U VENKATA ACHYUTH KRISHNA

CH.SC.U4CSE24148

OBJECT ORIENTED PROGRAMMING (23CSE111)

LAB RECORD

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BONAFIDE CERTIFICATE

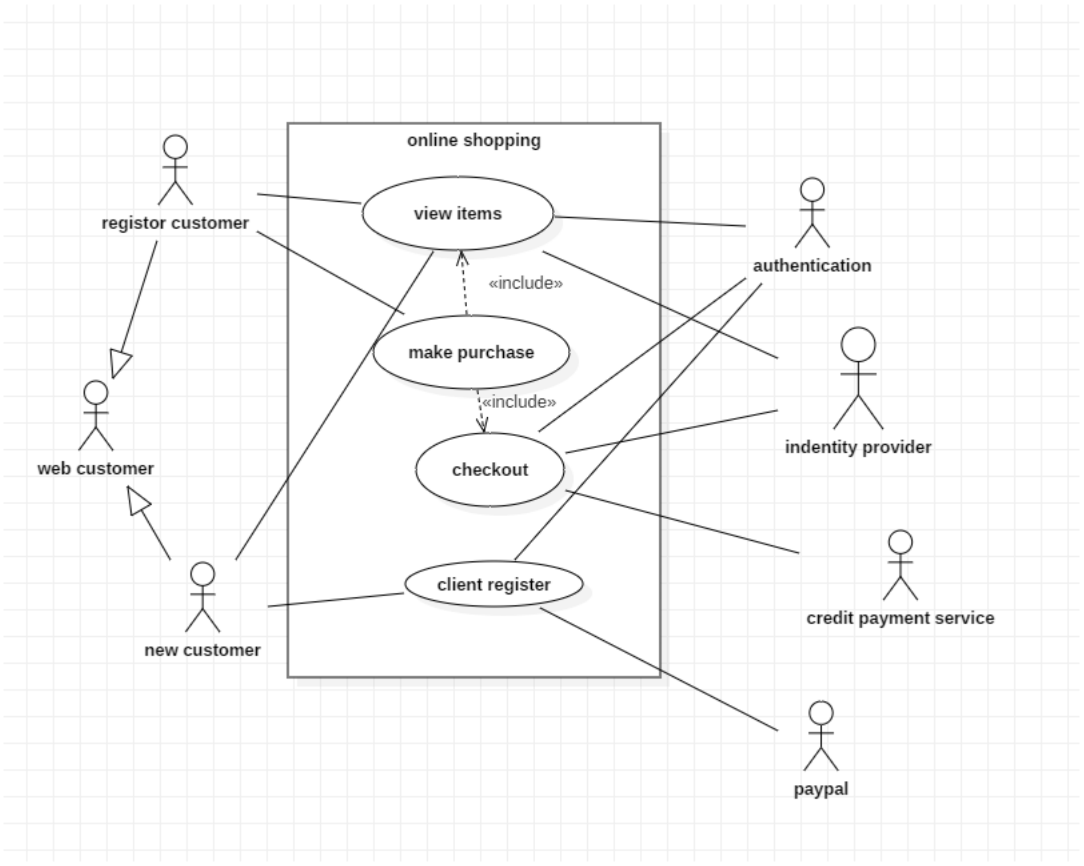
This is to certify that the Lab Record work for 23CSE111-Object Oriented Programming Subject submitted by **CH.SC.U4CSE24148 – U Venkata Achyuth Krishna** in "Computer Science and Engineering" is a Bonafide record of the work carried out under my guidance and supervision at Amrita School of Computing, Chennai.

This Lab examination on held on

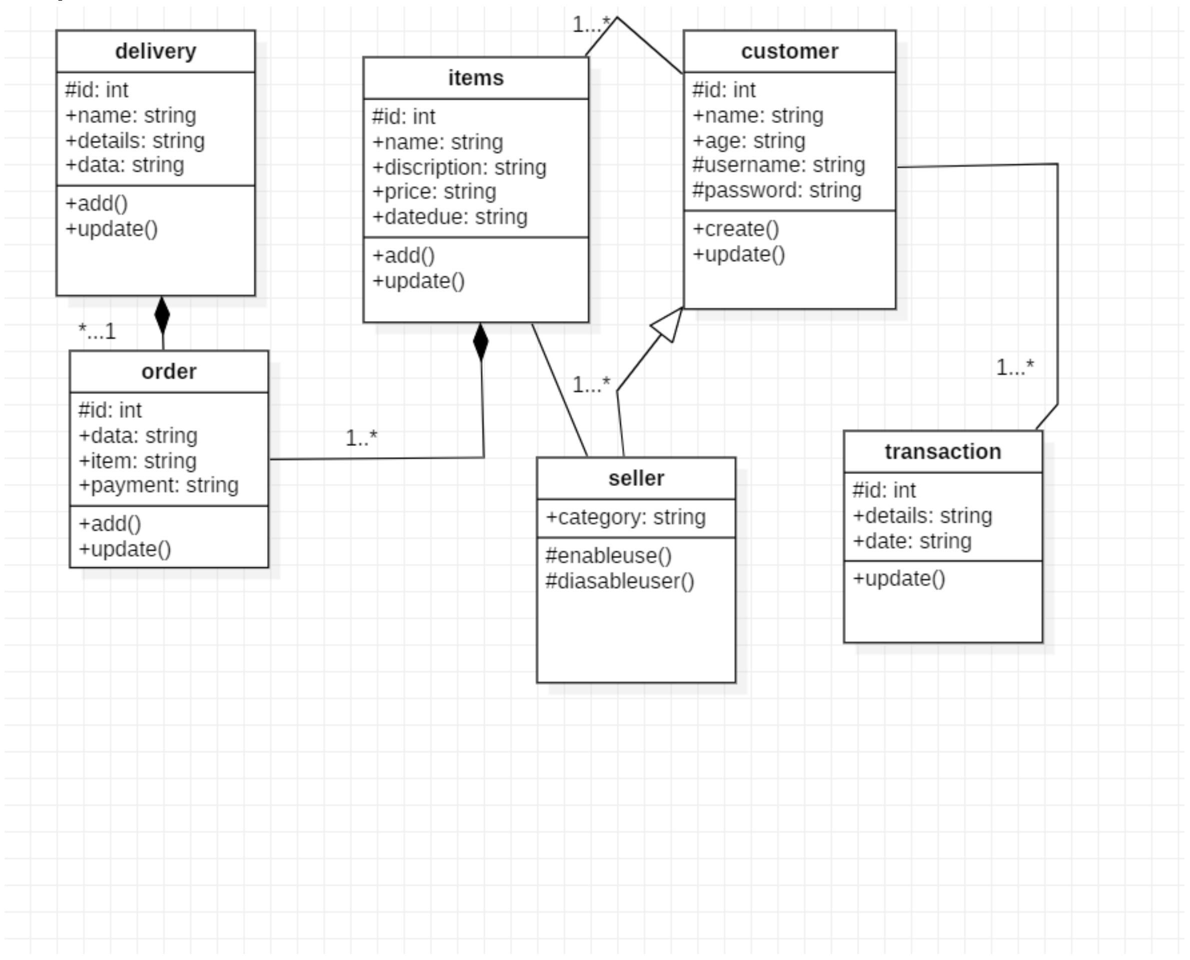
UML DIAGRAMS

ONLINE SHOPPING

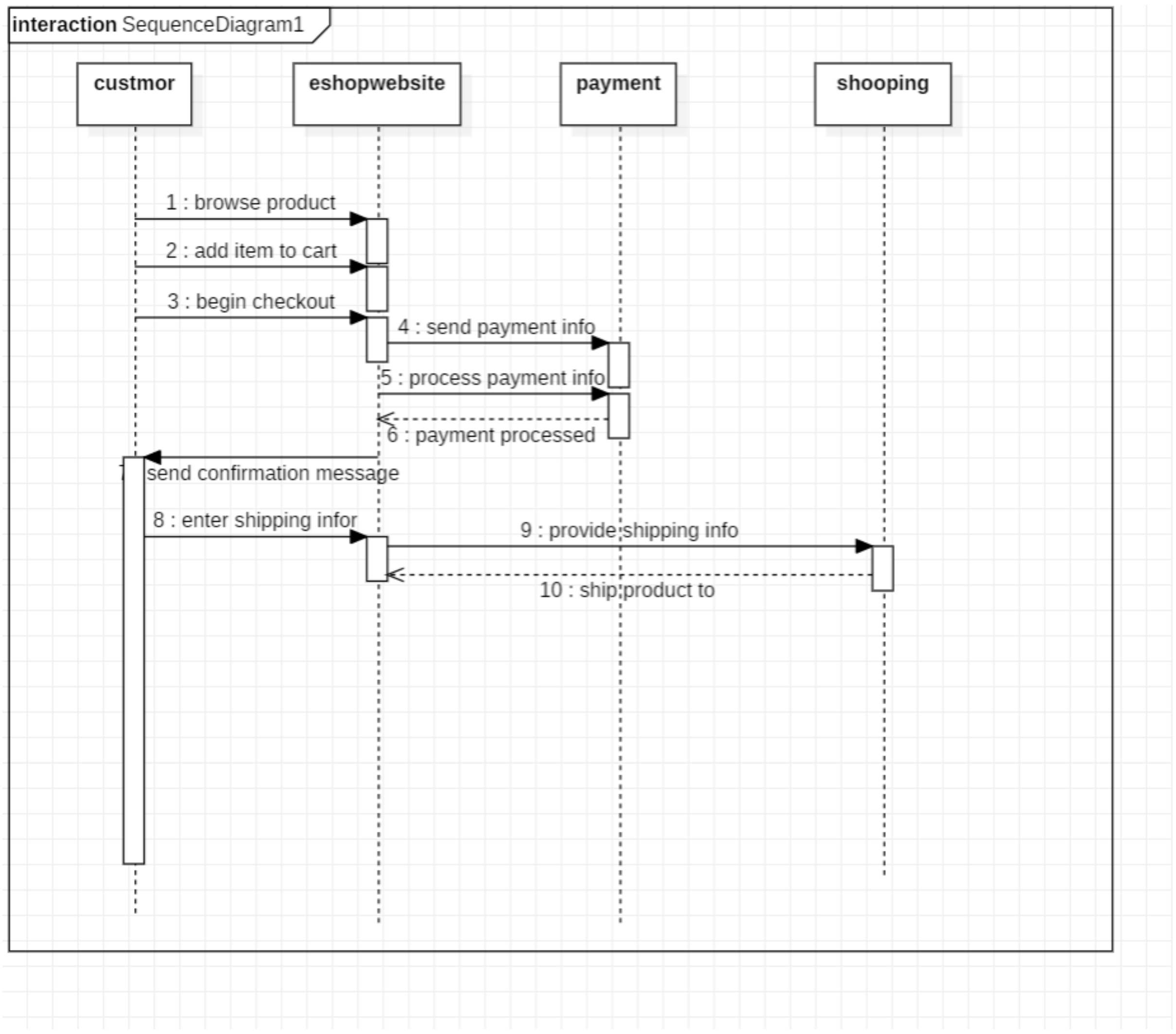
1 A) USE CASE DIAGRAM:



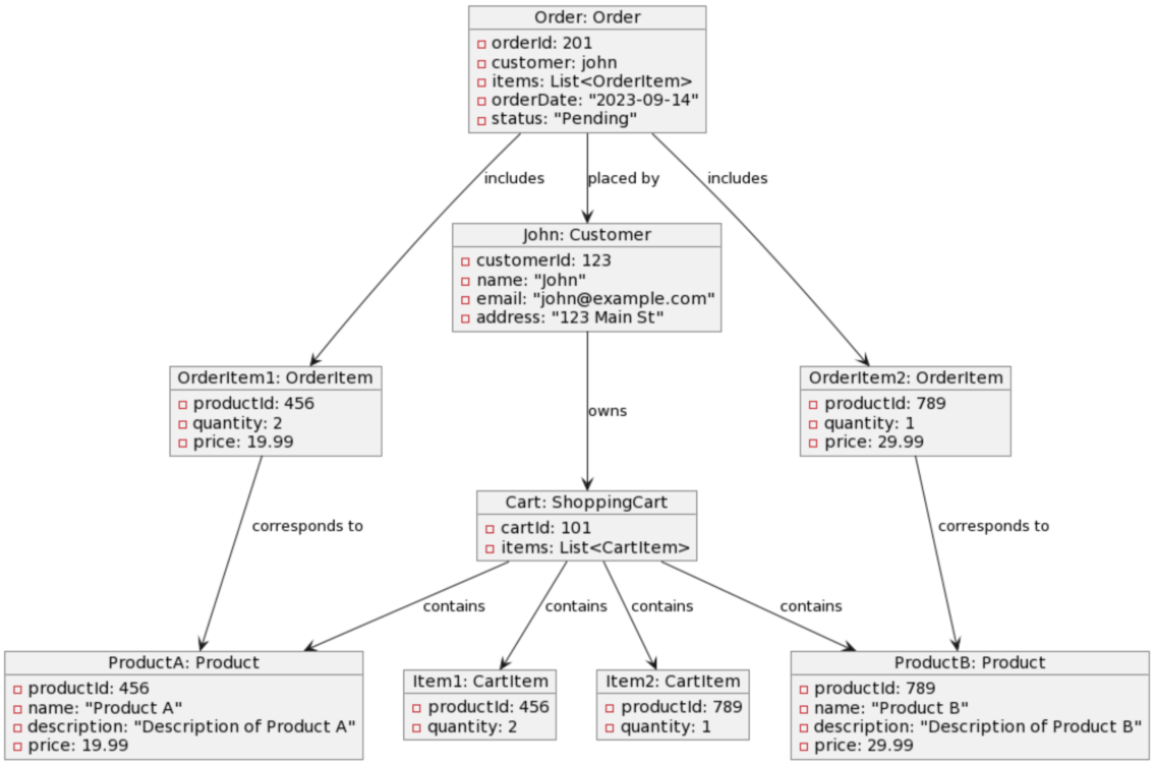
1 B) CLASS DIAGRAM:



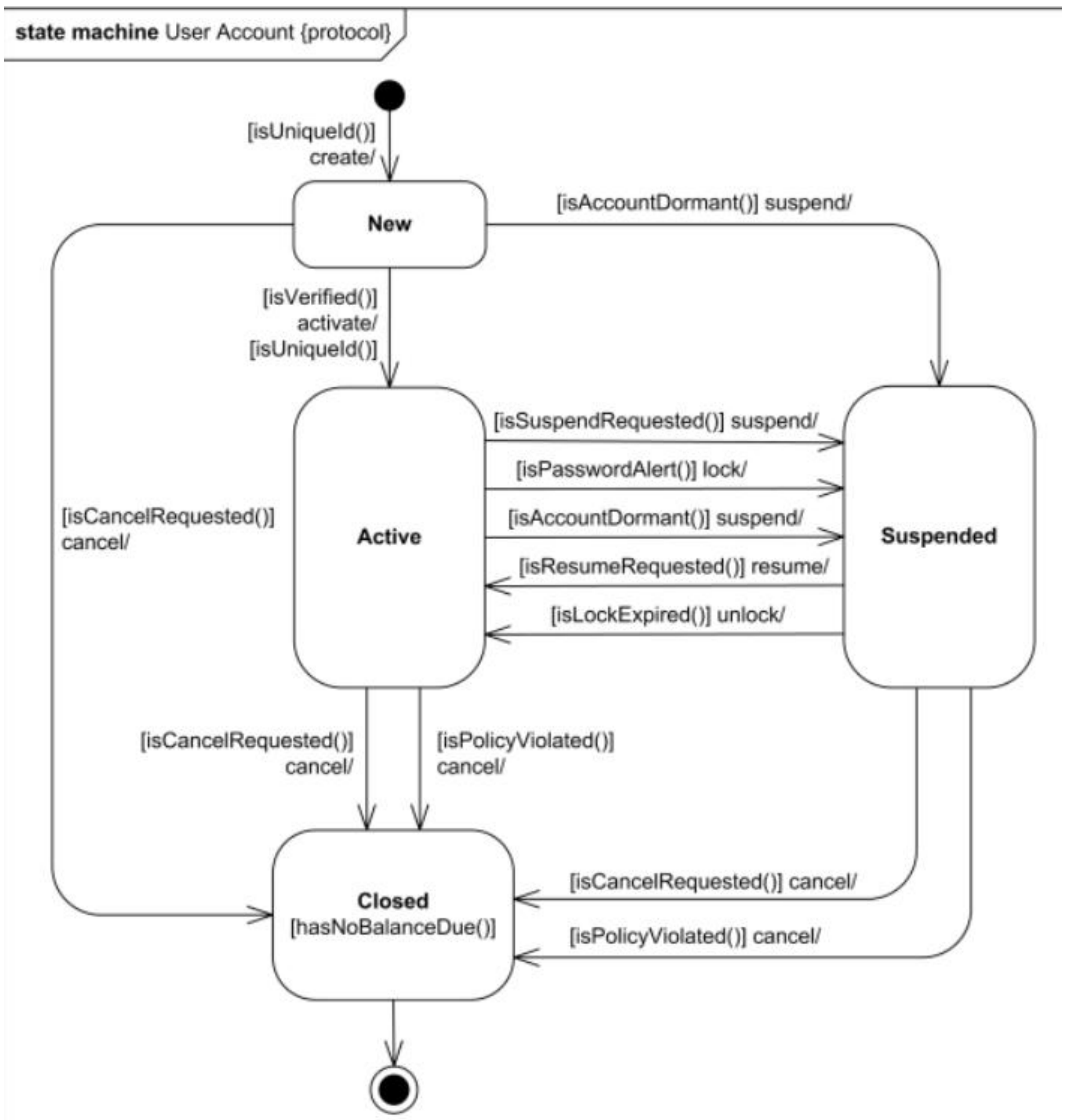
1 C) SEQUENCE DIAGRAM:



1 D) OBJECT DIAGRAM:

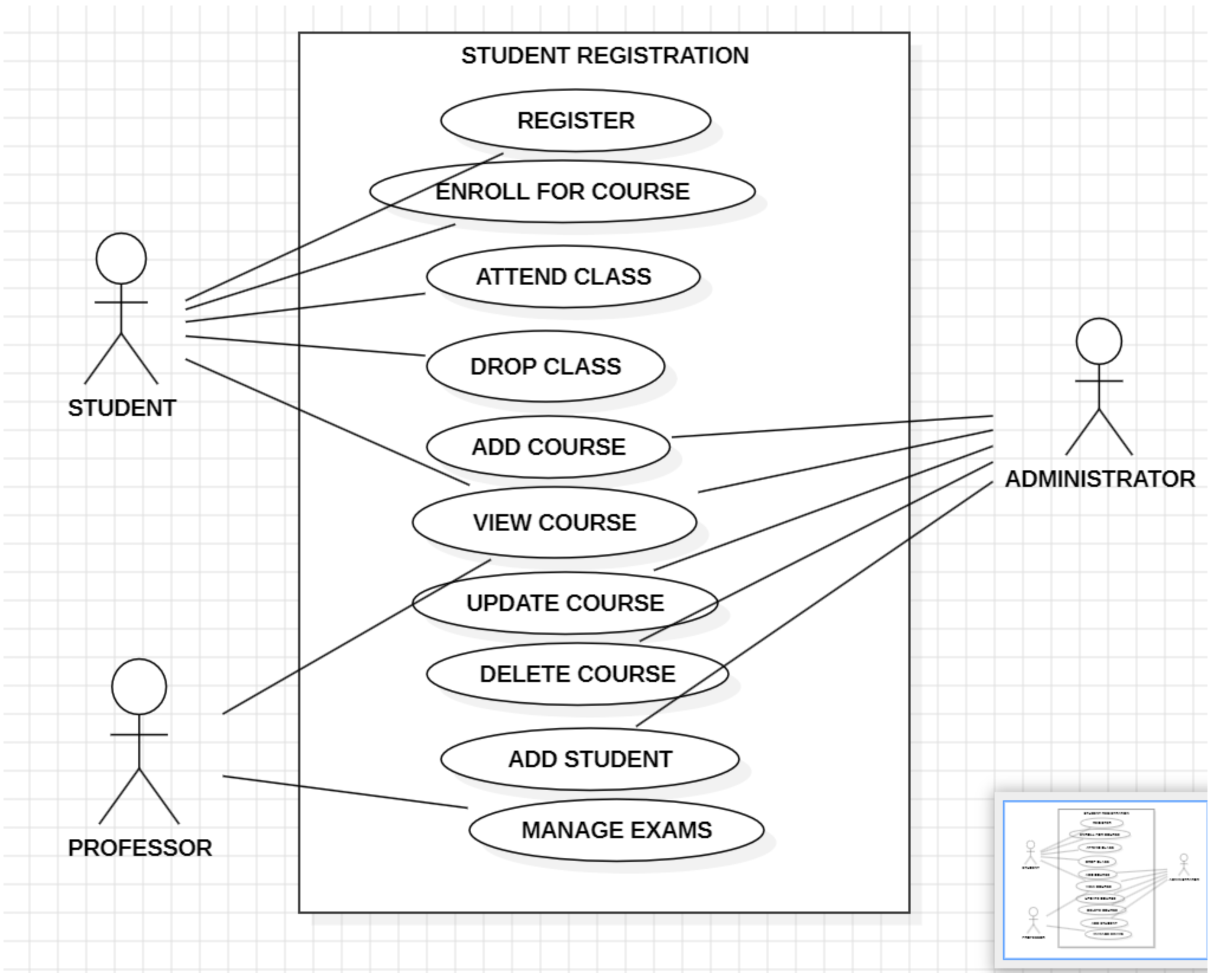


1 E) STATE ACTIVITY DIAGRAM:

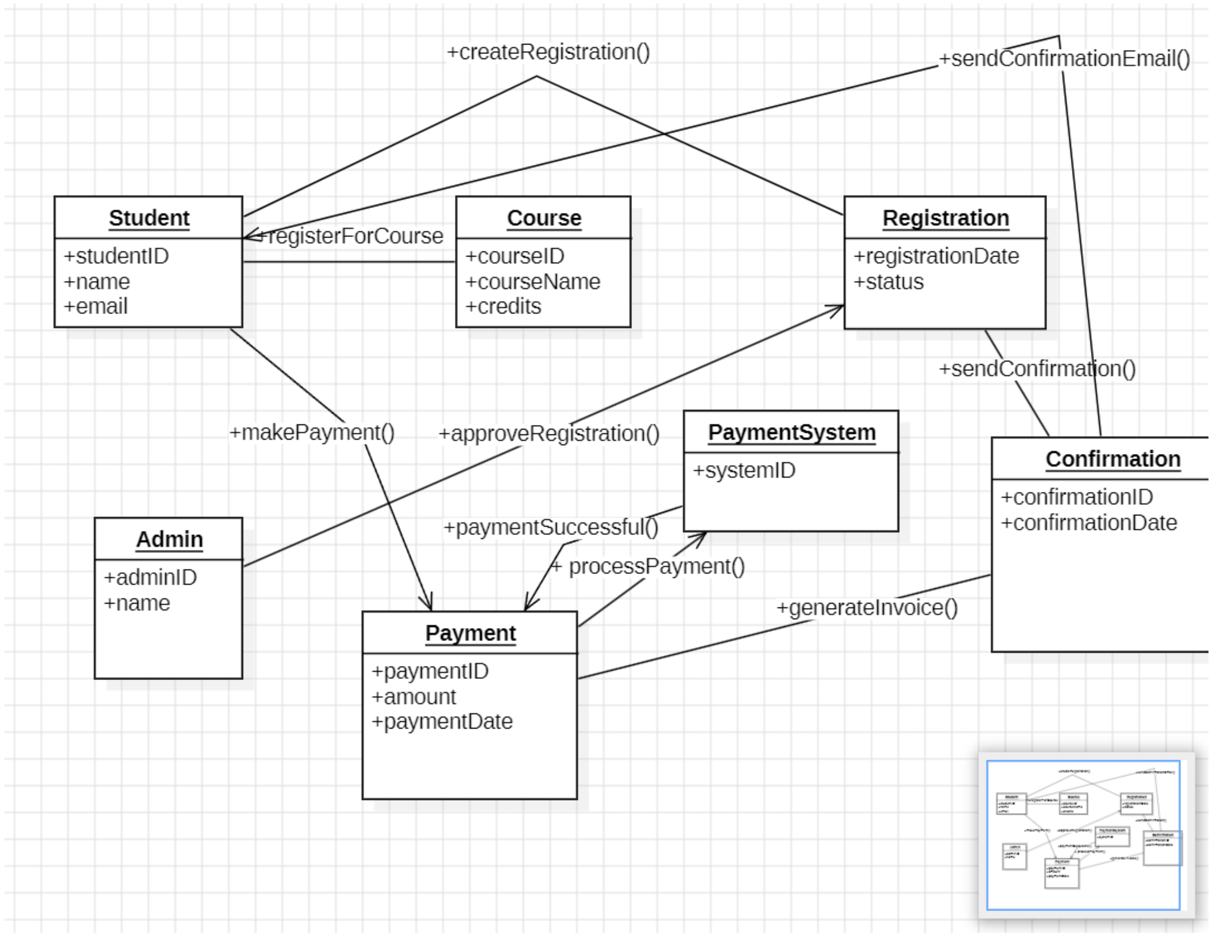

state machine User Account {protocol}
[isUniqueId()] create/
New
[isAccountDormant()] suspend/
[isVerified()] activate/ [isUniqueId()]
Active
Suspended
[isSuspendRequested()] suspend/
[isPasswordAlert()] lock/
[isAccountDormant()] suspend/
[isResumeRequested()] resume/
[isLockExpired()] unlock/
[isCancelRequested()] cancel/
[isCancelRequested()] cancel/
[isPolicyViolated()] cancel/
Closed [hasNoBalanceDue()]
[isCancelRequested()] cancel/
[isPolicyViolated()] cancel/

STUDENT REGISTRATION

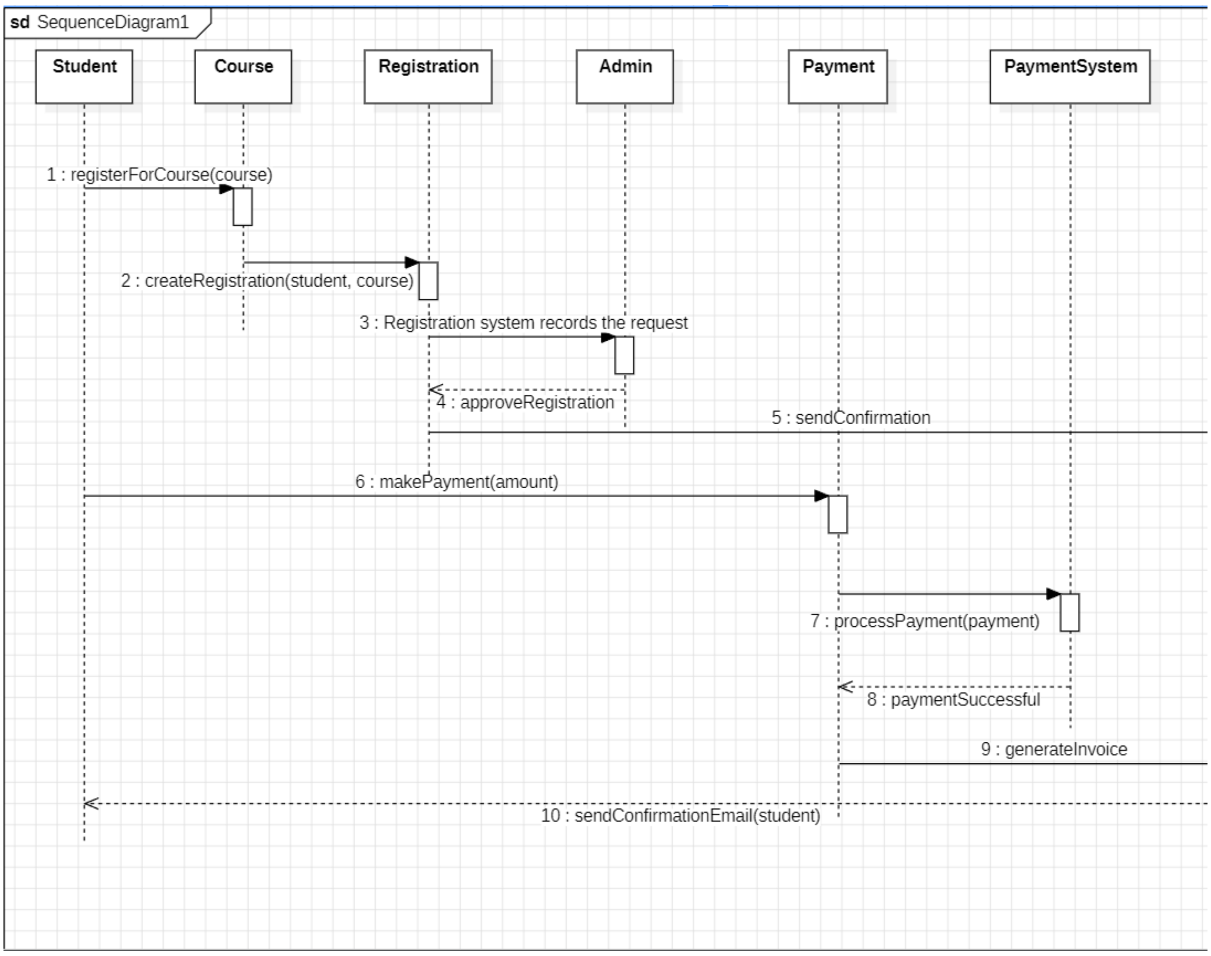
1 A) USE CASE DIAGRAM:



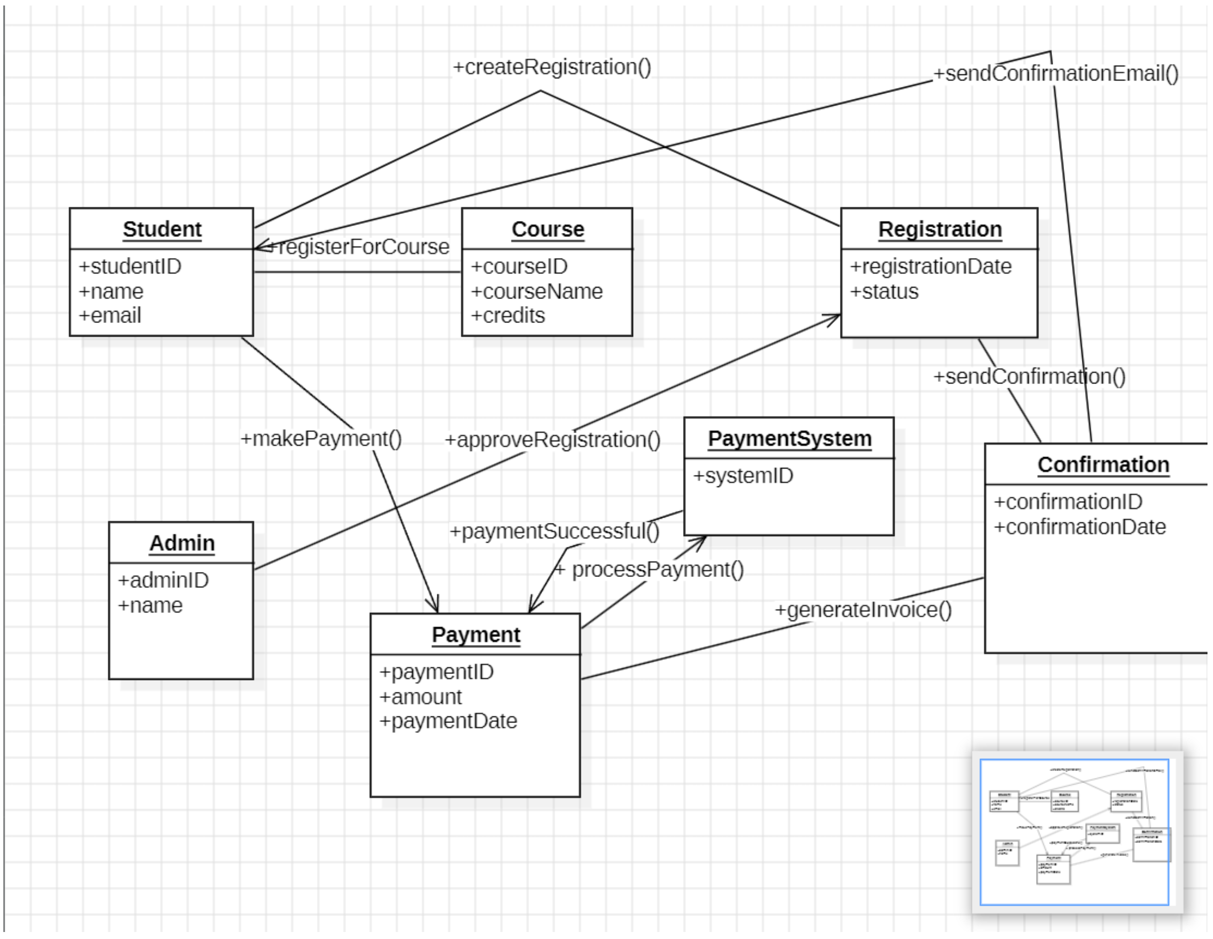
1 B) CLASS DIAGRAM:



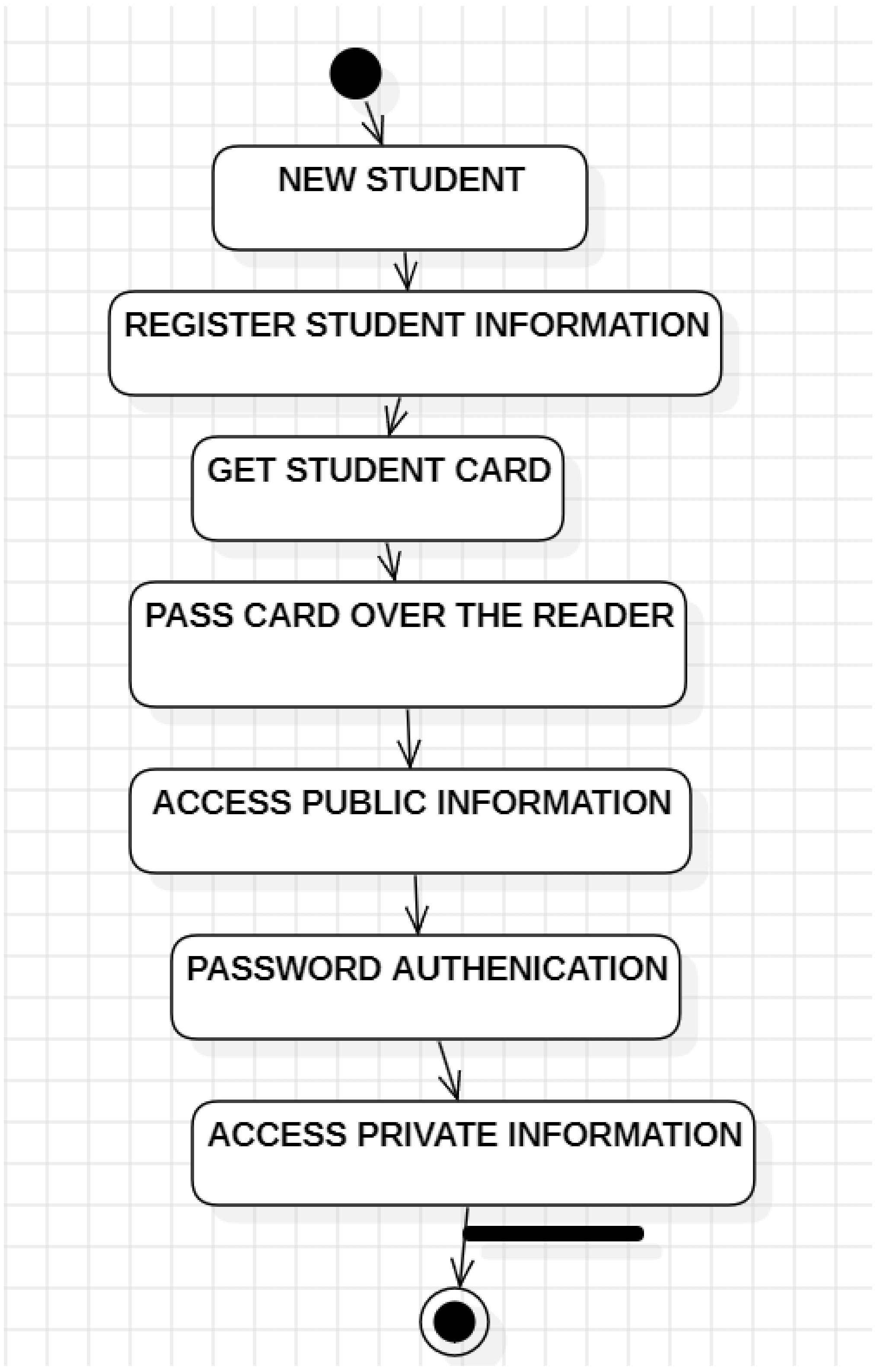
1 C) SEQUENCE DIAGRAM:



1 D) OBJECT DIAGRAM



1 E) STATE DIAGRAM


NEW STUDENT
REGISTER STUDENT INFORMATION
GET STUDENT CARD
PASS CARD OVER THE READER
ACCESS PUBLIC INFORMATION
PASSWORD AUTHENICATION
ACCESS PRIVATE INFORMATION

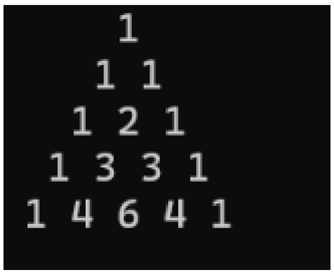
3.Basic Java Programs

3a) PascalTriangle :

Code:

```
public class PascalTriangle {
public static void main(String[] args) {
int rows = 5;
for (int i = 0; i < rows; i++) {
int number = 1;
for (int j = 0; j < rows - i; j++)
System.out.print(" ");
for (int j = 0; j <= i; j++) {
System.out.print(number + " ");
number = number * (i - j) / (j + 1);
}
System.out.println();
}
}
}
```

Output:



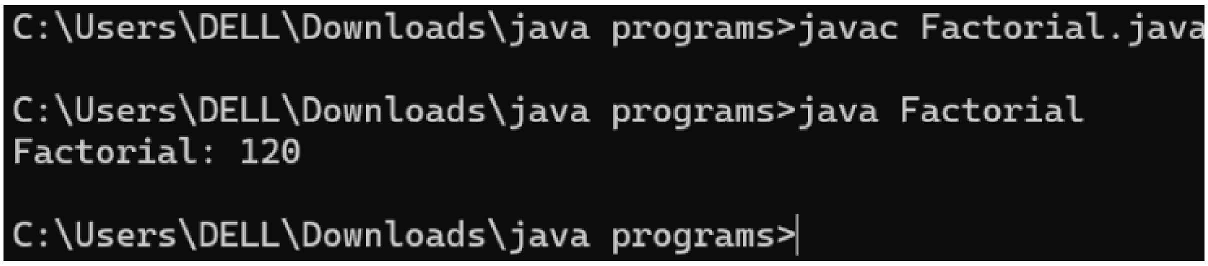
```
    1
   1 1
  1 2 1
 1 3 3 1
1 4 6 4 1
```

3 b) Factorial:

Code:

```
public class Factorial {
public static void main(String[] args) {
int num = 5, fact = 1;
for (int i = 1; i <= num; i++) {
fact *= i; // Multiplying i with fact
}
System.out.println("Factorial: " + fact);
}
}
```

Output:



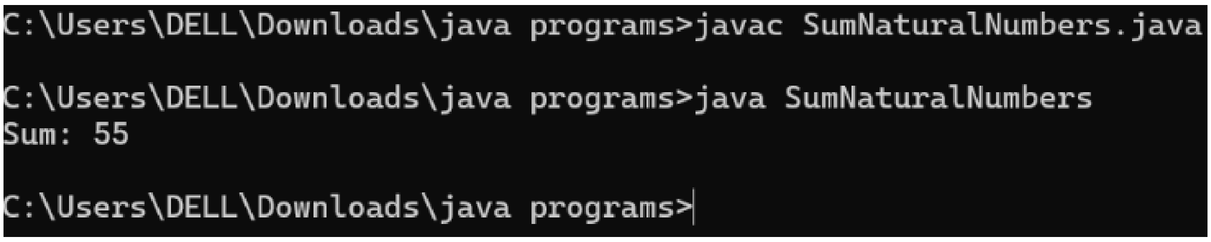
```
C:\Users\DELL\Downloads\java programs>javac Factorial.java

C:\Users\DELL\Downloads\java programs>java Factorial
Factorial: 120

C:\Users\DELL\Downloads\java programs>
```

3C) Sum Natural Numbers :

code:

```
public class SumNaturalNumbers {
public static void main(String[] args) {
int n = 10, sum = 0, i = 1;
while (i <= n) {
sum += i;
i++; // Increments i
}
System.out.println("Sum: " + sum);
}
}
```

Output:



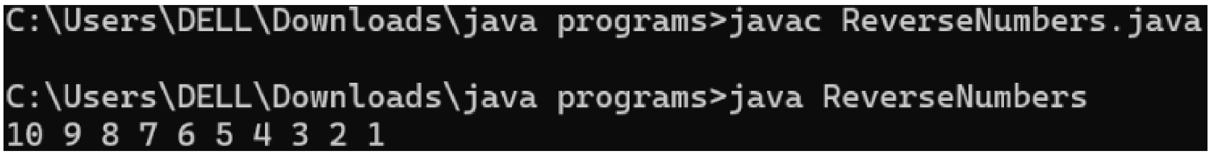
```
C:\Users\DELL\Downloads\java programs>javac SumNaturalNumbers.java

C:\Users\DELL\Downloads\java programs>java SumNaturalNumbers
Sum: 55

C:\Users\DELL\Downloads\java programs>
```

3d) Reverse Numbers :

Code:

```
public class ReverseNumbers {
public static void main(String[] args) {
for (int i = 10; i >= 1; i--) {
System.out.print(i + " ");
}
}
}
```

Output:

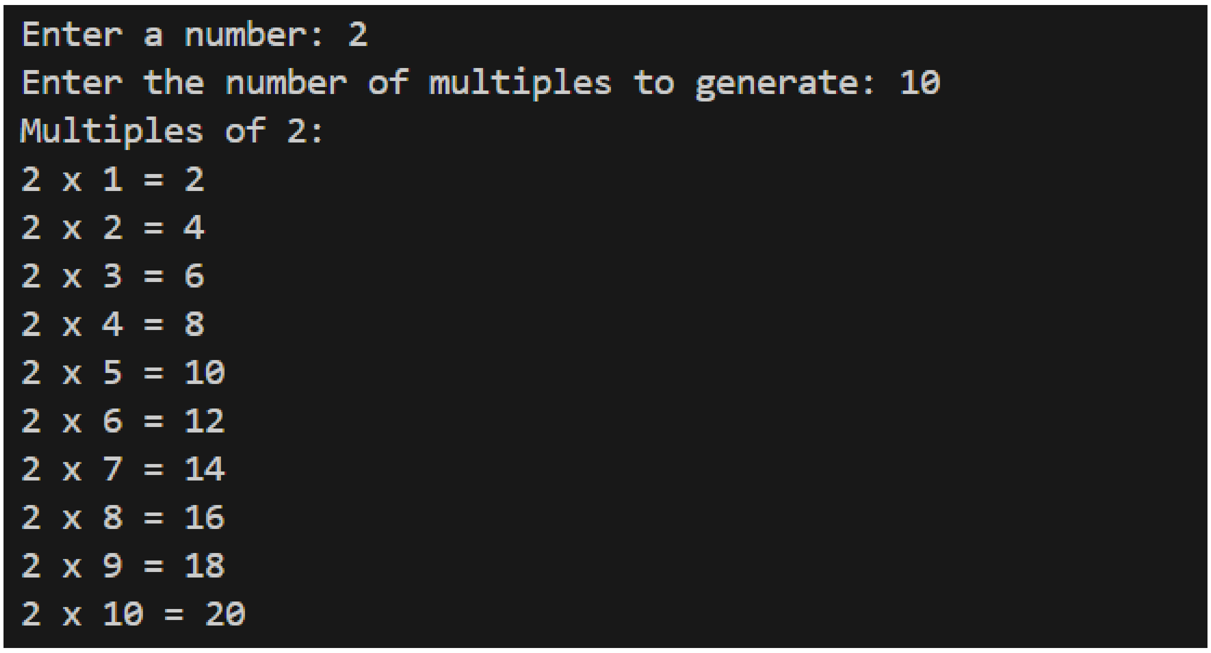


```
C:\Users\DELL\Downloads\java programs>javac ReverseNumbers.java

C:\Users\DELL\Downloads\java programs>java ReverseNumbers
10 9 8 7 6 5 4 3 2 1
```

3 e) Multiplication Calculator:

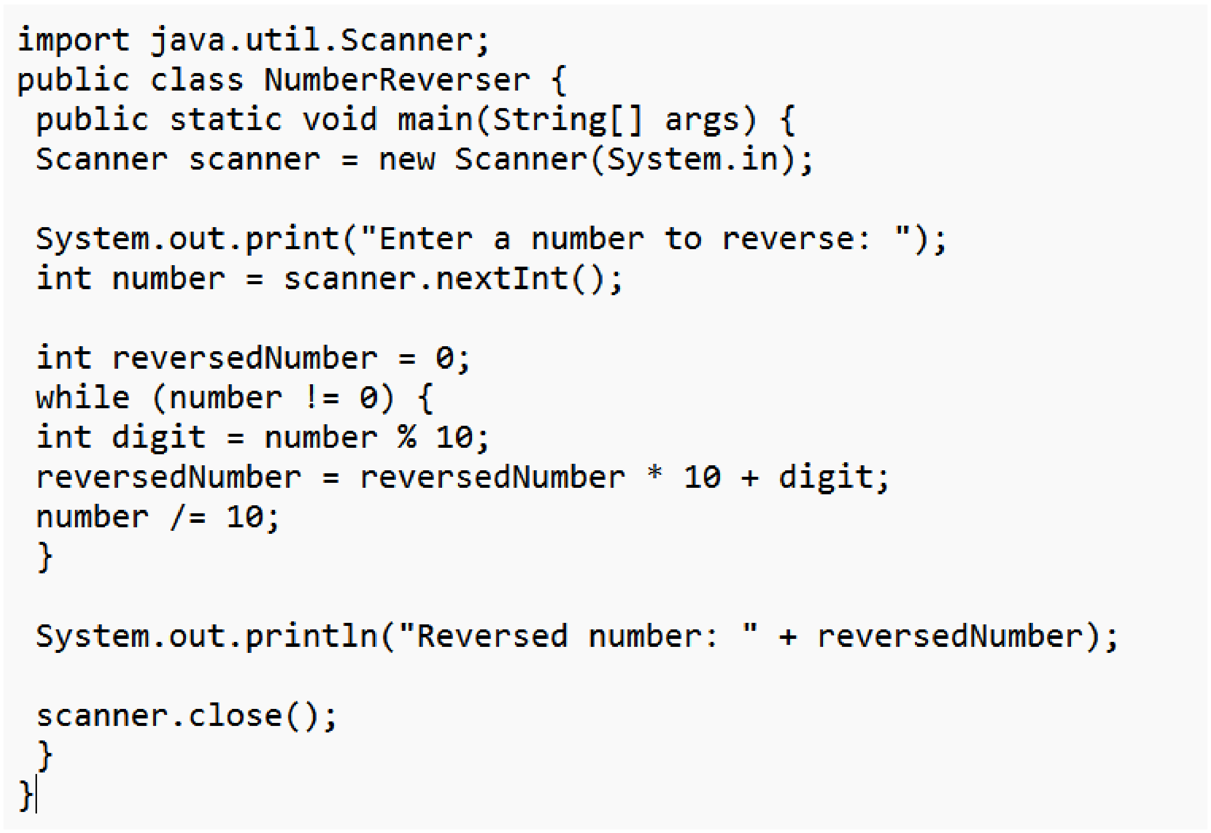
```
import java.util.Scanner;
public class MultiplicationCalculator {
  public static void main(String[] args) {
    Scanner scanner = new Scanner(System.in);
System.out.print("Enter a number: ");
   int number = scanner.nextInt();
  System.out.print("Enter the number of multiples to generate: ");
     int multiplesCount = scanner.nextInt();
System.out.println("Multiples of " + number + ":");
    for (int i = 1; i <= multiplesCount; i++) {
    System.out.println(number + " x " + i + " = " + (number * i));
      scanner.close();
   }
}
```

