Practical 1

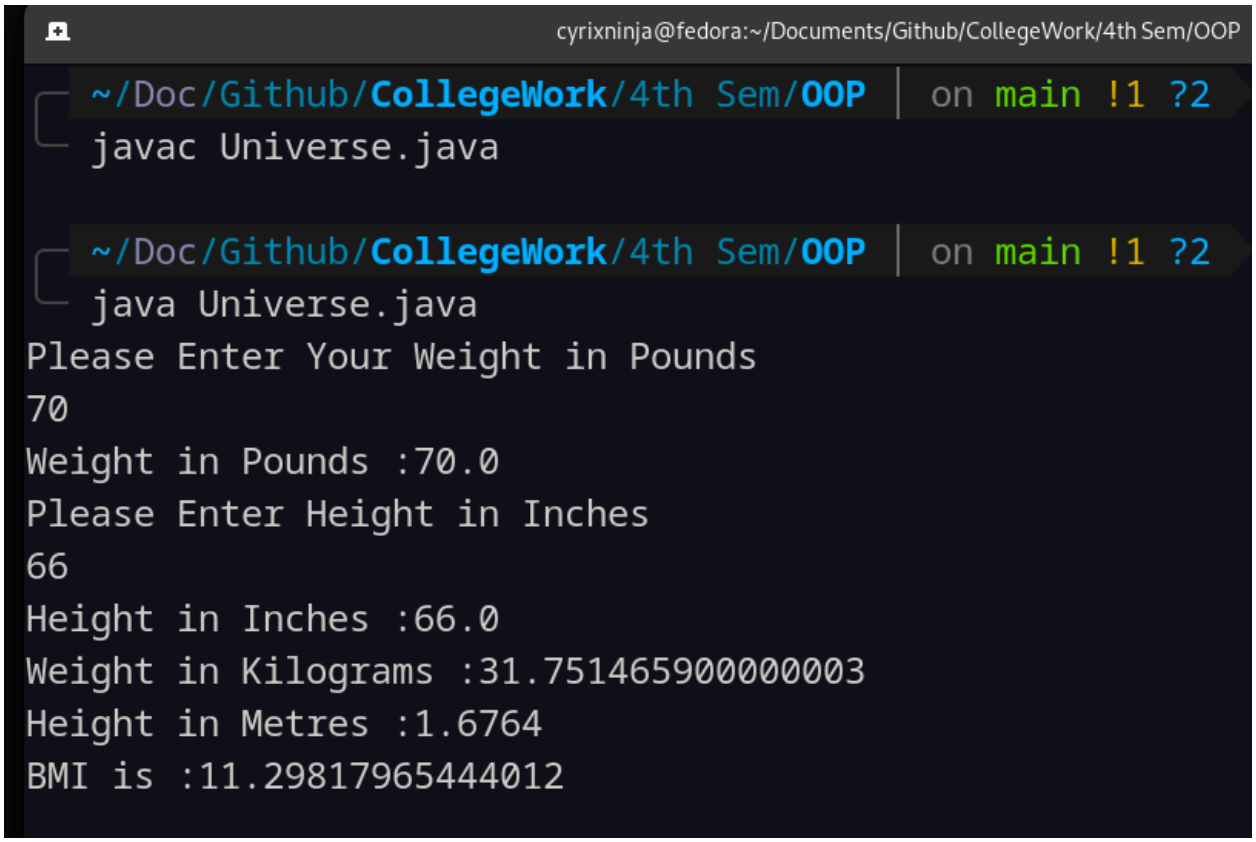
AIM: Body Mass Index (BMI) is a measure of health on weight. It can be calculated by taking your weight in kilograms and dividing by the square of your height in meters.
Write a program that prompts the user to enter a weight in pounds and height in inches and displays the BMI.
Note: - 1 pound=.45359237 Kg and 1 inch=.0254 meters.

COMPLETE CODE

```
// Import Libraries
import java.util.Scanner;

// Main Class
public class Universe {
     public static void main(String[] args) {
     double weight;
     System.out.println("Please Enter Your Weight in Pounds");
     Scanner weight_in_pounds = new Scanner(System.in);
     weight = weight_in_pounds.nextDouble();
     System.out.println("Weight in Pounds :" + weight);


     double height;
     System.out.println("Please Enter Height in Inches");
     Scanner height_in_inches = new Scanner(System.in);
     height = height_in_inches.nextDouble();
     System.out.println("Height in Inches :" + height);


     Double height_in_metres= height*0.0254;
     Double weight_in_kilogram = weight*0.45359237;
     System.out.println("Weight     in     Kilograms     :"     +
weight_in_kilogram);
     System.out.println("Height      in      Metres      :"      +
height_in_metres);
```

```
      Double                                bmi                                =
(weight_in_kilogram)/(height_in_metres*height_in_metres);
      System.out.println("BMI is :"+bmi);

      // Closing Scanners
      weight_in_pounds.close();
      height_in_inches.close();
      }
}
```

OUTPUT:



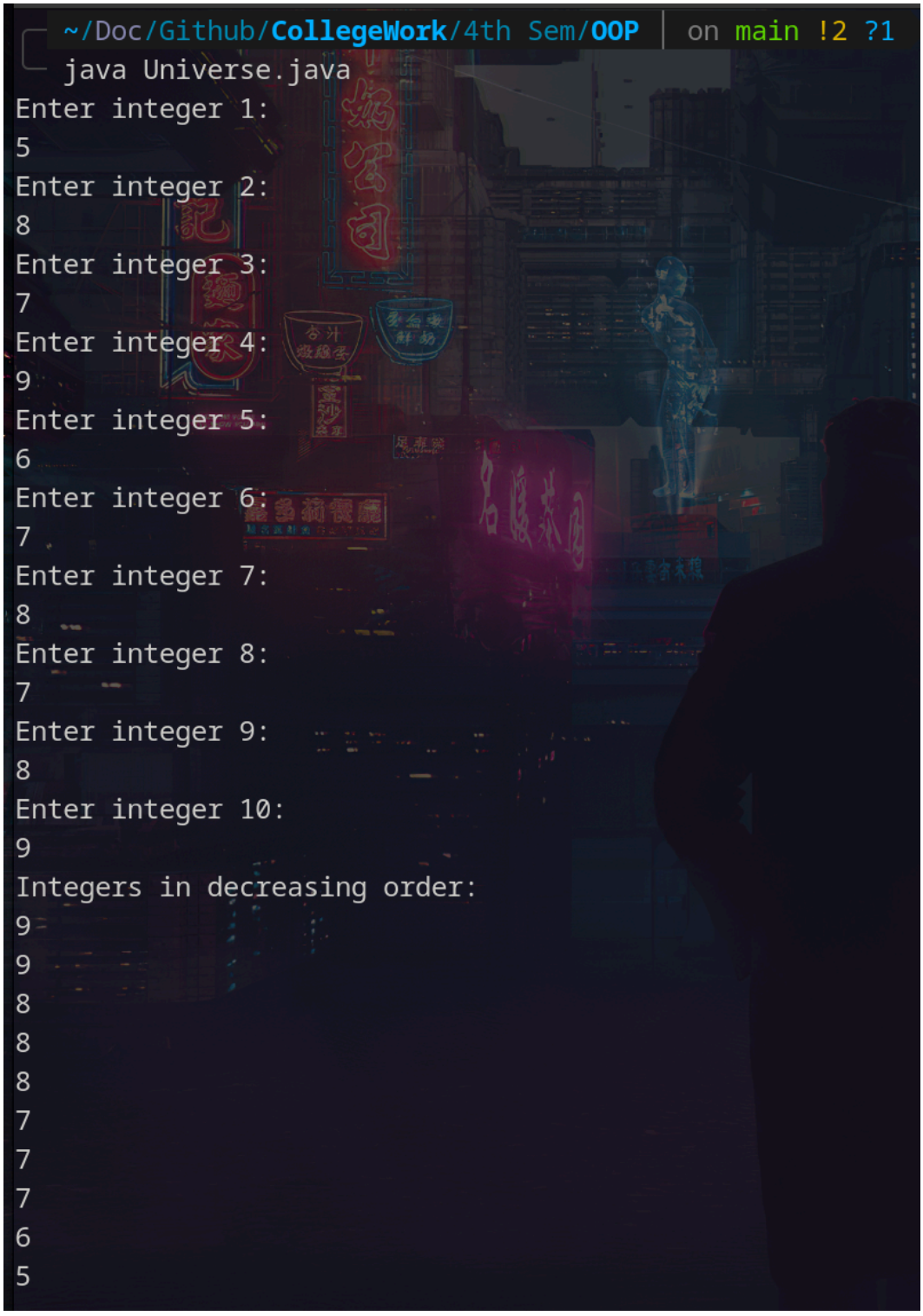
Practical 2

AIM: Write a program that prompts the user to enter 10 integers and display the integers in decreasing order using loop. Use the 'break'.

COMPLETE CODE

```
// Import the required classes
import java.util.Scanner;
import java.util.Arrays;
import java.util.Collections;

public class Universe {
     public static void main(String[] args) {
     // Create an array to store the integers
     Integer[] numbers = new Integer[10];
     // Create a scanner object to read input
     Scanner scanner = new Scanner(System.in);

     for (int i = 0; i < 10; i++) {
          System.out.println("Enter integer " + (i + 1) + ":");
          numbers[i] = scanner.nextInt();

          // Break the loop if 10 integers have been entered
          if (i == 9) {
               break;
          } }

     // Sort the array in decreasing order
     Arrays.sort(numbers, Collections.reverseOrder());
     System.out.println("Integers in decreasing order:");
     for (int number : numbers) {
          System.out.println(number); }
     scanner.close();
     } }
```

OUTPUT:


~/Doc/Github/CollegeWork/4th Sem/OOP | on main !2 ?1
java Universe.java
Enter integer 1:
5
Enter integer 2:
8
Enter integer 3:
7
Enter integer 4:
9
Enter integer 5:
6
Enter integer 6:
7
Enter integer 7:
8
Enter integer 8:
7
Enter integer 9:
8
Enter integer 10:
9
Integers in decreasing order:
9
9
8
8
8
7
7
7
6
5

Practical 3

AIM:

Write a program to demonstrate the following for String:

a. Input a string from standard input
b. Input a string from command line argument
c. Find the length of it.
d. Reverse a string
e. Copy a string to another string
f. Concatenate two strings
g. Extract some bytes from string
h. Get Substring
i. Check string starts and ends with particular string
j. Convert any data type object/variable to string
k. Split a string using regular expressions
l. Replace string with other
m. Find the indexes of a string in another string
n. Convert string to other types (byte and character array)
o. Convert into uppercase and lowercase
p. Check the equality of two strings (with and without consideration of case)
q. Print the hashcode of string

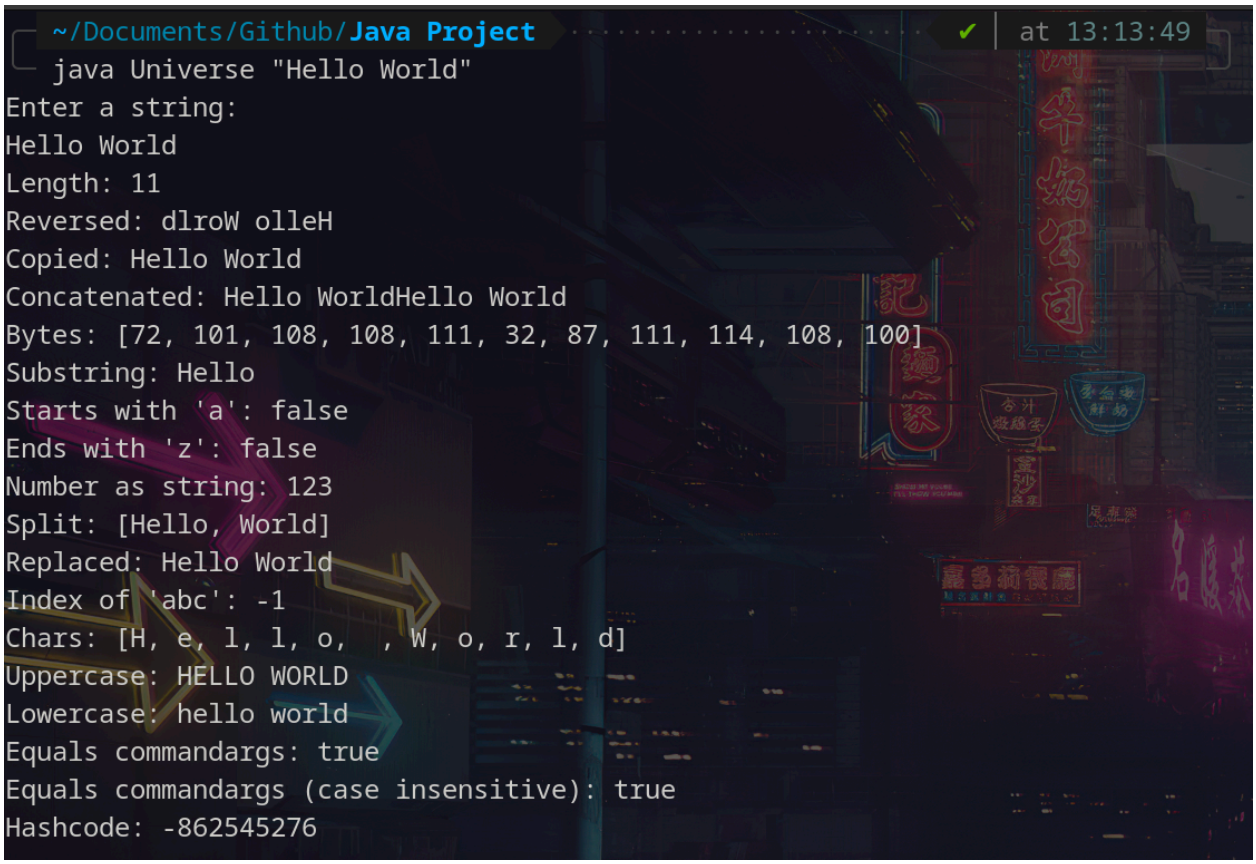
COMPLETE CODE

```
import java.util.Arrays;
import java.util.Scanner;

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


     // a. Input a string from standard input
     Scanner scanner = new Scanner(System.in);
     System.out.println("Enter a string:");
     String input = scanner.nextLine();
```

```
        // b. Input a string from command line argument
        String commandargs = args.length > 0 ? args[0] : "";

        // c. Find the length of it.
        System.out.println("Length: " + input.length());

        // d. Reverse a string
        String reversed = new
StringBuilder(input).reverse().toString();
        System.out.println("Reversed: " + reversed);

        // e. Copy a string to another string
        String copied = new String(input);
        System.out.println("Copied: " + copied);

        // f. Concatenate two strings
        String concatenated = input + commandargs;
        System.out.println("Concatenated: " + concatenated);

        // g. Extract some bytes from string
        byte[] bytes = input.getBytes();
        System.out.println("Bytes: " + Arrays.toString(bytes));

        // h. Get Substring
        String substring = input.substring(0, input.length() / 2);
        System.out.println("Substring: " + substring);

        // i. Check string starts and ends with particular string
        System.out.println("Starts with 'a': "
+ input.startsWith("a"));
        System.out.println("Ends with 'z': "
+ input.endsWith("z"));

        // j. Convert any data type object/variable to string
        int number = 123;
        String numberStr = Integer.toString(number);
        System.out.println("Number as string: " + numberStr);
```

```
        // k. Split a string using regular expressions
        String[] split = input.split("\\s+");
        System.out.println("Split: " + Arrays.toString(split));

        // l. Replace string with other
        String replaced = input.replace('a', 'b');
        System.out.println("Replaced: " + replaced);

        // m. Find the indexes of a string in another string
        int index = input.indexOf("abc");
        System.out.println("Index of 'abc': " + index);

        // n. Convert string to other types (byte and character
array)
        char[] chars = input.toCharArray();
        System.out.println("Chars: " + Arrays.toString(chars));

        // o. Convert into uppercase and lowercase
        System.out.println("Uppercase: " + input.toUpperCase());
        System.out.println("Lowercase: " + input.toLowerCase());

        // p. Check the equality of two strings (with and without
consideration of case)
        System.out.println("Equals commandargs: "
input.equals(commandargs));
        System.out.println("Equals commandargs (case insensitive):
" + input.equalsIgnoreCase(commandargs));

        // q. Print the hashcode of string
        System.out.println("Hashcode: " + input.hashCode());
        }
}
```

OUTPUT:


~/Documents/Github/Java Project
at 13:13:49
java Universe "Hello World"
Enter a string:
Hello World
Length: 11
Reversed: dlroW olleH
Copied: Hello World
Concatenated: Hello WorldHello World
Bytes: [72, 101, 108, 108, 111, 32, 87, 111, 114, 108, 100]
Substring: Hello
Starts with 'a': false
Ends with 'z': false
Number as string: 123
Split: [Hello, World]
Replaced: Hello World
Index of 'abc': -1
Chars: [H, e, l, l, o, , W, o, r, l, d]
Uppercase: HELLO WORLD
Lowercase: hello world
Equals commandargs: true
Equals commandargs (case insensitive): true
Hashcode: -862545276

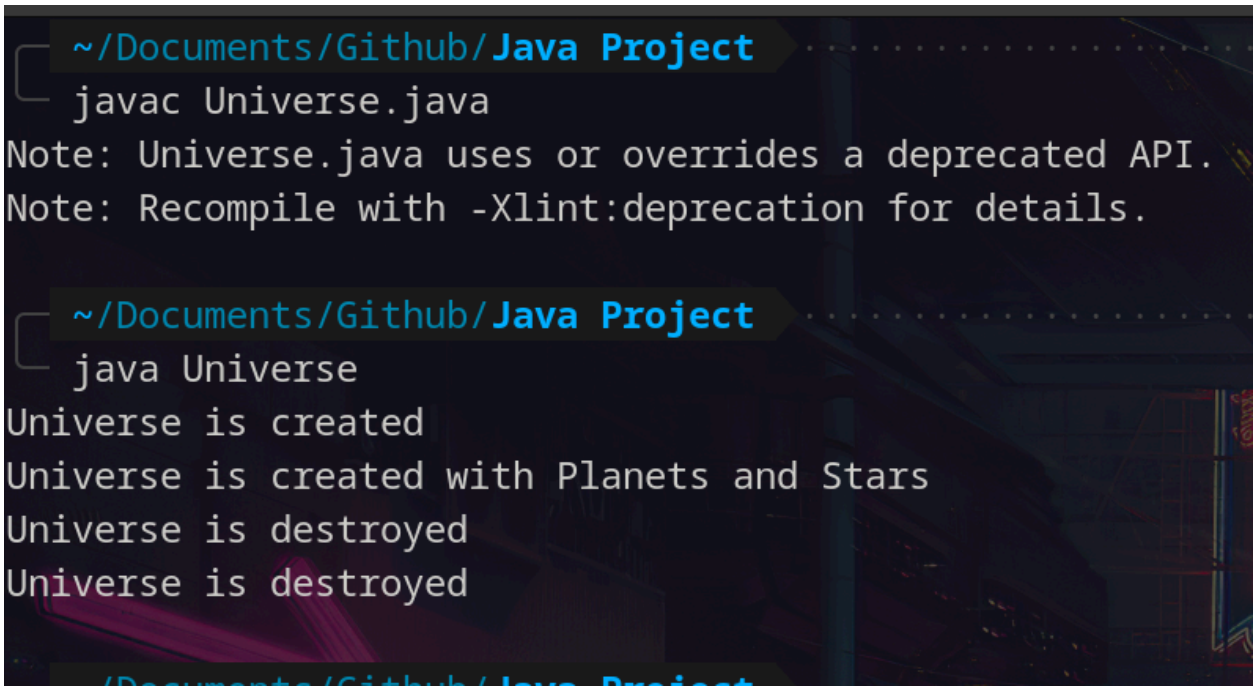
Practical 4

AIM: Write a program to demonstrate the use of constructor (with and without parameter) and destructor.

