

1.

(a) The most important difference between class and structure is security. A Structure is not secure and cannot hide its implementation details from the end user while a class is secure and can hide its programming and designing details.

(b) A data member belongs to an object of a class whereas local variable belongs to its current scope. A local variable is declared within the body of a function and can be used only from the point at which it is declared to the immediately following closing brace. Data members are accessible to all member function of the class. Local variable are not accessible in any another function or class.

2. A default constructor is the constructor that is called when a programmer creates an object without specifying any arguments to a constructor. The programmer can write a default constructor that initializes data members any way the programmer chooses. The compiler provides a default constructor with no parameters in any class that does not explicitly include a constructor. The default constructor provided by the compiler creates an object without assigning any initial values to the object's data member and thus data members must be initialized using the object's member functions. Every constructor implicitly calls the constructors of any data member objects before the body of the class's constructor executes.

3. In C++, compiler by default creates default constructor for every class. But, if we define our own constructor, compiler doesn't create the default constructor.

4.

```
#include <bits/stdc++.h>
```

```
using namespace std;
```

```
class Message
```

```
{  
    string from;  
    string to;  
    string text;  
    int time_stamp;
```

```
public:
```

```
    Message(string sender, string receipient, int tim);  
    void add(string body);  
    void print();
```

```
};
```

```
Message::Message(string sender, string receipient, int tim)
```

```
{  
    from = sender;  
    to = receipient;  
    time_stamp = tim;  
}
```

```
void Message::add(string body)
```

```
{  
    text.append(body);
```

```

}

void Message::print()
{
    cout << "From: " << from << "\n";
    cout << "To: " << to << "\n";
    cout << "Time: " << time_stamp/100 << ":" << time_stamp%100 << "\n";
    cout << text << "\n";
}

int main()
{
    time_t now = time(0);
    tm *ltm = localtime(&now);
    int tim = ((ltm->tm_hour)*100)+1 + ltm->tm_min;
    string receipient, sender, body;
    cout << "Send Message to: ";
    getline(cin, receipient);
    cout << "Message from: ";
    getline(cin, sender);
    Message m(sender, receipient, tim);
    cout << "Message : ";
    getline(cin, body);
    m.add(body);
    m.print();
    return 0;
}

```

The screenshot shows a Sublime Text editor window with the C++ code from the previous block. The code is for a simple messaging system. The main function prompts the user to send a message to a recipient, provides the sender's name, and then prints the message details including the time.

Overlaid on the bottom right is a terminal window. The terminal shows the command to compile and run the program: `g++ cpppp.cpp -o test` and `./test`. The output of the program is as follows:

```

shadow3049@shadow3049-Inspiron-5575: ~/Desktop
shadow3049@shadow3049-Inspiron-5575:~/Desktop$ g++ cpppp.cpp -o test
shadow3049@shadow3049-Inspiron-5575:~/Desktop$ ./test
Send Message to: Captain America
Message from: Iron Man
Message : I am Iron Man!!
From: Iron Man
To: Captain America
Time: 13:18
I am Iron Man!!
shadow3049@shadow3049-Inspiron-5575:~/Desktop$

```

5.

```
#include <bits/stdc++.h>
using namespace std;
class student
{
    public :
    string name;
    int rollno;
    int sem;
    student();
    student(string init, int initroll, int initsem);
    student(student &s);
};

student::student()
{
    sem = 1;
}

student::student(string init, int initroll, int initsem)
{
    name.append(init);
    rollno = initroll;
    sem = initsem;
}

student::student(student &s)
{
    name.append(s.name);
    rollno = s.rollno;
    sem = s.sem;
}

void compare(student &s1, student &s3)
{
    if((s1.name == s3.name)&&(s1.rollno == s3.rollno)&&(s1.sem == s3.sem))
        cout << "Objects are same\n";
    else cout << "Objects are different\n";
}

int main()
{
    student s1("abc", 221, 3);
    int initsem, initroll, n;
    string init;
    s1.sem = 4;
    cout << "Enter the name: ";
```

```

getline(cin, init);
cout << "Enter the roll number: ";
cin >> initroll;
cout << "Enter the semester: ";
cin >> initsem;
student s2(init, initroll, initsem);
student s3(s1);
    cout << "Enter value of n for array: ";
    cin >> n;
    student st[n];
    for(int i=0; i<n; ++i)
    {
        cout << "Student " << i + 1 << "\n";
        cin.ignore();
        cout << "Enter name" << "\n";
        getline(cin, init);
        cout << "Enter roll number" << "\n";
        cin >> initroll;
        cout << "Enter sem" << "\n";
        cin >> initsem;
        st[i].name = init;
        st[i].rollno = initroll;
        st[i].sem = initsem;
    }
    compare(s1, s3);
    return 0;
}