Output:



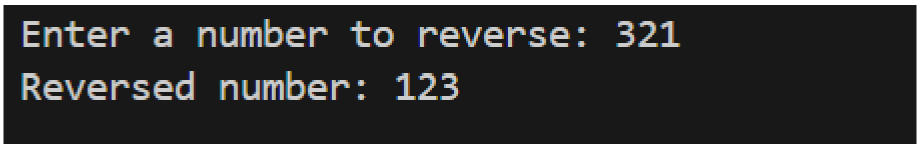
```
Enter a number: 2
Enter the number of multiples to generate: 10
Multiples of 2:
2 x 1 = 2
2 x 2 = 4
2 x 3 = 6
2 x 4 = 8
2 x 5 = 10
2 x 6 = 12
2 x 7 = 14
2 x 8 = 16
2 x 9 = 18
2 x 10 = 20
```

3f) Number Reverse:



```
import java.util.Scanner;
public class NumberReverser {
 public static void main(String[] args) {
 Scanner scanner = new Scanner(System.in);

 System.out.print("Enter a number to reverse: ");
 int number = scanner.nextInt();

 int reversedNumber = 0;
 while (number != 0) {
 int digit = number % 10;
 reversedNumber = reversedNumber * 10 + digit;
 number /= 10;
 }

 System.out.println("Reversed number: " + reversedNumber);

 scanner.close();
 }
}
```

Output:

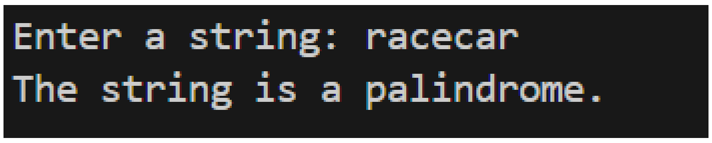


```
Enter a number to reverse: 321
Reversed number: 123
```

3g) Palindrome Checker:

```java
public class PalindromeChecker {
 public static void main(String[] args) {
 Scanner scanner = new Scanner(System.in);

 System.out.print("Enter a string: ");
 String input = scanner.nextLine();

 if (isPalindrome(input)) {
 System.out.println("The string is a palindrome.");
 }
 else {
 System.out.println("The string is not a palindrome.");
 }

 scanner.close();
 }

 public static boolean isPalindrome(String str) {
 str = str.replaceAll("[^a-zA-Z0-9]", "").toLowerCase();
 int left = 0, right = str.length() - 1;

 while (left < right) {
 if (str.charAt(left) != str.charAt(right)) {
 return false;
 }
 left++;
 right--;
 }

 return true;
 }
}
```

Output:

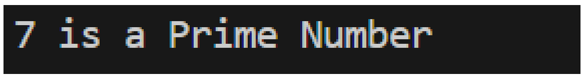


```
Enter a string: racecar
The string is a palindrome.
```

3h) Prime Check:

```
public class PrimeCheck {
 public static void main(String[] args) {
 int number = 7;
 boolean isPrime = true;
 if (number <= 1) {
 isPrime = false;
 } else {
 for (int i = 2; i <= number / 2; i++) {
 if (number % i == 0) {
 isPrime = false;
 break;
 }
 }
 }
 if (isPrime)
 System.out.println(number + " is a Prime Number");
 else
 System.out.println(number + " is not a Prime Number");
 }
}
```

Output:



```
7 is a Prime Number
```

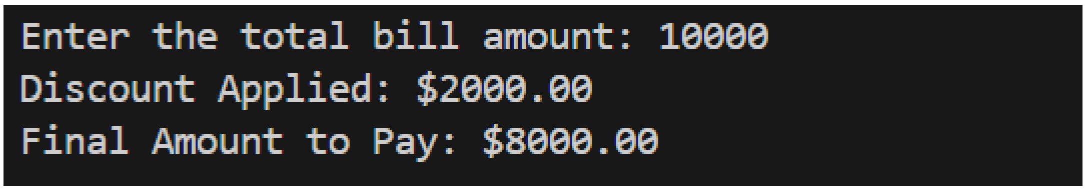
3i) Shopping Discount:

import java.util.Scanner;

public class ShoppingDiscount {

```
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in)
System.out.print("Enter the total bill amount: ");
        double billAmount = scanner.nextDouble();

        if (billAmount < 0) {
            System.out.println("Invalid bill amount. Please enter a positive number.");
        } else {
            double discount;

            if (billAmount >= 500) {
                discount = billAmount * 0.20;
            } else if (billAmount >= 200) {
                discount = billAmount * 0.10;
            } else {
                discount = billAmount * 0.05;
            }

            double finalAmount = billAmount - discount;

            System.out.printf("Discount Applied: $%.2f%n", discount);
            System.out.printf("Final Amount to Pay: $%.2f%n", finalAmount);
        }

        scanner.close();
    }
}
```

Output:

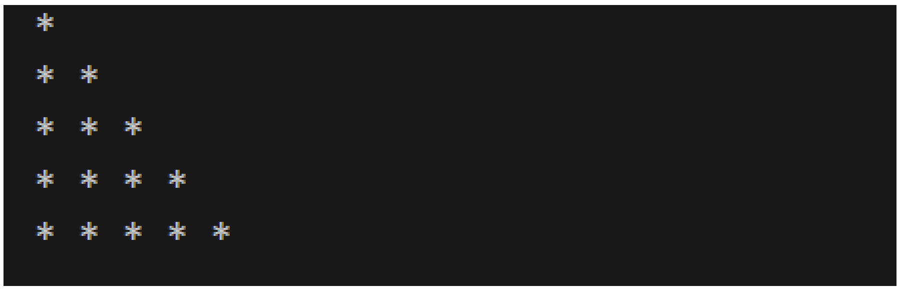


```
Enter the total bill amount: 10000
Discount Applied: $2000.00
Final Amount to Pay: $8000.00
```

3j) Star Pattern:

```
public class StarPattern {
 public static void main(String[] args) {
 int rows = 5;
 for (int i = 1; i <= rows; i++) {
 for (int j = 1; j <= i; j++) {
 System.out.print("* ");
 }
 System.out.println();
 }
 }
}
```

Output:



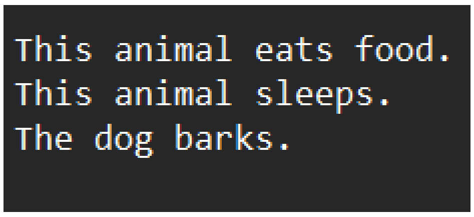
```
*
* *
* * *
* * * *
* * * * *
```

4. Single inheritance Programs

4 a) Animal inheritance

```
class Animal {
    void eat() {
        System.out.println("This animal eats food.");
    }

    void sleep() {
        System.out.println("This animal sleeps.");
    }
}

class Dog extends Animal {
    void bark() {
        System.out.println("The dog barks.");
    }
}

public class SingleInheritanceExample {
    public static void main(String[] args) {
        Dog myDog = new Dog();
        myDog.eat();
        myDog.sleep();
        myDog.bark();
    }
}
```

OUTPUT:

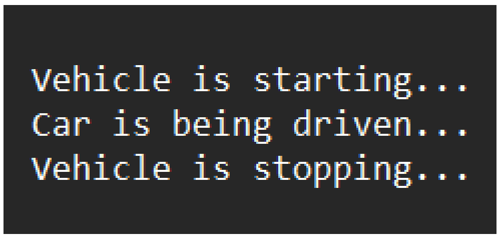


```
This animal eats food.
This animal sleeps.
The dog barks.
```

4b) Vehicle and Car:

```
class Vehicle {
  void start() {
    System.out.println("Vehicle is starting...");
  }

  void stop() {
    System.out.println("Vehicle is stopping...");
  }
}

class Car extends Vehicle {
  void drive() {
    System.out.println("Car is being driven...");
  }
}

public class SingleInheritanceVehicle {
  public static void main(String[] args) {
    Car myCar = new Car();
    myCar.start();
    myCar.drive();
    myCar.stop();
  }
}
```

Output:



```
Vehicle is starting...
Car is being driven...
Vehicle is stopping...
```

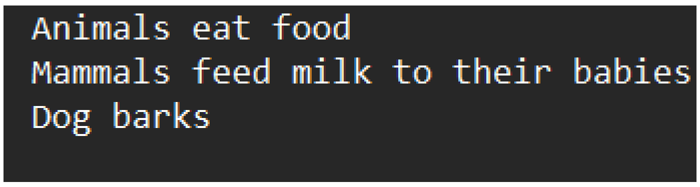
5) <u>Multilevel inheritance Programs</u>

5 a) Animal – mammal- dog

```
class Animal {
  void eat() {
    System.out.println("Animal eats food.");
  }
}

class Mammal extends Animal {
  void walk() {
    System.out.println("Mammals feed mik to their babies.");
  }
}

class Dog extends Mammal {
  void bark() {
    System.out.println("Dog barks.");
  }
}
```

```
public class MultilevelInheritanceExample {
    public static void main(String[] args) {
        Dog myDog = new Dog();
        myDog.eat();   // from Animal
        myDog.walk();  // from Mammal
        myDog.bark();  // from Dog
    }
}
```

