Batch: E2	**Roll No.: 16010123325**
Experiment / assignment / tutorial No.	
Grade: AA / AB / BB / BC / CC / CD /DD	
Signature of the Staff In-charge with date	

TITLE : Implementing a billing application using OOP concepts using C++

AIM: Develop a C++ application that generates an Electricity Bill using a Consumer class.

Expected OUTCOME of Experiment:

CO1:Apply the features of object oriented programming languages. (C++ and Java)
CO2:Explore arrays, vectors, classes and objects in C++ and Java

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Books/ Journals/ Websites referred:

1. E. Balagurusamy, “Programming with Java”, McGraw-Hill.
2. E. Balagurusamy, “Object Oriented Programming with C++”, McGraw-Hill.

Pre Lab/ Prior Concepts:

Class Definition:
The Consumer class should encapsulate the following information:

❖ consumer_no (integer): Unique identification number for the consumer.
❖ consumer_name (string): Name of the consumer.
❖ previous_reading (integer): Meter reading from the previous month.
❖ current_reading (integer): Meter reading from the current month.
❖ connection_type (string): Type of electricity connection (domestic or commercial).
❖ calculate_bill (member function): This function should calculate the electricity bill amount based on the connection_type and the number of units consumed (current reading - previous reading). The function should utilize a tiered pricing structure as

specified below:

Tiered Pricing:

Domestic Connection:
First 100 units: Rs. 1 per unit
101-200 units: Rs. 2.50 per unit
201-500 units: Rs. 4 per unit
Above 501 units: Rs. 6 per unit

Commercial Connection:
First 100 units: Rs. 2 per unit
101-200 units: Rs. 4.50 per unit
201-500 units: Rs. 6 per unit
Above 501 units: Rs. 7 per unit

Additional Considerations:

❖ The application should prompt the user to enter the details for a consumer (consumer number, name, previous reading, current reading, and connection type).
❖ The calculate_bill function should implement logic to determine the applicable unit charges based on the connection type and the number of units consumed within each tier.
❖ The application should display a clear breakdown of the bill, including the consumer details, number of units consumed, charge per unit for each tier, and the total bill amount.

Algorithm:

Input:

- Consumer number (cno)
- Consumer name (name)
- Previous reading (prev)
- Current reading (curr)
- Connection type (type)

Steps:

- Calculate units consumed: units = curr - prev
- Determine bill amount based on connection type and units consumed:

For domestic connections:

- If units <= 100, bill = 1.0 * units
- If 100 < units <= 200, bill = 100 * 1.0 + 2.5 * (units-100)
- If 200 < units <= 500, bill = 100 * 1.0 + 2.5 * 100 + 4.0 * (units-200)
- If units > 500, bill = 100 * 1.0 + 2.5 * 100 + 4.0 * 300 + 6.0 * (units-500)

For non-domestic connections:

