CS261 ASSIGNMENT 1

NAME:

ARCHIT AGRAWAL

ROLL NO. :

202052307

SECTION:

A

1. Differentiate between structured programming and object-oriented programming, with the help of the codes. Use two codes to show the varied features.

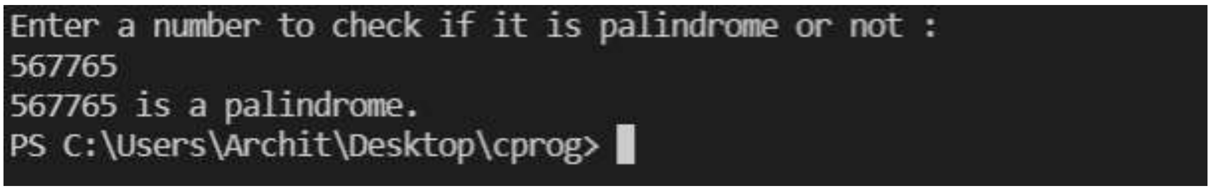
STRUCTURED PROGRAMMING	**OBJECT-ORIENTED PROGRAMMING**
It is a subset of procedural programming.	It relies on concept of objects that contain data and code.
It follows top-down approach.	It follows bottom-up approach.
Programs are divided into small programs or functions.	Programs are divided into objects or entities.
It is all about facilitating creation of programs with readable code and reusable components.	It is all about creating objects that usually contain both functions and data.
Its main aim is to improve and increase quality, clarity, and development time of computer program.	Its main aim is to improve and increase both quality and productivity of system analysis and design.
Structured Programming is **less** secure as there is no way of **data hiding**.	Object Oriented Programming is more secure as having data hiding feature.
Structured Programming provides **less reusability**, more function dependency.	Object Oriented Programming provides more reusability, less function **dependency**.
It provides less flexibility and abstraction as compared to object-oriented programming.	It provides more flexibility and abstraction as compared to structured programming.
In this, methods are written globally and code lines are processed one by one i.e., Run sequentially.	In this, method works dynamically, make calls as per need of code for certain time.
Examples include Pascal, C etc.	Examples include Java, C++ etc.

Writing the codes for checking if a number is palindrome or not in both Java and C.

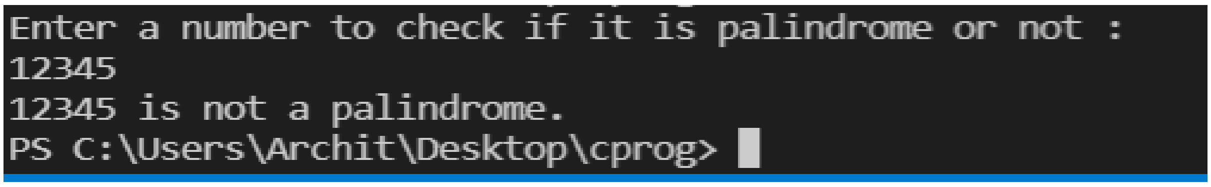
Java (Object – Oriented)

```
import java.util.*;

public class PalindromeCheck{

    int num;  //instance variable

    //method to find reverse of a number
    public int reverse(int n){
        int rev = 0;

        while(n > 0){
            rev = rev * 10 + n % 10;
            n /= 10;
        }

        return rev;
    }

    //method to find if the number is palindrome or not
    public boolean isPalindrome(int n){
        if(n == reverse(n)) return true; //if number is equal to its reverse,
then it is palindrome, otherwise it is not.
        return false;
    }

    public static void main(String[] args){

        Scanner sc = new Scanner(System.in);

        //creating object to use methods of this class
        PalindromeCheck obj = new PalindromeCheck();

        //taking input and initialising the instance variable of the object
        System.out.println("Enter a number to check if it is palindrome or not
 : ");
        obj.num = sc.nextInt();

        //calling isPalindrome method
        if(obj.isPalindrome(obj.num)){
            System.out.println(obj.num + " is a palindrome.");
        } else {
            System.out.println(obj.num + " is not a palindrome.");
        }

    }

}
```