```

The screenshot shows a C++ program in Sublime Text (UNREGISTERED) and its execution in a terminal window. The program defines a `student` struct with `name`, `rollno`, and `sem` fields. It includes a `compare` function that checks if two students are the same based on their name, roll number, and semester. The `main` function creates a student `s1` with name "abc", roll number 221, and semester 3. It then prompts the user to enter details for a new student. The user enters "Uzumaki Naruto", roll number 1, and semester 1. The program then prompts for an array size `n` (2) and iterates to enter details for two more students. The first student in the array is "Uchiha Sasuke" (roll 2, sem 1). The second student is "Haruno Sakura" (roll 3, sem 1). Finally, the program compares `s1` with the first student in the array and outputs "Objects are same".

```

25 student::student(student &s)
26 {
27     name.append(s.name);
28     rollno = s.rollno;
29     sem = s.sem;
30 }
31
32 void compare(student &s1, student &s3)
33 {
34     if((s1.name == s3.name)&&(s1.rollno == s3.rollno)&&(s1.sem == s3.sem))
35         cout << "Objects are same\n";
36     else cout << "Objects are different\n";
37 }
38
39 int main()
40 {
41     student s1("abc", 221, 3);
42     int initsem, initroll, n;
43     string init;
44     s1.sem = 4;
45     cout << "Enter the name: ";
46     getline(cin, init);
47     cout << "Enter the roll number: ";
48     cin >> initroll;
49     cout << "Enter the semester: ";
50     cin >> initsem;
51     student s2(init, initroll, initsem);
52     student s3(s1);
53     cout << "Enter value of n for array: ";
54     cin >> n;
55     student st[n];
56     for(int i=0; i<n; ++i)
57     {
58         cout << "Student " << i + 1 << "\n";
59         cin.ignore();
60         cout << "Enter name" << "\n";
61         getline(cin, init);
62         cout << "Enter roll number" << "\n";
63         cin >> initroll;
64         cout << "Enter sem" << "\n";
65         cin >> initsem;
66         st[i].name = init;
67         st[i].rollno = initroll;
68         st[i].sem = initsem;
69     }
70     compare(s1, s3);
71     return 0;
72 }
73

```

```

shadow3049@shadow3049-Inspiron-5575: ~/Desktop
shadow3049@shadow3049-Inspiron-5575:~/Desktop$ g++ cplusplus.cpp -o test
shadow3049@shadow3049-Inspiron-5575:~/Desktop$ ./test
Enter the name: Uzumaki Naruto
Enter the roll number: 1
Enter the semester: 1
Enter value of n for array: 2
Student 1
Enter name
Uchiha Sasuke
Enter roll number
2
Enter sem
1
Student 2
Enter name
Haruno Sakura
Enter roll number
3
Enter sem
1
Objects are same
shadow3049@shadow3049-Inspiron-5575:~/Desktop$

```

6. 76

7. Constructor Called  
Constructor Called

8. 4

9. A::a=10 B::b=0

10.

```
#include <bits/stdc++.h>
```

```
using namespace std;
```

```
class employee
```

```
{
```

```
    int salary;
```

```
public:
```

```
    employee(int);
```

```
    employee(employee&);
```

```
    void display();
```

```
};
```

```
employee::employee(int val)
```

```
{
```

```
    salary=val;
```

```
}
```

```
employee::employee(employee &e)
```

```
{
```

```
    salary=e.salary;
```

```
}
```

```
void employee::display()
```

```
{
```

```
    cout<<"Salary of employee1 :";e1.display();
```

```
}
```

```
int main()
```

```
{
```

```
    employee e1(450000);
```

```
    employee e2(e1);
```

```
    employee e3=e2;
```

```
    cout<<"Salary of employee1 :";e1.display();
```

```
    cout<<"Salary of employee2 :";e2.display();
```

```
    cout<<"Salary of employee3 :";e3.display();
```

```
    return(0);
```

```
}
```

