Advanced Java Programming LAB

(CIE-306P)

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Semester : 6

Group : AIML-II-B

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MISSION

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M2. To foster **moral values** in students and equip them for developing sustainable solutions to serve both national and global needs in society and industry.

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M5. To encourage faculty, student's networking with alumni, industry, institutions, and other stakeholders for collective engagement.

ADVANCED JAVA PROGRAMMING LAB

PRACTICAL RECORD

Name : **Amit Singhal** Paper Code: **CIE - 306P**

Enrollment No. : **11614802722**

Branch : **CSE-I**

Semester/Group : **6 – AIML II - B**

a) LIST OF EXPERIMENTS (prescribed by G.G.S.I.P.U)

S.No.	Experiment Name	Date of Perf.	M R1	A R2	R R3	K R4	S R5	Total Marks	Signature

Experiment - 1

AIM :: Write a java program to demonstrate the concept of multiple inheritance.

CODE ::

```java
package lab2;

interface Animal {
    void sound();
}

interface Movable {
    void move();
}

// A class that implements both Animal and Movable interfaces
public class MultipleInheritanceExample implements Animal, Movable {

    public void sound() {
        System.out.println("The animal makes a sound");
    }

    public void move() {
        System.out.println("The animal moves");
    }

    public static void main(String[] args) {
        MultipleInheritanceExample obj = new MultipleInheritanceExample();

        obj.sound(); // Calls sound() from Animal
        obj.move(); // Calls move() from Movable
    }
}
```

OUTPUT ::

```
PS C:\Users\mait\Downloads\amit-11614802722> javac lab2\MultipleInheritanceExample.java
PS C:\Users\mait\Downloads\amit-11614802722> java lab2.MultipleInheritanceExample
The animal makes a sound
The animal moves
```

Experiment - 2

AIM :: Write a java program to demonstrate the concept of labeled loops.

CODE ::

```java
package lab2;

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

        outerLoop: for (int i = 1; i <= 3; i++) {
            System.out.println("Outer loop iteration " + i);

            innerLoop: for (int j = 1; j <= 3; j++) {
                System.out.println("  Inner loop iteration " + j);

                if (j == 2) {
                    System.out.println(" Skipping the rest of the inner
                                        loop (j == 2)");
                    continue outerLoop;
                }
            }
        }
    }
}
```

OUTPUT ::

```
PS C:\Users\mait\Downloads\amit-11614802722> javac lab2\LabeledLoopExample.java
PS C:\Users\mait\Downloads\amit-11614802722> java lab2.LabeledLoopExample
Outer loop iteration 1
  Inner loop iteration 1
  Inner loop iteration 2
    Skipping the rest of the inner loop (j == 2)
Outer loop iteration 2
  Inner loop iteration 1
  Inner loop iteration 2
    Skipping the rest of the inner loop (j == 2)
Outer loop iteration 3
  Inner loop iteration 1
  Inner loop iteration 2
    Skipping the rest of the inner loop (j == 2)
```

Experiment - 3

AIM :: Write a java program to show the concept of all types of inheritances among interfaces.

CODE ::

```
package Code;

// Single Inheritance among Interfaces
interface Animal {
    void sound();
}

interface Dog extends Animal {
    void breed();
}

class Labrador implements Dog {
    public void sound() {
        System.out.println("Labrador barks");
    }

    public void breed() {
        System.out.println("Breed: Labrador");
    }
}

// Hierarchical Inheritance among Interfaces
interface Vehicle {
    void start();
}

interface Car extends Vehicle {
    void speed();
}

interface Bike extends Vehicle {
    void mileage();
}

class Sedan implements Car {
    public void start() {
        System.out.println("Sedan starts");
    }

    public void speed() {
        System.out.println("Sedan has a speed of 120 km/h");
    }
}
```

```java
class SportsBike implements Bike {
  public void start() {
    System.out.println("Sports Bike starts");
  }

  public void mileage() {
    System.out.println("Sports Bike has a mileage of 30 km/l");
  }
}

public class InterfaceInheritance{
    public static void main(String[] args) {
        // Single Inheritance
        Labrador labrador = new Labrador();
        labrador.sound();
        labrador.breed();

        // Hierarchical Inheritance
        Sedan sedan = new Sedan();
        sedan.start();
        sedan.speed();

        SportsBike bike = new SportsBike();
        bike.start();
        bike.mileage();
    }
}
```

Output ::

```
singhal-amit@singhal-amit-ThinkPad-T430:~/Downloads/Sem 6/LabWork/Advanced Java$ javac Code/InterfaceInheritance.java
singhal-amit@singhal-amit-ThinkPad-T430:~/Downloads/Sem 6/LabWork/Advanced Java$ java Code.InterfaceInheritance
Labrador barks
Breed: Labrador
Sedan starts
Sedan has a speed of 120 km/h
Sports Bike starts
Sports Bike has a mileage of 30 km/l
```

Experiment - 4

AIM :: Write a java program to demonstrate the concept of multi-level inheritance.

CODE ::

```
class Appliance {

    void powerOn() {
        System.out.println("Appliance is powered on");
    }
}

class WashingMachine extends Appliance {

    void wash() {
        System.out.println("Washing Machine is washing clothes");
    }
}

class SmartWashingMachine extends WashingMachine {

    void connectToWifi() {
        System.out.println("Smart Washing Machine is connected to WiFi");
    }
}

class AdvancedWasher extends SmartWashingMachine {

    @Override
    void powerOn() {
        System.out.println("Advanced Washer is powered on");
    }

    @Override
    void wash() {
```

```
        System.out.println("Advanced Washer is washing clothes");
    }

    @Override
    void connectToWifi() {
        System.out.println("Advanced Washer is connected to WiFi");
    }
}

public class MultiLevelInheritance {
    public static void main(String[] args) {
        AdvancedWasher washer = new AdvancedWasher();
        washer.powerOn();
        washer.wash();
        washer.connectToWifi();
    }
}
```

OUTPUT ::

```
PS C:\Users\mait\Downloads\amit> javac .\MultiLevelInheritance.java
PS C:\Users\mait\Downloads\amit> java MultiLevelInheritance
Advanced Washer is powered on
Advanced Washer is washing clothes
Advanced Washer is connected to WiFi
```

Experiment - 5

AIM :: Write a java program to demonstrate the concept of dynamic method dispatch.

