Program 1. Write a java program for Creation and Casting of Variables.

Code:

```
import myPack.Intro;
import static java.lang.System.* ;
public class Casting1{
	public static void main(String args[]){
		Intro.print("Type casting") ;
		//implicit castings
		byte byt = 2 ;
		short srt = byt ;
		int nt = srt;
		float flt = nt ;
		double dbl = flt ;
		dbl = 25434.545345 ;
		// explicit casting
		flt = (float)dbl ;
		nt = (int)flt ;
		srt = (short)nt ;
		byt = (byte)srt ;
		out.println("flt : "+flt);
		out.println("nt : "+nt);
		out.println("srt : "+srt);
		out.println("byt : "+byt);
	}
}
```

Output:

```
C:\Users\Jitendra Sahu GT\Nextcloud\MCA\Java\assignment\programs>exec.bat Casting1.java
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : Type casting
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

flt : 25434.545
nt : 25434
srt : 25434
byt : 90
Press any key to continue . . .
```

Program 2. Write a java program to demonstrate the various Operators.

Code:

```
import myPack.Intro;
import static java.lang.System.* ;

public class Operator{
    public static void main(String args[]){
        Intro.print("Different kind of operators in JAVA") ;
        // Arithmetic Operators
        out.println("Arithmetic Operators") ;
        int a = 5 , b = 6 ;
        out.println(a + " + " + b +" = " + (a+b)) ;
        out.println(a + " - " + b +" = " + (a-b)) ;
        out.println(a + " * " + b +" = " + (a*b)) ;
        out.println(a + " / " + b +" = " + (a/b)) ;
        out.println(a + " % " + b +" = " + (a%b)) ;
         // Comparison Operators
        out.println("\nComparison Operators") ;
        out.println(a + " = " + b +" = " + (a=b)) ;
        out.println(a + " != " + b +" = " + (a!=b)) ;
        out.println(a + "<" + b +" = " + (a<b)) ;
        out.println(a + ">" + b +" = " + (a>b)) ;
        out.println(a + "<= " + b +" = " + (a<=b)) ;
        out.println(a + ">= " + b +" = " + (a>=b)) ;
        // Bitwise operators
        out.println("\nBitwise Operators") ;
        out.println(a + "&" + b +" = " + (a&b)) ;
        out.println(a + " | " + b +" = " + (a|b)) ;
        out.println(a + " ^ " + b +" = " + (a^b)) ;
        out.println(a + "<<" + b +" = " + (a<<b)) ;
        out.println(a + ">>" + b +" = " + (a>>b)) ;
        out.println(" ~ " + b +" = " + (~b)) ;
        // Logical operators
        int d = 7 , e = 8 ;
        out.println("\nLogical Operators") ;
        out.println(a + " == " + b +"&&" + d + " == " + e + " : " +( a==b && d==e)) ;
        out.println(a + " == " + b +" || " + d + " == " + e + " : " +( a==b || d==e)) ;
```

```
                out.println("!("+a + " == " + b +") : " + !( a==b)) ;
        }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : Different kind of operators in JAVA
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Arithmetic Operators
5 + 6 = 11
5 - 6 = -1
5 * 6 = 30
5 / 6 = 0
5 % 6 = 5

Comparison Operators
5 = 6 = 6
6 != 6 = false
6 < 6 = false
6 > 6 = false
6 <= 6 = true
6 >= 6 = true

Bitwise Operators
6 & 6 = 6
6 | 6 = 6
6 ^ 6 = 0
6 << 6 = 384
6 >> 6 = 0
 ~ 6 = -7

Logical Operators
6 == 6 && 7 == 8 : false
6 == 6 || 7 == 8 : true
!(6 == 6) : false
```

Program 3. Write a java program for printing the current date in different formats.

Code:

```
import myPack.Intro;
import static java.lang.System.* ;
import java.text.SimpleDateFormat ;
import java.util.Date ;
public class CurrentDateInVariousFormat{
        public static void main(String args[]){
                Intro.print("Printing current date in defferent formates") ;
                Date currentDate = new Date() ;
                SimpleDateFormat f1 = new SimpleDateFormat("dd/MM/yyyy") ;
                SimpleDateFormat f2 = new SimpleDateFormat("dd-MMM-yyyy") ;
                SimpleDateFormat f3 = new SimpleDateFormat("MMM dd yyyy") ;
                System.out.println("Current date in format1 : "+f3.format(currentDate)) ;
                System.out.println("Current date in format2 : "+f2.format(currentDate)) ;
                System.out.println("Current date in format3 : "+f3.format(currentDate)) ;
            }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
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Program Topic : Printing current date in defferent formates
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Current date in format1 : Apr 21 2024
Current date in format2 : 21-Apr-2024
Current date in format3 : Apr 21 2024
```

Program 4. Write a java program for Inputting Data From Keyboard through Scanner Class.

Code:

```
import myPack.Intro;
import static java.lang.System.* ;
import java.util.Scanner ;
public class InputWithScanner{
        public static void main(String args[]){
                Intro.print("Input using Scanner") ;
                // creating object
                Scanner sc = new Scanner(System.in) ;
                float a ;
                String s ;
                // input number
                out.print("Enter number: ") ;
                a = sc.nextFloat() ;
                sc.nextLine() ; // to escap line
                out.print("Enter string: ") ;
                s = sc.nextLine() ;
                sc.close() ;
                out.println("Number : " + a ) ;
                out.println("String : " + s )  ;
        }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
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Program Topic : Input using Scanner
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Enter number: 51
Enter string: Jitendra Kumar
Number : 51.0
String : Jitendra Kumar
```

Program 5. Write a java program for Inputting Data From Keyboard through BufferedReader Class.

Code:

```
import myPack.Intro;
import static java.lang.System.* ;
import java.io.BufferedReader ;
import java.io.InputStreamReader ;
import java.io.IOException;
public class BufferedInputReaderExample{
        public static void main(String args[]) throws IOException {
                Intro.print("") ;
                BufferedReader br = new BufferedReader(new InputStreamReader(System.in)) ;
                out.print("Enter a number : ") ;
                float flt = Float.parseFloat(br.readLine()) ;
                out.print("Enter string : ") ;
                String s  = br.readLine() ;
                out.println("Number : + 5 : "+(flt+5)) ;
                out.println("String : + 9 : "+s+9) ;
        }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
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Program Topic :
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Enter a number : 550.5
Enter string : what symbole of nine?
Number : + 5 : 555.5
String : + 9 : what symbole of nine?9
```

Program 6. Write a java program for Inputting Data From Keyboard through Console Class.

Code:

```
import myPack.Intro;
import static java.lang.System.* ;
import java.io.* ;

public class InputWithConsoleClass{
        public static void main(String args[]){
                Intro.print("Input output using console") ;
                Console cl  = System.console() ;
                if(cl == null) {
                        out.println("console not found") ;
                   return ;
                }
                // taking input from console
                cl.printf("Enter a number : ") ;
                float number = Float.parseFloat(cl.readLine()) ;
                cl.printf("Enter a string : ") ;
                String s = cl.readLine() ;
                cl.printf("Enter you password : ");
                char[] pass = cl.readPassword() ;
                cl.printf("\number + 5 : %f",number) ;

                s = s+5 ;
                cl.printf("\nstring + 5: %s",s) ;

                cl.printf("\npassword : ");
                out.println(pass) ;
        }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
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Program Topic : Input output using console
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Enter a number : 4533.232
Enter a string : JitendraG
Enter you password :

umber + 5 : 4533.231934
string + 5: JitendraG5
password : hardPassword
```

Program 7. Write a java program to demonstrate the use of for–each loop.

Code:

```
import myPack.Intro;
import static java.lang.System.* ;
public class ForEachLoop{
	public static void main(String args[]){
		Intro.print("Demostration of for each loop") ;

		int arr[] = {12,34,56,7,87,98,9,45,43,3} ;

		out.println("Items of array are : ") ;
		//using for each loop to iterate over array elements and printing values
		for (int i : arr) out.print(i+"") ;
		out.println();
	}
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
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Program Topic : Demostration of for each loop
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Items of array are :
12 34 56 7 87 98 9 45 43 3
```

Program 8. Write a java program to demonstrate ragged arrays.

Code:

```
import myPack.Intro;
import static java.lang.System.* ;

public class RaggedArrayInJava{
	public static void main(String args[]){
		Intro.print("Program to demonstrate ragged array") ;
		int raggedArray[][] = {
			{34,5,5,3,5},
			{23,6,87,2},
			{23,87,34},
			{34,3},
			{32,5,769,98,0,067}
		};
		// printing ragged array
		out.println("printing ragged array ") ;
		for (int i = 0  ; i< 5 ; i++ ) {
			for(int j : raggedArray[i] ) out.print(j+"") ;
			out.println() ;
		}
	}
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : Program to demonstrate ragged array
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

printing ragged array
34 5 5 3 5
23 6 87 2
23 87 34
34 3
32 5 769 98 0 55
```

Program 9. Write a java program to demonstrate anonymous arrays.

Code:

```
import myPack.Intro;
import static java.lang.System.* ;
public class AnonymousArray{
	static void printArray(int arr[]){
		for (int i : arr) out.print(i+"") ;
	}

	static float getAvg(int arr[]){
		int sum =  0 ;
		for (int i : arr) sum += i ;
		return sum / arr.length ;
	}
	public static void main(String args[]){
		Intro.print("Program to Anonymous array") ;

		out.println("Array elements : ") ;
		printArray(new int[] {3,4,5,6,7,8,9,12}) ;
		out.println("\nAvg : " + getAvg(new int[] {3,4,5,6,7,8,9,12})) ;
	}
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : Program to Anonymous array
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Array elements :
3 4 5 6 7 8 9 12
Avg : 6.0
```

Program 10. Write a java program to demonstrate the methods of Arrays Class.

Code:

```
import myPack.Intro;
import java.util.Arrays ;

public class MethodsOfArraysClass{
	public static void main(String args[]){
		Intro.print("Methods of Arrays Class");

		// Demonstrating some methods of Arrays class
		int[] numbers = {5, 3, 8, 2, 9};
		Arrays.sort(numbers);
		System.out.println("Sorted array: " + Arrays.toString(numbers));
		System.out.println("Index of 8: " + Arrays.binarySearch(numbers, 8));

		// Additional functions
		int[] copiedArray = Arrays.copyOf(numbers, 3);
		System.out.println("Copied array: " + Arrays.toString(copiedArray));

		int[] filledArray = new int[5];
		Arrays.fill(filledArray, 10);
		System.out.println("Filled array: " + Arrays.toString(filledArray));
	}
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : Methods of Arrays Class
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Sorted array: [2, 3, 5, 8, 9]
Index of 8: 3
Copied array: [2, 3, 5]
Filled array: [10, 10, 10, 10, 10]
```

Program 11. Write a java program for Application Of Classes And Objects.

Code:

```
import myPack.Intro ;
```

```
class Person{
        String name ;
        int age;
        Person(String name, int age){
                this.name = name ;
                this.age = age ;
        }

        void show(){
                System.out.println("Person name : "+name) ;
                System.out.println("Person age : "+age) ;
        }

        void eat(){
                System.out.println(name + " is eating rice and curry");
        }
}


public class ClassesAndObject{
        public static void main(String args[]){

                Intro.print("Demonstration of classes and object");

                Person a = new Person("Jitendra Kumar", 22) ;
                Person b = new Person("Purusottam", 21) ;

                a.show();
                a.eat();
                System.out.println();
                b.show();
                b.eat() ;
        }
}
```

Output:

```
ClassesAndObject
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : Demonstration of classes and object
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Person name : Jitendra Kumar
Person age : 22
Jitendra Kumar is eating rice and curry

Person name : Purusottam
Person age : 21
Purusottam is eating rice and curry
```

Program 12. Write a java program to demonstrate method overloading.