The screenshot shows a Sublime Text editor window with a C++ file named `cpppp.cpp`. The code defines a class `employee` with a static member `salary` and two constructors: a parameterized one and a default one. It also has a `display` method. The `main` function creates three `employee` objects and prints their salaries. An overlaying terminal window shows the compilation and execution of the program, resulting in the following output:

```
shadow3049@shadow3049-Inspiron-5575: ~/Desktop
shadow3049@shadow3049-Inspiron-5575:~/Desktop$ cd Desktop/
shadow3049@shadow3049-Inspiron-5575:~/Desktop$ g++ cpppp.cpp -o test
shadow3049@shadow3049-Inspiron-5575:~/Desktop$ ./test
Salary of employee1 :450000
Salary of employee2 :450000
Salary of employee3 :450000
shadow3049@shadow3049-Inspiron-5575:~/Desktop$
```

11. (i) Seminar `s1, s2(60);` //s1 executes function 1 and s2 executes function 2;

(ii) Function 4 is a destructor.

A destructor function is called automatically when the object goes out of scope:

- (1) the function ends
- (2) the program ends
- (3) a block containing local variables ends
- (4) a delete operator is called

(iii) Function 1 and Function 3 illustrate constructor overloading in C++ programming, which is same as function overloading. When we create more than one constructors in a class with different number of parameters or different types of parameters or different order of parameters, it is called as constructor overloading.

12.

(i) `Sample::Sample()`  
{  
    `x = 0;`  
    `y = 0;`  
}

(ii) `Sample::Sample(int a)`  
{  
    `x = a;`  
    `y = 0;`  
}

```

(iii) Sample::Sample(int a, int b)
{
    x = a;
    y = b;
}

Sample::Sample(int a, double b)
{
    x = a;
    y = b;
}

```

The screenshot shows a C++ development environment. The main window is a code editor with a dark theme, displaying the following C++ code:

```

1 // Sample.cpp
2 #include "Sample.h"
3
4 class Sample
5 {
6 private:
7     int x;
8     double y;
9 public:
10    Sample();
11    Sample(int);
12    Sample(int, int);
13    Sample(int, double);
14    void print()
15    {
16        cout << x << " " << y << "\n";
17    }
18 };
19
20 Sample::Sample()
21 {
22     x = 0;
23     y = 0;
24 }
25
26 Sample::Sample(int a)
27 {
28     x = a;
29     y = 0;
30 }
31
32 Sample::Sample(int a, int b)
33 {
34     x = a;
35     y = b;
36 }
37
38 Sample::Sample(int a, double b)
39 {
40     x = a;
41     y = b;
42 }
43
44 int main()
45 {
46     Sample s1, s2(2), s3(3,4), s4(5, 6.1419);
47     s1.print();
48     s2.print();
49     s3.print();
50     s4.print();
51 }

```

An inset terminal window shows the execution of the program:

```

shadow3049@shadow3049-Inspiron-5575: ~/Desktop
shadow3049@shadow3049-Inspiron-5575:~/Desktop$ cd Desktop/
shadow3049@shadow3049-Inspiron-5575:~/Desktop$ g++ cpppp.cpp -o test
shadow3049@shadow3049-Inspiron-5575:~/Desktop$ ./test
0 0
2 0
3 4
5 6.1419
shadow3049@shadow3049-Inspiron-5575:~/Desktop$

```

13.  
#include <bits/stdc++.h>

using namespace std;

```

class cashRegister
{
private:
    int cashOnHand;
public:
    cashRegister();
    cashRegister(int cashIn);
    int getCurrentBalance();
}

```

```

        void acceptAmount(int amountIn);
};

cashRegister::cashRegister()
{
    cashOnHand = 500;
}

cashRegister::cashRegister(int cashIn)
{
    cashOnHand = cashIn;
}

int cashRegister::getCurrentBalance()
{
    return cashOnHand;
}

void cashRegister::acceptAmount(int amountIn)
{
    cashOnHand = cashOnHand + amountIn;
}

class dispenserType
{
private:
    int numberOfItems;
    int cost;
public:
    dispenserType();
    dispenserType(int setNoOfItems, int setCost);
    int getNoOfItems();
    int getCost();
    void makeSale();
};

dispenserType::dispenserType()
{
    numberOfItems = 50;
    cost = 50;
}

dispenserType::dispenserType(int setNoOfItems, int setCost)
{
    numberOfItems = setNoOfItems;
    cost = setCost;
}

int dispenserType::getNoOfItems()