CODE ::

```
package Code;

// Superclass
class Animal {
    // Method in superclass
    void sound() {
        System.out.println("Animal makes a sound");
    }
}

// Subclass 1
class Dog extends Animal {
    // Overriding sound() method
    @Override
    void sound() {
        System.out.println("Dog barks");
    }
}

// Subclass 2
class Cat extends Animal {
    // Overriding sound() method
    @Override
    void sound() {
        System.out.println("Cat meows");
    }
}

public class DynamicMethodDispatch {
```

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

        // creating objects of subclasses
        Animal animal1 = new Dog(); // Reference type: Animal, Object type:
Dog
        Animal animal2 = new Cat(); // Reference type: Animal, Object type:
Cat


        // the method that is called depends on the actual object type
        animal1.sound(); // Output: Dog barks (since animal1 points to a Dog
object)
        animal2.sound(); // Output: Cat meows (since animal2 points to a Cat
object)
    }
}
```

Output ::

```
singhal-amit@singhal-amit-ThinkPad-T430:~/Downloads/Sem 6/LabWork/Advanced Java$ javac Code/DynamicMethodDispatch.java
singhal-amit@singhal-amit-ThinkPad-T430:~/Downloads/Sem 6/LabWork/Advanced Java$ java Code.DynamicMethodDispatch
Dog barks
Cat meows
```

Experiment - 6

AIM :: Write a java program to show the use of command line arguments.

CODE ::

```
public class CommandLineArgs {

    public static void main(String[] args) {
        if (args.length != 2) {
            System.out.println("<name> <age> not defined in command line
arguments");
            return;
        }

        String name = args[0];
        String ageString = args[1];

        try {
            int age = Integer.parseInt(ageString);
            System.out.println("Hello, " + name + "! You are " + age + "
years old.");
        } catch (NumberFormatException e) {
            System.out.println("Error: The second argument should be a valid
number (age).");
        }
    }
}
```

OUTPUT ::

```
PS C:\Users\mait\Downloads\amit> javac .\CommandLineArgs.java
PS C:\Users\mait\Downloads\amit> java CommandLineArgs Amit 21
Hello, Amit! You are 21 years old.
```

Experiment - 7

AIM :: Write a java program to create a class, declare variables and methods and call those methods using the object of the class.

CODE ::

```
public class ObjectCall {
    String name;
    int age;

    public void greet() {
        System.out.println("Hello, my name is " + name + " and I am " + age +
" years old.");
    }

    public int getAge() {
        return age;
    }

    public void setAge(int newAge) {
        this.age = newAge;
    }

    public static void main(String[] args) {
        ObjectCall person1 = new ObjectCall();

        person1.name = "John";
        person1.age = 25;

        person1.greet();
        System.out.println("Age: " + person1.getAge());

        person1.setAge(30);
        System.out.println("Updated Age: " + person1.getAge());
    }
}
```

OUTPUT ::

```
PS C:\Users\mait\Downloads\amit> javac .\ObjectCall.java
PS C:\Users\mait\Downloads\amit> java ObjectCall
Hello, my name is John and I am 25 years old.
Age: 25
Updated Age: 30
```

Experiment - 8

AIM :: Write a java program to show the concept of Single Inheritance.

CODE ::

```
class Animal {

    String name;

    public Animal(String name) {
        this.name = name;
    }

    public void makeSound() {
        System.out.println("The animal makes a sound.");
    }

    public String getName() {
        return name;
    }
}

class Dog extends Animal {

    public Dog(String name) {
        super(name);  // Calls the constructor of the parent class
    }

    @Override
    public void makeSound() {
        System.out.println("The dog barks.");
    }

    public void fetch() {
        System.out.println("The dog is fetching the ball.");
    }
}

public class SingleInheritance {
    public static void main(String[] args) {
        Dog myDog = new Dog("Buddy");

        System.out.println("Dog's name: " + myDog.getName());
        myDog.makeSound();
        myDog.fetch();
    }
}
```

OUTPUT ::

```
PS C:\Users\mait\Downloads\amit> javac .\SingleInheritance.java
PS C:\Users\mait\Downloads\amit> java SingleInheritance
Dog's name: Buddy
The dog barks.
The dog is fetching the ball.
```

Experiment - 9

AIM :: Write a java program to show the concept of Constructors.

CODE ::

```
class Car {
    String model;
    int year;
    String color;

    public Car() {
        this.model = "Unknown";
        this.year = 0;
        this.color = "Unknown";
        System.out.println("Default constructor called");
    }

    public Car(String model, int year, String color) {
        // Initialize with the provided values
        this.model = model;
        this.year = year;
        this.color = color;
        System.out.println("Parameterized constructor called");
    }

    public void displayDetails() {
        System.out.println("Car Model: " + model);
        System.out.println("Car Year: " + year);
        System.out.println("Car Color: " + color);
    }
}

public class Constructor {
    public static void main(String[] args) {
        Car car1 = new Car();
        car1.displayDetails();

        System.out.println();

        Car car2 = new Car("Tesla Model S", 2023, "Red");
        car2.displayDetails();
    }
}
```

OUTPUT ::

```
PS C:\Users\mait\Downloads\amit> javac .\Constructor.java
PS C:\Users\mait\Downloads\amit> java Constructor
Default constructor called
Car Model: Unknown
Car Year: 0
Car Color: Unknown

Parameterized constructor called
Car Model: Tesla Model S
Car Year: 2023
Car Color: Red
```

Experiment - 10

AIM :: Write a java program to show the concept of Method Overloading.

CODE ::

```
class Calculator {

    public int add(int a, int b) {
        return a + b;
    }

    public int add(int a, int b, int c) {
        return a + b + c;
    }

    public double add(double a, double b) {
        return a + b;
    }

    public double add(int a, double b) {
        return a + b;
    }
}

public class MethodOverloading {

    public static void main(String[] args) {
        Calculator calc = new Calculator();

        System.out.println("Sum of 10 and 20: " + calc.add(10, 20));

        System.out.println("Sum of 10, 20, and 30: " + calc.add(10, 20, 30));

        System.out.println("Sum of 10.5 and 20.5: " + calc.add(10.5, 20.5));

        System.out.println("Sum of 10 and 20.5: " + calc.add(10, 20.5));
    }
}
```

OUTPUT ::

```
PS C:\Users\mait\Downloads\amit> javac .\MethodOverloading.java
PS C:\Users\mait\Downloads\amit> java MethodOverloading
Sum of 10 and 20: 30
Sum of 10, 20, and 30: 60
Sum of 10.5 and 20.5: 31.0
Sum of 10 and 20.5: 30.5
```

Experiment - 11

AIM :: WAP where a method with the same name is declared in both the parent and child classes.

- The method should have the same parameter list in one case and a different parameter list in another case.
- Also, provide a description of which category this program falls into.

Code ::

```
class Parent {
    void show(int a) {
        System.out.println("Parent class method with 1 parameter: " + a);
    }

    void show(int a, int b) {
        System.out.println("Parent class method with 2 parameters: " + a + ", " + b);
    }
}

class Child extends Parent {
    @Override
    void show(int a) {
        System.out.println("Child class method (Overriding) with 1 parameter: " + a);
    }

    void show(String msg) {
        System.out.println("Child class method (Overloading) with string parameter: "
+ msg);
    }
}

public class q11_specialquestion {
    public static void main(String[] args) {
        Child obj = new Child();
        obj.show(116);
        obj.show("Hello");
        obj.show(116, 105);
    }
}
```

Output ::

```
Code$ javac q11_specialquestion.java
Code$ java q11_specialquestion
Child class method (Overriding) with 1 parameter: 116
Child class method (Overloading) with string parameter: Hello
Parent class method with 2 parameters: 116, 105
```

Experiment - 12

AIM :: WAP To implement for Loop & Methods Of Thread like join, wait, sleep and suspend.

Code ::

```
class MyThread extends Thread {
    private volatile boolean suspended = false; // Flag to manage suspension

    public void run() {
        try {
            System.out.println(Thread.currentThread().getName() + " started.");

            // Using sleep() to pause the thread for 1 second
            Thread.sleep(1000);
            System.out.println(Thread.currentThread().getName() + " slept for 1
second.");

            // Simulating wait() (but in a synchronized block)
            synchronized (this) {
                wait(1000); // Makes the current thread wait for 1 second
                System.out.println(Thread.currentThread().getName() + " resumed after
waiting.");
            }