Code:

```
import myPack.Intro;
class Adder {

	void printSum(int a, int b){
		System.out.println("sum = "+ (a+b));
	}

	void printSum(int a, int b, int c){
		System.out.println("sum = "+ (a+b+c));
	}
	void printSum(float a, float b){
		System.out.println("sum = "+ (a+b));
	}

}
public class MethodOverloading{
	public static void main(String args[]){
		Intro.print("Demonstration of method overloading") ;

		Adder a = new Adder() ;
		a.printSum(3, 5);
		a.printSum(5.2f, 6.3f);
		a.printSum(2, 3,6);
	}
}
```

Output:

```
C:\Users\Jitendra Sahu GT\Nextcloud\MCA\Java\assignment\programs>execJava.bat MethodOverloadi
MethodOverloading
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : Demonstration of method overloading
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

sum = 8
sum = 11.5
sum = 11
```

Program 13. Write a java program to demonstrate constructor overloading.

Code:

```
import myPack.Intro;

class DemoConstOverloading {
// Constructor overloading
DemoConstOverloading() {
System.out.println("Default constructor");
}

DemoConstOverloading(int x) {
System.out.println("Parameterized constructor with one parameter: " + x);
}

DemoConstOverloading(int x, String str) {
System.out.println("Parameterized constructor with two parameters: " + x + ", " + str);
}
}
public class ConstructorOverloading {
public static void main(String[] args) {
Intro.print("Constructor Overloading demonstration");

DemoConstOverloading obj1 = new DemoConstOverloading();
DemoConstOverloading obj2 = new DemoConstOverloading(5);
DemoConstOverloading obj3 = new DemoConstOverloading(5, "Hello");
}
}
```

Output:

```
ConstructorOverloading
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
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Program Topic : Constructor Overloading demonstration
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Default constructor
Parameterized constructor with one parameter: 5
Parameterized constructor with two parameters: 5, Hello
```

Program 14. Write a java program Using Single Inheritance.

Code:

```
import myPack.Intro;

class ParentClass {
    void displayParent() {
        System.out.println("Parent class method");
    }
}
class ChildClass extends ParentClass {
    void displayChild() {
        System.out.println("Child class method");
    }
}
public class SingleInheritance {
    public static void main(String[] args) {
        Intro.print("Single Inheritance");
        // Single inheritance demonstration
        ChildClass obj = new ChildClass();
        obj.displayParent();
        obj.displayChild();
    }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : Single Inheritance
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Parent class method
Child class method
```

Program 15. Write a java program Using Super And This Keyword.

Code:

```
import myPack.Intro;
class ParentClass {
	void display() {
		System.out.println("Parent class method");
	}
}

class ChildClass extends ParentClass {
	void display() {
		super.display(); // Calls the parent class method
		System.out.println("Child class method");
	}
}
public class SuperAndThisKeyword {
	public static void main(String[] args) {
		Intro.print("Super and This Keyword demonstration");
		ChildClass obj = new ChildClass();
		obj.display();
	}
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : Super and This Keyword demonstration
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Parent class method
Child class method
```

Program 16. Write a java program to demonstrate multilevel inheritance.

Code:

```
import myPack.Intro;

class GrandParentClass {
	void displayGrandParent() {
		System.out.println("GrandParent class method");
	}
}

class ParentClass extends GrandParentClass {
	void displayParent() {
		System.out.println("Parent class method");
	}
}

class ChildClass extends ParentClass {
	void displayChild() {
		System.out.println("Child class method");
	}
}

public class MultilevelInheritance {
	public static void main(String[] args) {
		Intro.print("Multilevel Inheritance");
		// Multilevel inheritance demonstration
		ChildClass obj = new ChildClass();
		obj.displayGrandParent();
		obj.displayParent();
		obj.displayChild();
	}

}
```

Output:

```
MultilevelInheritance
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : Multilevel Inheritance
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

GrandParent class method
Parent class method
Child class method
```

Program 17. Write a java program to demonstrate method overriding.

Code:

```
import myPack.Intro;
class ParentClass {
	void func1(){
		System.out.println("func1 one from parent");
	}
	void display() {
		System.out.println("Parent class method");
	}
}

class ChildClass extends ParentClass {
	@Override
	void display() {
		System.out.println("Child class method");
	}
}

class MethodOverriding {
	public static void main(String[] args) {
		Intro.print("Method Overriding");
		// Method overriding demonstration
		ChildClass obj = new ChildClass();
		obj.func1();
		obj.display();
	}
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : Method Overriding
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

func1 one from parent
Child class method
```

Program 18. Write a java program Using Multiple Inheritance Concept through interfaces.

Code:

```
import myPack.Intro;
interface Interface1 {
        void method1();
}
interface Interface2 {
        void method2();
}
class TestClass implements Interface1, Interface2 {
        public void method1() {
                System.out.println("Method1 implementation");
        }
        public void method2() {
                System.out.println("Method2 implementation");
        }
}
public class MultipleInhritWithInf {
        public static void main(String[] args) {
                Intro.print("Multiple Inheritance through Interfaces");

        TestClass obj = new TestClass();
                obj.method1();
                obj.method2();
        }
}
```

Output:

```
MultipleInhritWithInf
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : Multiple Inheritance through Interfaces
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Method1 implementation
Method2 implementation
```

Program 19. Write a java program to demonstrate the concept of inner class.

Code:

```
import myPack.Intro;
public class InnerClassDemo {
	public static void main(String[] args) {
	Intro.print("Concept of Inner Class");
	// Creating object of Outer class
	Outer outer = new Outer();
	// Accessing inner class method
	outer.display();
	}
	static class Outer {
	void display() {
		System.out.println("Inside Outer class method");
		// Inner class definition
		class Inner {
		void innerMethod() {
			System.out.println("Inside Inner class method");
		}
	}
	// Creating object of Inner class
	Inner inner = new Inner();
		inner.innerMethod();
		}
	}
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : Concept of Inner Class
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Inside Outer class method
Inside Inner class method
```

Program 20. Write a java program to demonstrate the concept of local class.

Code:

```
import myPack.Intro;
public class LocalClassDemo {
	public static void main(String[] args) {
		Intro.print("Concept of Local Class");
		// Calling method with local class
		displayMessage();
	}
	static void displayMessage() {
	System.out.println("Inside method");
	// Local class definition
	class Local {
		void localMethod() {
			System.out.println("Inside local method");
		}
	}
// Creating object of Local class
	Local local = new Local();
	local.localMethod();
	}
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : Concept of Local Class
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Inside method
Inside local method
```

Program 21. Write a java program that creates its own package containing two classes.

Code:

Animal.java

```
package AnimalPack ;
public class Animal{
        String name  , breed ;

        public void setName(String name)  {
                this.name = name ;
        }
        public void setBreed(String breed) {
                this.breed = breed ;
        }
}
```

Dog.java

```
package AnimalPack ;
public class Dog extends Animal{
                public Dog(String name , String breed){
                        setName(name)  ;
                        setBreed(breed) ;
        }
        public void print(){
                System.out.println("Dog properties : ") ;
                System.out.println("name : " +name) ;
                System.out.println("breed : "+breed) ;
        }
}
```

Cat.java

```
package AnimalPack ;
public class Cat extends Animal{
                public Cat(String name , String breed){
                setName(name) ;
                setBreed(breed) ;
        }
        public void print(){
                System.out.println("Cat properties : ") ;
                System.out.println("name : " +name) ;
```

```
                System.out.println("breed : "+breed) ;
        }
}
```

TestAnimal.java

```
import myPack.Intro;
import AnimalPack.Dog ;
import AnimalPack.Cat ; // imported two classes from AnimalPack
public class TestAnimals{
        public static void main(String arg[]){
                Intro.print("Package having two Classes") ;
                Dog dg = new Dog("Diggu", "Pug") ;
                dg.print() ;
                System.out.println() ;
                Cat ct = new Cat("Kittu", "Beagle") ;
                ct.print() ;
        }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : Package having two Classes
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Dog properties :
name : Diggu
breed : Pug

Cat properties :
name : Kittu
breed : Beagle
```

Program 22. Write a java program Using Try And Catch Statement.

Code:

```
import myPack.Intro;
public class TryAndCatch{
        public static void main(String args[]){
                Intro.print("Try catch statement") ;
    int arr[] = {3,4,5,7,8} ;
    try{
        for (int i = 0; i <= 5; i++) {
            System.err.print(arr[i]+" ");
        }
    }catch (IndexOutOfBoundsException e){
        System.err.println("\nException caught : ") ;
        e.printStackTrace() ;
    }

        }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : Try catch statement
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

3 4 5 7 8
Exception caught :
java.lang.ArrayIndexOutOfBoundsException: Index 5 out of bounds for length 5
        at TryAndCatch.main(TryAndCatch.java:11)
```

Program 23. Write a java program Using Multiple Catch Statements.

Code:

```
import myPack.Intro;
public class MultpleCatch {
   public static void main(String args[]) {
      Intro.print("Multiple catch block in try catch statement");
      int arr[] = { 3, 4, 5, 7, 8 };
      float c = 0;
      try {
         c = arr[1] / (arr.length - 5);
         System.err.println("c= " + c);
         for (int i = 0; i <= 5; i++) {
            System.err.print(arr[i] + " ");
         }
      } catch (IndexOutOfBoundsException e) {
         System.err.println("\nException caught : ");
         e.printStackTrace();
      } catch (ArithmeticException ae) {
         System.err.println("\nException caught : ");
         ae.printStackTrace();
      } catch (Exception e) {
         System.err.println("\nException caught : ");
         e.printStackTrace();
      }

   }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : Multiple catch block in try catch statement
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~


Exception caught :
java.lang.ArithmeticException: / by zero
        at MultpleCatch.main(MultpleCatch.java:10)
```

Program 24. Write a java program to demonstrate the MultiCatch feature.

Code:

```
import myPack.Intro;
public class MultipleCatchFeature {
    public static void main(String args[]) {
        Intro.print("Multiple catch block in try catch statement");
        int arr[] = { 3, 4, 5, 7, 8 };
        float c = 0;
        try {
            c = arr[1] / (arr.length - 5);
            System.err.println("c= " + c);
            for (int i = 0; i <= 5; i++) {
                System.err.print(arr[i] + " ");
            }
        } catch (IndexOutOfBoundsException | ArithmeticException e) {
            e.printStackTrace();
        } catch (Exception e) {
            e.printStackTrace();
        }
    }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : Multiple catch block in try catch statement
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

java.lang.ArithmeticException: / by zero
        at MultipleCatchFeature.main(MultipleCatchFeature.java:10)
```

Program 25. Write a java program to demonstrate the use of finally block.

Code:

```
import myPack.Intro;

public class FinallyTryCatch {
   public static void main(String args[]) {
      Intro.print("Finally block in try catch statement");

      int arr[] = { 3, 4, 5, 7, 8 };
      float c = 0;
      try {
         c = arr[1] / (arr.length - 5);
         System.err.println("c= " + c);
         for (int i = 0; i <= 5; i++) {
            System.err.print(arr[i] + " ");
         }

      } catch (IndexOutOfBoundsException e) {
         System.err.println("\nException caught : ");
         e.printStackTrace();
      } catch (ArithmeticException ae) {
         System.err.println("\nException caught : ");
         ae.printStackTrace();
      } catch (Exception e) {
         System.err.println("\nException caught : ");
         e.printStackTrace();
      }finally{
         System.out.println("any how executed from finally block");
      }
   }
}
```

Output:

```
FinallyTryCatch
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : Finally block in try catch statement
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~


Exception caught :
java.lang.ArithmeticException: / by zero
        at FinallyTryCatch.main(FinallyTryCatch.java:10)
any how executed from finally block
```

Program 26. Write a java program Using Nested Try Statements.