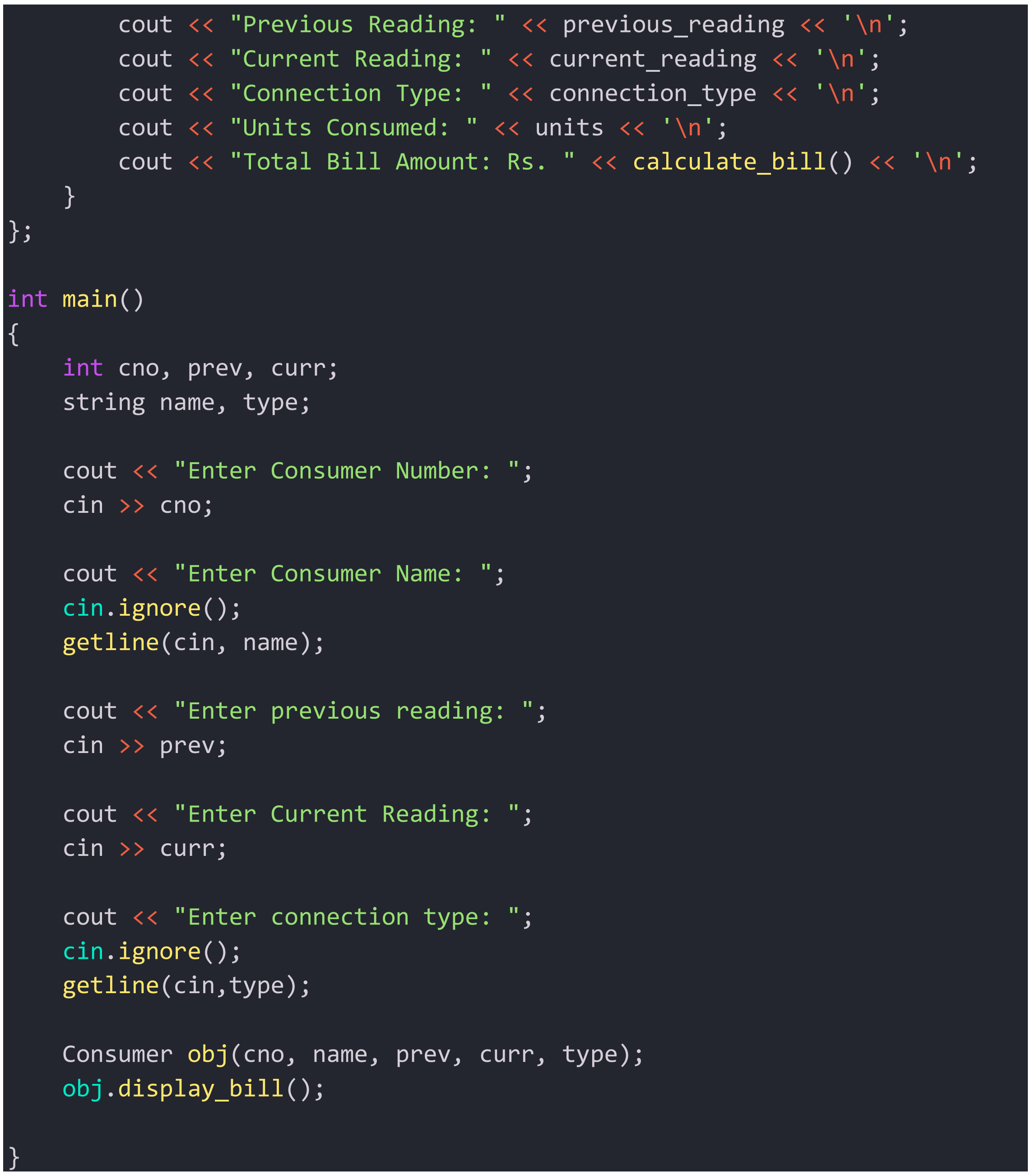
- If units <= 100, bill = 2.0 * units
- If 100 < units <= 200, bill = 100 * 2.0 + 4.5 * (units-100)
- If 200 < units <= 500, bill = 100 * 2.0 + 200 * 4.5 + 6.0 * (units-200)
- If units > 500, bill = 100 * 2.0 + 100 * 4.5 + 300 * 6.0 + 7.0 * (units-500)

- Display bill details:
    - Consumer number
    - Consumer name
    - Previous reading
    - Current reading
    - Connection type
    - Units consumed
    - Total bill amount

Implementation details:

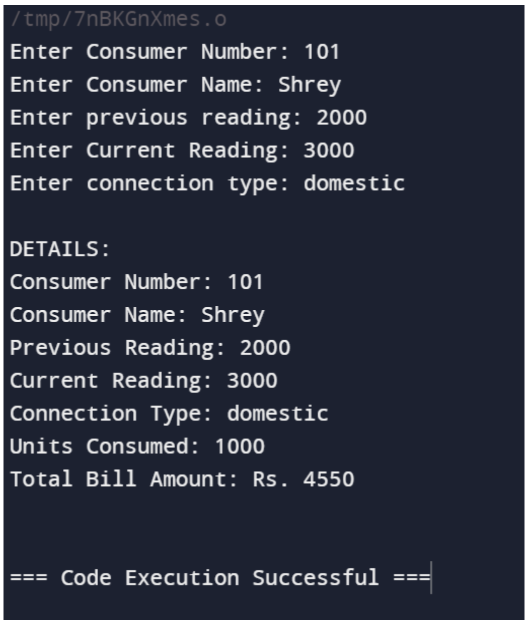
```
#include <bits/stdc++.h>
using namespace std;

class Consumer {
    public:
        int consumer_no;
        string consumer_name;
        int previous_reading;
        int current_reading;
        string connection_type;

    Consumer(int cno, string name, int prev, int curr, string
type):consumer_no(cno), consumer_name(name), previous_reading(prev),
current_reading(curr), connection_type(type) {}
```

```
    double calculate_bill() {
        int units = current_reading - previous_reading;
        double bill = 0.0;

        if(connection_type=="domestic") {
            if(units <= 100) {
                bill = 1.0* units;
            }
            else if(units > 100 && units <= 200) {
                bill = 100 * 1.0 + 2.5 * (units-100);
            }
            else if(units>200 && units<=500) {
                bill = 100 * 1.0 + 2.5 * 100 + 4.0 * (units-200);
            } else {
                bill = 100 * 1.0 + 2.5 * 100 + 4.0 * 300 + 6.0 * (units-
500);
            }
        }
        else {
            if(units <= 100) {
                bill = 2.0 * units;
            } else if(units > 100 && units <= 200) {
                bill = 100 * 2.0 + 4.5 * (units-100);
            } else if(units > 200 && units <= 500) {
               bill = 100 * 2.0 + 200 * 4.5 + 6.0 * (units-200);
            } else {
                bill = 100 * 2.0 + 100 * 4.5 + 300 * 6.0 + 7.0 * (units-
500);
            }
        }
        return bill;
    }

    void display_bill()
    {
        int units = current_reading - previous_reading;

        cout <<""<<endl;
        cout << "DETAILS:"<<endl;
        cout << "Consumer Number: " << consumer_no << '\n';
        cout << "Consumer Name: " << consumer_name << '\n';
```

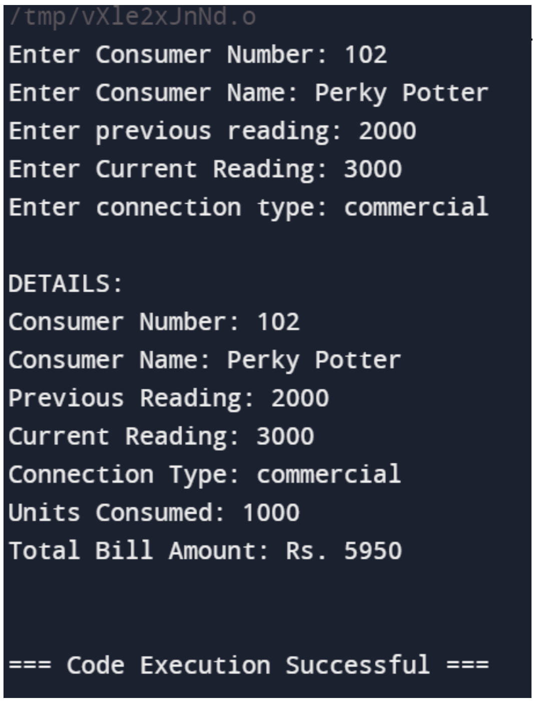


```
        cout << "Previous Reading: " << previous_reading << '\n';
        cout << "Current Reading: " << current_reading << '\n';
        cout << "Connection Type: " << connection_type << '\n';
        cout << "Units Consumed: " << units << '\n';
        cout << "Total Bill Amount: Rs. " << calculate_bill() << '\n';
    }
};

int main()
{
    int cno, prev, curr;
    string name, type;

    cout << "Enter Consumer Number: ";
    cin >> cno;

    cout << "Enter Consumer Name: ";
    cin.ignore();
    getline(cin, name);

    cout << "Enter previous reading: ";
    cin >> prev;

    cout << "Enter Current Reading: ";
    cin >> curr;

    cout << "Enter connection type: ";
    cin.ignore();
    getline(cin,type);

    Consumer obj(cno, name, prev, curr, type);
    obj.display_bill();

}
```