            // Check if the thread is suspended and wait
            synchronized (this) {
                while (suspended) {
                    wait(); // Wait until resumed
                }
            }
            System.out.println(Thread.currentThread().getName() + " is running after
resume.");

        } catch (InterruptedException e) {
            System.out.println(e);
        }
    }

    // Suspend method using a flag
    public void suspendThread() {
        suspended = true;
        System.out.println(Thread.currentThread().getName() + " is suspended.");
    }

    // Resume method to wake up the suspended thread
    public synchronized void resumeThread() {
        suspended = false;
        notify(); // Notify the waiting thread
        System.out.println(Thread.currentThread().getName() + " is resumed.");
    }
}

public class q12_BasicThreadMethods {
    public static void main(String[] args) {
        MyThread t1 = new MyThread();
        MyThread t2 = new MyThread();

        // Start both threads using a for loop
        for (int i = 0; i < 2; i++) {
            if (i == 0) {
                t1.start();
```

```
            } else {
                t2.start();
            }
        }

        // Using join() to ensure the main thread waits for both threads to finish
        try {
            t1.join();
            t2.join();
            System.out.println("Both threads have finished.");
        } catch (InterruptedException e) {
            System.out.println(e);
        }

        // Suspending and resuming thread (demonstration)
        t1.suspendThread();
        try {
            Thread.sleep(2000); // Wait for 2 seconds before resuming
        } catch (InterruptedException e) {
            System.out.println(e);
        }
        t1.resumeThread();
    }
}
```

Output ::

```
Code$ javac q12_BasicThreadMethods.java
Code$ java q12_BasicThreadMethods
Thread-0 started.
Thread-1 started.
Thread-0 slept for 1 second.
Thread-1 slept for 1 second.
Thread-0 resumed after waiting.
Thread-0 is running after resume.
Thread-1 resumed after waiting.
Thread-1 is running after resume.
Both threads have finished.
main is suspended.
main is resumed.
```

Experiment - 13

AIM :: WAP to implement synchronization in threads and remove deadlock.

Code ::

```
class Resource {
    // Synchronize methods to avoid thread interference and ensure thread safety.
    public synchronized void methodA(Resource other) {
        System.out.println(Thread.currentThread().getName() + " is in methodA.");
        try {
            Thread.sleep(1000);  // Simulate work being done
            other.methodB(this);  // Call methodB of the other resource
        } catch (InterruptedException e) {
            System.out.println(e);
        }
    }

    public synchronized void methodB(Resource other) {
        System.out.println(Thread.currentThread().getName() + " is in methodB.");
        try {
            Thread.sleep(1000);  // Simulate work being done
            other.methodA(this);  // Call methodA of the other resource
        } catch (InterruptedException e) {
            System.out.println(e);
        }
    }
}

public class q13_DeadlockPrevention {
    public static void main(String[] args) {
        Resource resource1 = new Resource();
        Resource resource2 = new Resource();

        // Thread 1: Locking in a consistent order to prevent deadlock
        Thread t1 = new Thread(() -> {
            synchronized (resource1) {  // First lock
                System.out.println(Thread.currentThread().getName() + " locked
resource1.");
                try { Thread.sleep(100); } catch (InterruptedException e) {}
                synchronized (resource2) {  // Then lock resource2
                    System.out.println(Thread.currentThread().getName() + " locked
resource2.");
                    resource1.methodA(resource2);  // Call methodA on resource2
                }
            }
        });

        // Thread 2: Locking in a consistent order to prevent deadlock
        Thread t2 = new Thread(() -> {
            synchronized (resource1) {  // First lock
                System.out.println(Thread.currentThread().getName() + " locked
resource1.");
                try { Thread.sleep(100); } catch (InterruptedException e) {}
                synchronized (resource2) {  // Then lock resource2
                    System.out.println(Thread.currentThread().getName() + " locked
resource2.");
                    resource1.methodB(resource2);  // Call methodB on resource2
                }
            }
        });
```

```
            t1.start();
            t2.start();
        }
    }
```

Output ::

```
Code$ javac q13_DeadlockPrevention.java
Code$ java q13_DeadlockPrevention
Thread-0 locked resource1.
Thread-0 locked resource2.
Thread-0 is in methodA.
Thread-0 is in methodB.
Thread-0 is in methodA.
Thread-0 is in methodB.
Thread-0 is in methodA.
Thread-0 is in methodB.
```

Experiment - 14

AIM :: WAP To implement Producer-Consumer problem in java.

Code ::

```
import java.util.LinkedList;
                    import java.util.Queue;

class SharedBuffer {
    private final Queue<Integer> buffer = new LinkedList<>();
    private final int MAX_CAPACITY = 5;

    // Method for Producer to add items to the buffer
    public synchronized void produce() throws InterruptedException {
        while (buffer.size() == MAX_CAPACITY) {
            System.out.println("Buffer is full. Producer is waiting...");
            wait(); // Wait if the buffer is full
        }
        int item = (int) (Math.random() * 100); // Generate a random item
        buffer.add(item);
        System.out.println("Produced: " + item);
        notify(); // Notify the consumer that the buffer is no longer empty
    }

    // Method for Consumer to consume items from the buffer
    public synchronized void consume() throws InterruptedException {
        while (buffer.isEmpty()) {
            System.out.println("Buffer is empty. Consumer is waiting...");
            wait(); // Wait if the buffer is empty
        }
        int item = buffer.poll();
        System.out.println("Consumed: " + item);
        notify(); // Notify the producer that the buffer is no longer full
    }
}

class Producer implements Runnable {
    private final SharedBuffer sharedBuffer;

    public Producer(SharedBuffer sharedBuffer) {
        this.sharedBuffer = sharedBuffer;
    }

    @Override
    public void run() {
        try {
            while (true) {
                sharedBuffer.produce();
                Thread.sleep(1000); // Simulate time taken to produce an item
            }
        } catch (InterruptedException e) {
            System.out.println(e);
        }
    }
}

class Consumer implements Runnable {
    private final SharedBuffer sharedBuffer;

    public Consumer(SharedBuffer sharedBuffer) {
        this.sharedBuffer = sharedBuffer;
```

```
    }

    @Override
    public void run() {
        try {
            while (true) {
                sharedBuffer.consume();
                Thread.sleep(1500); // Simulate time taken to consume an item
            }
        } catch (InterruptedException e) {
            System.out.println(e);
        }
    }
}

public class q14_ProducerConsumerProblem {
    public static void main(String[] args) {
        SharedBuffer sharedBuffer = new SharedBuffer();

        Thread producerThread = new Thread(new Producer(sharedBuffer));
        Thread consumerThread = new Thread(new Consumer(sharedBuffer));

        producerThread.start();
        consumerThread.start();
    }
}
```

Output ::

```
Code$ javac q14_ProducerConsumerProblem.java
Code$ java q14_ProducerConsumerProblem
Produced: 51
Consumed: 51
Produced: 65
Consumed: 65
Produced: 1
Consumed: 1
Produced: 18
Produced: 50
Consumed: 18
Produced: 3
Consumed: 50
Produced: 39
Produced: 60
Consumed: 3
```

Experiment - 15

AIM :: WAP To implement try-catch-finally block in java.

Code ::