```



```

{
    return numberOfItems;
}

int dispenserType::getCost()
{
    return cost;
}

void dispenserType::makeSale()
{
    numberOfItems--;
}

void sellProduct(dispenserType& product, cashRegister& pCounter)
{
    int amount;
    int amount2;
    if (product.getNoOfItems() > 0)
    {
        cout << "Please deposit " << product.getCost() << " rupees" << "\n";
        cin >> amount;
        if (amount < product.getCost())
        {
            cout<<"Please deposit another "<<product.getCost()-amount<< " rupees"<< "\n";
            cin >> amount2;
            amount = amount + amount2;
        }

        else if (amount == product.getCost())
        {
            pCounter.acceptAmount(amount);
            product.makeSale();
            cout << "Collect your item at the bottom and enjoy." << "\n\n\n";
        }

        else if (amount > product.getCost())
        {
            cout<<"here's your change: "<<amount - product.getCost() << " rupees" << "\n";
            pCounter.acceptAmount(amount);
            product.makeSale();
            cout << "Collect your item at the bottom and enjoy." << "\n\n\n" ;
        }

        else
            cout<<"The amount is not enough. "<<"Collect what you deposited."<< "\n\n\n";
    }
    else
        cout << "Sorry, this item is sold out." << "\n";
}

```

```

}

void showSelection()
{
    cout << "To select an item, enter " << "\n";
    cout << "1 for Candy" << "\n";
    cout << "2 for Chips" << "\n";
    cout << "3 for Gum" << "\n";
    cout << "4 for Cookies" << "\n";
    cout << "0 to exit" << "\n";
}

int main()
{
    cashRegister counter;
    dispenserType candy(10, 5);
    dispenserType chips(10, 20);
    dispenserType gum(15, 10);
    dispenserType cookies(1, 30);
    int choice;
    showSelection();
    cin >> choice;
    while (choice)
    {
        switch (choice)
        {
            case 1:
                sellProduct(candy, counter);
                break;
            case 2:
                sellProduct(chips, counter);
                break;
            case 3:
                sellProduct(gum, counter);
                break;
            case 4:
                sellProduct(cookies, counter);
                break;
            default:
                cout << "Invalid selection." << "\n";
        }
        showSelection();
        cin >> choice;
    }
    return 0;
}

```

```
Activities Terminal Apr 27 12:18 PM
~/Desktop/cpppp.cpp - Sublime Text (UNREGISTERED)

File Edit Selection Find View Goto Tools Project Preferences Help

index.html x cpppp.cpp x

70
71 void dispenserType::makeSale()
72 {
73     numberOfItems--;
74 }
75
76 void sellProduct(dispenserType& product, cashRegister& pCounter)
77 {
78     int amount;
79     int amount2;
80     if (product.getNoOfItems() > 0)
81     {
82         cout << "Please deposit " << product.getCost() << " rupees" << "\n";
83         cin >> amount;
84         if (amount < product.getCost())
85         {
86             cout << "Please deposit another " << product.getCost() - amount << " rupees" << "\n";
87             cin >> amount2;
88             amount = amount + amount2;
89         }
90         else if (amount == product.getCost())
91         {
92             pCounter.acceptAmount(amount);
93             product.makeSale();
94             cout << "Collect your item at the bottom and enjoy." << "\n\n\n";
95         }
96         else if (amount > product.getCost())
97         {
98             cout << "here's your change: " << amount - product.getCost() << " rupees" << "\n";
99             pCounter.acceptAmount(amount);
100             product.makeSale();
101             cout << "Collect your item at the bottom and enjoy." << "\n\n\n";
102         }
103         else
104             cout << "The amount is not enough. " << "Collect what you deposited." << "\n\n\n";
105     }
106     else
107         cout << "Sorry, this item is sold out." << "\n";
108 }
109
110 void showSelection()
111 {
112     cout << "To select an item, enter " << "\n";
113     cout << "1 for Candy" << "\n";
114     cout << "2 for Chips" << "\n";
115     cout << "3 for Gum" << "\n";
116 }
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