Output:

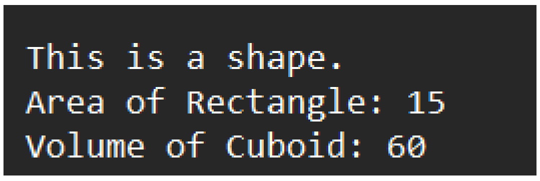


```
Animals eat food
Mammals feed milk to their babies
Dog barks
```

5 B) Shape → Rectangle → Cuboid

```
class Shape {
    void displayShape() {
        System.out.println("This is a shape.");
    }
}

class Rectangle extends Shape {
    int length = 5;
    int breadth = 3;

    void area() {
        int area = length * breadth;
        System.out.println("Area of Rectangle: " + area);
    }
}

class Cuboid extends Rectangle {
    int height = 4;

    void volume() {
        int volume = length * breadth * height;
        System.out.println("Volume of Cuboid: " + volume);
    }
}

public class MultilevelInheritance {
    public static void main(String[] args) {
        Cuboid myCuboid = new Cuboid();
        myCuboid.displayShape();
        myCuboid.area();
        myCuboid.volume();
    }
}
```

Output:



```
This is a shape.
Area of Rectangle: 15
Volume of Cuboid: 60
```

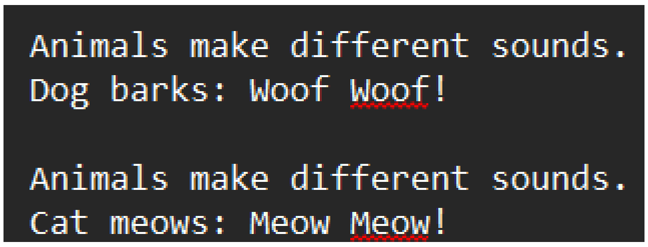
6.Hierarchical inheritance Programs

6 a) Animal → Dog, Cat

```
class Animal {
  void sound() {
    System.out.println("Animals make different sounds.");
  }
}

class Dog extends Animal {
  void bark() {
    System.out.println("Dog barks: Woof Woof!");
  }
}

class Cat extends Animal {
  void meow() {
    System.out.println("Cat meows: Meow Meow!");
  }
}

public class HierarchicalInheritance {
  public static void main(String[] args) {
    Dog dog = new Dog();
    Cat cat = new Cat();

    dog.sound();
    dog.bark();

    System.out.println();
```

```
        cat.sound();

        cat.meow();

    }

}
```

Output:



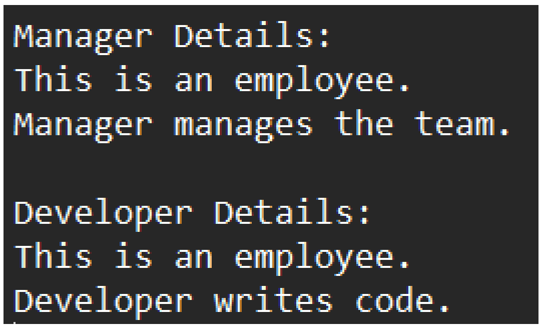
```
Animals make different sounds.
Dog barks: Woof Woof!

Animals make different sounds.
Cat meows: Meow Meow!
```

6 b) Employee → Manager, Developer

```
class Employee {

   void displayDetails() {

      System.out.println("This is an employee.");

   }

}


class Manager extends Employee {

   void manageTeam() {

      System.out.println("Manager manages the team.");

   }

}


class Developer extends Employee {

   void writeCode() {

      System.out.println("Developer writes code.");

   }

}
```

```
public class HierarchicalInheritance {
    public static void main(String[] args) {
        Manager m = new Manager();
        Developer d = new Developer();

        System.out.println("Manager Details:");
        m.displayDetails();
        m.manageTeam();

        System.out.println("\nDeveloper Details:");
        d.displayDetails();
        d.writeCode();
    }
}
```

Output:



```
Manager Details:
This is an employee.
Manager manages the team.

Developer Details:
This is an employee.
Developer writes code.
```

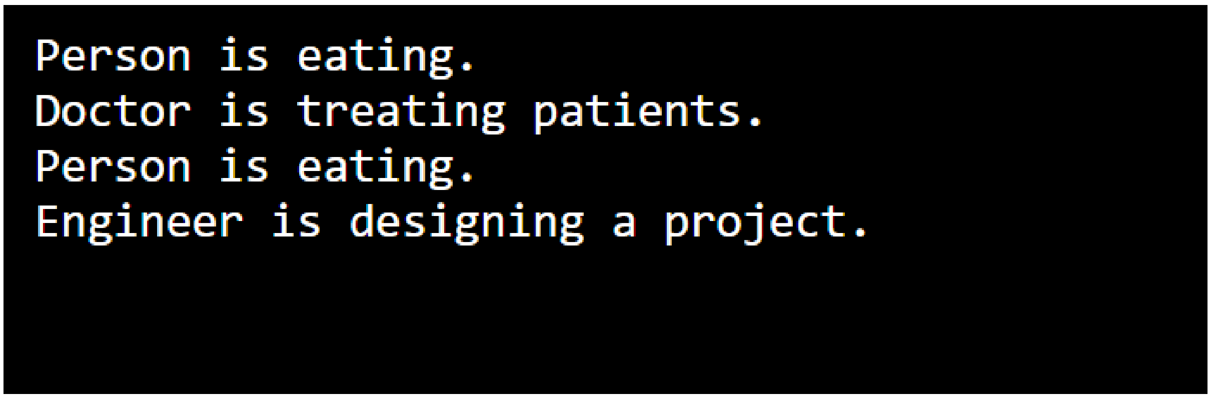
7.Hybrid inheritance Programs

7 a) person-doctor\ engineer

```
interface Worker {
   void performDuties();
}

class Person {
   void eat() {
      System.out.println("Person is eating.");
   }
}

class Doctor extends Person implements Worker {
   public void performDuties() {
      System.out.println("Doctor is treating patients.");
   }
}

class Engineer extends Person implements Worker {
   public void performDuties() {
      System.out.println("Engineer is designing a project.");
   }
}
```

```
public class HybridInheritance1 {
   public static void main(String[] args) {
      Doctor d = new Doctor();
      d.eat();
      d.performDuties();

      Engineer e = new Engineer();
      e.eat();
      e.performDuties();
   }
}
```

OUTPUT:



```
Person is eating.
Doctor is treating patients.
Person is eating.
Engineer is designing a project.
```

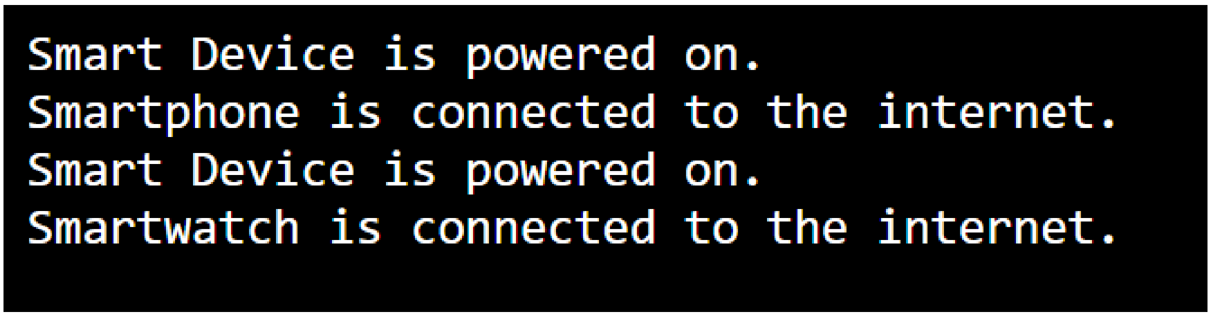
7 b) smart device- smart phone \ smart watch

```
interface Connectivity {
   void connectToInternet();
}
```

```
class SmartDevice {
  void powerOn() {
    System.out.println("Smart Device is powered on.");
  }
}

class Smartphone extends SmartDevice implements Connectivity {
  public void connectToInternet() {
    System.out.println("Smartphone is connected to the internet.");
  }
}

class SmartWatch extends SmartDevice implements Connectivity {
  public void connectToInternet() {
    System.out.println("Smartwatch is connected to the internet.");
  }
}

public class HybridInheritance2 {
  public static void main(String[] args) {
    Smartphone phone = new Smartphone();
    phone.powerOn();
    phone.connectToInternet();

    SmartWatch watch = new SmartWatch();
```

```
        watch.powerOn();

        watch.connectToInternet();

    }

}
```

Output:



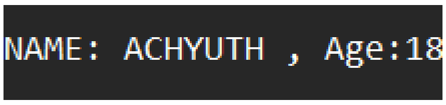
```
Smart Device is powered on.
Smartphone is connected to the internet.
Smart Device is powered on.
Smartwatch is connected to the internet.
```

8.Constructor Programs

8 a) student constructor

```
class Student {
  String name;
  int age;

  Student(String n, int a) {
    name = n;
    age = a;
  }

  void display() {
    System.out.println("Name: " + name + ", Age: " + age);
  }

  public static void main(String[] args) {
    Student s1 = new Student("Achyuth", 18);
    s1.display();
  }
}
```