```
public class q15_TryCatch {
    public static void main(String[] args) {
        int arr[] = { 66, 69, 122, 105, 80085 };
        int n = arr.length;

        try {
            System.out.println("Currently In Try Block");
            checkArrayIndex(arr, n);
        } catch (Exception e) {
            System.out.println();
            System.out.println("\nCurrently In Catch Block");
            System.out.println(e.getMessage());
        } finally {
            System.out.println();
            System.out.println("This is finally block, Program Has Ended");
        }
    }

    public static void checkArrayIndex(int[] arr, int n) throws
ArrayIndexOutOfBoundsException {
        for (int i = 0; i ≤ n; i++) {
            if (i ≥ arr.length) {
                throw new ArrayIndexOutOfBoundsException("Array index out of bounds:
" + i);
            }
            System.out.print(arr[i] + " ");
        }
    }
}
```

Output ::

```
Code$ javac q15_TryCatch.java
Code$ java q15_TryCatch
Currently In Try Block
66 69 122 105 80085

Currently In Catch Block
Array index out of bounds: 5

This is finally block, Program Has Ended
```

Experiment - 16

AIM :: WAP to implement a basic applet.

Code ::

1. **q16_BasicApplet.java**

```
import java.applet.Applet;
import java.awt.Graphics;

public class q16_BasicApplet extends Applet {
    // Override the paint method to display the message
    @Override
    public void paint(Graphics g) {
        // Display the message on the applet window
        g.drawString("Hi, This is Amit Singhal", 50, 60);
    }
}
```

2. **q16_BasicApplet.html**

```
<html>
    <body>
        <applet code="q16_BasicApplet.class" width="400" height="150"></applet>
    </body>
</html>
```

Output ::

```
Code$ javac q16_BasicApplet.java
Code$ java q16_BasicApplet
```

Experiment - 17

AIM :: WAP to implement a moving banner in java using applet and threads.

Code ::

1. q17_MovingBanner.java

```
import java.applet.Applet;
import java.awt.*;

public class q17_MovingBanner extends Applet implements Runnable {
  private String message = "Welcome to Java Programming!";
  private int xPos = 100; // Initial position of the text
  private int yPos = 50; // Y-coordinate of the text
  private Thread thread;

  @Override
  public void init() {
    thread = new Thread(this);
    thread.start();
  }

  @Override
  public void run() {
    while (true) {
      xPos -= 2; // Move the text to the left

      // If the text moves completely off screen, reset its position
      if (xPos < -getFontMetrics(getFont()).stringWidth(message)) {
        xPos = getWidth();
      }

      repaint(); // Redraw the applet

      try {
        Thread.sleep(50); // Control the speed of movement
      } catch (InterruptedException e) {
        Thread.currentThread().interrupt();
      }
    }
  }
```

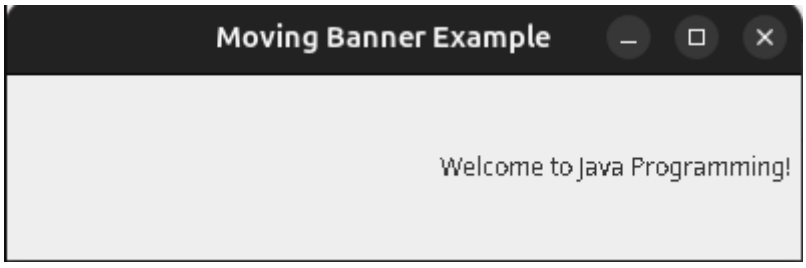
```
    @Override
    public void paint(Graphics g) {
      g.drawString(message, xPos, yPos);
    }

    @Override
    public void stop() {
      thread = null; // Stop the thread when applet is stopped
    }
  }
```

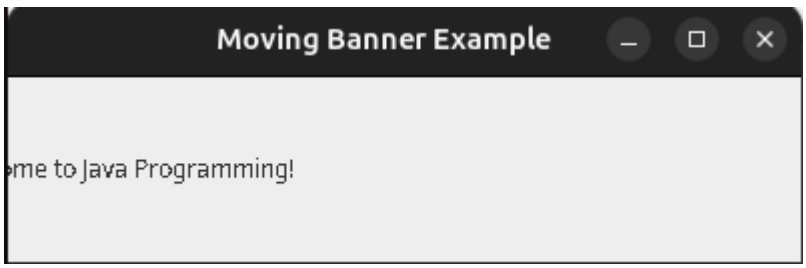
2. q17_MovingBanner.html

```
<html>
  <body>
    <applet code="q17_MovingBanner.class" width="400" height="150"></applet>
  </body>
</html>
```

Output ::

```
Code$ javac  q17_MovingBanner.java
Code$ java q17_MovingBanner
```





Experiment - 18

AIM :: WAP to call a frame using applet and awt.

Code ::

1. q18_AppletWithFrame.java

```
import java.applet.Applet;
import java.awt.*;

@SuppressWarnings("removal")
public class q18_AppletWithFrame extends Applet {

    @Override
    public void init() {
        // Create a Frame
        Frame myFrame = new Frame("Applet with Frame");

        // Create a Label in the Frame
        Label label = new Label("Hello, I am inside a Frame!");

        // Set layout and add label
        myFrame.setLayout(new FlowLayout());
        myFrame.add(label);

        // Set frame size and make it visible
        myFrame.setSize(300, 200);
        myFrame.setVisible(true);
    }

    @Override
    public void paint(Graphics g) {
        g.drawString("This is an Applet!", 50, 50);
    }
}
```

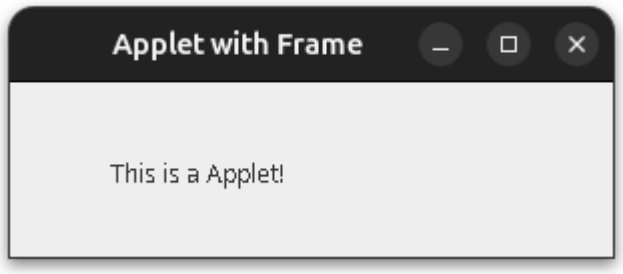
2. q18_AppletWithFrame.html

```
<html>
    <body>
        <applet code="q18_AppletWithFrame.class" width="400" height="250"></applet>
```

```
    </body>
</html>
```

Output ::