Code:

```
import myPack.Intro;
public class NestedTryAndCatch {
    public static void main(String args[]) {
        Intro.print("Nested Try catch statement");
        int arr[] = { 3, 4, 5, 7, 8 };
        try {
            for (int i = 0; i < 5; i++) {
                System.err.print(arr[i] + " ");
            }
            try {
                float div = arr[0] / (9 - 5 - 4);
                System.out.println("div : " + div);
            } catch (ArithmeticException e) {
                e.printStackTrace();
            }
        } catch (IndexOutOfBoundsException e) {
            System.err.println("\nException caught : ");
            e.printStackTrace();
        }

    }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : Nested Try catch statement
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

3 4 5 7 8 java.lang.ArithmeticException: / by zero
        at NestedTryAndCatch.main(NestedTryAndCatch.java:14)
```

Program 27. Write a java program To Create Your Own Exception Class And Display Corresponding Error Message.

Code:

```
import myPack.Intro;
class myOwnException extends Exception {
        myOwnException(){
                super("your own exception occurred >_<");
        }
}
public class MakingOwnException{
        public static void main(String[] args) {
                Intro.print("Creating my own exception");
                try{
                        throw new myOwnException() ;
                }catch(myOwnException e){
                        System.err.println(e);
                }
        }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : Creating my own exception
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

myOwnException: your own exception occurred >_<
```

Program 28. Write a java program For Creating And Executing Threads by extending the Thread class.

Code:

```
class ConcurrentFun extends Thread {
        char c;
        ConcurrentFun(char c) {
                this.c = c;
        }
        public void run() {
                for (int i = 0; i < 10; i++) {
                        System.out.println(c + " = " + i);
                }
        System.out.println("Finished " + c);
        }
}

public class MultiThreading {
        public static void main(String args[]) {
                ConcurrentFun f1 = new ConcurrentFun('i');
                ConcurrentFun f2 = new ConcurrentFun('k');
                f1.start();
                f2.start();
                for (int i = 0; i < 10; i++) {
                        System.out.println("m = " + i);
                }
                System.out.println("Finished Main");
        }
}
```

Output:

```
C:\Users\Jitendra Sahu GT\Nextcloud\MCA\Java\assignment\programs>execJava.bat MultiThreading.
MultiThreading
m = 0
m = 1
m = 2
k = 0
i = 0
k = 1
m = 3
k = 2
i = 1
k = 3
m = 4
k = 4
i = 2
k = 5
m = 5
m = 6
k = 6
i = 3
k = 7
m = 7
k = 8
i = 4
k = 9
m = 8
Finished k
i = 5
m = 9
i = 6
Finished Main
i = 7
i = 8
i = 9
Finished i
```

Program 29. Write a java program To run Three Threads by implementing the Runnable Interface.

Code:

```
import myPack.Intro;
class Counter implements Runnable {
	char ch;
	Counter(char c) {
		ch = c;
	}
	public void run() {
		for (int i = 1; i <= 5; i++) {
			System.out.printf("%c%d\n",ch,i);
		}
		System.out.println("Executed thread "+ch);
	}
}
public class MultithreadRunnable {
	public static void main(String[] args) {
		Intro.print("multithreading with runnable");
		Thread ct1 = new Thread(new Counter('a'));
		Thread ct2 = new Thread(new Counter('b'));
		Thread ct3 = new Thread(new Counter('c'));
		ct1.start();
		ct2.start();
		ct3.start();
	}
}
```

Output:

```
MultithreadRunnable
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : multithreading with runnable
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

c1
b1
b2
a1
b3
c2
b4
a2
b5
c3
a3
a4
c4
c5
a5
Executed thread a
Executed thread b
Executed thread c
```

Program 30. Write a java program to demonstrate the use of join() method.

Code:

```
import myPack.Intro;
class Counter implements Runnable {
		char ch;
		Counter(char c) {
		ch = c;
	}
	public void run() {
		for (int i = 1; i <= 5; i++) {
			System.out.printf("%c%d\n", ch, i);
		}
	System.out.println("Executed thread " + ch);
	}
}
class AnotherThread extends Thread {
	public void run() {
		for (int i = 0; i < 5; i++) {
		try {
			Thread.sleep(1000);
		} catch (InterruptedException e) {
			e.printStackTrace();
		}
		System.out.println("i = " + i);
	}
	System.out.println("Executed AN THREAD");
	}
}
public class JoinThread {
	public static void main(String[] args) {
		Intro.print("Join function in multithreading");
		Thread ct1 = new Thread(new Counter('a'));
		Thread ct2 = new Thread(new Counter('b'));
		AnotherThread AN = new AnotherThread();
		AN.start();
		try {
			AN.join(2100); // thread name an will continue
```

```
                    // it's execution for 2100 ms then only another thread will get chance
                } catch (InterruptedException e) {
                    System.out.println(e);
                }
                ct1.start();
                ct2.start();
        }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : Join function in multithreading
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

i = 0
i = 1
a1
a2
b1
b2
b3
b4
b5
a3
a4
a5
Executed thread b
Executed thread a
i = 2
i = 3
i = 4
Executed AN THREAD
```

Program 31. Write a java program to demonstrate Multithreading using wait () & notify().

Code:

```
import myPack.*;
public class WaitAndNotify {
	public static void main(String[] args) {
		new Intro("Wait and notify method") ;
		SharedData shared = new SharedData();
		Thread proThread = new Thread(() -> {
			try {
				shared.produce("how are you");
			} catch (InterruptedException e) {
				e.printStackTrace();
			}
		});
		Thread conThread = new Thread(() -> {
			try {
				shared.consume();
			} catch (InterruptedException e) {
				e.printStackTrace();
			}
		});
		proThread.start();
		conThread.start();
	}
}

class SharedData {
	private String msg;
	private boolean isProduced = false;

	public synchronized void produce(String msg) throws InterruptedException {
		while (isProduced) {
			wait();
		}
		this.msg = msg;
		System.out.println("Produced : " + msg);
```

```
                isProduced = true;
                notify();
        }
        public synchronized void consume() throws InterruptedException {
                while (!isProduced) {
                        wait();
                }
                System.out.println("consumed : " + msg);
                isProduced = !isProduced;
                notify();
        }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : Wait and notify method
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Produced : how are you
consumed : how are you
```

Program 32. Write a java program to demonstrate The String Class & its methods.

Code:

```
import myPack.Intro;
public class StringClassAndMethod {
    public static void main(String[] args) {
        Intro.print("The String Class & its methods");
        String str = "Hello, World!";
        System.out.println("Original String: " + str);
        // Length of the string
        System.out.println("Length: " + str.length());
        // Character at a specific index
        System.out.println("Character at index 7: " + str.charAt(7));
        // Substring
        System.out.println("Substring (7, 12): " + str.substring(7, 12));
        // Replace
        String replacedStr = str.replace("World", "Java");
        System.out.println("Replaced String: " + replacedStr);
        System.out.println("Uppercase: " + str.toUpperCase());
        System.out.println("Lowercase: " + str.toLowerCase());
        // Check if string contains a sequence
        System.out.println("Contains 'Hello': " + str.contains("Hello"));
    }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : The String Class & its methods
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Original String: Hello, World!
Length: 13
Character at index 7: W
Substring (7, 12): World
Replaced String: Hello, Java!
Uppercase: HELLO, WORLD!
Lowercase: hello, world!
Contains 'Hello': true
```

Program 33. Write a java program to demonstrate StringBuffer Class & its methods.

Code:

```
import myPack.Intro;
import java.util.Scanner;
public class StringBufferDemo {
    public static void main(String[] args) {
        Intro.print("StringBuffer Class & its methods");
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter a string: ");
        String initialString = scanner.nextLine();
        StringBuffer sb = new StringBuffer(initialString);
        System.out.println("Original StringBuffer: " + sb);
        // Append
        System.out.print("Enter a string to append: ");
        String appendString = scanner.nextLine();
        sb.append(appendString);
        System.out.println("After append: " + sb);
        // Insert
        System.out.print("Enter the position to insert: ");
        int insertPosition = scanner.nextInt();
        scanner.nextLine(); // Consume newline
        System.out.print("Enter a string to insert: ");
        String insertString = scanner.nextLine();
        if (insertPosition >= 0 && insertPosition <= sb.length()) {
            sb.insert(insertPosition, insertString);
            System.out.println("After insert: " + sb);
        } else {
            System.out.println("Invalid position");
        }
        // Replace
        System.out.print("Enter start index for replace: ");
        int replaceStart = scanner.nextInt();
        System.out.print("Enter end index for replace: ");
        int replaceEnd = scanner.nextInt();
        scanner.nextLine(); // Consume newline
        System.out.print("Enter a string for replacement: ");
        String replaceString = scanner.nextLine();
```

```
        if (replaceStart >= 0 && replaceEnd <= sb.length() && replaceStart < replaceEnd) {
            sb.replace(replaceStart, replaceEnd, replaceString);
            System.out.println("After replace: " + sb);
        } else {
            System.out.println("Invalid indices");
        }
        // Delete
        System.out.print("Enter start index for delete: ");
        int deleteStart = scanner.nextInt();
        System.out.print("Enter end index for delete: ");
        int deleteEnd = scanner.nextInt();
        scanner.nextLine(); // Consume newline
        if (deleteStart >= 0 && deleteEnd <= sb.length() && deleteStart < deleteEnd) {
            sb.delete(deleteStart, deleteEnd);
            System.out.println("After delete: " + sb);
        } else {
            System.out.println("Invalid indices");
        }
        // Reverse
        sb.reverse();
        System.out.println("After reverse: " + sb);

        // Length
        System.out.println("Length: " + sb.length());
    }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : StringBuffer Class & its methods
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Enter a string: Jitendra had added some string
Original StringBuffer: Jitendra had added some string
Enter a string to append: APPENDED text
After append: Jitendra had added some stringAPPENDED text
Enter the position to insert: 10
Enter a string to insert: INSERTED texT
After insert: Jitendra hINSERTED texT ad added some stringAPPENDED text
Enter start index for replace:
14
Enter end index for replace: 17
Enter a string for replacement:
After replace: Jitendra hINSED texT ad added some stringAPPENDED text
Enter start index for delete: 5
Enter end index for delete: 8
After delete: Jiten hINSED texT ad added some stringAPPENDED text
After reverse: txet DEDNEPPAgnirts emos dedda da Txet DESNIh netiJ
Length: 51
```

Program 34. Write a java program to demonstrate various Wrapper Classes.