COMPLETE CODE

```
class Universe {
    Universe() {
    System.out.println("Universe is created");
    }

    Universe(String s) {
    System.out.println("Universe is created with " +
s);
    }

    public void finalize() {
    System.out.println("Universe is destroyed");
    }

    public static void main(String[] args) {
    Universe u1 = new Universe();
    Universe u2 = new Universe("Planets and Stars");
    u1 = null;
    u2 = null;
    System.gc();
    }
}
```

OUTPUT:


~/Documents/Github/Java Project
javac Universe.java
Note: Universe.java uses or overrides a deprecated API.
Note: Recompile with -Xlint:deprecation for details.
~/Documents/Github/Java Project
java Universe
Universe is created
Universe is created with Planets and Stars
Universe is destroyed
Universe is destroyed

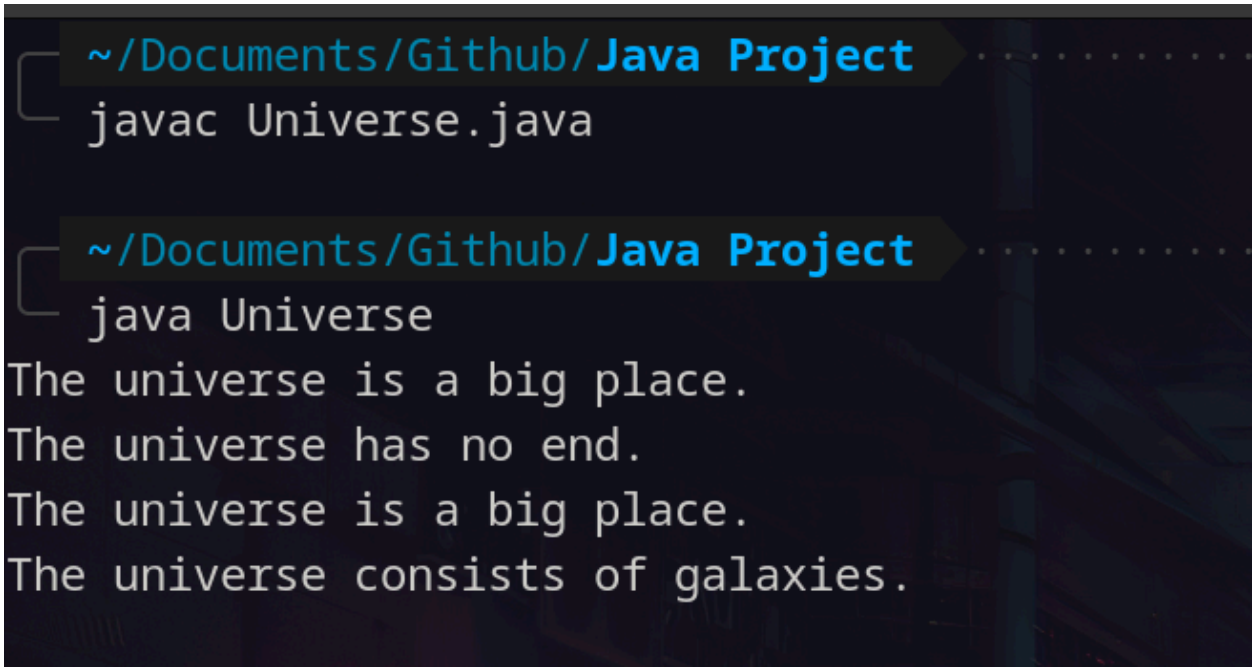
Practical 5

AIM: Write a program to demonstrate method overloading and constructor overloading.

COMPLETE CODE

```
class Universe {
     // Constructor overloading

     Universe() {
     System.out.println("The universe is a big place.");
     }

     Universe(String s) {
     System.out.println(s);
     }

     // Method overloading

     void display() {
     System.out.println("The universe is a big place.");
     }

     void display(String s) {
     System.out.println(s);
     }

     public static void main(String[] args) {
     Universe u = new Universe();
     Universe u1 = new Universe("The universe has no end.");
     u.display();
     u.display("The universe consists of galaxies.");
     }
}
```

OUTPUT:


~/Documents/Github/Java Project
javac Universe.java
~/Documents/Github/Java Project
java Universe
The universe is a big place.
The universe has no end.
The universe is a big place.
The universe consists of galaxies.

Practical 6

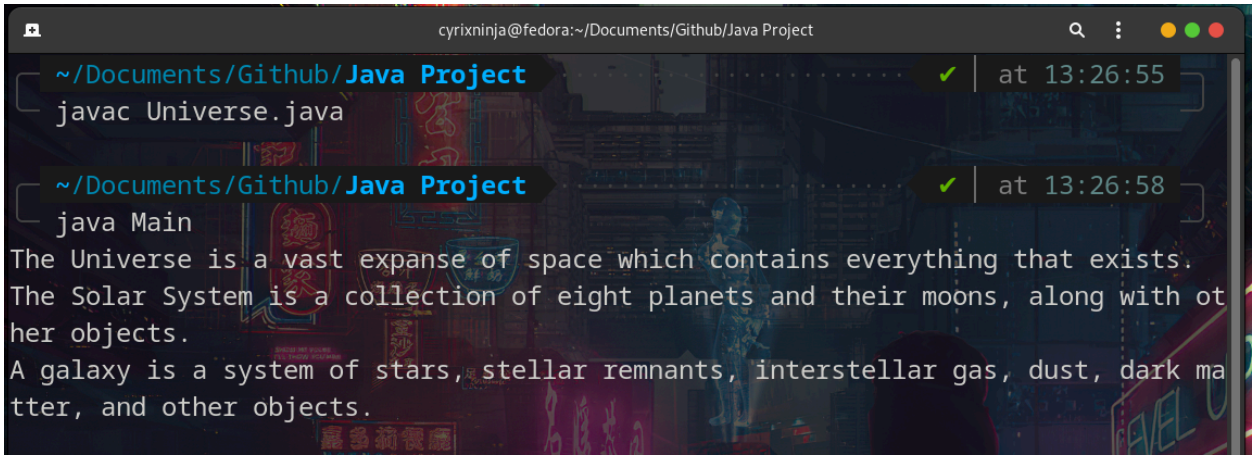
AIM: Write a program to demonstrate method overriding.

COMPLETE CODE

```
class Universe {
    void display() {
    System.out.println("The Universe is a vast expanse
of space which contains everything that exists.");
    }
}

// Inheritance
class SolarSystem extends Universe {
    void display() {
    System.out.println("The Solar System is a
collection of eight planets and their moons, along
with other objects.");
    }
}

// Inheritance
class Galaxy extends Universe {
    void display() {
    System.out.println("A galaxy is a system of stars,
stellar remnants, interstellar gas, dust, dark matter,
and other objects.");
    }
}
```

```
class Main {
    public static void main(String[] args) {
    Universe universe = new Universe();
    universe.display();

    SolarSystem solarSystem = new SolarSystem();
    solarSystem.display();

    Galaxy galaxy = new Galaxy();
    galaxy.display();
    }
}
```

OUTPUT:



Practical 7

AIM: Write a program to demonstrate the use of following types of inheritance:

1. Single Inheritance
2. Multilevel Inheritance
3. Multiple Inheritance
4. Hierarchical Inheritance
5. Hybrid Inheritance

COMPLETE CODE

```
/*
Write a program to demonstrate the use of following types of
inheritance:
1. Single Inheritance
2. Multilevel Inheritance
3. Multiple Inheritance
4. Hierarchical Inheritance
5. Hybrid Inheritance
 */

 interface CelestialBody {
     void display();
}

// 4. Hierarchical Inheritance: This is when one class serves as
a superclass (base class) for more than one subclass. In this
program, the Stars class serves as the superclass for Planets,
BlackHoles, and Supernovas, demonstrating hierarchical
inheritance.
class Stars implements CelestialBody {
     public void display() {
```

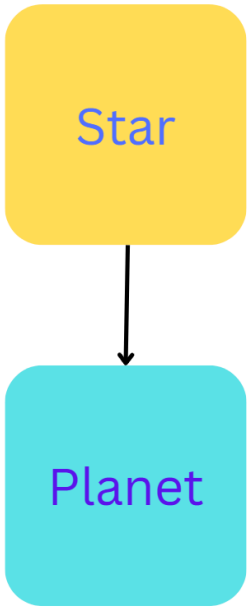
```
     System.out.println("Stars are celestial bodies that produce
light and heat.");
     }
}



// 1. Single Inheritance: This is when a class inherits from a
single superclass. In this program, the Planets class is a
subclass of the Stars class, demonstrating single inheritance.
class Planets extends Stars {
     public void display() {
     super.display();
     System.out.println("Planets are celestial bodies that
revolve around a star.");
     }
}

//   2. Multilevel Inheritance: This is when a class inherits
from a superclass, which in turn inherits from another
superclass. Here, the Comets class extends the Planets class,
which extends the Stars class, demonstrating multilevel
inheritance.
class Comets extends Planets {
     public void display() {
     super.display();
     System.out.println("Comets are celestial bodies that
revolve around a star in an elliptical orbit.");
     }
}



interface BlackHoleProperties {
     default void displayBlackHoleProperties() {
     System.out.println("Black Holes are celestial bodies that
have a gravitational pull so strong that nothing can escape
it.");
     }
}
```

```
//3.Multiple Inheritance: Java does not support multiple inheritance with classes due to the "Diamond Problem". However, it can be simulated using interfaces. In this program, the BlackHoles class extends the Stars class and also implements the BlackHoleProperties interface, simulating multiple inheritance.

// 5. Hybrid Inheritance: This is a mix of two or more types of inheritance. In this program, the BlackHoles class demonstrates hybrid inheritance as it is involved in both single (extends Stars) and multiple inheritance (implements BlackHoleProperties).

class BlackHoles extends Stars implements BlackHoleProperties {
     public void display() {
     super.display();
     displayBlackHoleProperties();
     }
}

class Supernovas extends Stars {
     public void display() {
     super.display();
     System.out.println("Supernovas are celestial bodies that explode and release a huge amount of energy.");
     }
}

public class Universe {
     public static void main(String[] args) {
     // Single Inheritance
     Stars stars = new Stars();
     stars.display();

     // Multilevel Inheritance
     Planets planets = new Planets();
     planets.display();

     // Hierarchical Inheritance
```

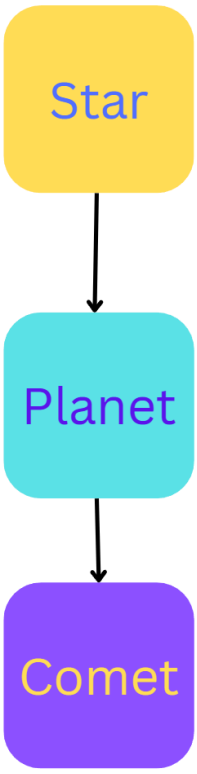
```
        Comets comets = new Comets();
        comets.display();


           // Multiple Inheritance
           // Hybrid Inheritance
        BlackHoles blackHoles = new BlackHoles();
        blackHoles.display();

        Supernovas supernovas = new Supernovas();
        supernovas.display();
        }
}
```