```
Code$ javac  q18_AppletWithFrame.java
Code$ java q18_AppletWithFrame
```



Experiment - 19

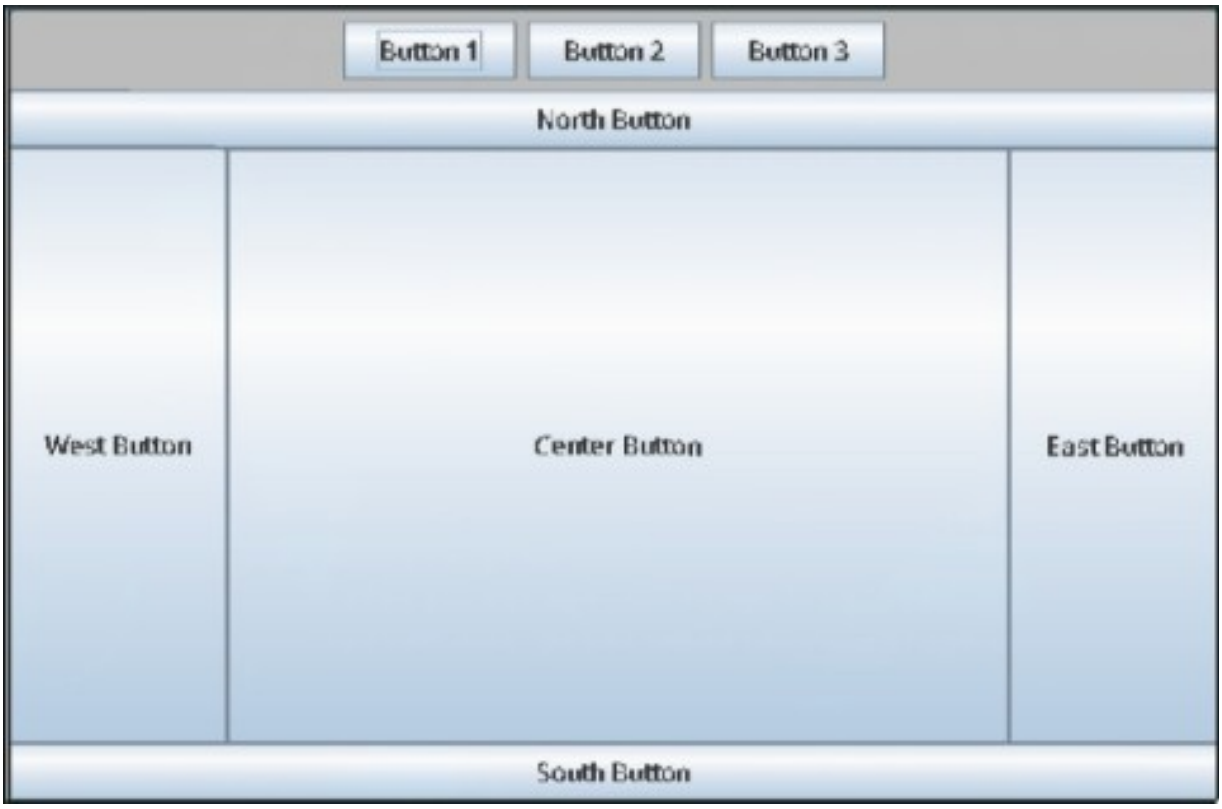
AIM :: Write a Java Program to showcase the use of Layout Manager

Code ::

LayoutManagersExample.java

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

public class LayoutManagersExample {
    public static void main(String[] args) {
        // Create a new JFrame (main window)
        JFrame frame = new JFrame("Layout Manager Example");
        frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
        frame.setSize(400, 200); // Set the size of the window

        // Create a panel with FlowLayout
        JPanel flowPanel = new JPanel(new FlowLayout());
        flowPanel.setBackground(Color.LIGHT_GRAY); // Set background color for the panel
        flowPanel.add(new JButton("Button 1"));
        flowPanel.add(new JButton("Button 2"));
        flowPanel.add(new JButton("Button 3"));

        // Create a panel with BorderLayout
        JPanel borderPanel = new JPanel(new BorderLayout());
        borderPanel.setBackground(Color.CYAN);
        borderPanel.add(new JButton("North Button"), BorderLayout.NORTH);
        borderPanel.add(new JButton("South Button"), BorderLayout.SOUTH);
        borderPanel.add(new JButton("East Button"), BorderLayout.EAST);
        borderPanel.add(new JButton("West Button"), BorderLayout.WEST);
        borderPanel.add(new JButton("Center Button"), BorderLayout.CENTER);

        // Use BorderLayout for the main frame
        frame.setLayout(new BorderLayout());

        // Add FlowLayout panel at the top
        frame.add(flowPanel, BorderLayout.NORTH);

        // Add BorderLayout panel in the center
        frame.add(borderPanel, BorderLayout.CENTER);

        // Make the frame visible
        frame.setVisible(true);
    }
}
```

Output ::


Button 1
Button 2
Button 3
North Button
West Button
Center Button
East Button
South Button

Experiment - 20

AIM :: Write a Java Program to represent a Human Skull

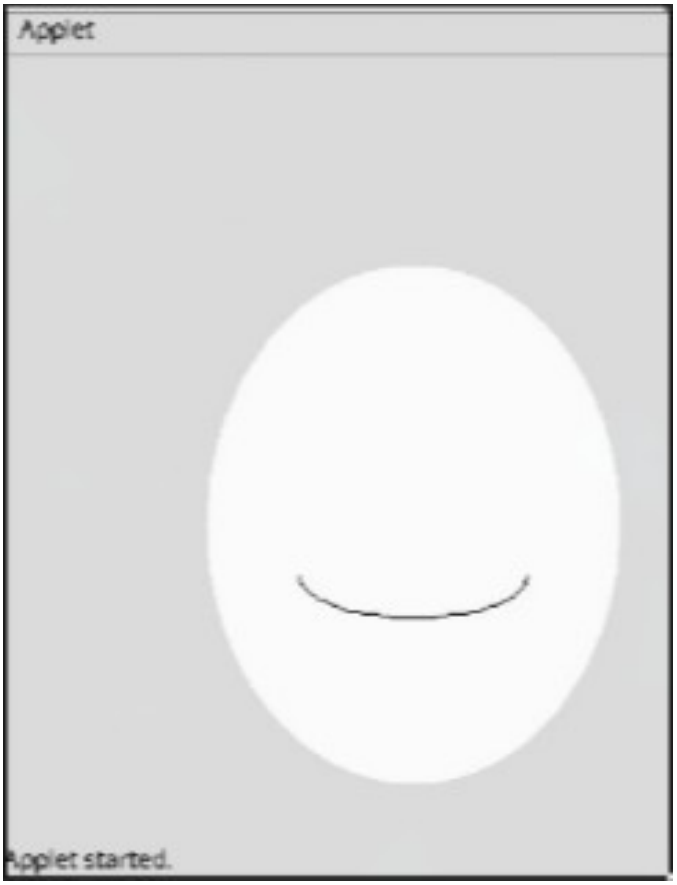
Code ::