Output:



```
Enter a number to check if it is palindrome or not :
567765
567765 is a palindrome.
PS C:\Users\Archit\Desktop\cprog>
```

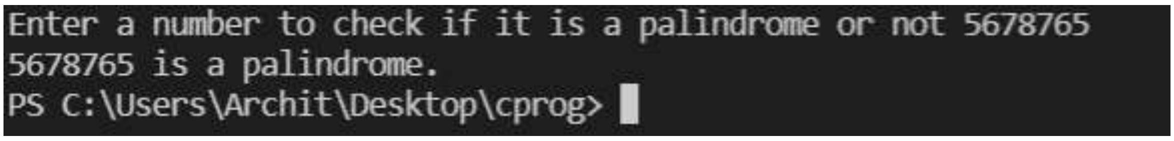


```
Enter a number to check if it is palindrome or not :
12345
12345 is not a palindrome.
PS C:\Users\Archit\Desktop\cprog>
```

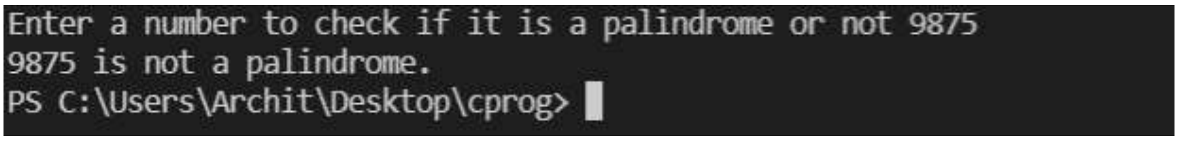
C (Structured Programming)

```
#include<stdio.h>

int main(){
    int num;

    //taking input
    printf("Enter a number to check if it is a palindrome or not ");
    scanf("%d", &num);

    //calling isPalindrome method
    if(isPalindrome(num) == 1){
        printf("%d is a palindrome.", num);
    } else {
        printf("%d is not a palindrome.", num);
    }

}

//finding reverse of a number
int reverse(int n){
    int rev = 0;
    while(n > 0){
        rev = rev * 10 + n % 10;
        n /= 10;
    }
    return rev;
}

//checking if a number is Palindrome or not
int isPalindrome(int n){
    if(reverse(n) == n) return 1;  //if reverse of num is equal to num then it
 is palindrome
    return 0;
}
```

Output:



```
Enter a number to check if it is a palindrome or not 5678765
5678765 is a palindrome.
PS C:\Users\Archit\Desktop\cprog> █
```



```
Enter a number to check if it is a palindrome or not 9875
9875 is not a palindrome.
PS C:\Users\Archit\Desktop\cprog> █
```

Observation:

In Java, we needed to create an object to call the respective methods while in C, there was no such need. The design changes completely. In structured programming we follow Top-Down approach. We just create a function at top and call it simply, but in the object-oriented programming the design is such that code follows bottom-up approach.
We define a class in object-oriented programming we get many benefits like availability of a default constructor, use of instance variable also helps a lot, we can keep all functions of one feature in a single class so the code becomes clean, but this feature wasn’t available in structured programming.

2. Write a program in JAVA to reverse a number using:
   a. Loop
   b. Recursion

a. Using Loop:

Approach: In this approach, we initiate the value of rev to 0 and update the value of num in each iteration of while loop by num/10. The loop runs till num is greater than 0. In each iteration, we update rev by rev*10 and add the unit digit of num to rev. When num = 0, then the value of rev is the reverse of the number.

Dry Run:

Input = 34657

Step 1: num = 34657 and rev = 0

[rev = (0 * 10) + 7 = 7]

Step 2: num = 3465 and rev = 7

[rev = (7 * 10) + 5 = 75]

Step 3: num = 346 and rev = 75

[rev = (75 * 10) + 6 = 756]

Step 4: num = 34 and rev = 756

[rev = (756 * 10) + 4 = 7564]

Step 5: num = 3 and rev = 7564

[rev = (7564 * 10) + 3 = 75643]

b. Using Recursion:

Approach: In this approach, we simply maintain a global variable revRec which stores the number reversed till now and each recursive call is made for n/10 till n becomes 0.