Code:

```
import myPack.Intro;
import java.util.Scanner;

public class WrapperClassesDemo {
    public static void main(String[] args) {
        Intro.print("Various Wrapper Classes");
        Scanner scanner = new Scanner(System.in);
        // Integer
        System.out.print("Enter an integer: ");
        int intInput = scanner.nextInt();
        Integer intObj = Integer.valueOf(intInput);
        System.out.println("Integer value: " + intObj);
        // Double
        System.out.print("Enter a double: ");
        double doubleInput = scanner.nextDouble();
        Double doubleObj = Double.valueOf(doubleInput);
        System.out.println("Double value: " + doubleObj);
        // Boolean
        System.out.print("Enter a boolean (true/false): ");
        boolean boolInput = scanner.nextBoolean();
        Boolean boolObj = Boolean.valueOf(boolInput);
        System.out.println("Boolean value: " + boolObj);
        // Character
        System.out.print("Enter a character: ");
        char charInput = scanner.next().charAt(0);
        Character charObj = Character.valueOf(charInput);
        System.out.println("Character value: " + charObj);
        // Auto-boxing
        int primitiveInt = intObj;
        double primitiveDouble = doubleObj;
        boolean primitiveBool = boolObj;
        char primitiveChar = charObj;
        System.out.println("Unboxed values: " + primitiveInt + ", " + primitiveDouble + ", " + primitiveBool +
", " + primitiveChar);
    }
```

```
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : Various Wrapper Classes
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Enter an integer: 54
Integer value: 54
Enter a double: 454.454
Double value: 454.454
Enter a boolean (true/false): false
Boolean value: false
Enter a character: c
Character value: c
Unboxed values: 54, 454.454, false, c
```

Program 35. Write a java program to demonstrate HashSet Class & its methods.

Code:

```
import myPack.Intro;
import java.util.HashSet;
import java.util.Scanner;
public class HashSetDemo {
   public static void main(String[] args) {
      Intro.print("HashSet Class & its methods");
      HashSet<String> set = new HashSet<>();
      Scanner scanner = new Scanner(System.in);
      // Adding elements
      System.out.println("Enter elements for the HashSet (type 'exit' to stop):");
      while (true) {
         String input = scanner.nextLine();
         if (input.equalsIgnoreCase("exit")) {
            break;
         }
         set.add(input);
      }
      System.out.println("HashSet: " + set);
      // Check if set contains an element
      System.out.print("Enter an element to check: ");
      String elementToCheck = scanner.nextLine();
      System.out.println("Contains '" + elementToCheck + "': " + set.contains(elementToCheck));
      // Remove an element
      System.out.print("Enter an element to remove: ");
      String elementToRemove = scanner.nextLine();
      set.remove(elementToRemove);
      System.out.println("After removing '" + elementToRemove + "': " + set);
      // Size of the set
      System.out.println("Size of HashSet: " + set.size());
      // Iterating over the elements
      System.out.println("Iterating over HashSet:");
      for (String item : set) {
         System.out.println(item);
      }
   }
```

```
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : HashSet Class & its methods
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Enter elements for the HashSet (type 'exit' to stop):
jitendra
kumar
sahu
58
59
india
exit
HashSet: [58, 59, jitendra, india, kumar, sahu]
Enter an element to check: india
Contains 'india': true
Enter an element to remove:
After removing '': [58, 59, jitendra, india, kumar, sahu]
Size of HashSet: 6
Iterating over HashSet:
58
59
jitendra
india
kumar
sahu
```

Program 36. Write a java program to demonstrate ArrayList Class & its methods.

Code:

```
import myPack.Intro;
import java.util.ArrayList;
import java.util.Scanner;
public class ArrayListDemo {
    public static void main(String[] args) {
        Intro.print("ArrayList Class & its methods");
        ArrayList<String> list = new ArrayList<>();
        Scanner scanner = new Scanner(System.in);
        // Adding elements
        System.out.println("Enter elements for the ArrayList (type 'exit' to stop):");
        while (true) {
            String input = scanner.nextLine();
            if (input.equalsIgnoreCase("exit")) {
                break;
            }
            list.add(input);
        }
        System.out.println("ArrayList: " + list);
        // Accessing elements
        System.out.print("Enter an index to access: ");
        int index = scanner.nextInt();
        scanner.nextLine(); // Consume newline
        if (index >= 0 && index < list.size()) {
            System.out.println("Element at index " + index + ": " + list.get(index));
        } else {
            System.out.println("Index out of bounds");
        }
        // Removing an element
        System.out.print("Enter an index to remove: ");
        int removeIndex = scanner.nextInt();
        scanner.nextLine(); // Consume newline
        if (removeIndex >= 0 && removeIndex < list.size()) {
            list.remove(removeIndex);
            System.out.println("After removing element at index " + removeIndex + ": " + list);
        } else {
```

```
            System.out.println("Index out of bounds");
        }
        // Size of the list
        System.out.println("Size of ArrayList: " + list.size());
        // Iterating over the elements
        System.out.println("Iterating over ArrayList:");
        for (String item : list) {
            System.out.println(item);
        }
    }
}
```

Output:

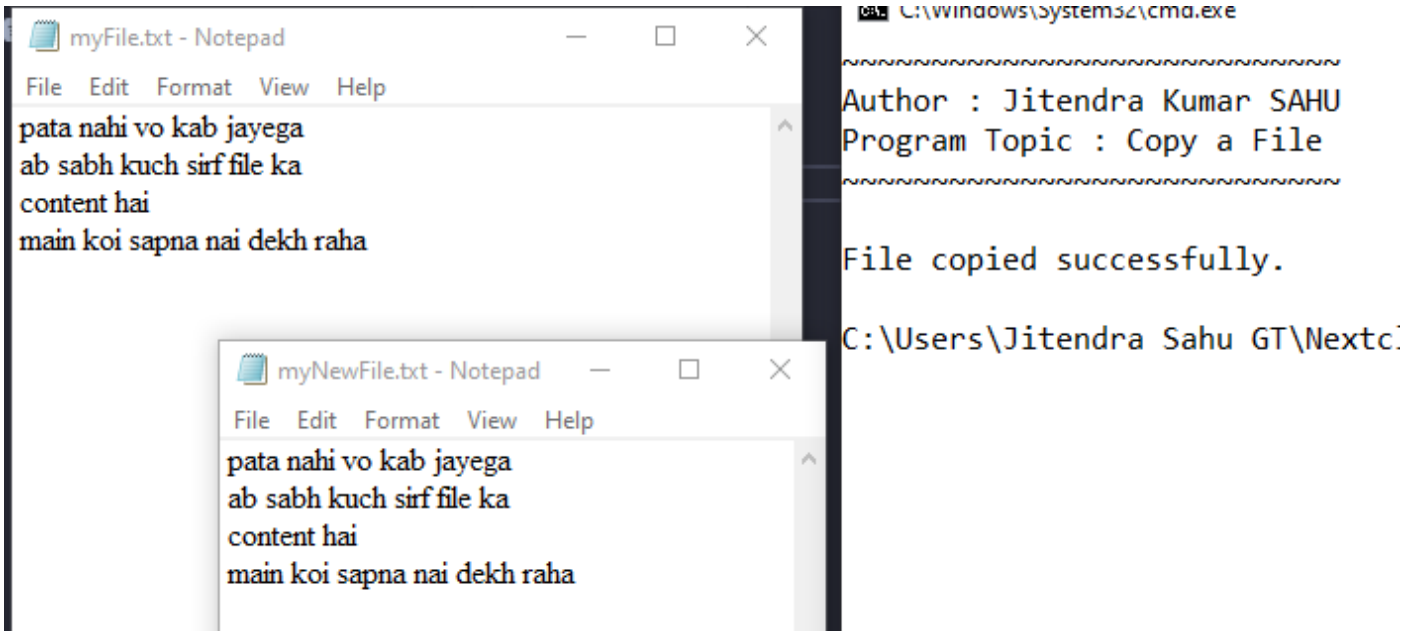
```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : ArrayList Class & its methods
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Enter elements for the ArrayList (type 'exit' to stop):
jsdf
23
dgfsdf
fdsf
jiteu
dff
jiteu
jiteu
exit
ArrayList: [jsdf, 23, dgfsdf, fdsf, jiteu, dff, jiteu, jiteu]
Enter an index to access: 1
Element at index 1: 23
Enter an index to remove: 2
After removing element at index 2: [jsdf, 23, fdsf, jiteu, dff, jiteu, jiteu]
Size of ArrayList: 7
Iterating over ArrayList:
jsdf
23
fdsf
jiteu
dff
jiteu
jiteu
```

Program 37. Write a java program to copy a File.

Code:

```
import myPack.Intro;
import java.io.*;
import java.util.Scanner;

public class FileCopyDemo {
    public static void main(String[] args) {
        Intro.print("Copy a File");
        String sourcePath = "myFile.txt" ;
        String destinationPath = "myNewFile.txt" ;
        File inputFile = new File(sourcePath);
        File outputFile = new File(destinationPath);
        try (FileInputStream fis = new FileInputStream(inputFile);
             FileOutputStream fos = new FileOutputStream(outputFile)) {
            byte[] buffer = new byte[1024];
            int length;
            while ((length = fis.read(buffer)) > 0) {
                fos.write(buffer, 0, length);
            }
            System.out.println("File copied successfully.");
        } catch (IOException e) {
            System.out.println("An error occurred: " + e.getMessage());
        }
    }
}
```

Output:


myFile.txt - Notepad
File Edit Format View Help
pata nahi vo kab jayega
ab sabh kuch sirf file ka
content hai
main koi sapna nai dekh raha
myNewFile.txt - Notepad
File Edit Format View Help
pata nahi vo kab jayega
ab sabh kuch sirf file ka
content hai
main koi sapna nai dekh raha
C:\Windows\System32\cmd.exe
Author : Jitendra Kumar SAHU
Program Topic : Copy a File
File copied successfully.
C:\Users\Jitendra Sahu GT\Nextc

Program 38. Write a java program to Count the numbers of Characters in a File.

Code:

```
import myPack.Intro;
import java.io.*;
public class CharacterCountFileDemo {
    public static void main(String[] args) {
        Intro.print("Count the numbers of Characters in a File");
        String filePath ="myFile.txt";
        File file = new File(filePath);
        int charCount = 0;
        try (FileReader fr = new FileReader(file)) {
            int character;
            while ((character = fr.read()) != -1) {
                charCount++;
            }
            System.out.println("Number of characters in the file: " + charCount);
        } catch (IOException e) {
            System.out.println("An error occurred: " + e.getMessage());
        }
    }
}
```

Output:

```
CharacterCountFileDemo
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : Count the numbers of Characters in a File
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Number of characters in the file: 94
```

Program 39. Write a java program to demonstrate Object Serialization.