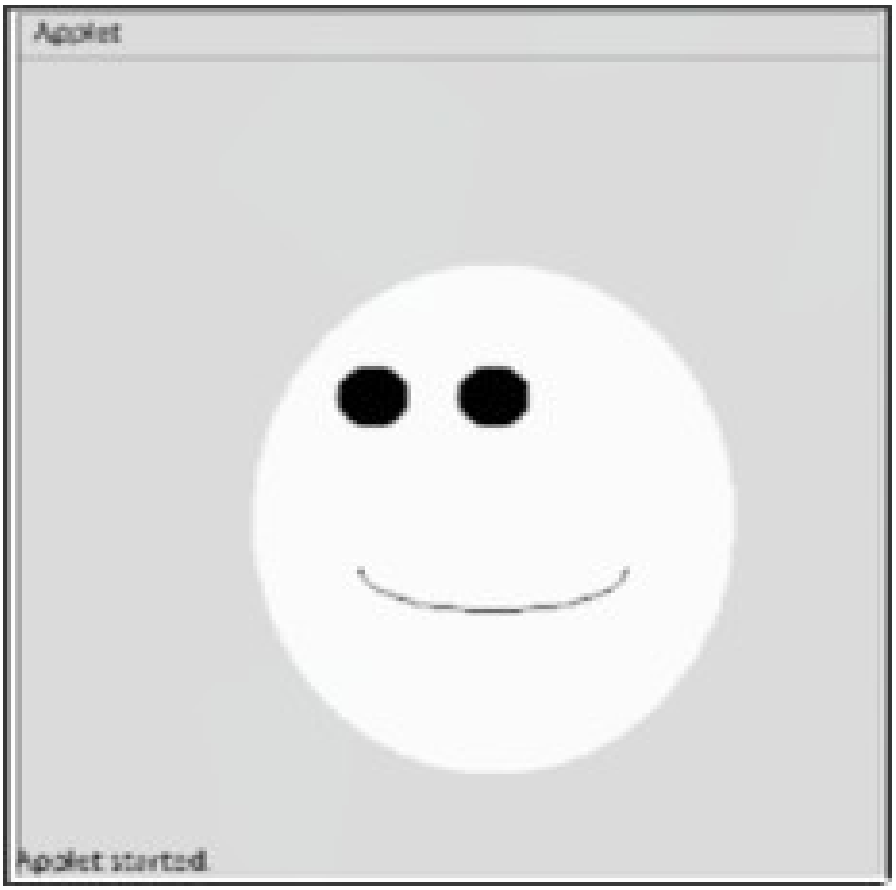
HumanSkullDrawing.java

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

public class HumanSkullDrawing extends JPanel {

    @Override
    protected void paintComponent(Graphics g) {
        super.paintComponent(g);

        // Cast Graphics to Graphics2D for better control over drawing
        Graphics2D g2d = (Graphics2D) g;

        // Anti-aliasing for smoother curves
        g2d.setRenderingHint(RenderingHints.KEY_ANTIALIASING,
RenderingHints.VALUE_ANTIALIAS_ON);

        // Draw skull outline (main head shape)
        g2d.setColor(new Color(255, 255, 255)); // Skull color: white
        g2d.fillOval(100, 50, 200, 250); // Oval for the skull

        // Draw eyes (two black circles)
        g2d.setColor(Color.BLACK);
        g2d.fillOval(145, 120, 35, 50); // Left eye
        g2d.fillOval(220, 120, 35, 50); // Right eye

        // Draw nose (triangle-like shape)
        int[] xPoints = {190, 210, 200}; // X coordinates for the triangle
        int[] yPoints = {180, 180, 220}; // Y coordinates for the triangle
        g2d.fillPolygon(xPoints, yPoints, 3); // Nose is a simple triangle

        // Draw mouth (curved shape)
        g2d.setColor(Color.BLACK);
        g2d.drawArc(150, 220, 100, 50, 0, -180); // Mouth using arc

        // Draw teeth (simplified)
        g2d.setColor(Color.WHITE);
        g2d.fillRect(160, 230, 20, 30); // Left tooth
        g2d.fillRect(180, 230, 20, 30); // Second tooth
        g2d.fillRect(200, 230, 20, 30); // Third tooth
        g2d.fillRect(220, 230, 20, 30); // Fourth tooth
        g2d.fillRect(240, 230, 20, 30); // Fifth tooth

        // Draw cracks on the skull (optional for effect)
        g2d.setColor(Color.GRAY);
        g2d.drawLine(160, 80, 220, 110); // Example crack
        g2d.drawLine(230, 100, 170, 150); // Another crack
    }

    public static void main(String[] args) {
        // Create a frame to display the panel
        JFrame frame = new JFrame("Human Skull Drawing");
        HumanSkullDrawing skullPanel = new HumanSkullDrawing();
        frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
        frame.setSize(400, 400); // Set the frame size
        frame.add(skullPanel);   // Add the drawing panel to the frame
```

```
        frame.setVisible(true);  // Make the frame visible
    }
            }
```

Output ::





Experiment - 21

AIM :: WAP to implement a student java bean and access it using another java file.

Code ::

1. Student.java

```
import java.io.Serializable;

public class Student implements Serializable {
    private static final long serialVersionUID = 1L;
    private int id; private int age;
    private String name;

    public Student() {}
    public Student(int id, String name, int age) {
        this.id = id;
        this.name = name;
        this.age = age;
    }
    public int getId() { return id; }
    public void setId(int id) { this.id = id; }

    public String getName() { return name; }
    public void setName(String name) { this.name = name; }

    public int getAge() { return age; }
    public void setAge(int age) {
        if (age > 0) {
            this.age = age;
        } else {
            System.out.println("Age must be positive.");
        }
    }

    @Override
    public String toString() {
        return "Student [ID=" + id + ", Name=" + name + ", Age=" + age + "]";
    }
}
```

2. StudentTest.java

```
public class StudentTest {
  public static void main(String[] args) {
     // Creating a Student object using no-arg constructor
     Student student = new Student();
     student.setId(101);
     student.setName("Alice");
     student.setAge(20);

     // Displaying student details
     System.out.println("Student ID: " + student.getId());
     System.out.println("Student Name: " + student.getName());
     System.out.println("Student Age: " + student.getAge());
     System.out.println("The Student 1 Is : " + student);

     // Creating another Student object using parameterized constructor
     Student student2 = new Student(102, "Bob", 22);
     System.out.println("The Student 2 Is : " + student2);
  }
}
```

Output ::

```
Code$ javac Student.java StudentTest.java
Code$ java StudentTest
Student ID: 101
Student Name: Alice
Student Age: 20
The Student 1 Is : Student [ID=101, Name=Alice, Age=20]
The Student 2 Is : Student [ID=102, Name=Bob, Age=22]
```

Experiment - 22

AIM :: WAP to implement an employee java bean and access it using another java file.

Code ::

1. Employee.java

```
import java.io.Serializable;

public class Employee implements Serializable {
    private static final long serialVersionUID = 1L;
    private int empId;
    private double salary;
    private String empName;

    public Employee() {}

    public int getEmpId() { return empId; }
    public void setEmpId(int empId) { this.empId = empId; }

    public String getEmpName() { return empName; }
    public void setEmpName(String empName) { this.empName = empName; }

    public double getSalary() { return salary; }
    public void setSalary(double salary) {
        if (salary > 0) {
            this.salary = salary;
        } else {
            System.out.println("Salary must be positive.");
        }
    }

    @Override
    public String toString() {
        return "Employee [ID=" + empId + ", Name=" + empName + ", Salary=" + salary + "]";
    }
}
```

2. EmployeeTest.java

```
public class EmployeeTest {
```

```
    public static void main(String[] args) {
        // Creating an Employee Bean using the no-arg constructor
        Employee emp = new Employee();

        // Setting properties using setter methods with random values
        emp.setEmpId(2034);
        emp.setEmpName("Lena Rivers");
        emp.setSalary(78560.50);

        // Getting properties using getter methods
        System.out.println("Employee ID: " + emp.getEmpId());
        System.out.println("Employee Name: " + emp.getEmpName());
        System.out.println("Employee Salary: $" + emp.getSalary());
        System.out.println("The Employee Details Are : " + emp);
    }
}
```

Output ::

```
Code$ javac Employee.java EmployeeTest.java
Code$ java EmployeeTest
Employee ID: 2034
Employee Name: Lena Rivers
Employee Salary: $78560.5
The Employee Details Are : Employee [ID=2034, Name=Lena Rivers, Salary=78560.5]
```

Experiment - 23

AIM :: Write a servlet using Web-Servlet to handle GET request and display HTML response

Code ::

HelloServlet.java

```
import java.io.*;
import jakarta.servlet.*;
import jakarta.servlet.http.*;
import jakarta.servlet.annotation.*;