We can do this by extracting the unit digit of the number and then add it to revRec.

The point to be noted here is that we have to multiply revRec by 10 before adding the digit to it in order to update the place value of digits in the reverse so far.

Dry Run:

Input = 12345

Step 1: reverseRecursion(12345) and revRec = 0

Step 2: reverseRecursion (1234) and revRec = 5

Step 3: reverseRecursion (123) and revRec = 54

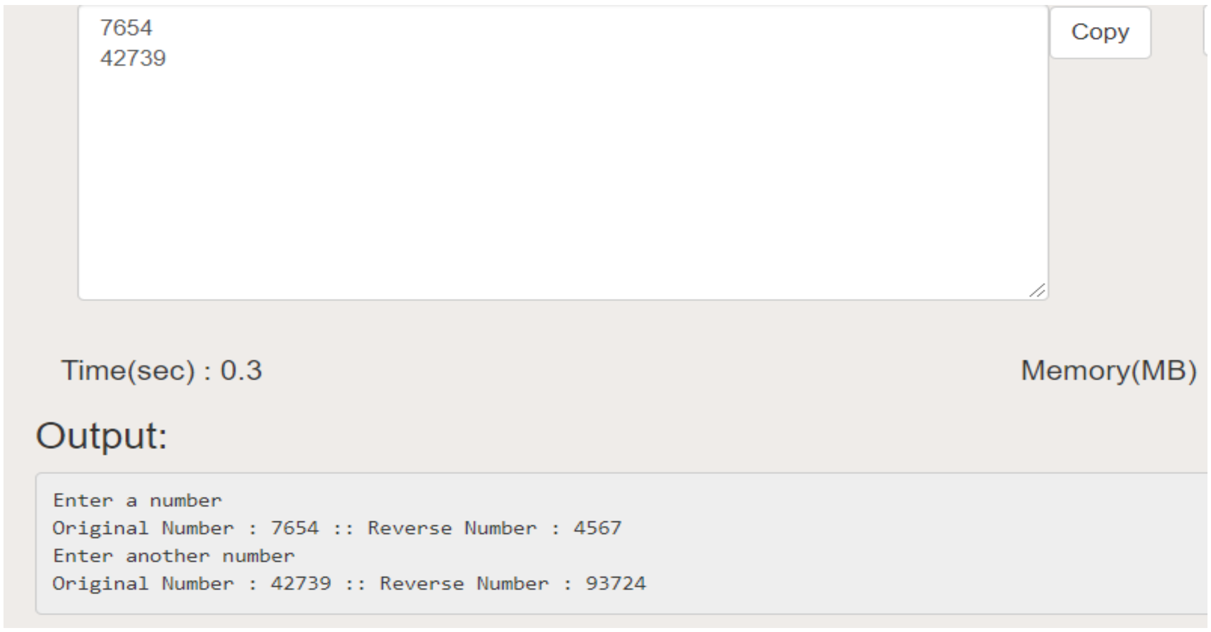
Step 4: reverseRecursion (12) and revRec = 543

Step 5: reverseRecursion (1) and revRec = 5432

Step 6: reverseRecursion (0) and revRec = 54321

Step 7: return revRec = 54321

```
public class Reverse{


    public int reverseLoop(int n){
        int rev = 0;
        //rev contains the number reversed till that iteration
        while(n > 0){
            rev = rev * 10 + n % 10;
            n /= 10;
        }

        return rev;
    }

    int revRec = 0;
    public int reverseRecursion(int n){
        // base condition to end the recursive call
        if(n == 0) return revRec;
        else{
            //revRec stores the number reversed till now
            revRec = (revRec * 10) + (n % 10);
            // recursive calling of the function
            reverseRecursion(n/10);
        }
        return revRec;
    }


    public static void main(String[] args){

        Scanner sc = new Scanner(System.in);
        //creating object of reverse class
        Reverse obj = new Reverse();
        //taking input
        System.out.println("Enter a number");
        int n = sc.nextInt();
        //reversing it using loop
        System.out.println("Original Number : " + n + " :: Reverse Number : "+
 obj.reverseLoop(n));

        System.out.println("Enter another number");
        //taking another input
        n = sc.nextInt();
        //reversing it using recursion
        System.out.println("Original Number : "+  n + " :: Reverse Number : "+
 obj.reverseRecursion(n));
    }
}
```