DIAGRAM:

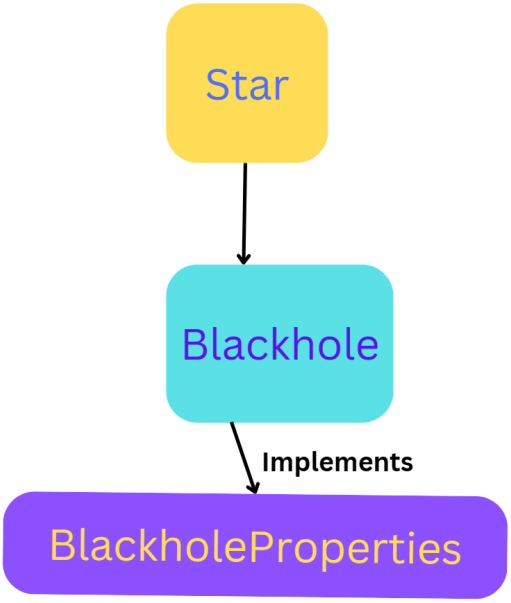
1. **Single Inheritance**



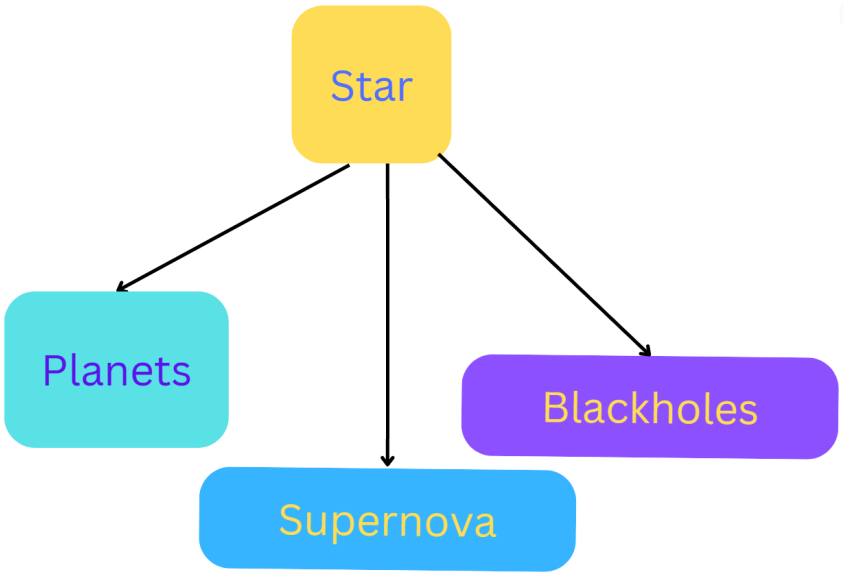
2. **Multilevel Inheritance**



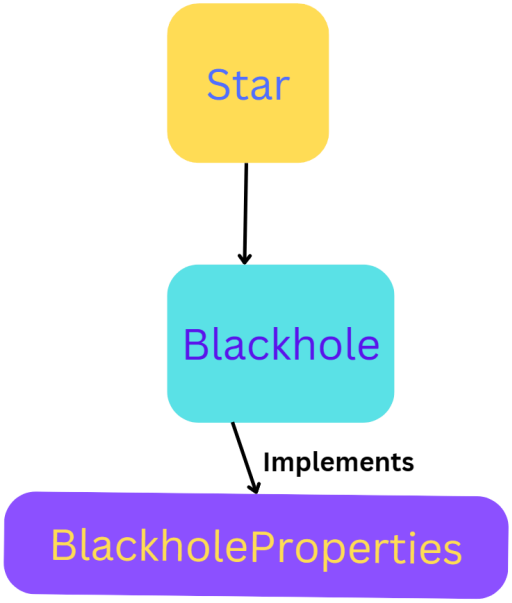
3. **Multiple Inheritance**



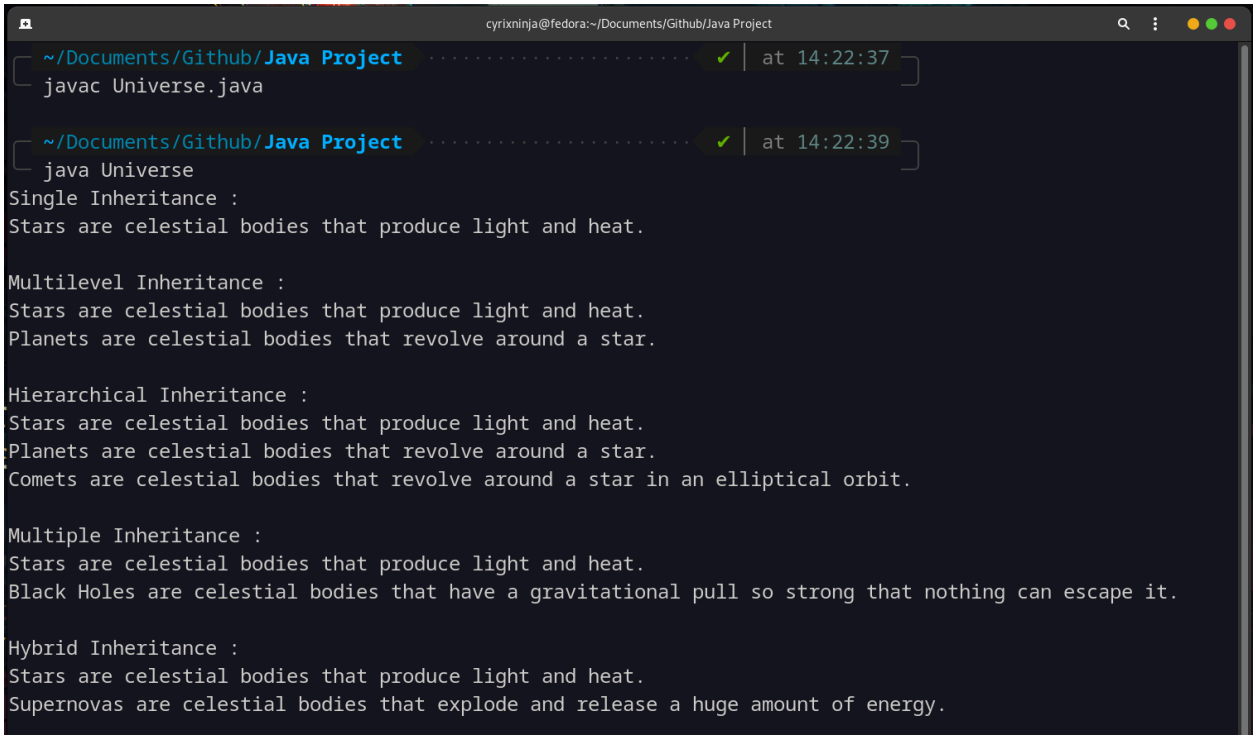
4. **Hierarchial Inheritance**



5. Hybrid Inheritance



OUTPUT:


cyrixninja@fedora:~/Documents/Github/Java Project
~/Documents/Github/Java Project
at 14:22:37
javac Universe.java
~/Documents/Github/Java Project
at 14:22:39
java Universe
Single Inheritance :
Stars are celestial bodies that produce light and heat.
Multilevel Inheritance :
Stars are celestial bodies that produce light and heat.
Planets are celestial bodies that revolve around a star.
Hierarchical Inheritance :
Stars are celestial bodies that produce light and heat.
Planets are celestial bodies that revolve around a star.
Comets are celestial bodies that revolve around a star in an elliptical orbit.
Multiple Inheritance :
Stars are celestial bodies that produce light and heat.
Black Holes are celestial bodies that have a gravitational pull so strong that nothing can escape it.
Hybrid Inheritance :
Stars are celestial bodies that produce light and heat.
Supernovas are celestial bodies that explode and release a huge amount of energy.

Practical 8

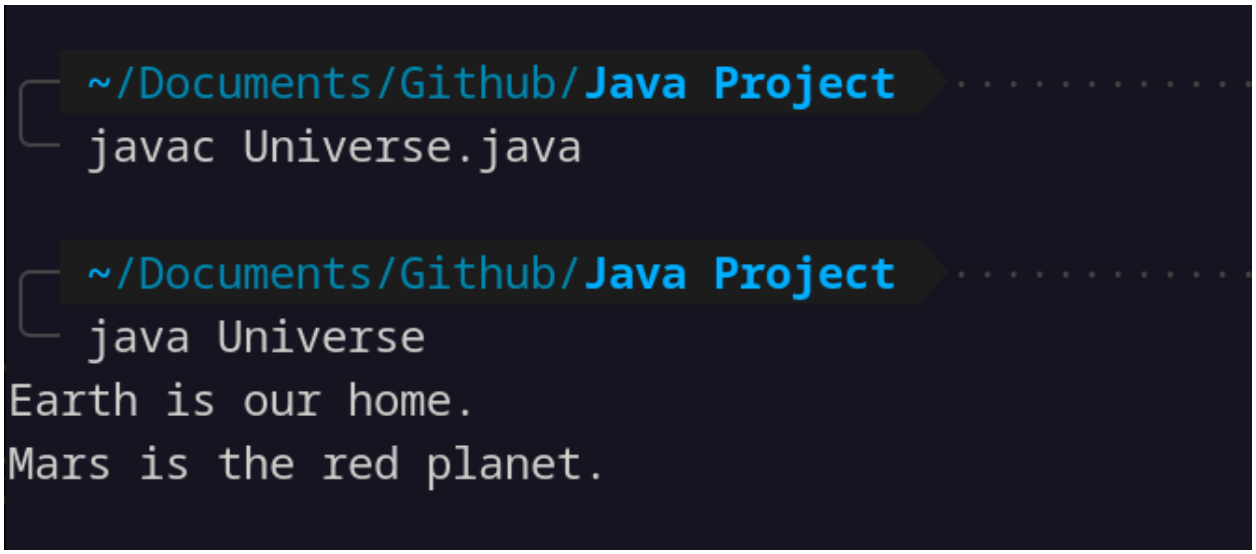
AIM: Demonstrate the use of "interface" using a program.