@WebServlet("/hello")
public class HelloServlet extends HttpServlet {
    private static final long serialVersionUID = 1L;

    protected void doGet(HttpServletRequest request , HttpServletResponse response)
            throws ServletException, IOException {
        response.setContentType("text/html");
        PrintWriter out = response.getWriter();
        out.println("<!DOCTYPE html><html lang='en'><head>");

        out.println("<meta charset='UTF-8'><meta name='viewport' content='width=device-
width, initial-scale=1.0'>");
        out.println("<title>Document</title></head><body>");
        out.println("<h2>Hello, World! Welcome to Servlet Programming.</h2>");
        out.println("<p>Created By : Amit Singhal , 11614802722</p></body></html>");
    }
}
```

pom.xml (Dependency Section Snippet)

```
<dependency>
    <groupId>jakarta.servlet</groupId>
    <artifactId>jakarta.servlet-api</artifactId>
    <version>5.0.0</version>
    <scope>provided</scope>
</dependency>
```

Output ::

Experiment - 24

AIM :: Write a Java Program to create a Chat Server

Code ::

1. ChatServer.java

```
import java.io.*;
import java.net.*;
import java.util.*;

public class ChatServer {
    // List to hold all connected client handlers
    private static final List<ClientHandler> clients = new ArrayList<>();

    public static void main(String[] args) {
        int port = 12345; // The server port
        try (ServerSocket serverSocket = new ServerSocket(port)) {
            System.out.println("Chat Server started on port " + port);
            // Continuously accept client connections
            while (true) {
                Socket clientSocket = serverSocket.accept();
                System.out.println("New client connected: " +
clientSocket.getInetAddress());
                // Create a new client handler to manage the client's messages
                ClientHandler clientHandler = new ClientHandler(clientSocket);
                clients.add(clientHandler);
                // Start a new thread for the client
                new Thread(clientHandler).start();
            }
        } catch (IOException e) {
            e.printStackTrace();
        }
    }

    // Method to broadcast messages to all clients
    public static void broadcastMessage(String message, ClientHandler sender) {
        for (ClientHandler client : clients) {
            // Don't send the message to the sender
            if (client != sender) {
                client.sendMessage(message);
            }
        }
    }

    // Inner class to handle each client's communication
    private static class ClientHandler implements Runnable {
        private Socket socket;
        private PrintWriter out;
        private BufferedReader in;
        private String clientName;

        public ClientHandler(Socket socket) {
            this.socket = socket;
            try {
                // Setup input and output streams
                in = new BufferedReader(new InputStreamReader(socket.getInputStream()));
                out = new PrintWriter(socket.getOutputStream(), true);
                // Get the client's name
                out.println("Enter your name: ");
```

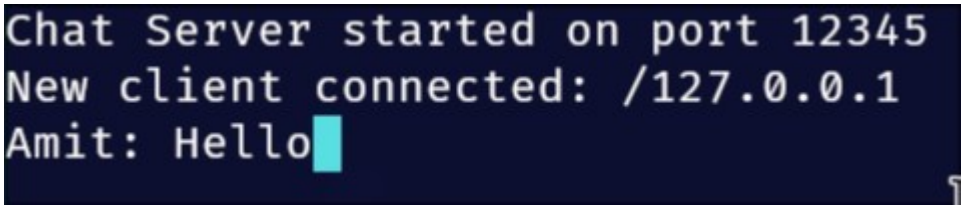
```
                clientName = in.readLine();
                out.println("Welcome to the chat, " + clientName + "!");
            } catch (IOException e) {
                e.printStackTrace();
            }
        }

        // Method to send message to the client
        public void sendMessage(String message) {
            out.println(message);
        }

        @Override
        public void run() {
            String message;
            try {
                while ((message = in.readLine()) != null) {
                    if (message.equalsIgnoreCase("exit")) {
                        break;
                    }
                    // Broadcast the message to all clients
                    System.out.println(clientName + ": " + message);
                    ChatServer.broadcastMessage(clientName + ": " + message, this);
                }
            } catch (IOException e) {
                e.printStackTrace();
            } finally {
                try {
                    // Remove the client from the list of active clients
                    clients.remove(this);
                    socket.close();
                    System.out.println(clientName + " has disconnected.");
                } catch (IOException e) {
                    e.printStackTrace();
                }
            }
        }
    }
}
```

2. ChatClient.java

```
import java.io.*;
import java.net.*;

public class ChatClient {
    private static PrintWriter out;
    private static BufferedReader in;
    private static BufferedReader userInput;

    public static void main(String[] args) {
        String serverAddress = "localhost"; // The server address (localhost for local
machine)
        int port = 12345; // The server port

        try (Socket socket = new Socket(serverAddress, port)) {
            // Setup input and output streams
            in = new BufferedReader(new InputStreamReader(socket.getInputStream()));
            out = new PrintWriter(socket.getOutputStream(), true);
            userInput = new BufferedReader(new InputStreamReader(System.in));

            // Read welcome message from the server
            String serverMessage = in.readLine();
            System.out.println(serverMessage);

            // Get the client's name from the user
```

```
            String name = userInput.readLine();
            out.println(name);

            // Listen for server messages and print them to the console
            new Thread(new ServerListener()).start();

            // Send messages to the server
            String message;
            while (true) {
                message = userInput.readLine();
                out.println(message);
                if (message.equalsIgnoreCase("exit")) {
                    break;
                }
            }
        } catch (IOException e) {
            e.printStackTrace();
        }
    }