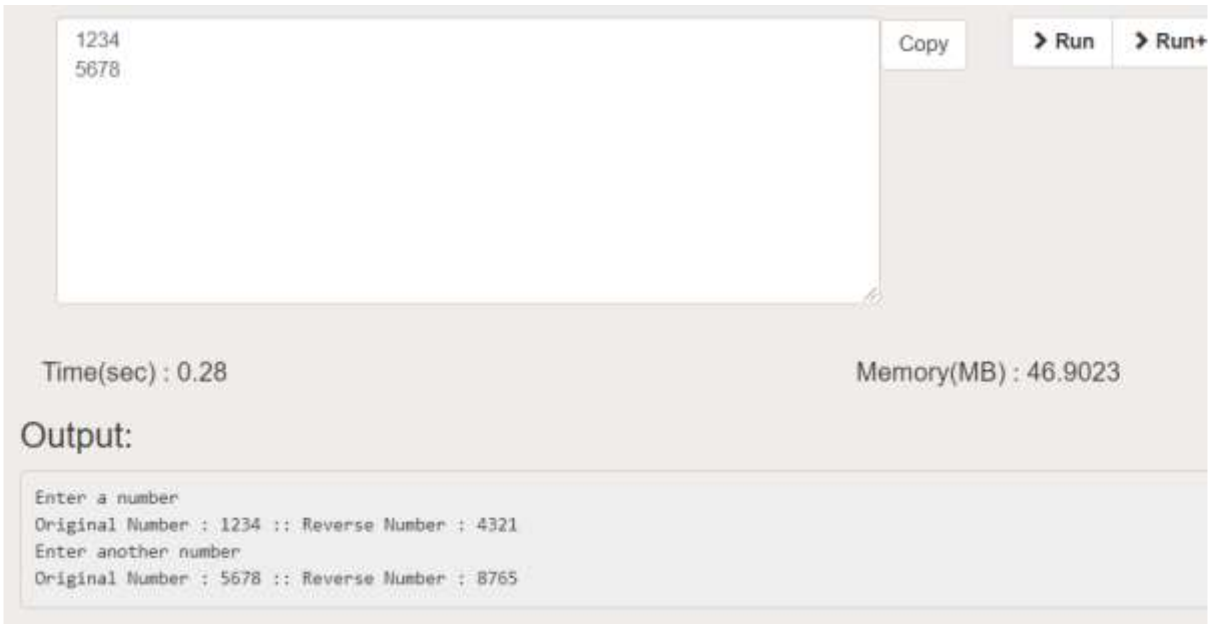


```
7654
42739
```

Time(sec) : 0.3 Memory(MB)

Output:

```
Enter a number
Original Number : 7654 :: Reverse Number : 4567
Enter another number
Original Number : 42739 :: Reverse Number : 93724
```


```
1234
5678
```