COMPLETE CODE

```
// Demonstrate the use of "interface" using a program.

// Define the SolarSystem interface
interface SolarSystem {
    // Declare the execute method
    void execute();
}

// Implement the SolarSystem interface in the Earth class
class Earth implements SolarSystem {
    public void execute() {
        System.out.println("Earth is our home.");
    }
}

// Implement the SolarSystem interface in the Mars class
class Mars implements SolarSystem {
    public void execute() {
        System.out.println("Mars is the red planet.");
    }
}

// Main class to demonstrate the use of the SolarSystem
interface
class Universe {
    public static void main(String[] args) {
           // Create an instance of Earth and assign it to the
SolarSystem reference variable
        SolarSystem u = new Earth();
        // Call the execute method on the Earth instance
        u.execute();
```

```
            // Create an instance of Mars and assign it to the
SolarSystem reference variable
        u = new Mars();
        // Call the execute method on the Mars instance
        u.execute();
    }
}
```

OUTPUT:



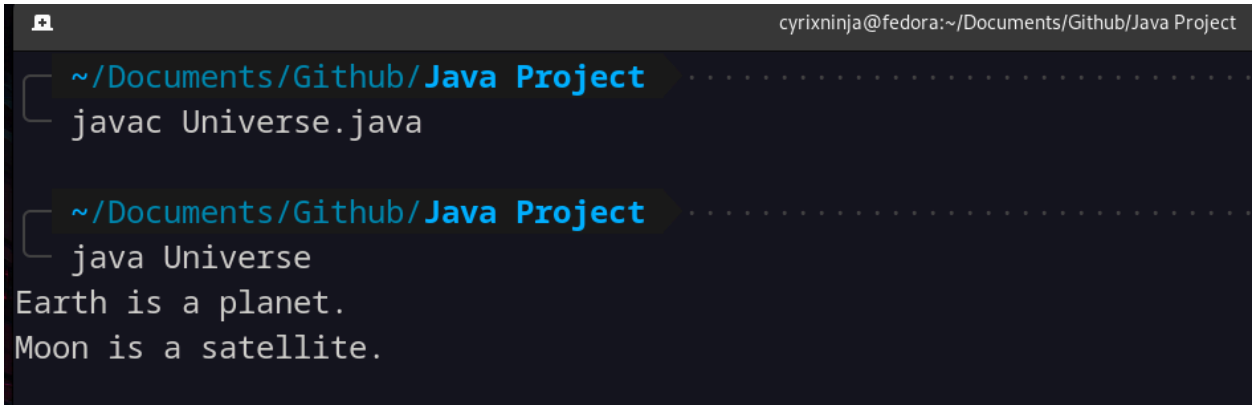
Practical 9

AIM: Demonstrate abstract class using the program.

COMPLETE CODE

```
// Abstract class is a class that is declared using the abstract keyword. It can have abstract methods(methods without a body) as well as concrete methods(methods with a body). It can't be instantiated, but can be subclassed. It can have constructors and static methods also.

abstract class SolarSystem {
     abstract void execute();
}

class Earth extends SolarSystem {
     void execute() {
     System.out.println("Earth is a planet.");
     }
}

class Moon extends SolarSystem {
     void execute() {
     System.out.println("Moon is a satellite.");
     }
}

class Universe {
     public static void main(String[] args) {
     Earth e = new Earth();
     e.execute();
     Moon m = new Moon();
     m.execute();
     }
}
```

OUTPUT:


cyrixninja@fedora:~/Documents/Github/Java Project
~/Documents/Github/Java Project
javac Universe.java
~/Documents/Github/Java Project
java Universe
Earth is a planet.
Moon is a satellite.

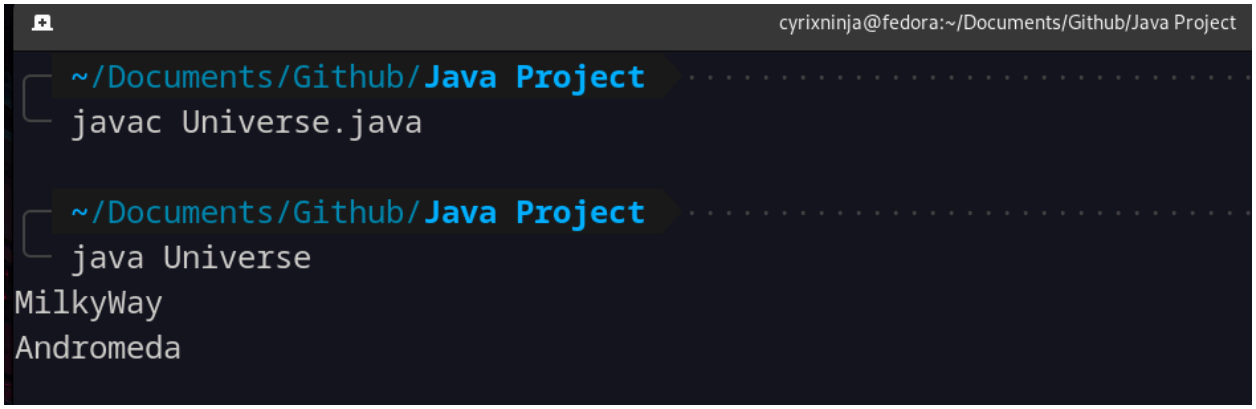
Practical 10

AIM: Write a program to demonstrate static and dynamic binding of objects.

COMPLETE CODE

```
// Static binding: The binding which can be resolved at compile time by the compiler is known as static or early binding.
// Dynamic binding: The binding which can be resolved at runtime is known as dynamic or late binding.

class Galaxy {
     void show() {
     System.out.println("Galaxy");
     }
}

class MilkyWay extends Galaxy {
     void show() {
     System.out.println("MilkyWay");
     }
}

class Andromeda extends Galaxy {
     void show() {
     System.out.println("Andromeda");
     }
}
class Universe {
     public static void main(String[] args) {
     // Static binding
     Galaxy g = new MilkyWay();
     g.show();
     // Dynamic binding
     g = new Andromeda();
     g.show();
     }}
```

OUTPUT:


cyrixninja@fedora:~/Documents/Github/Java Project
~/Documents/Github/Java Project
javac Universe.java
~/Documents/Github/Java Project
java Universe
MilkyWay
Andromeda

Practical 11

AIM: Write a program to demonstrate the visibility modifiers in java.

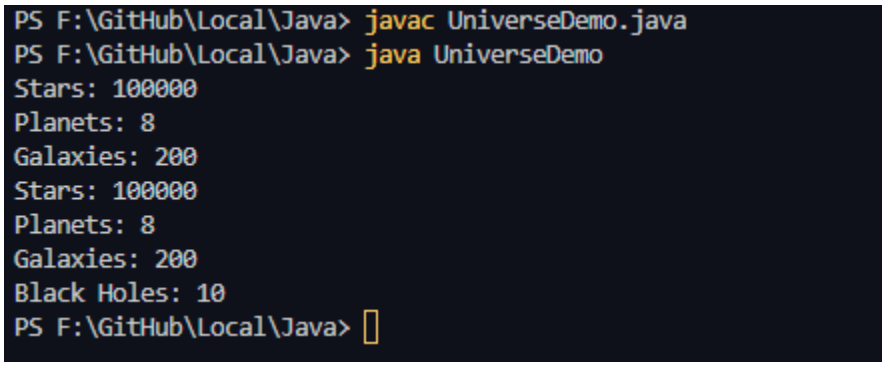
COMPLETE CODE

```
//Write a program to demonstrate the visibility modifiers in java.

// Visibility modifiers: public, private, protected, and default
// public: The members (variables, methods, etc.) can be accessed from anywhere.
// private: The members can only be accessed within the same class.
// protected: The members can be accessed within the same package and also in the subclass in any package.
// default (package-private): If no modifier is specified, it's treated as default. The members can be accessed only within the same package.

class Universe {
    // public variable
    public int stars = 100000;

    // private variable
    private int blackHoles = 10;

    // protected variable
    protected int planets = 8;

    // default (package-private) variable
    int galaxies = 200;

    // public method
    public void displayStars() {
        System.out.println("Stars: " + stars);
```

```
    }

    // private method
    private void displayBlackHoles() {
        System.out.println("Black Holes: " + blackHoles);
    }

    // protected method
    protected void displayPlanets() {
        System.out.println("Planets: " + planets);
    }

    // default (package-private) method
    void displayGalaxies() {
        System.out.println("Galaxies: " + galaxies);
    }

    // method to access private method within the same class
    public void accessPrivateMethod() {
        displayBlackHoles();
    }
}

public class UniverseDemo {
    public static void main(String[] args) {
        Universe universe = new Universe();

        // Accessing public variable
        System.out.println("Stars: " + universe.stars);

        // Accessing protected variable
        System.out.println("Planets: " + universe.planets);

        // Accessing default variable
        System.out.println("Galaxies: " + universe.galaxies);

        // Accessing private variable will give an error
                    //   System.out.println("Black   Holes:   "   +
universe.blackHoles);
```

```
        // Accessing public method
        universe.displayStars();

        // Accessing protected method
        universe.displayPlanets();

        // Accessing default method
        universe.displayGalaxies();

        // Accessing private method will give an error
        // universe.displayBlackHoles();

        // Accessing private method through a public method
        universe.accessPrivateMethod();
    }
}
```

OUTPUT:



Practical 12

AIM: Write a program to demonstrate try, catch, finally-exception handling.

COMPLETE CODE

```
import java.util.Scanner;

public class Universe {
     public static void main(String[] args) {
     Scanner sc = new Scanner(System.in);
     System.out.println("Enter the value of a and b: ");
     int a = sc.nextInt();
     int b = sc.nextInt();
     try {
          int c = a / b;
          System.out.println("The value of c is: " + c);
     } catch (ArithmeticException e) {
          System.out.println("The value of b cannot be zero.");
     } finally {
          System.out.println("The  program  has  been  executed
successfully.");
     }
     }
}
```

OUTPUT:


~/Documents/Github/Java Project
java Universe
Enter the value of a and b:
10 5
The value of c is: 2
The program has been executed successfully.
~/Documents/Github/Java Project
java Universe
Enter the value of a and b:
0 6
The value of c is: 0
The program has been executed successfully.
~/Documents/Github/Java Project
java Universe
Enter the value of a and b:
6 0
The value of b cannot be zero.
The program has been executed successfully.