Code:

```
import myPack.Intro;
import java.io.*;

class Person1 implements Serializable {
    private static final long serialVersionUID = 1L;
    String name;
    int age;
    Person1(String name, int age) {
        this.name = name;
        this.age = age;
    }
}

public class ObjectSerializationDemo {
    public static void main(String[] args) {
        Intro.print("Object Serialization");
        Person1 person = new Person1("John Doe", 30);
        try (FileOutputStream fos = new FileOutputStream("person.ser");
                ObjectOutputStream oos = new ObjectOutputStream(fos)) {
            oos.writeObject(person);
            System.out.println("Object has been serialized");

        } catch (IOException e) {
            System.out.println("An error occurred: " + e.getMessage());
        }

        try (FileInputStream fis = new FileInputStream("person.ser");
                ObjectInputStream ois = new ObjectInputStream(fis)) {
            Person1 deserializedPerson = (Person1) ois.readObject();
            System.out.println("Object has been deserialized");
            System.out.println("Name: " + deserializedPerson.name);
            System.out.println("Age: " + deserializedPerson.age);
        } catch (IOException | ClassNotFoundException e) {
            System.out.println("An error occurred: " + e.getMessage());
        }
```

```
    }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : Object Serialization
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Object has been serialized
Object has been deserialized
Name: John Doe
Age: 30
```

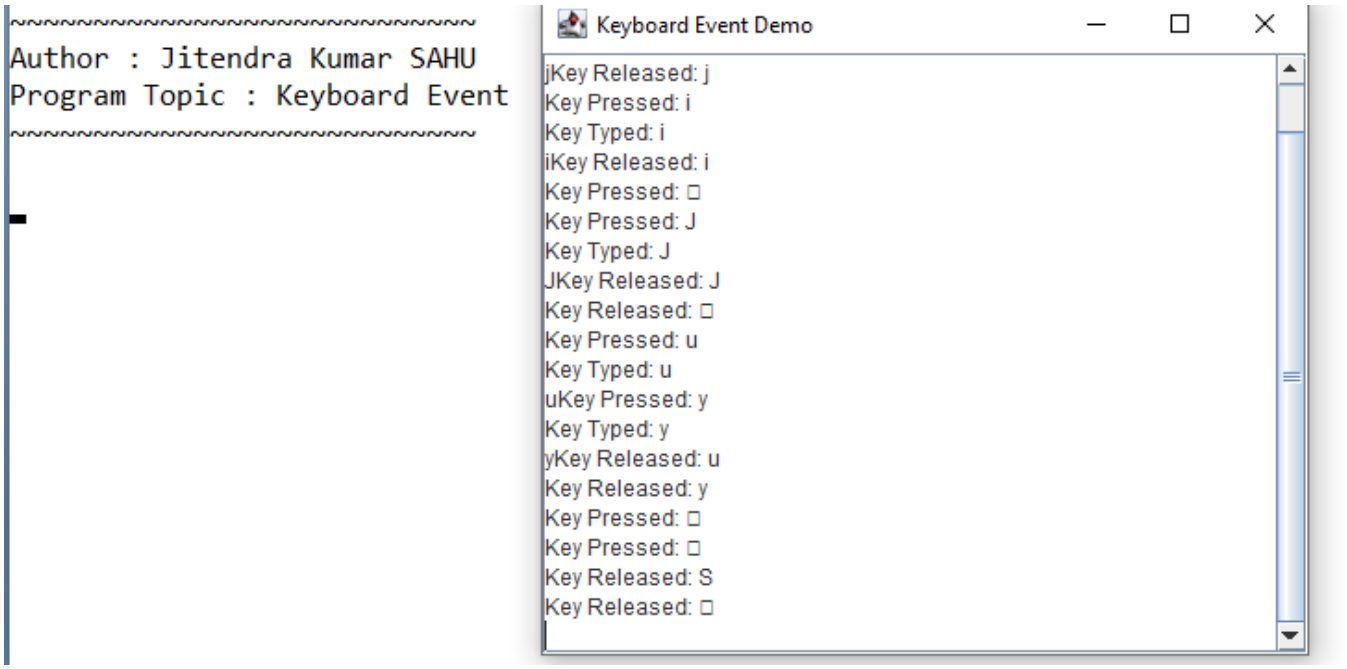
Program 40. Write a java program to demonstrate Keyboard Event.

Code:

```
import myPack.Intro;
import javax.swing.*;
import java.awt.event.KeyEvent;
import java.awt.event.KeyListener;

public class KeyboardEventDemo extends JFrame implements KeyListener {
    private JTextArea textArea;

    public KeyboardEventDemo() {
        Intro.print("Keyboard Event");

        textArea = new JTextArea();
        textArea.addKeyListener(this);

        add(new JScrollPane(textArea));
        setTitle("Keyboard Event Demo");
        setSize(400, 300);
        setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
        setVisible(true);
    }

    @Override
    public void keyTyped(KeyEvent e) {
        textArea.append("Key Typed: " + e.getKeyChar() + "\n");
    }

    @Override
    public void keyPressed(KeyEvent e) {
        textArea.append("Key Pressed: " + e.getKeyChar() + "\n");
    }

    @Override
    public void keyReleased(KeyEvent e) {
```

```
        textArea.append("Key Released: " + e.getKeyChar() + "\n");
    }

    public static void main(String[] args) {
        new KeyboardEventDemo();
    }
}
```

Output:



Program 41. Write a java program to demonstrate Mouse Event.

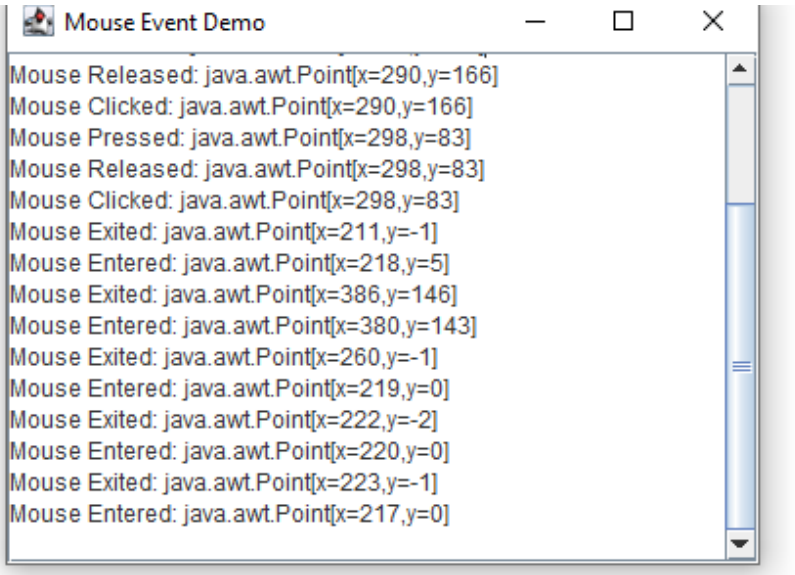
Code:

```
import myPack.Intro;
import javax.swing.*;
import java.awt.event.MouseEvent;
import java.awt.event.MouseListener;

public class MouseEventDemo extends JFrame implements MouseListener {
    private JTextArea textArea;

    public MouseEventDemo() {
        Intro.print("Mouse Event");

        textArea = new JTextArea();
        textArea.addMouseListener(this);

        add(new JScrollPane(textArea));
        setTitle("Mouse Event Demo");
        setSize(400, 300);
        setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
        setVisible(true);
    }

    @Override
    public void mouseClicked(MouseEvent e) {
        textArea.append("Mouse Clicked: " + e.getPoint() + "\n");
    }

    @Override
    public void mousePressed(MouseEvent e) {
        textArea.append("Mouse Pressed: " + e.getPoint() + "\n");
    }

    @Override
    public void mouseReleased(MouseEvent e) {
```

```
        textArea.append("Mouse Released: " + e.getPoint() + "\n");
    }
    @Override
    public void mouseEntered(MouseEvent e) {
        textArea.append("Mouse Entered: " + e.getPoint() + "\n");
    }
    @Override
    public void mouseExited(MouseEvent e) {
        textArea.append("Mouse Exited: " + e.getPoint() + "\n");
    }
    public static void main(String[] args) {
        new MouseEventDemo();
    }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : Mouse Event
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
```



Program 42. Write a java program to establish connection to the database.

Code:

```
import myPack.Intro;
import java.sql.Connection;
import java.sql.DriverManager;
import java.sql.ResultSet;
import java.sql.SQLException;
import java.sql.Statement;

public class DatabaseConnectionDemo {
   public static void main(String[] args) {
      Intro.print("Establish connection to the database");
      final String dbString = "jdbc:mysql://localhost:3306/test";
      Connection con = null;
      Statement stmt = null;
      ResultSet rset = null;
      try {
         con = DriverManager.getConnection(dbString, "root", "");
         System.out.println("Connection stablized");

         stmt = con.createStatement();
         String query = "select id , sname from student ";
         rset = stmt.executeQuery(query);

         while (rset.next()) {
            System.out.println("id : " + rset.getInt("id") + " name : " + rset.getString("sname"));
         }

      } catch (SQLException e) {
         e.printStackTrace();
      } finally {
         try {
            if (rset != null) rset.close();
            if (stmt != null) stmt.close();
            if (con != null) con.close();
         } catch (SQLException e) {
            e.printStackTrace();
```

```
        }
      }
    }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : Establish connection to the database
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Connection stablized
id : 1 name : Jitendra
id : 2 name : Ravindra
```

Program 43. Write a java program to create a table named employee with fields as emp_id, emp_name, age, dept.

Code:

```
import myPack.Intro ;
import java.sql.Statement ;
import java.sql.Connection ;
import java.sql.SQLException ;
import java.sql.DriverManager ;

public class CreateEmployeeTable {
   public static void main(String[] args) {
                new Intro("create employee table in db") ;
      final String dbUrl = "jdbc:mysql://localhost/test" ;
                final String username = "root" ;
                final String password = "" ;

                try(Connection con = DriverManager.getConnection(dbUrl,username,password) ){
                        Statement stmt = con.createStatement() ;
                        String sql = "create TABLE employee(emp_id int(2), emp_name varchar(15),age
int(2), dept varchar(20))" ;
                        stmt.execute(sql) ;
                        System.out.println("Table created!\n") ;
                }catch(SQLException e){
                        e.printStackTrace() ;
                }
   }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : create employee table in db
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Table created!
```

Program 44. Write a java program to create a table and drop it.

Code:

```
import myPack.Intro;
import java.sql.Statement;
import java.sql.Connection;
import java.sql.SQLException;
import java.sql.DriverManager;
import java.util.Scanner;

public class CreateAndDropTable {
	public static void main(String[] args) {
		new Intro("create and delete a table in db");
		final String dbUrl = "jdbc:mysql://192.168.1.43/test";
		final String username = "root";
		final String password = "root";
		Scanner sc = new Scanner(System.in);
		try (Connection con = DriverManager.getConnection(dbUrl, username, password)) {
			Statement stmt = con.createStatement();
			String sql_createTable = "create TABLE temp(id int(2), tname varchar(15))";
			String sql_dropTable = "drop TABLE temp";
			stmt.execute(sql_createTable);
			System.out.println("Table created!\n");
			System.out.println("Enter to delete table!\n");
			sc.nextLine();
			stmt.execute(sql_dropTable);
			System.out.println("Table Dropped!\n");
		} catch (SQLException e) {
			e.printStackTrace();
		}
	}
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : create and delete a table in db
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Table created!

Enter to delete table!


Table Dropped!
```

Below DBconfig Class is used in following several classes that deals with database connection.

DBconfig.java

```
package jkdatabase;
public class DBconfig {
    static String db_name = "test" ;
    public static final String dbString = "jdbc:mysql://192.168.30.128:3306/"+db_name;
    public static final String username = "root";
    public static final String password = "root";
}
```

Program 45. Write a java program to insert multiple rows in a table using prepared statement.

Code:

```
import myPack.Intro;
import java.sql.Connection;
import java.sql.DriverManager;
import java.sql.ResultSet;
import java.sql.SQLException;
import java.sql.Statement;
import java.sql.PreparedStatement;
import jkdatabase.DBconfig;
public class InsertMultipleWithPrepare {
   public static void main(String[] args) {
      Intro.print("Multiple Insert Using Prepare Statement");
      Statement stmt = null;
      ResultSet rset = null;
      try (Connection con = DriverManager.getConnection(DBconfig.dbString, DBconfig.username,
DBconfig.password)) {
         String insertQuery = "insert into employee (emp_id, emp_name, age , dept) values (?,?,?,?)";
         PreparedStatement prepStmt = con.prepareStatement(insertQuery);
          System.out.println("connection established!");
          con.setAutoCommit(false);
          prepStmt.setString(1, "1");
          prepStmt.setString(2, "Jitendra Sahu");
          prepStmt.setString(3, "21");
          prepStmt.setString(4, "CS&IT");
          prepStmt.addBatch();
          prepStmt.setString(1, "2");
          prepStmt.setString(2, "Mohan Markam");
          prepStmt.setString(3, "26");
          prepStmt.setString(4, "Social");
          prepStmt.addBatch();
          prepStmt.setString(1, "3");
          prepStmt.setString(2, "Kanhaiya");
          prepStmt.setString(3, "41");
          prepStmt.setString(4, "LibraryScience");
          prepStmt.addBatch();
```

```
            int[] affectedRecords = prepStmt.executeBatch();
            con.commit();
            System.out.println("Rows inserted : " + affectedRecords.length);
        } catch (SQLException e) {
            e.printStackTrace();
        } finally {
            try {
                if (rset != null) rset.close();
                if (stmt != null) stmt.close();
            } catch (SQLException e) {
                e.printStackTrace();
            }
        }
    }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : Multiple Insert Using Prepare Statement
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

connection established!
Rows inserted : 3
```

Program 46. Write a java program to display contents of a table on the console.