Time(sec) : 0.28 Memory(MB) : 46.9023

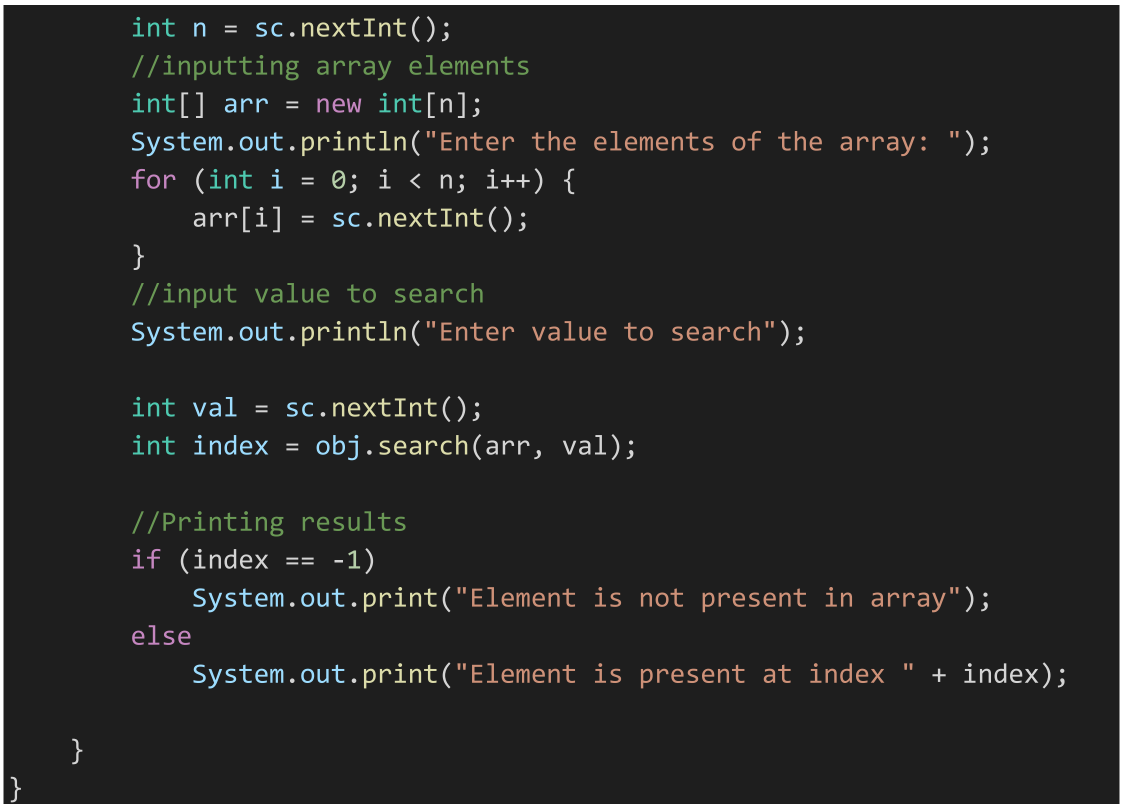
Output:

```
Enter a number
Original Number : 1234 :: Reverse Number : 4321
Enter another number
Original Number : 5678 :: Reverse Number : 8765
```

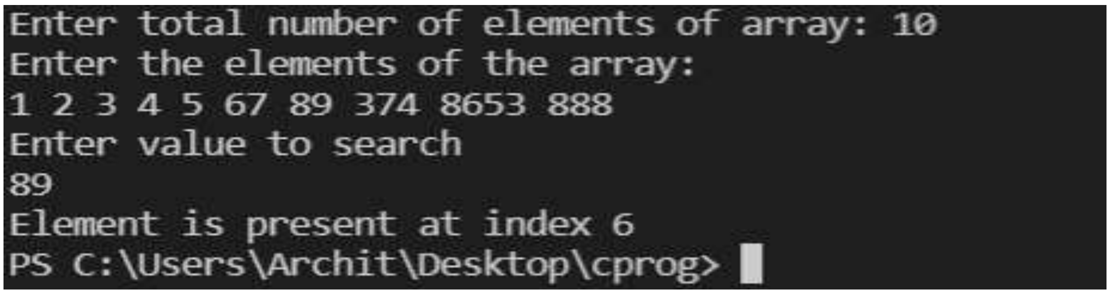
3. Write a program in JAVA to implement Linear Search using Arrays.

   Approach: We begin with index 0 of the array and compare each element in the array with the target element(the element to be found). If found, we return the index at which the element is present, else we return -1. As -1 cannot be an index of array, hence it means that the element is not found.