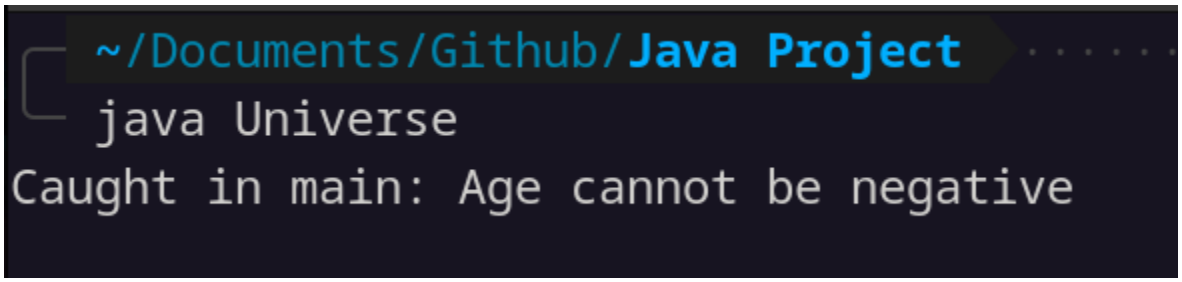
Practical 13

AIM: Write a program to demonstrate the use of throws.

COMPLETE CODE

```
class Universe {
     void ageCheck(int age) throws ArithmeticException {
     if (age < 0) {
          throw new ArithmeticException("Age cannot be
negative");
     } else {
          System.out.println("Age is " + age);
     }
     }
     public static void main(String args[]) {
     try {
          Universe universe = new Universe();
          universe.ageCheck(-5);
     } catch (ArithmeticException e) {
          System.out.println("Caught in main: " +
e.getMessage());
     }
     }
}
```

OUTPUT:



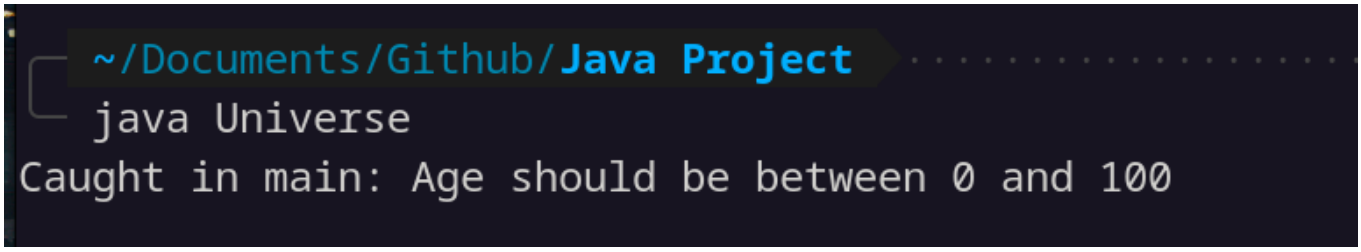
Practical 14

AIM: Write a program to demonstrate user defined exceptions.

COMPLETE CODE

```
class AgeOutOfRangeException extends Exception {
     public AgeOutOfRangeException(String message) {
     super(message);
     }
}

class Universe {
     void ageCheck(int age) throws AgeOutOfRangeException {
     if (age < 0 || age > 100) {
          throw new AgeOutOfRangeException("Age should be
between 0 and 100");
     } else {
          System.out.println("Age is " + age);
     }
     }

     public static void main(String args[]) {
     try {
          Universe universe = new Universe();
          universe.ageCheck(150);
     } catch (AgeOutOfRangeException e) {
          System.out.println("Caught in main: " +
e.getMessage());
     }
     }
}
```

OUTPUT:


~/Documents/Github/Java Project
java Universe
Caught in main: Age should be between 0 and 100

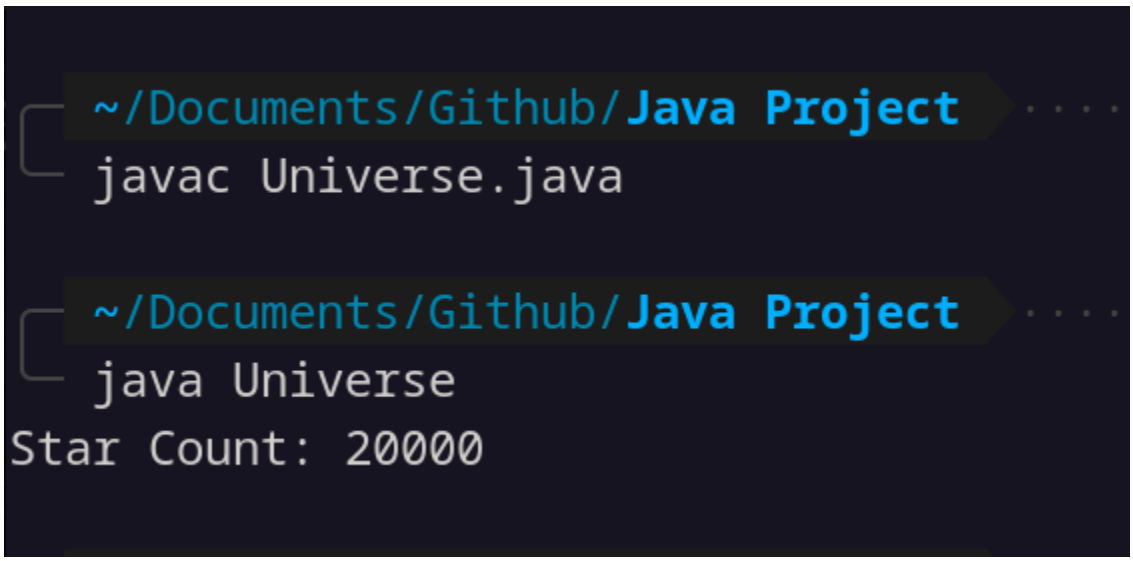
Practical 15

AIM: Demonstrate all the ways to use multithreading and synchronize methods using suitable programs

COMPLETE CODE : 1. Using Thread Class

```
class Universe extends Thread {
     private int starCount = 0;

     public synchronized void incrementStarCount() {
     starCount++;
     }

     public void run() {
     for (int i = 0; i < 10000; i++) {
          incrementStarCount();
     }
     }

     public static void main(String[] args) throws
InterruptedException {
     Universe universe1 = new Universe();
     Universe universe2 = new Universe();
     universe1.start();
     universe2.start();
     universe1.join();
     universe2.join();
     System.out.println("Star Count: " + (universe1.starCount +
universe2.starCount));
     }
}
```

OUTPUT:

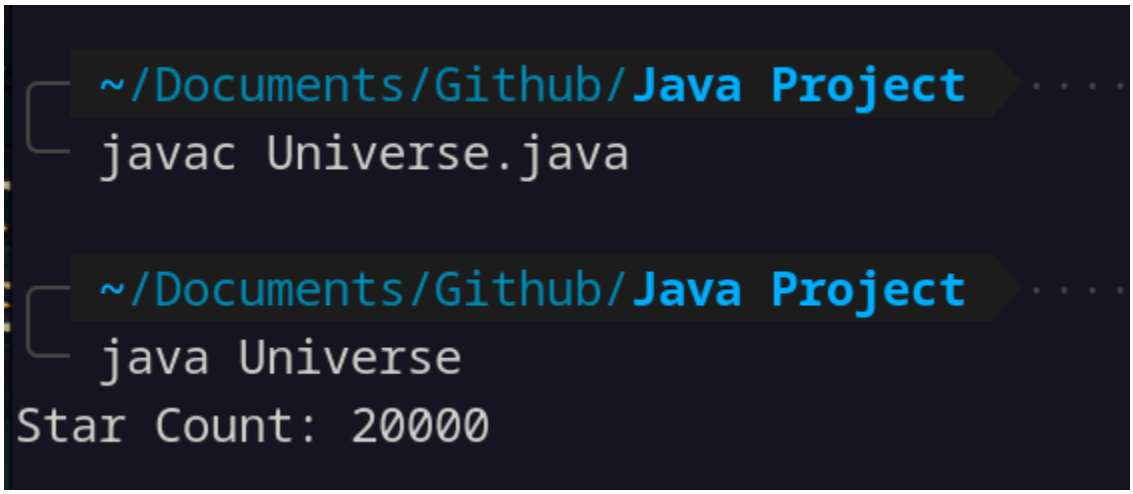


COMPLETE CODE : 2. Using a Runnable Interface

```
class Universe implements Runnable {
     private int starCount = 0;

     public synchronized void incrementStarCount() {
     starCount++;
     }

     public void run() {
     for (int i = 0; i < 10000; i++) {
          incrementStarCount();
     }
     }

     public static void main(String[] args) throws
InterruptedException {
     Universe universe = new Universe();
     Thread thread1 = new Thread(universe);
     Thread thread2 = new Thread(universe);
     thread1.start();
     thread2.start();
```

```
      thread1.join();
      thread2.join();
      System.out.println("Star Count: " + universe.starCount);
      }
}
```

OUTPUT:

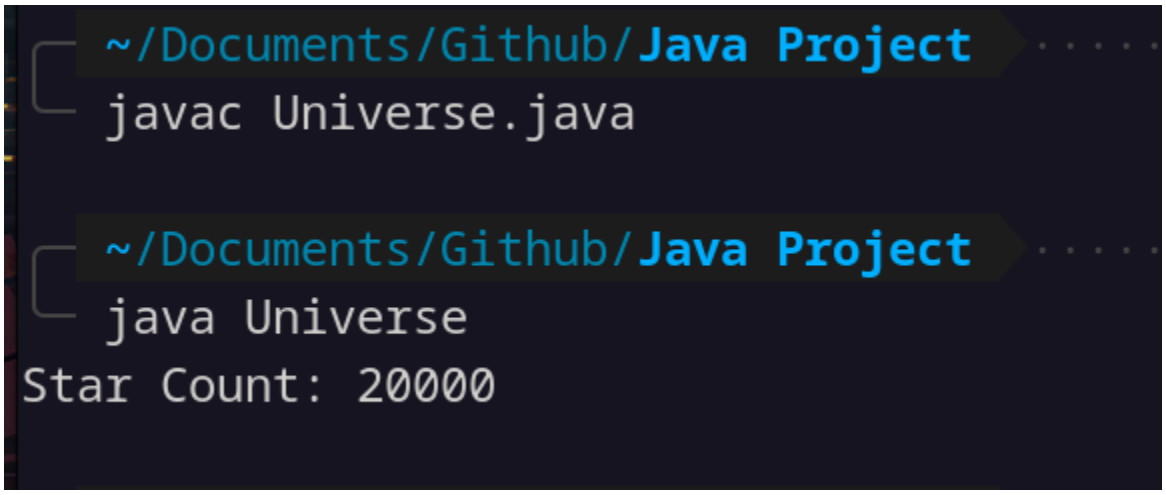


COMPLETE CODE : 3. Using the ExecuterService

```
import java.util.concurrent.ExecutorService;
import java.util.concurrent.Executors;

class Universe {
      private int starCount = 0;

      public synchronized void incrementStarCount() {
      starCount++;
      }

      public void createStars() {
      for (int i = 0; i < 10000; i++) {
            incrementStarCount();
      }
      }
```

```
    public static void main(String[] args) throws
InterruptedException {
    Universe universe = new Universe();
    ExecutorService executorService =
Executors.newFixedThreadPool(2);
    executorService.submit(universe::createStars);
    executorService.submit(universe::createStars);
    executorService.shutdown();
    while (!executorService.isTerminated()) {
    }
    System.out.println("Star Count: " + universe.starCount);
    }
}
```

OUTPUT:



Practical 16

AIM: Write a program to demonstrate file properties using java.io.File.