Code:

DisplayTableContentToConsole.java

```
import java.sql.SQLException;
import java.sql.Connection;
import java.sql.DriverManager;
import java.sql.ResultSet;
import java.sql.Statement;
import jkdatabase.DBconfig;
// import java.sql.
import myPack.Intro;

public class DisplayTableContentToConsole {
   public static void main(String[] args) {
      Intro.print("Display table content to console");
      Statement stmt = null;
      ResultSet rset = null;
      try (Connection con = DriverManager.getConnection(DBconfig.dbString, DBconfig.username,
DBconfig.password)) {
         System.out.println("Connection stabilized");
         stmt = con.createStatement();
         String sql = "select * from employee";
         rset = stmt.executeQuery(sql);

         int i = 1;
         System.out.println("Employee table data : ");
         while (rset.next()) {
            int emp_id = rset.getInt(1);
            String name = rset.getString(2);
            int age = rset.getInt(3);
            String dept = rset.getString(4);
            System.out.printf("row %d : %d\t%s\t%d\t%s\n", i++, emp_id, name, age, dept);
         }

      } catch (SQLException e) {
         e.printStackTrace();
      } finally {
```

```
        try {
            if (rset != null)rset.close();
            if (stmt != null)stmt.close();
        } catch (SQLException e) {
            e.printStackTrace();
        }
    }
  }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : Display table content to console
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Connection stabilized
Employee table data :
row 1 : 1       Jitendra Sahu   21      CS&IT
row 2 : 2       Mohan Markam    26      Social
row 3 : 3       Kanhaiya        41      LibraryScience
```

Program 47. Write a java program to update rows using result set.

Code:

```
import java.sql.SQLException;
import java.sql.Connection;
import java.sql.DriverManager;
import java.sql.ResultSet;
import java.sql.Statement;
import java.util.Scanner;

import jkdatabase.DBconfig;
// import java.sql.
import myPack.Intro;

public class UpdateTableUsingResultSet {
   public static void main(String[] args) {
      Intro.print("Update row using ResultSet");
      Statement stmt = null;
      ResultSet rset = null;
      try (Connection con = DriverManager.getConnection(DBconfig.dbString, DBconfig.username,
DBconfig.password)) {
         System.out.println("Connection stabilized");
         stmt = con.createStatement(
               ResultSet.TYPE_SCROLL_INSENSITIVE,
               ResultSet.CONCUR_UPDATABLE);
         String sql = "select * from employee";
         rset = stmt.executeQuery(sql);

         int i = 1;
         System.out.println("Employee table data before update : ");
         while (rset.next()) {
            int emp_id = rset.getInt(1);
            String name = rset.getString(2);
            int age = rset.getInt(3);
            String dept = rset.getString(4);
            System.out.printf("row %d : %d\t%s\t%d\t%s\n", i++, emp_id, name, age, dept);
         }
         // update starts from here
```

```
        Scanner sc = new Scanner(System.in);
        System.out.println("|\nEnter name for id = 2");
        String newName = sc.nextLine();
        // re-initialize rset so it again point to starting record
        rset  = stmt.executeQuery(sql) ;
        System.out.println("Employee table data after update : ");
        i = 1 ;
        while (rset.next()) {
           int emp_id = rset.getInt(1);
           if (emp_id == 2){
              rset.updateString("emp_name",newName) ;
              rset.updateRow();
           }
           String name = rset.getString(2);
           int age = rset.getInt(3);
           String dept = rset.getString(4);
           System.out.printf("row %d : %d\t%s\t%d\t%s\n", i++, emp_id, name, age, dept);
        }
     } catch (SQLException e) {
        e.printStackTrace();
     } finally {
        try {
           if (rset != null)
              rset.close();
           if (stmt != null)
              stmt.close();
        } catch (SQLException e) {
           e.printStackTrace();
        }
     }
  }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : Update row using ResultSet
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Connection stabilized
Employee table data before update :
row 1 : 1       Jitendra Sahu   21      CS&IT
row 2 : 2       Mohan Markam    26      Social
row 3 : 3       Kanhaiya        41      LibraryScience

Enter name for id = 2
Ravi Vishal
Employee table data after update :
row 1 : 1       Jitendra Sahu   21      CS&IT
row 2 : 2       Ravi Vishal     26      Social
row 3 : 3       Kanhaiya        41      LibraryScience
```

Program 48. Write a java program to describe the functions of metadata objects. (resultset & database)

Code:

```
import java.sql.Connection;
import java.sql.DatabaseMetaData;
import java.sql.DriverManager;
import java.sql.ResultSet;
import java.sql.ResultSetMetaData;
import java.sql.SQLException;
import java.sql.Statement;
import jkdatabase.DBconfig ;
import myPack.Intro;
public class DBMetadataExample {

   // JDBC URL, username, and password of MySQL server
   public static void main(String[] args) {
      new Intro("printing database metadata");
      Connection connection = null;
      Statement statement = null;
      ResultSet resultSet = null;

      try {
         // Establish the connection
         connection = DriverManager.getConnection(DBconfig.dbString, DBconfig.username,
DBconfig.password);

         // Get DatabaseMetaData
         DatabaseMetaData dbMetaData = connection.getMetaData();

         // Print general database information
         System.out.println("Database Product Name: " + dbMetaData.getDatabaseProductName());
         System.out.println("Database Product Version: " + dbMetaData.getDatabaseProductVersion());
         System.out.println("Database URL: " + dbMetaData.getURL());
         System.out.println("Database User: " + dbMetaData.getUserName());

         // Print tables in the database
         ResultSet tables = dbMetaData.getTables(null, null, "%", new String[]{"TABLE"});
```

```
            System.out.println("\nTables in the database:");
            // while (tables.next()) {
            //     System.out.println(tables.getString("emp_id"));
            // }

            // Create a statement to execute a query
            statement = connection.createStatement();
            resultSet = statement.executeQuery("SELECT * FROM employee");

            // Get ResultSetMetaData
            ResultSetMetaData rsMetaData = resultSet.getMetaData();

            // Print column information
            int columnCount = rsMetaData.getColumnCount();
            System.out.println("\nColumns in the Employee table:");
            for (int i = 1; i <= columnCount; i++) {
                System.out.println("Column " + i + ": " + rsMetaData.getColumnName(i) + " - " +
rsMetaData.getColumnTypeName(i));
            }

        } catch (SQLException e) {
            e.printStackTrace();
        } finally {
            // Close resources in reverse order of their creation
            try {
                if (resultSet != null) resultSet.close();
                if (statement != null) statement.close();
                if (connection != null) connection.close();
            } catch (SQLException e) {
                e.printStackTrace();
            }
        }
    }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : printing database metadata
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Database Product Name: MySQL
Database Product Version: 5.5.5-10.4.6-MariaDB
Database URL: jdbc:mysql://192.168.40.102:3306/test
Database User: root@192.168.40.227

Tables in the database:

Columns in the Employee table:
Column 1: emp_id - INT
Column 2: emp_name - VARCHAR
Column 3: age - INT
Column 4: dept - VARCHAR
```

Program 49. Write a java program to demonstrate the ArrayList class.

Code:

```
import myPack.Intro;
import java.util.ArrayList;
import java.util.Scanner;
public class ArrayListDemo {
    public static void main(String[] args) {
        Intro.print("ArrayList Class & its methods");
        ArrayList<String> list = new ArrayList<>();
        Scanner scanner = new Scanner(System.in);
        // Adding elements
        System.out.println("Enter elements for the ArrayList (type 'exit' to stop):");
        while (true) {
            String input = scanner.nextLine();
            if (input.equalsIgnoreCase("exit")) {
                break;
            }
            list.add(input);
        }
        System.out.println("ArrayList: " + list);
        // Accessing elements
        System.out.print("Enter an index to access: ");
        int index = scanner.nextInt();
        scanner.nextLine(); // Consume newline
        if (index >= 0 && index < list.size()) {
            System.out.println("Element at index " + index + ": " + list.get(index));
        } else {
            System.out.println("Index out of bounds");
        }
        // Removing an element
        System.out.print("Enter an index to remove: ");
        int removeIndex = scanner.nextInt();
        scanner.nextLine(); // Consume newline
        if (removeIndex >= 0 && removeIndex < list.size()) {
            list.remove(removeIndex);
            System.out.println("After removing element at index " + removeIndex + ": " + list);
        } else {
```

```
            System.out.println("Index out of bounds");
        }
        // Size of the list
        System.out.println("Size of ArrayList: " + list.size());
        // Iterating over the elements
        System.out.println("Iterating over ArrayList:");
        for (String item : list) {
            System.out.println(item);
        }
    }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : ArrayList Class & its methods
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Enter elements for the ArrayList (type 'exit' to stop):
jsdf
23
dgfsdf
fdsf
jiteu
dff
jiteu
jiteu
exit
ArrayList: [jsdf, 23, dgfsdf, fdsf, jiteu, dff, jiteu, jiteu]
Enter an index to access: 1
Element at index 1: 23
Enter an index to remove: 2
After removing element at index 2: [jsdf, 23, fdsf, jiteu, dff, jiteu, jiteu]
Size of ArrayList: 7
Iterating over ArrayList:
jsdf
23
fdsf
jiteu
dff
jiteu
jiteu
```

Program 50. Write a java program to demonstrate the HashSet class.

Code:

```
import myPack.Intro;
import java.util.HashSet;
import java.util.Scanner;

public class HashSetDemo2 {
    public static void main(String[] args) {
        Intro.print("HashSet Class & its methods");

        HashSet<String> set = new HashSet<>();

        Scanner scanner = new Scanner(System.in);

        // Adding elements
        System.out.println("Enter elements for the HashSet (type 'exit' to stop):");
        while (true) {
            String input = scanner.nextLine();
            if (input.equalsIgnoreCase("exit")) {
                break;
            }
            set.add(input);
        }

        System.out.println("HashSet: " + set);

        // Check if set contains an element
        System.out.print("Enter an element to check: ");
        String elementToCheck = scanner.nextLine();
        System.out.println("Contains '" + elementToCheck + "': " + set.contains(elementToCheck));
        // Remove an element
        System.out.print("Enter an element to remove: ");
        String elementToRemove = scanner.nextLine();
        set.remove(elementToRemove);
        System.out.println("After removing '" + elementToRemove + "': " + set);
        // Size of the set
        System.out.println("Size of HashSet: " + set.size());
```

```
        // Iterating over the elements
        System.out.println("Iterating over HashSet:");
        for (String item : set) {
            System.out.println(item);
        }
    }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : HashSet Class & its methods
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Enter elements for the HashSet (type 'exit' to stop):
jks
mks
jks
12
25
jks
12
exit
HashSet: [12, jks, 25, mks]
Enter an element to check: dks
Contains 'dks': false
Enter an element to remove: 25
After removing '25': [12, jks, mks]
Size of HashSet: 3
Iterating over HashSet:
12
jks
mks
```

Program 51. Write a java program to demonstrate the HashMap class.