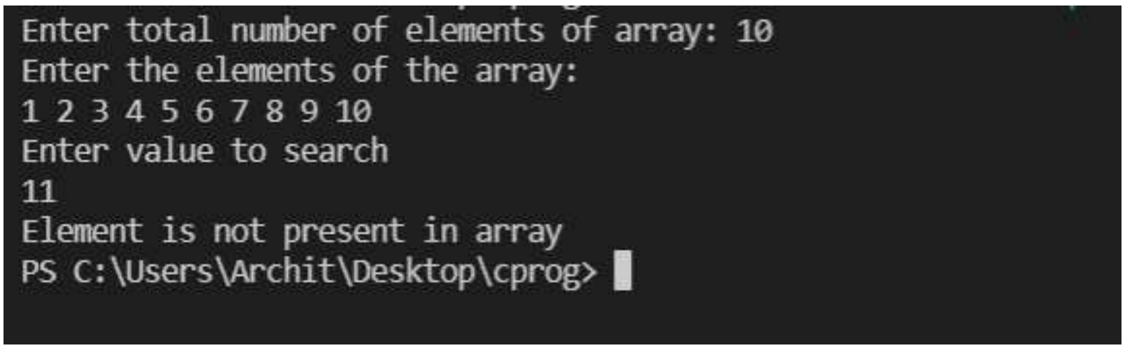
```java
import java.util.*;
public class LinearSearch {

    public int search(int[] arr, int num){
        //checking if num is present in the array
        //if present, return the first index at which it is present
        for(int i = 0; i < arr.length; i++){
            if(arr[i] == num) return i;
        }

        return -1;
    }

    public static void main(String args[]) {
        Scanner sc = new Scanner(System.in);
        //creating object of the class
        LinearSearch obj = new LinearSearch();
        System.out.print("Enter total number of elements of array: ");
```



```
        int n = sc.nextInt();
        //inputting array elements
        int[] arr = new int[n];
        System.out.println("Enter the elements of the array: ");
        for (int i = 0; i < n; i++) {
            arr[i] = sc.nextInt();
        }
        //input value to search
        System.out.println("Enter value to search");

        int val = sc.nextInt();
        int index = obj.search(arr, val);

        //Printing results
        if (index == -1)
            System.out.print("Element is not present in array");
        else
            System.out.print("Element is present at index " + index);

    }
}
```



```
Enter total number of elements of array: 10
Enter the elements of the array:
1 2 3 4 5 67 89 374 8653 888
Enter value to search
89
Element is present at index 6
PS C:\Users\Archit\Desktop\cprog>
```



```
Enter total number of elements of array: 10
Enter the elements of the array:
1 2 3 4 5 6 7 8 9 10
Enter value to search
11
Element is not present in array
PS C:\Users\Archit\Desktop\cprog>
```

4. Write a program to create a room class, the attributes/variables of this class are roomNo, roomType, and roomArea. In this class, the member functions are setData and displayData. The program should perform some tasks such as assigning roomArea, printing room details, etc.

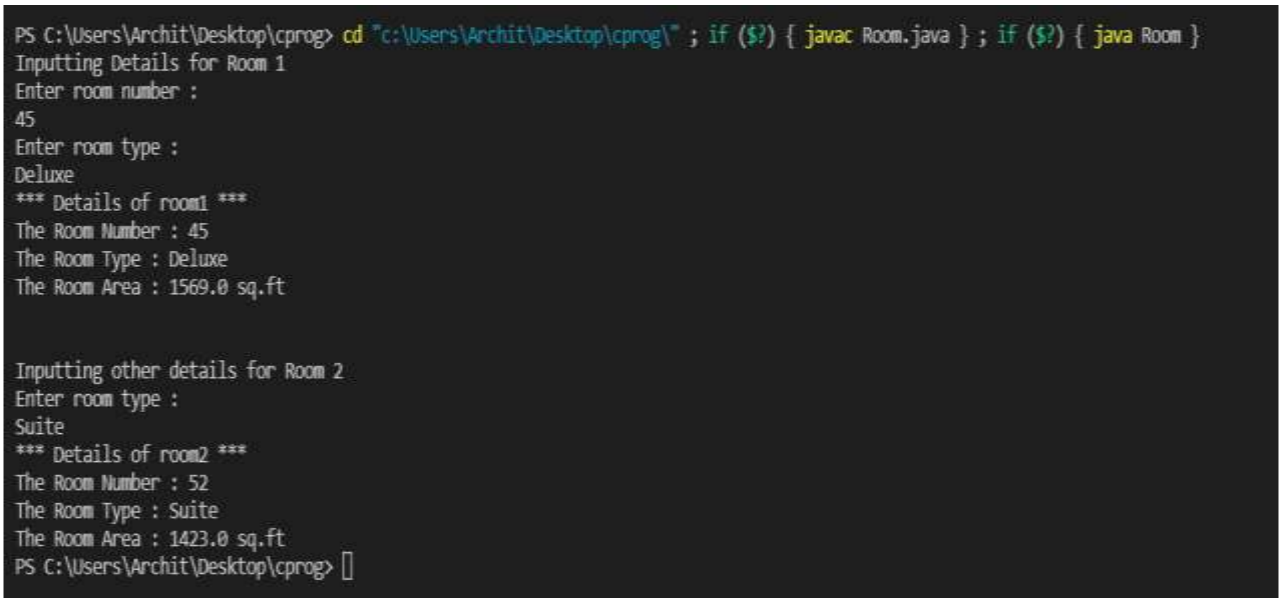
   Approach:
   In this, we create a class named as 'Room' and then we create three instance variables in it named roomNo, roomArea, roomType. This class has a default constructor and another constructor that can assign a specific roomNo at the the time of creating the object. After this we created a method called setData(int num , String type, double area) which basically sets the values of the three instance variables equal to the values of its parameters. We can use either Math.random() and Math.round() for roomNo and roomArea or we can also take them as input from the user.