COMPLETE CODE

```
import java.io.File;
import java.util.Scanner;

class Universe {
     public static void main(String[] args) {
     Scanner sc = new Scanner(System.in);
     System.out.println("Enter the file name: ");
     String fileName = sc.nextLine();
     File file = new File(fileName);
     if (file.exists()) {
          System.out.println("File name: " + file.getName());
          System.out.println("Absolute       path:       "       +
file.getAbsolutePath());
          System.out.println("Size:   "   +   file.length()   +   "
bytes");
          System.out.println("Readable: " + file.canRead());
          System.out.println("Writable: " + file.canWrite());
          System.out.println("Executable:           "           +
file.canExecute());
     } else {
          System.out.println("File does not exist.");
     }
     sc.close();
     }
}
```

OUTPUT:

```
~/Documents/Github/Java Project
javac Universe.java

~/Documents/Github/Java Project
java Universe
Enter the file name:
hello_world.sh
File name: hello_world.sh
Absolute path: /home/cyrixninja/Documents/Github/Java Project/hello_world.sh
Size: 19 bytes
Readable: true
Writable: true
Executable: false
```

Practical 17

AIM: Write a program to demonstrate list and stack operations.

COMPLETE CODE

```
import java.util.*;

class Universe {
     public static void main(String[] args) {
     List<String> planets = new ArrayList<String>();
     planets.add("Mercury");
     planets.add("Venus");
     planets.add("Earth");
     planets.add("Mars");
     planets.add("Jupiter");
     planets.add("Saturn");
     planets.add("Uranus");
     planets.add("Neptune");
     planets.add("Pluto");

     System.out.println("Planets in the Solar System (List): " +
planets);

     Stack<String> stack = new Stack<String>();
     stack.push("Mercury");
     stack.push("Venus");
     stack.push("Earth");
     stack.push("Mars");
     stack.push("Jupiter");
     stack.push("Saturn");
     stack.push("Uranus");
     stack.push("Neptune");
     stack.push("Pluto");

     System.out.println("Planets in the Solar System (Stack): "
+ stack);
```

```
        // List operations
        System.out.println("Number of planets in the Solar System: " + planets.size());
        System.out.println("Is Earth a planet? " + planets.contains("Earth"));
        System.out.println("Index of Mars: " + planets.indexOf("Mars"));
        System.out.println("Get planet at index 3: " + planets.get(3));
        System.out.println("Remove Pluto from the list");
        planets.remove("Pluto");
        System.out.println("Updated list of planets: " + planets);

        // Stack operations
        System.out.println("Top element of the stack: " + stack.peek());
        System.out.println("Pop element from the stack: " + stack.pop());
        System.out.println("Updated stack of planets: " + stack);
        }
}
```

OUTPUT:

```
~/Documents/Github/Java Project ✔ at 16:50:02
javac Universe.java

~/Documents/Github/Java Project ✔ at 16:50:04
java Universe
Planets in the Solar System (List): [Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, Pluto]
Planets in the Solar System (Stack): [Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, Pluto
]
Number of planets in the Solar System: 9
Is Earth a planet? true
Index of Mars: 3
Get planet at index 3: Mars
Remove Pluto from the list
Updated list of planets: [Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune]
Top element of the stack: Pluto
Pop element from the stack: Pluto
Updated stack of planets: [Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune]
```

Practical 18

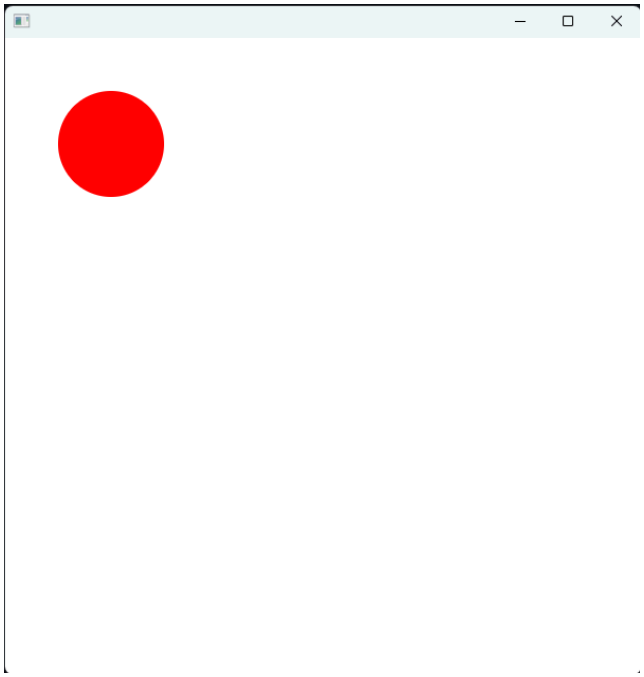
AIM: Write a program that moves a circle up, down, left or right using arrow keys.

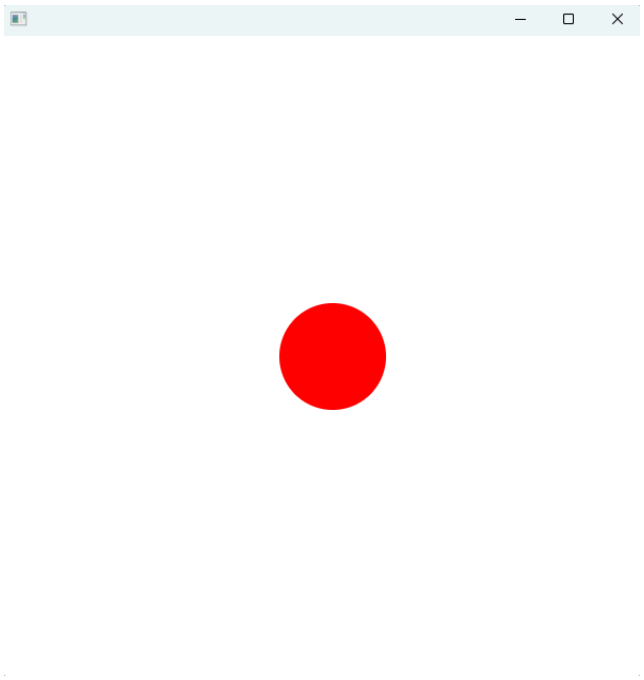
COMPLETE CODE

```
// Write a program that moves a circle up, down, left or right using arrow keys.

package com.universe;
import javafx.application.Application;
import javafx.scene.Scene;
import javafx.scene.input.KeyCode;
import javafx.scene.layout.Pane;
import javafx.scene.shape.Circle;
import javafx.stage.Stage;
import javafx.scene.paint.Color;

public class Universe extends Application {

    @Override
    public void start(Stage stage) {
         Circle circle = new Circle(50); // Create a circle with radius 50
        circle.setCenterX(100); // Set initial position
        circle.setCenterY(100);
        circle.setFill(Color.RED);

           Pane pane = new Pane(circle); // Add the circle to a pane

           Scene scene = new Scene(pane, 600, 600); // Create a scene with the pane

            scene.setOnKeyPressed(event -> { // Set key pressed event
             if (event.getCode() == KeyCode.UP) {
```

```
                circle.setCenterY(circle.getCenterY() - 10); //
Move up
            } else if (event.getCode() == KeyCode.DOWN) {
                circle.setCenterY(circle.getCenterY() + 10); //
Move down
            } else if (event.getCode() == KeyCode.LEFT) {
                circle.setCenterX(circle.getCenterX() - 10); //
Move left
            } else if (event.getCode() == KeyCode.RIGHT) {
                circle.setCenterX(circle.getCenterX() + 10); //
Move right
            }
        });

        stage.setScene(scene); // Set the scene on the stage
        stage.show(); // Show the stage

    }

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

OUTPUT:





Practical 19

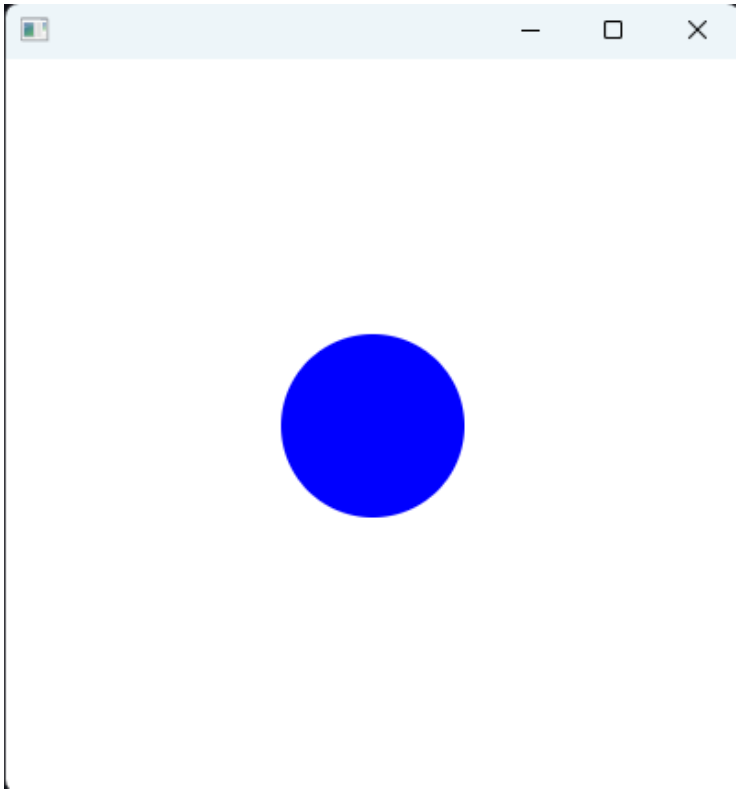
AIM: Write a program that displays the color of a circle as red when the mouse button is pressed and as blue when the mouse button is released.

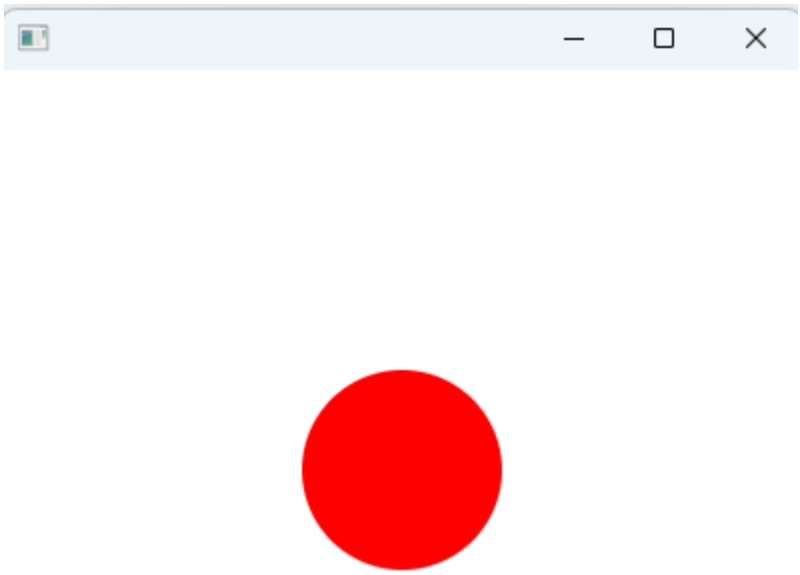
COMPLETE CODE