    // Inner class to listen for messages from the server
    private static class ServerListener implements Runnable {
        @Override
        public void run() {
            String message;
            try {
                while ((message = in.readLine()) != null) {
                    System.out.println(message);
                }
            } catch (IOException e) {
                e.printStackTrace();
            }
        }
    }
}
```

Output ::



Experiment - 25

AIM :: Write a Java Program to Showcase the use of Listeners

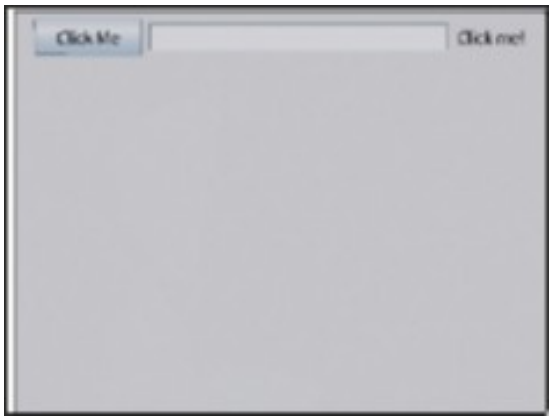
Code ::

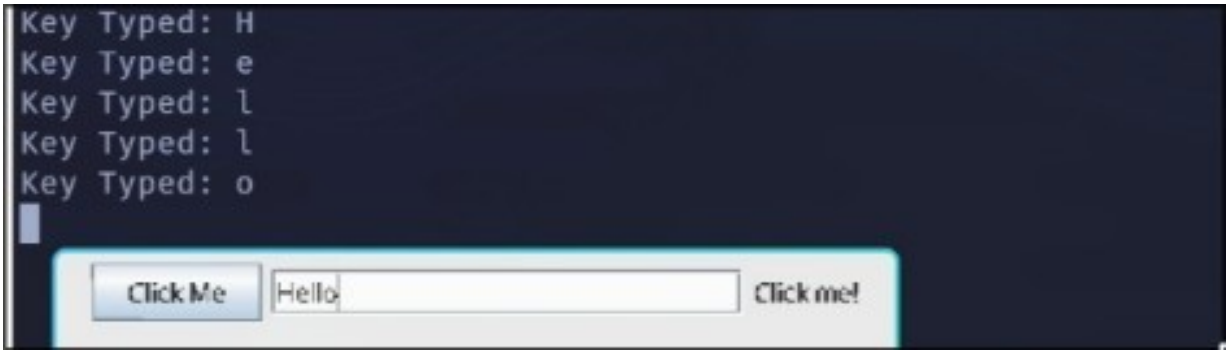
1. SwingListenersExample.java

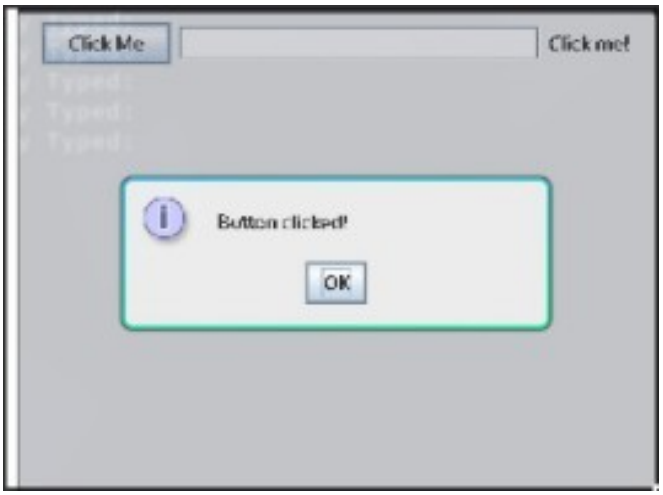
```
import javax.swing.*;
import java.awt.*;
import java.awt.event.*;

public class SwingListenersExample {
    public static void main(String[] args) {
        // Create a frame for the GUI
        JFrame frame = new JFrame("Swing Listeners Example");
        frame.setSize(400, 300);
        frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);

        // Create a panel to hold components
        JPanel panel = new JPanel();
        panel.setLayout(new FlowLayout());

        // Create a button and add an ActionListener
        JButton button = new JButton("Click Me");
        button.addActionListener(new ActionListener() {
            @Override
            public void actionPerformed(ActionEvent e) {
                JOptionPane.showMessageDialog(frame, "Button clicked!");
            }
        });

        // Create a text field and add a KeyListener
        JTextField textField = new JTextField(20);
        textField.addKeyListener(new KeyAdapter() {
            @Override
            public void keyTyped(KeyEvent e) {
                // Display the key that is typed
                char c = e.getKeyChar();
                System.out.println("Key Typed: " + c);
            }
        });

        // Create a label and add a MouseListener
        JLabel label = new JLabel("Click me!");
        label.addMouseListener(new MouseAdapter() {
            @Override
            public void mouseClicked(MouseEvent e) {
                JOptionPane.showMessageDialog(frame, "Label clicked!");
            }
        });

        // Add the components to the panel
        panel.add(button);
        panel.add(textField);
        panel.add(label);

        // Add the panel to the frame
        frame.add(panel);

        // Set the frame to be visible
```

```
            frame.setVisible(true);
        }
    }
```

Output ::







Experiment - 26

AIM :: Write a simple Swing Program in java.

Code ::

1. SimpleSwingProgram.java

```
import javax.swing.*;
import java.awt.*;
import java.awt.event.*;

public class SimpleSwingProgram {
    public static void main(String[] args) {
        // Create a new JFrame (main window)
        JFrame frame = new JFrame("Simple Swing Program");

        // Set the layout for the frame
        frame.setLayout(new FlowLayout());

        // Create a label
        JLabel label = new JLabel("Enter your name:");

        // Create a text field for user input
        JTextField textField = new JTextField(20);

        // Create a button that will trigger an action
        JButton button = new JButton("Submit");

        // ActionListener for the button
        button.addActionListener(new ActionListener() {
            @Override
            public void actionPerformed(ActionEvent e) {
                String name = textField.getText();
                label.setText("Hello, " + name + "!");
            }
        });

        // Add the components to the frame
        frame.add(label);
        frame.add(textField);
        frame.add(button);

        // Set frame properties
        frame.setSize(300, 150); // Set the size of the window
        frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE); // Close the application
when the window is closed
        frame.setVisible(true);
    }
}
```

Output ::

Experiment - 27

AIM :: Write a Java Program to showcase the use of JSP

Code ::

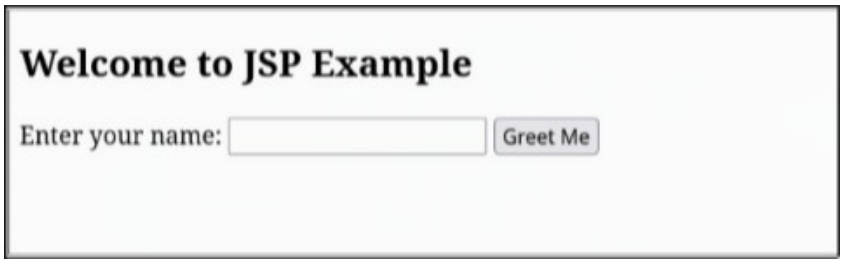
1. index.html

```
<html>
<head>
    <title>Simple JSP Example</title>
</head>
<body>
    <h2>Welcome to JSP Example</h2>
    <form action="greet.jsp" method="post">
        Enter your name: <input type="text" name="username" />
        <input type="submit" value="Greet Me" />
    </form>
</body>
</html>
```

2. greet.jsp

```
<!DOCTYPE html>
<html>
<head>
    <title>Greeting Page</title>
</head>
<body>
    <h2>Hello, <%= request.getParameter("username") %>!</h2>
    <p>Welcome to the JSP World!</p>
    <a href="index.jsp">Go Back</a>
</body>
</html>
```

Output ::



Experiment - 28

AIM :: Write a Java Program to showcase the use of a Servlet

Code ::

1. HelloWorldServlet.java

```
import java.io.*;
import javax.servlet.*;
import javax.servlet.http.*;

public class HelloWorldServlet extends HttpServlet {
    // Overriding the doGet method to handle HTTP GET requests
    @Override
    protected void doGet(HttpServletRequest request, HttpServletResponse response)
            throws ServletException, IOException {
        // Setting the response content type
        response.setContentType("text/html");

        // Writing the response message
        PrintWriter out = response.getWriter();
        out.println("<html><body>");
        out.println("<h1>Hello, World!</h1>");
        out.println("</body></html>");
    }
}
```

2. web.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<web-app xmlns="http://java.sun.com/xml/ns/javaee"
         xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
         xsi:schemaLocation="http://java.sun.com/xml/ns/javaee
                             http://java.sun.com/xml/ns/javaee/web-app_3_0.xsd"
         version="3.0">

    <servlet>
        <servlet-name>HelloWorldServlet</servlet-name>
        <servlet-class>HelloWorldServlet</servlet-class>
    </servlet>

    <servlet-mapping>
        <servlet-name>HelloWorldServlet</servlet-name>
        <url-pattern>/hello</url-pattern>
    </servlet-mapping>

</web-app>
```

Output ::