Output:



```
/tmp/7nBKGnXmes.o
Enter Consumer Number: 101
Enter Consumer Name: Shrey
Enter previous reading: 2000
Enter Current Reading: 3000
Enter connection type: domestic

DETAILS:
Consumer Number: 101
Consumer Name: Shrey
Previous Reading: 2000
Current Reading: 3000
Connection Type: domestic
Units Consumed: 1000
Total Bill Amount: Rs. 4550


=== Code Execution Successful ===
```



```
/tmp/vXle2xJnNd.o
Enter Consumer Number: 102
Enter Consumer Name: Perky Potter
Enter previous reading: 2000
Enter Current Reading: 3000
Enter connection type: commercial

DETAILS:
Consumer Number: 102
Consumer Name: Perky Potter
Previous Reading: 2000
Current Reading: 3000
Connection Type: commercial
Units Consumed: 1000
Total Bill Amount: Rs. 5950


=== Code Execution Successful ===
```

Conclusion:

The Electricity Bill Calculator program successfully calculates and displays the total bill amount for a consumer based on their connection type and units consumed, providing a simple and efficient way to manage and calculate electricity bills.

Date: ______________ **Signature of faculty in-charge**

Post Lab Descriptive Questions:

Q.1 Explain the concept of constructors and destructors in C++.

Ans:

Constructors:

- Constructors are special member functions of a class that are executed automatically whenever an object of that class is created.
- They are used to initialize the data members of the class and set them to their default or specified values.
- Constructors have the same name as the class and do not have a return type, not even void.
- There are different types of constructors in C++, such as default constructor, parameterized constructor, copy constructor, etc.

Destructors:

- Destructors are special member functions of a class that are executed automatically whenever an object of that class goes out of scope or is explicitly destroyed using the delete operator.
- They are used to deallocate any memory or resources that were allocated by the constructor or during the lifetime of the object.
- Destructors have the same name as the class, preceded by a tilde (~) symbol, and do not have any parameters or a return type.

- Destructors are important for ensuring that objects are cleaned up properly and that resources are not leaked.

Q.2 Write the output of following program with suitable explanation

```
#include<iostream>

using namespace std;

class Test
{
  static int i;
  int j;
};

int Test::i;

int main()
{
    cout << sizeof(Test);
    return 0;
}
```

Output:
4
The output of the program is 4. This is because sizeof(Test) measures the size of an object of class Test. The class contains a non-static member int j, which typically takes up 4 bytes. Static members are not included in the object's size calculation.

Q.3 Explain all the applications of the scope resolution operator in C++.
Ans:

- **Accessing Global Variables**: To access global variables when a local variable has the same name.

- **Accessing Static Members**: To access static members (variables or functions) of a class.
- **Defining Functions Outside the Class**: To define functions outside a class when they are declared inside the class.
- **Accessing Namespace Members**: To access members (variables, functions, or classes) of a namespace.
- **Overloading Operators**: To overload operators for user-defined classes.
- **Specifying Namespace**: To specify a namespace when using a class or function from that namespace.
- **Defining Nested Classes**: To define nested classes outside the outer class.
- **Accessing Enum Members**: To access members of an enumeration.