Code:

```
import myPack.Intro;
import java.util.HashMap;
import java.util.Map;
import java.util.Scanner;

public class HashMapDemo {
    public static void main(String[] args) {
        Intro.print("HashMap Class & its methods");

        HashMap<String, Integer> map = new HashMap<>();
        Scanner scanner = new Scanner(System.in);

        // Adding elements
        System.out.println("Enter elements for the HashMap (key-value pairs, type 'exit' to stop):");
        while (true) {
            System.out.print("Enter key: ");
            String key = scanner.nextLine();
            if (key.equalsIgnoreCase("exit")) {
                break;
            }
            System.out.print("Enter value: ");
            int value = scanner.nextInt();
            scanner.nextLine(); // Consume newline
            map.put(key, value);
        }
        System.out.println("HashMap: " + map);
        // Accessing a value
        System.out.print("Enter a key to get its value: ");
        String keyToGet = scanner.nextLine();
        if (map.containsKey(keyToGet)) {
            System.out.println("Value for key '" + keyToGet + "': " + map.get(keyToGet));
        } else {
            System.out.println("Key not found");
        }
```

```
        // Removing an element
        System.out.print("Enter a key to remove: ");
        String keyToRemove = scanner.nextLine();
        map.remove(keyToRemove);
        System.out.println("After removing key '" + keyToRemove + "': " + map);
        // Size of the map
        System.out.println("Size of HashMap: " + map.size());
        // Iterating over the elements
        System.out.println("Iterating over HashMap:");
        for (Map.Entry<String, Integer> entry : map.entrySet()) {
            System.out.println("Key: " + entry.getKey() + ", Value: " + entry.getValue());
        }
    }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : HashMap Class & its methods
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Enter elements for the HashMap (key-value pairs, type 'exit' to stop):
Enter key: 1
Enter value: 222
Enter key: 2
Enter value: 333
Enter key: 3
Enter value: 444
Enter key: 4
Enter value: 555
Enter key: exit
HashMap: {1=222, 2=333, 3=444, 4=555}
Enter a key to get its value: 3
Value for key '3': 444
Enter a key to remove: 1
After removing key '1': {2=333, 3=444, 4=555}
Size of HashMap: 3
Iterating over HashMap:
Key: 2, Value: 333
Key: 3, Value: 444
Key: 4, Value: 555
```

Program 52. Write a java program to demonstrate the Vector class.

Code:

```
import myPack.Intro;
import java.util.Vector;
import java.util.Scanner;

public class VectorDemo {
    public static void main(String[] args) {
        Intro.print("Vector class demonstration");

        Vector<String> vector = new Vector<>();
        Scanner scanner = new Scanner(System.in);
         System.out.println("Menu:");
            System.out.println("1. Add element");
            System.out.println("2. Display elements");
            System.out.println("3. Exit");
        while (true) {

            System.out.print(">> ");

            int choice = scanner.nextInt();
            scanner.nextLine();  // Consume newline

            switch (choice) {
                case 1:
                    System.out.print("Enter element to add: ");
                    String element = scanner.nextLine();
                    vector.add(element);
                    break;
                case 2:
                    System.out.println("Vector Elements:");
                    for (String elem : vector) {
                        System.out.println(elem);
                    }
                    break;
                case 3:
                    System.out.println("Exiting...");
```

```
                scanner.close();
                return;
            default:
                System.out.println("Invalid choice. Please try again.");
        }
    }
  }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : Vector class demonstration
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Menu:
1. Add element
2. Display elements
3. Exit
>> 1
Enter element to add: 23
>> 1
Enter element to add: 34
>> 1
Enter element to add: 56
>> 1
Enter element to add: 789
>> 1
Enter element to add: 89
>> 2
Vector Elements:
23
34
56
789
89
>> 3
Exiting...
```

Program 53. Write a java program to demonstrate the LinkedList class.

Code:

```
import myPack.Intro;
import java.util.LinkedList;
import java.util.Scanner;
public class LinkedListDemo {
   public static void main(String[] args) {
      Intro.print("LinkedList Class & its methods");

      LinkedList<String> linkedList = new LinkedList<>();
      Scanner scanner = new Scanner(System.in);
      // Adding elements
      System.out.println("Enter elements for the LinkedList (type 'exit' to stop):");
      while (true) {
         String input = scanner.nextLine();
         if (input.equalsIgnoreCase("exit")) {
            break;
         }
         linkedList.add(input);
      }
      System.out.println("LinkedList: " + linkedList);

      // Adding element at the first position
      System.out.print("Enter an element to add at the first position: ");
      String firstElement = scanner.nextLine();
      linkedList.addFirst(firstElement);
      System.out.println("After adding at the first position: " + linkedList);
      // Adding element at the last position
      System.out.print("Enter an element to add at the last position: ");
      String lastElement = scanner.nextLine();
      linkedList.addLast(lastElement);
      System.out.println("After adding at the last position: " + linkedList);
      // Accessing elements
      System.out.print("Enter an index to access: ");
      int index = scanner.nextInt();
      scanner.nextLine(); // Consume newline
      if (index >= 0 && index < linkedList.size()) {
```

```
            System.out.println("Element at index " + index + ": " + linkedList.get(index));
        } else {
            System.out.println("Index out of bounds");
        }
        // Removing an element
        System.out.print("Enter an index to remove: ");
        int removeIndex = scanner.nextInt();
        scanner.nextLine(); // Consume newline
        if (removeIndex >= 0 && removeIndex < linkedList.size()) {
            linkedList.remove(removeIndex);
            System.out.println("After removing element at index " + removeIndex + ": " + linkedList);
        } else {
            System.out.println("Index out of bounds");
        }
        // Size of the LinkedList
        System.out.println("Size of LinkedList: " + linkedList.size());
        // Iterating over the elements
        System.out.println("Iterating over LinkedList:");
        for (String item : linkedList) {
            System.out.println(item);
        }
    }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : LinkedList Class & its methods
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Enter elements for the LinkedList (type 'exit' to stop):

12
23
23
45
465
445
exit
LinkedList: [, 12, 23, 23, 45, 465, 445]
Enter an element to add at the first position: 1111
After adding at the first position: [1111, , 12, 23, 23, 45, 465, 445]
Enter an element to add at the last position: 9999
After adding at the last position: [1111, , 12, 23, 23, 45, 465, 445, 9999]
Enter an index to access: 2
Element at index 2: 12
Enter an index to remove: 1
After removing element at index 1: [1111, 12, 23, 23, 45, 465, 445, 9999]
Size of LinkedList: 8
Iterating over LinkedList:
1111
12
23
23
45
465
445
9999
```

Program 54. Write a java program to demonstrate the JTextField class.

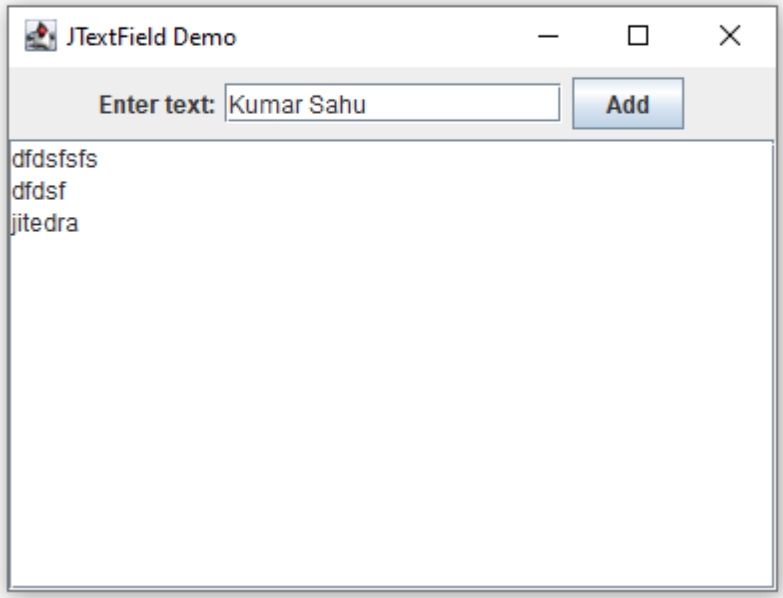
Code:

```
import myPack.Intro;
import javax.swing.*;
import java.awt.*;
import java.awt.event.ActionEvent;
import java.awt.event.ActionListener;
public class JTextFieldDemo extends JFrame {
    private JTextField inputField;
    private JTextArea displayArea;
    public JTextFieldDemo() {
        Intro.print("JTextField demonstration");
        setTitle("JTextField Demo");
        setSize(400, 300);
        setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
        setLayout(new BorderLayout());
        JPanel inputPanel = new JPanel();
        inputPanel.setLayout(new FlowLayout());
        JLabel inputLabel = new JLabel("Enter text:");
        inputPanel.add(inputLabel);
        inputField = new JTextField(15);
        inputPanel.add(inputField);
        JButton addButton = new JButton("Add");
        inputPanel.add(addButton);
        add(inputPanel, BorderLayout.NORTH);
        displayArea = new JTextArea();
        displayArea.setEditable(false);
        add(new JScrollPane(displayArea), BorderLayout.CENTER);
        addButton.addActionListener(new ActionListener() {
            @Override
            public void actionPerformed(ActionEvent e) {
                String text = inputField.getText();
                if (!text.isEmpty()) {
                    displayArea.append(text + "\n");
                    inputField.setText("");
                }
            }
```

```
        });
        setVisible(true);
    }
    public static void main(String[] args) {
        new JTextFieldDemo();
    }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : JTextField demonstration
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
```



Program 55. Write a java program to demonstrate the JButton class.

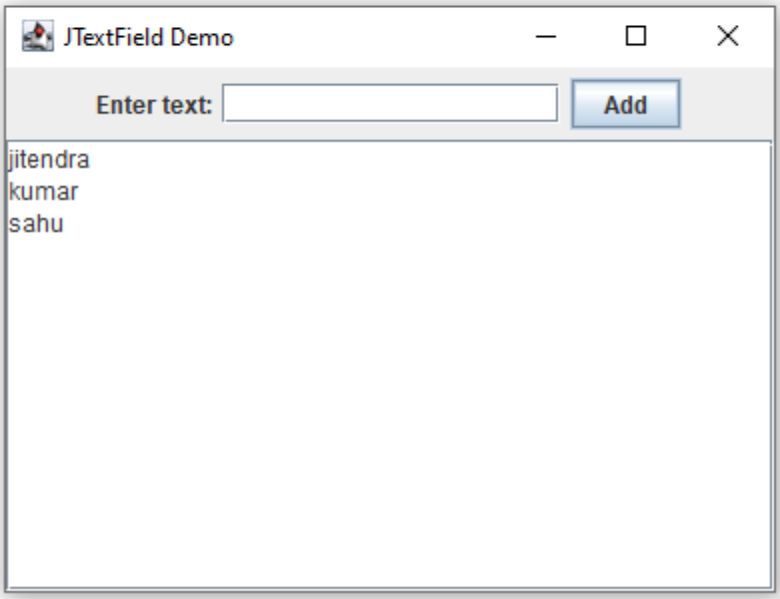
Code:

```
import myPack.Intro;
import javax.swing.*;
import java.awt.*;
import java.awt.event.ActionEvent;
import java.awt.event.ActionListener;
public class JButtonDemo extends JFrame {
    private JTextField inputField;
    private JTextArea displayArea;
    public JButtonDemo() {
        Intro.print("JButton demonstration");
        setTitle("JTextField Demo");
        setSize(400, 300);
        setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
        setLayout(new BorderLayout());
        JPanel inputPanel = new JPanel();
        inputPanel.setLayout(new FlowLayout());
        JLabel inputLabel = new JLabel("Enter text:");
        inputPanel.add(inputLabel);
        inputField = new JTextField(15);
        inputPanel.add(inputField);
        JButton addButton = new JButton("Add");
        inputPanel.add(addButton);
        add(inputPanel, BorderLayout.NORTH);
        displayArea = new JTextArea();
        displayArea.setEditable(false);
        add(new JScrollPane(displayArea), BorderLayout.CENTER);
        addButton.addActionListener(new ActionListener() {
            @Override
            public void actionPerformed(ActionEvent e) {
                String text = inputField.getText();
                if (!text.isEmpty()) {
                    displayArea.append(text + "\n");
                    inputField.setText("");
                }
            }
```

```
        });
        setVisible(true);
    }
    public static void main(String[] args) {
        new JButtonDemo();
    }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : JButton demonstration
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
```



Program 56. Write a java program to demonstrate the JToggleButton class.

