units_consumed <= 100:
17         return units_consumed * 1.5
18     elif units_consumed <= 200:
19         return 100 * 1.5 + (units_consumed - 100) * 2.5
20     else:
21         return 100 * 1.5 + 100 * 2.5 + (units_consumed - 200) * 4.0
22 elif customer_type == "Industrial":
23     if units_consumed <= 100:
24         return units_consumed * 2.0
25     elif units_consumed <= 200:
26         return 100 * 2.0 + (units_consumed - 100) * 3.0
27     else:
28         return 100 * 2.0 + 100 * 3.0 + (units_consumed - 200) * 5.0
29 return 0 # Invalid type
30
31 def calculate_fixed_charges(customer_type):
32 """
33 Calculate Fixed Charges based on customer type.
34 Domestic: $100, Commercial: $200, Industrial: $300.
35 """
36 if customer_type == "Domestic":
37     return 100.0
38 elif customer_type == "Commercial":
39     return 200.0
40 elif customer_type == "Industrial":
41     return 300.0
42 return 0 # Invalid type
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
conda : The term 'conda' is not recognized as the name of a cmdlet, function, script file, or operable program
+ FullyQualifiedErrorId : CommandNotFound
Exception
● PS C:\Users\shash> & 'c:\Users\shash\anaconda3\envs\Shashidhar\python.exe' 'c:\Users\shash\.vscode\extension
Enter Previous Units (PU): 150
Enter Current Units (CU): 200
Enter Type of Customer (Domestic/Commercial/Industrial): Domestic
Units Consumed: 150.0
Energy Charges (EC): $150.00
Fixed Charges (FC): $100.00
Customer Charges (CC): $50.00
Electricity Duty (ED): $16.00
○ PS C:\Users\shash>
```

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The screenshot shows a terminal window with the following content:

```
PS C:\Users\shash ~ & 'c:\Users\shash\anaconda3\envs\shashidhar\python.exe' 'c:\Users\shash\vscode\extensions\pyright\lib\builtins\__main__.py'
Enter Previous Units (PU): 150
Enter Current Units (CU): 280
Enter Type of Customer (Domestic/Commercial/Industrial): Domestic
Units Consumed: 130.0
Energy Charges (EC): $160.00
Fixed Charges (FC): $100.00
Customer Charges (CC): $50.00
Electricity Duty (ED): $16.00
```

### **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

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```
C:\> Users > shash > AAC A (3.3).py > ...
1  # Final Electricity Bill Generator
2
3  def calculate_energy_charges(customer_type, units_consumed):
4      """
5          Calculate Energy Charges based on customer type and units consumed.
6          Slabs: Domestic (1/2/3), Commercial (1.5/2.5/4), Industrial (2/3/5) per unit tiers.
7      """
8      if customer_type == "Domestic":
9          if units_consumed <= 100:
10              return units_consumed * 1.0
11          elif units_consumed <= 200:
12              return 100 * 1.0 + (units_consumed - 100) * 2.0
13          else:
14              return 100 * 1.0 + 100 * 2.0 + (units_consumed - 200) * 3.0
15      elif customer_type == "Commercial":
16          if units_consumed <= 100:
17              return units_consumed * 1.5
18          elif units_consumed <= 200:
19              return 100 * 1.5 + (units_consumed - 100) * 2.5
20          else:
21              return 100 * 1.5 + 100 * 2.5 + (units_consumed - 200) * 4.0
22      elif customer_type == "Industrial":
23          if units_consumed <= 100:
24              return units_consumed * 2.0
25          elif units_consumed <= 200:
26              return 100 * 2.0 + (units_consumed - 100) * 3.0
27          else:
28              return 100 * 2.0 + 100 * 3.0 + (units_consumed - 200) * 5.0
29      return 0
30
31  def calculate_fixed_charges(customer_type):
32      """Fixed Charges: Domestic $100, Commercial $200, Industrial $300."""
33      if customer_type == "Domestic":
34          return 100.0
35      elif customer_type == "Commercial":
36          return 200.0
37      elif customer_type == "Industrial":
38          return 300.0
39      return 0
40
41  def calculate_customer_charges():
42      """Final Customer Charges: ECA """
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
● PS C:\Users\shash> cd 'c:\Users\shash'; & 'c:\Users\shash\anaconda3\envs\Shashidhar\python.exe' 'c:\Users\shash\AAC A (3.3).py'
Enter Previous Units (PU): 150
Enter Current Units (CU): 280
Enter Type of Customer (Domestic/Commercial/Industrial): Domestic
=====
ELECTRICITY BILL SUMMARY
=====
Customer Type: Domestic
Units Consumed: 130.0
Energy Charges (EC): $160.00
Fixed Charges (FC): $100.00
```

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The screenshot shows a Jupyter Notebook interface with a single code cell. The code defines functions for calculating fixed charges, customer charges, and electricity duty, and then calculates a total bill based on user input for previous and current units and customer type. The terminal output shows the execution of the script and the resulting bill details.

```
C:\Users>shash> AAC A (3.3).py >_
31 def calculate_fixed_charges(customer_type):
32     return 0
33
34 def calculate_customer_charges():
35     """Fixed Customer Charges: $50."""
36     return 50.0
37
38 def calculate_electricity_duty(ec):
39     """Electricity Duty: 10% of EC."""
40     return 0.10 * ec
41
42 # Main program
43 previous_units = float(input("Enter Previous Units (PU): "))
44 current_units = float(input("Enter Current Units (CU): "))
45 customer_type = input("Enter Type of Customer (Domestic/Commercial/Industrial): ").strip()
46
47 if customer_type not in ["Domestic", "Commercial", "Industrial"]:
48     print("Invalid type! Defaulting to Domestic.")
49     customer_type = "Domestic"
50
51 units_consumed = current_units - previous_units
52 ec = calculate_energy_charges(customer_type, units_consumed)
53 fc = calculate_fixed_charges(customer_type)
54 cc = calculate_customer_charges()
55 ed = calculate_electricity_duty(ec)
56 total_bill = ec + fc + cc + ed
57
58 # Nicely formatted bill display
59 print("\n" + "="*40)
60 print("ELECTRICITY BILL SUMMARY")
61 print("="*40)
62 print(f"Customer Type: {customer_type}")
63 print(f"Units Consumed: {units_consumed}")
64 print(f"Energy Charges (EC): ${ec:.2f}")
65 print(f"Fixed Charges (FC): ${fc:.2f}")
66 print(f"Customer Charges (CC): ${cc:.2f}")
67 print(f"Electricity Duty (ED): ${ed:.2f}")
68 print("-"*40)
69 print(f"TOTAL BILL AMOUNT: ${total_bill:.2f}")
70 print("="*40)
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

```
PS C:\Users\shash> c:; cd "c:\Users\shash"; & 'c:\Users\shash\anaconda3\envs\Shashidhar\python.exe' 'c:\Users\shash\AAC A (3.3).py'
=====
Customer Type: Domestic
Units Consumed: 130.0
Energy Charges (EC): $160.00
Fixed Charges (FC): $100.00
Customer Charges (CC): $50.00
Electricity Duty (ED): $16.00
-----
TOTAL BILL AMOUNT: $326.00
=====
```

**Note:** Report should be submitted as a word document for all tasks in a single document with prompts, comments & code explanation, and output and if required, screenshots.