```
//  Write a program that displays the color of a circle as red when the mouse button is pressed and as blue when the mouse button is released.

package com.universe;
import javafx.application.Application;
import javafx.scene.Scene;
import javafx.scene.input.MouseEvent;
import javafx.scene.layout.Pane;
import javafx.scene.paint.Color;
import javafx.scene.shape.Circle;
import javafx.stage.Stage;

public class Universe extends Application {


    @Override
    public void start(Stage stage) {
         Circle circle = new Circle(50); // Create a circle with radius 50
        circle.setCenterX(100); // Set initial position
        circle.setCenterY(100);
        circle.setFill(Color.RED);

        circle.setOnMousePressed((MouseEvent event) -> {
              circle.setFill(Color.RED); // Set the color of the circle to red when mouse button is pressed
        });

        circle.setOnMouseReleased((MouseEvent event) -> {
             circle.setFill(Color.BLUE); // Set the color of the circle to blue when mouse button is released
```

```
        });

           Pane pane = new Pane(circle); // Add the circle to a
pane

           Scene scene = new Scene(pane, 400, 400); // Create a
scene with the pane

        stage.setScene(scene); // Set the scene on the stage
        stage.show(); // Show the stage
    }

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

OUTPUT:





Practical 20

AIM: Write a GUI program that uses buttons to move the message to the left and right and uses the radio button to change the color for the message displayed.

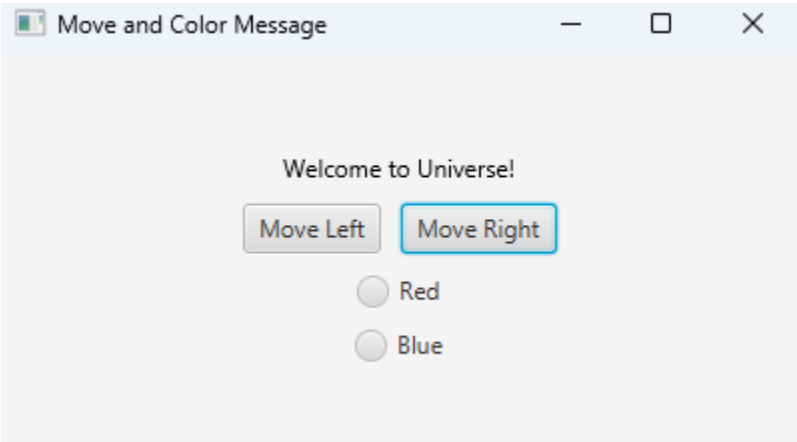
COMPLETE CODE

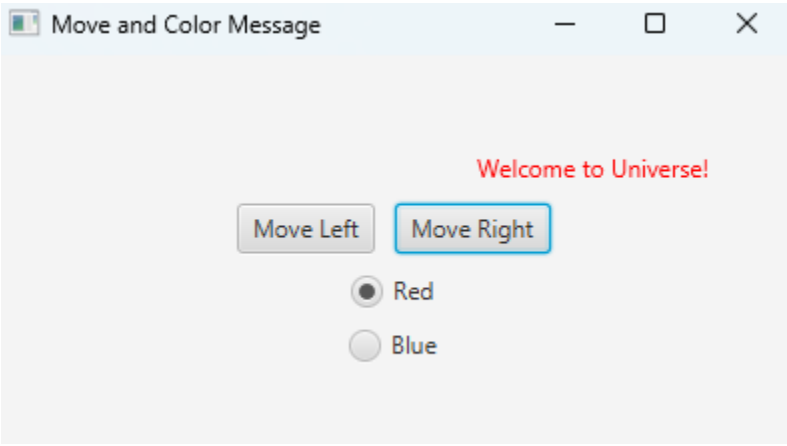
```
//  Write a GUI program that uses buttons to move the message to the left and right and uses the radio button to change the color for the message displayed.

package com.universe;
import javafx.application.Application;
import javafx.geometry.Insets;
import javafx.geometry.Pos;
import javafx.scene.Scene;
import javafx.scene.control.Button;
import javafx.scene.control.RadioButton;
import javafx.scene.control.ToggleGroup;
import javafx.scene.layout.HBox;
import javafx.scene.layout.VBox;
import javafx.scene.paint.Color;
import javafx.scene.text.Text;
import javafx.stage.Stage;
import javafx.animation.TranslateTransition;
import javafx.util.Duration;

public class Universe extends Application {

    @Override
    public void start(Stage stage) {
        Text message = new Text("Welcome to Universe!");
        message.setX(50);
        message.setY(50);

        Button leftButton = new Button("Move Left");
        Button rightButton = new Button("Move Right");

                            TranslateTransition tt = new
TranslateTransition(Duration.millis(100), message);
```

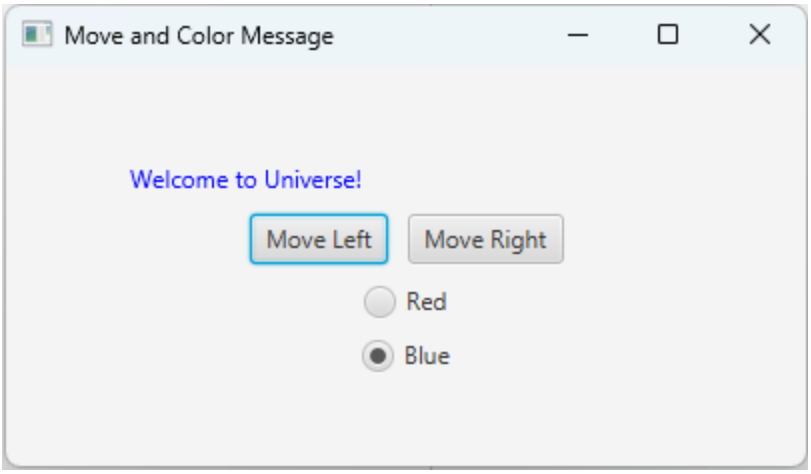
```
        leftButton.setOnAction(event -> {
        tt.setToX(message.getTranslateX() - 10);
        tt.play();
        });

        rightButton.setOnAction(event -> {
        tt.setToX(message.getTranslateX() + 10);
        tt.play();
        });

        RadioButton redButton = new RadioButton("Red");
        RadioButton blueButton = new RadioButton("Blue");

        ToggleGroup group = new ToggleGroup();
        redButton.setToggleGroup(group);
        blueButton.setToggleGroup(group);

                                    redButton.setOnAction(event    ->
message.setFill(Color.RED));
                                   blueButton.setOnAction(event    ->
message.setFill(Color.BLUE));

        HBox buttons = new HBox(10, leftButton, rightButton);
        buttons.setAlignment(Pos.CENTER);

        VBox radioButtons = new VBox(10, redButton, blueButton);
        radioButtons.setAlignment(Pos.CENTER);

                VBox  root  =  new  VBox(10,  message,  buttons,
radioButtons);
        root.setAlignment(Pos.CENTER);
        root.setPadding(new Insets(10));

        Scene scene = new Scene(root, 400, 200);
        stage.setScene(scene);
        stage.setTitle("Move and Color Message");
        stage.show();
```

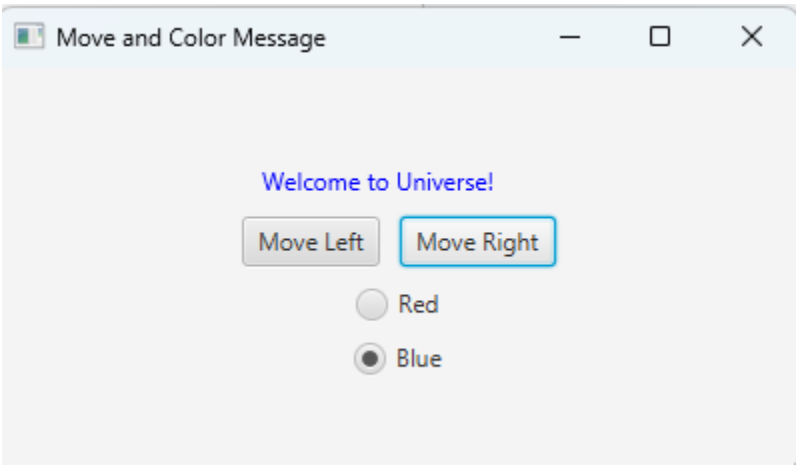
```
    }

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

OUTPUT:






Move and Color Message
Welcome to Universe!
Move Left
Move Right
Red
Blue


Move and Color Message
Welcome to Universe!
Move Left
Move Right
Red
Blue