   The display() method displays the details of the object of class Room.

```
import java.util.*;

public class Room {

    //declaring instance variables
    static int roomNo;
    static String roomType;
    static double roomArea;

    //default constructor for class Room
    //it assigns roomNo = 0
    //roomType = ""
    //roomArea = 0
    Room(){
        this.roomNo = 0;
        this.roomType = "";
        this.roomArea = 0.0;
    }

    //another constructor
    //it assigns roomNo = number
    Room(int number){
        this.roomNo = number;
```

```java
    }

    // method to set data
    public void setData(int num, String type, double area) {
        roomNo = num;
        roomType = type;
        roomArea = area;
    }

    //method to display the details of room
    public void displayData() {
        System.out.println("The Room Number : " + roomNo);
        System.out.println("The Room Type : " + roomType);
        System.out.println("The Room Area : " + roomArea + " sq.ft");
    }

    public static void main(String args[]) {
        Scanner sc = new Scanner(System.in);
        Room room1 = new Room(); //creating object of Room class

        System.out.println("Inputting Details for Room 1");
        System.out.println("Enter room number : ");
        //inputting room number from user
        int n = sc.nextInt();
        room1.roomNo = n;
        System.out.println("Enter room type : ");
        //inputting room type from user
        sc.nextLine();
        String roomType = sc.nextLine();
        //assigning room area using random method
        double roomArea = 1000 + Math.round(1000 * Math.random());

        //calling setData to set the data for the room1 object
        room1.setData(roomNo, roomType, roomArea);

        System.out.println("*** Details of room1 ***");
        room1.displayData();

        //creating room2 object with roomNo 52
        Room room2 = new Room(52);
        System.out.println();
        System.out.println();
        System.out.println("Inputting other details for Room 2");

        System.out.println("Enter room type : ");
        //inputting room type from user
        roomType = sc.nextLine();
        //assigning room area using random method
        roomArea = 1000 + Math.round(1000 * Math.random());

        //calling setData to set the data for the room2 object
        room2.setData(roomNo, roomType, roomArea);

        System.out.println("*** Details of room2 ***");
        room2.displayData();
    }

}
```

<u>Output</u> :



```
PS C:\Users\Archit\Desktop\cprog> cd "c:\Users\Archit\Desktop\cprog\" ; if ($?) { javac Room.java } ; if ($?) { java Room }
Inputting Details for Room 1
Enter room number :
45
Enter room type :
Deluxe
*** Details of room1 ***
The Room Number : 45
The Room Type : Deluxe
The Room Area : 1569.0 sq.ft


Inputting other details for Room 2
Enter room type :
Suite
*** Details of room2 ***
The Room Number : 52
The Room Type : Suite
The Room Area : 1423.0 sq.ft
PS C:\Users\Archit\Desktop\cprog> []
```