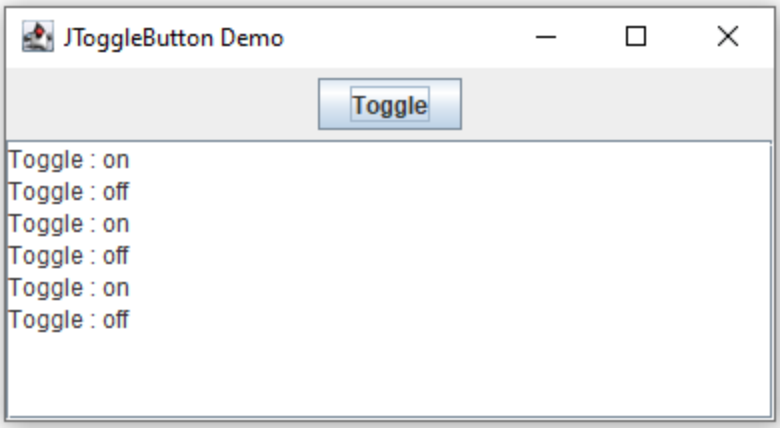
Code:

```
import myPack.Intro;
import javax.swing.*;
import java.awt.*;
import java.awt.event.ActionEvent;
import java.awt.event.ActionListener;
public class JToggleButtonDemo extends JFrame {
   private JTextArea displayArea;
   private JToggleButton toggleButton;
   public JToggleButtonDemo() {
      Intro.print("JToggleButton");
      setTitle("JToggleButton Demo");
      setSize(400, 300);
      setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
      setLayout(new BorderLayout());
      JPanel inputPanel = new JPanel();
      inputPanel.setLayout(new FlowLayout());
      toggleButton = new JToggleButton("Toggle");
      inputPanel.add(toggleButton);
      add(inputPanel, BorderLayout.NORTH);
      displayArea = new JTextArea();
      displayArea.setEditable(false);
      add(new JScrollPane(displayArea), BorderLayout.CENTER);
      toggleButton.addActionListener(new ActionListener() {
         @Override
         public void actionPerformed(ActionEvent e) {
            if (toggleButton.isSelected())
               displayArea.append("Toggle : on\n");
            else
               displayArea.append("Toggle : off\n") ;
         }
      });
      setVisible(true);
   }
   public static void main(String[] args) {
      new JToggleButtonDemo();
```

```
    }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : JToggleButton
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
```



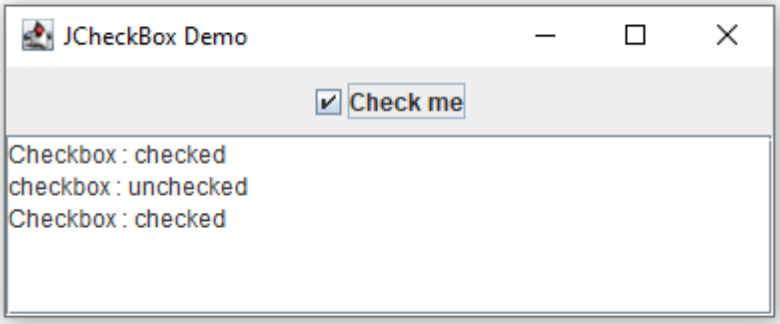
Program 57. Write a java program to demonstrate the JCheckbox class.

Code:

```
import myPack.Intro;
import javax.swing.*;
import java.awt.*;
import java.awt.event.ActionEvent;
import java.awt.event.ActionListener;
public class JCheckBoxDemo extends JFrame {
   private JTextArea displayArea;
   private JCheckBox checkBox;
   public JCheckBoxDemo() {
      Intro.print("JCheckBox");
      setTitle("JCheckBox Demo");
      setSize(400, 300);
      setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
      setLayout(new BorderLayout());
      JPanel inputPanel = new JPanel();
      inputPanel.setLayout(new FlowLayout());
      checkBox = new JCheckBox("Check me");
      inputPanel.add(checkBox);
      add(inputPanel, BorderLayout.NORTH);
      displayArea = new JTextArea();
      displayArea.setEditable(false);
      add(new JScrollPane(displayArea), BorderLayout.CENTER);
      checkBox.addActionListener(new ActionListener(){
         @Override
         public void actionPerformed(ActionEvent e){
            if (checkBox.isSelected()) displayArea.append("Checkbox : checked\n") ;
            else displayArea.append("checkbox : unchecked\n") ;
         }
      }) ;
      setVisible(true);
   }
   public static void main(String[] args) {
      new JCheckBoxDemo();
   }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : JCheckBox
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
```



Program 58. Write a java program to demonstrate the JRadioButton class.

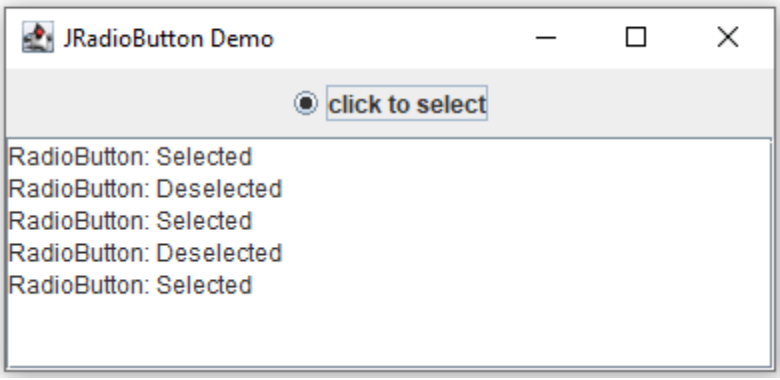
Code:

```
import myPack.Intro;
import javax.swing.*;
import java.awt.*;
import java.awt.event.ActionEvent;
import java.awt.event.ActionListener;
public class JRadioButtonDemo extends JFrame {
   private JTextArea displayArea;
   private JRadioButton radioButton;
   public JRadioButtonDemo() {
      Intro.print("JRadioButton");
      setTitle("JRadioButton Demo");
      setSize(400, 300);
      setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
      setLayout(new BorderLayout());
      JPanel inputPanel = new JPanel();
      inputPanel.setLayout(new FlowLayout());
      radioButton = new JRadioButton("click to select");
      inputPanel.add(radioButton);
      add(inputPanel, BorderLayout.NORTH);
      displayArea = new JTextArea();
      displayArea.setEditable(false);
      add(new JScrollPane(displayArea), BorderLayout.CENTER);
      radioButton.addActionListener(new ActionListener() {
         @Override
         public void actionPerformed(ActionEvent e) {
            if (radioButton.isSelected()) {
               displayArea.append("RadioButton: Selected\n");
            } else {
               displayArea.append("RadioButton: Deselected\n");
            }
         }
      });
      setVisible(true);
   }
```

```
    public static void main(String[] args) {
        new JRadioButtonDemo();
    }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : JRadioButton
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
```



Program 59. Write a java program to demonstrate the JComboBox class.

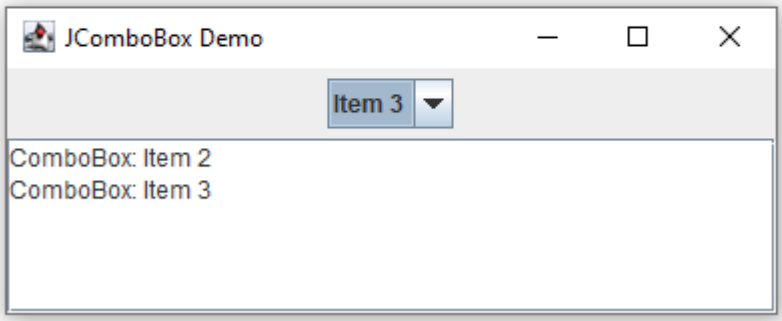
Code:

```
import myPack.Intro;
import javax.swing.*;
import java.awt.*;
import java.awt.event.ActionEvent;
import java.awt.event.ActionListener;
public class JComboBoxDemo extends JFrame {
   private JTextArea displayArea;
   private JComboBox<String> comboBox ;
   public JComboBoxDemo() {
      Intro.print("JComboBox");
      setTitle("JComboBox Demo");
      setSize(400, 300);
      setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
      setLayout(new BorderLayout());
      JPanel inputPanel = new JPanel();
      inputPanel.setLayout(new FlowLayout());
      String[] comboBoxItems ={"Item 1", "Item 2", "Item 3"};
      comboBox = new JComboBox<> (comboBoxItems);
      inputPanel.add(comboBox);
      add(inputPanel, BorderLayout.NORTH);
      displayArea = new JTextArea();
      displayArea.setEditable(false);
      add(new JScrollPane(displayArea), BorderLayout.CENTER);
      comboBox.addActionListener(new ActionListener() {
         @Override
         public void actionPerformed(ActionEvent e) {
            displayArea.append("ComboBox: " + comboBox.getSelectedItem() + "\n");
         }
      });
      setVisible(true);
   }
```

```
    public static void main(String[] args) {
        new JComboBoxDemo();
    }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : JComboBox
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
```



Program 60. Write a java program to demonstrate the JList class.

Code:

```
import myPack.Intro;
import javax.swing.*;
import java.awt.*;

public class JListDemo extends JFrame {
    private JTextArea displayArea;
    private JList<String> list;
    public JListDemo() {
        Intro.print("JList");
        setTitle("JList Demo");
        setSize(400, 300);
        setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
        setLayout(new BorderLayout());
        JPanel inputPanel = new JPanel();
        inputPanel.setLayout(new FlowLayout());
        String[] listItems = {"Item A", "Item B", "Item C"};
        list = new JList<>(listItems);
        list.setSelectionMode(ListSelectionModel.SINGLE_SELECTION);
        JScrollPane listScrollPane = new JScrollPane(list);
         listScrollPane.setPreferredSize(new Dimension(100, 60));
        inputPanel.add(listScrollPane);
        add(inputPanel, BorderLayout.NORTH);

        displayArea = new JTextArea();
        displayArea.setEditable(false);
        add(new JScrollPane(displayArea), BorderLayout.CENTER);

        list.addListSelectionListener(e -> {
            if (!e.getValueIsAdjusting()) {
                displayArea.append("List: " + list.getSelectedValue() + "\n");
            }
        });
        setVisible(true);
    }
```

```
    public static void main(String[] args) {
        new JListDemo();
    }
}
```

Output:

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Author : Jitendra Kumar SAHU
Program Topic : JList
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
```