Output:



```
NAME: ACHYUTH , Age:18
```

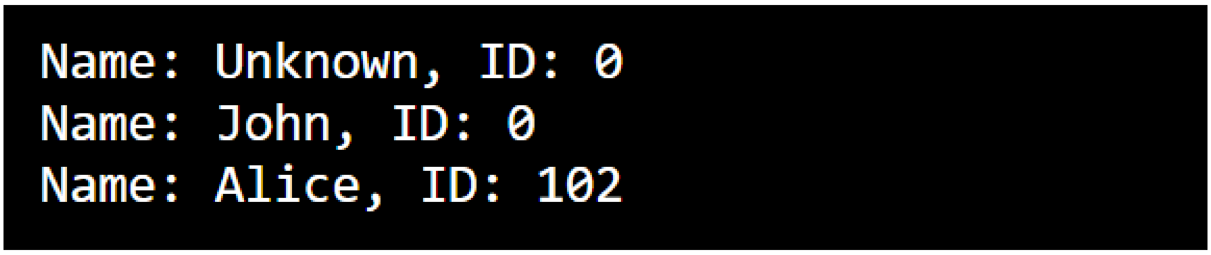
9.Constructor overloading Programs

9 a) Employee Constructor Overloading

```
class Employee {
  String name;
  int id;

  Employee() {
    name = "Unknown";
    id = 0;
  }

  Employee(String n) {
    name = n;
    id = 0;
  }

  Employee(String n, int i) {
    name = n;
    id = i;
  }

  void display() {
    System.out.println("Name: " + name + ", ID: " + id);
  }
```

```
    public static void main(String[] args) {
        Employee e1 = new Employee();
        Employee e2 = new Employee("John");
        Employee e3 = new Employee("Alice", 102);

        e1.display();
        e2.display();
        e3.display();
    }
}
```

Output:



```
Name: Unknown, ID: 0
Name: John, ID: 0
Name: Alice, ID: 102
```

10.Method overloading Programs

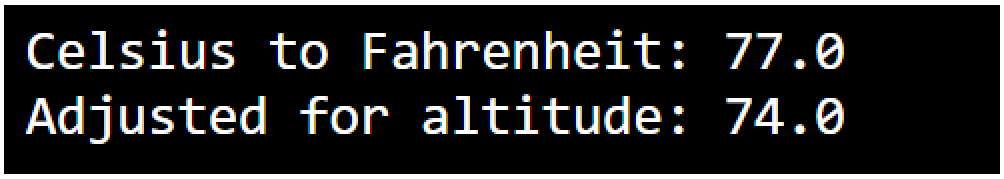
10 a) temperature converter overloading

```
class Employee {
    String name;
    int id;

    // Constructor 1
    Employee() {
        name = "Unknown";
        id = 0;
```

```
}

// Constructor 2
Employee(String n) {
  name = n;
  id = 0;
}

// Constructor 3
Employee(String n, int i) {
  name = n;
  id = i;
}

void display() {
  System.out.println("Name: " + name + ", ID: " + id);
}

public static void main(String[] args) {
  Employee e1 = new Employee();
  Employee e2 = new Employee("John");

  class TemperatureConverter {
    // Convert Celsius to Fahrenheit
    double convert(double celsius) {
      return (celsius * 9 / 5) + 32;
```

```
            }

            // Convert Celsius and adjust for altitude
            double convert(double celsius, int altitude) {
                return ((celsius * 9 / 5) + 32) - (altitude * 0.003);
            }
        }

        TemperatureConverter converter = new TemperatureConverter();
        System.out.println("Celsius to Fahrenheit: " + converter.convert(25));
        System.out.println("Adjusted for altitude: " + converter.convert(25,
1000));

        Employee e3 = new Employee("Alice", 102);
        e1.display();
        e2.display();
        e3.display();
    }
}
```

Output:

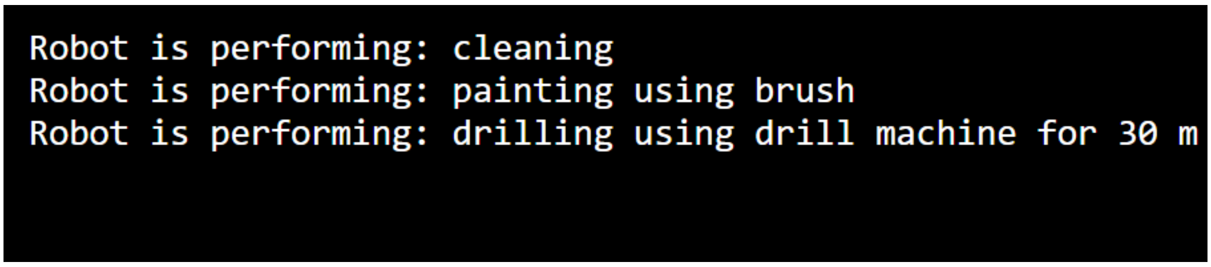


```
Celsius to Fahrenheit: 77.0
Adjusted for altitude: 74.0
```

10 b) robot task execution overloading

```
class Robot {
    void performTask(String task) {
        System.out.println("Robot is performing: " + task);
    }

    void performTask(String task, String tool) {
        System.out.println("Robot is performing: " + task + " using " + tool);
    }

    void performTask(String task, String tool, int duration) {
        System.out.println("Robot is performing: " + task + " using " + tool + " for
" + duration + " minutes.");
    }

    public static void main(String[] args) {
        Robot r = new Robot();
        r.performTask("cleaning");
        r.performTask("painting", "brush");
        r.performTask("drilling", "drill machine", 30);
    }
}
```

Output:



```
Robot is performing: cleaning
Robot is performing: painting using brush
Robot is performing: drilling using drill machine for 30 m
```

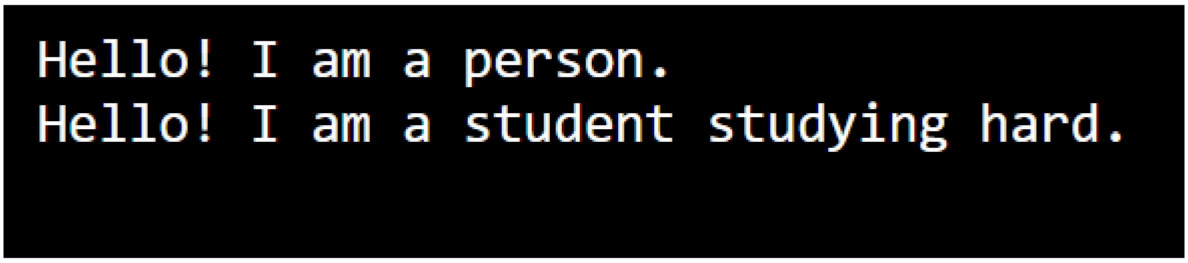
11.Method overriding Programs

11 a) parent-child greeting

```
class Person {
  void greet() {
    System.out.println("Hello! I am a person.");
  }
}

class Student extends Person {
  void greet() {
    System.out.println("Hello! I am a student studying hard.");
  }
}

public class MethodOverridingUnique1 {
  public static void main(String[] args) {
    Person p = new Person();
    p.greet();

    Student s = new Student();
    s.greet();
  }
}
```

Output:

```
}
```

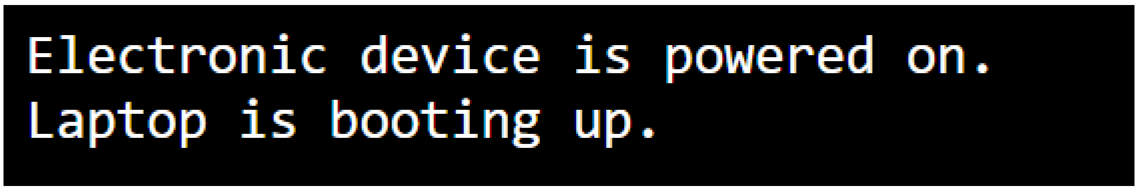


```
Hello! I am a person.
Hello! I am a student studying hard.
```

11 b) electronic device power

```
class ElectronicDevice {
  void powerOn() {
    System.out.println("Electronic device is powered on.");
  }
}

class Laptop extends ElectronicDevice {
  void powerOn() {
    System.out.println("Laptop is booting up.");
  }
}

public class MethodOverridingUnique2 {
  public static void main(String[] args) {
    ElectronicDevice device = new ElectronicDevice();
    device.powerOn();

    Laptop myLaptop = new Laptop();
    myLaptop.powerOn();
  }
}
```

Output:



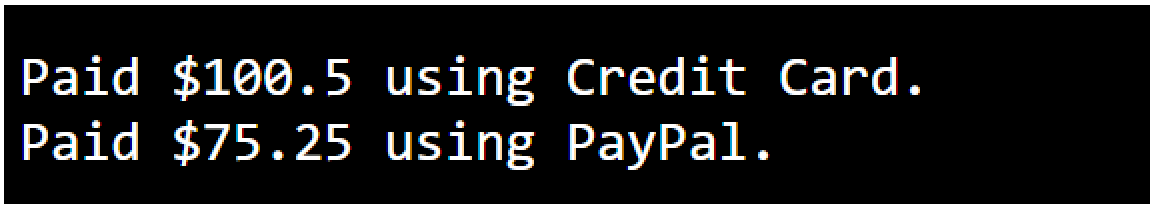
```
Electronic device is powered on.
Laptop is booting up.
```

12.Interface Programs

12 a) payment system

```
interface Payment {
   void makePayment(double amount);
}

class CreditCardPayment implements Payment {
   public void makePayment(double amount) {
      System.out.println("Paid $" + amount + " using Credit Card.");
   }
}

class PayPalPayment implements Payment {
   public void makePayment(double amount) {
      System.out.println("Paid $" + amount + " using PayPal.");
   }
}

public class InterfaceExample1 {
   public static void main(String[] args) {
      Payment payment1 = new CreditCardPayment();
      payment1.makePayment(100.50);

      Payment payment2 = new PayPalPayment();
      payment2.makePayment(75.25);
   }
}
```

Output:



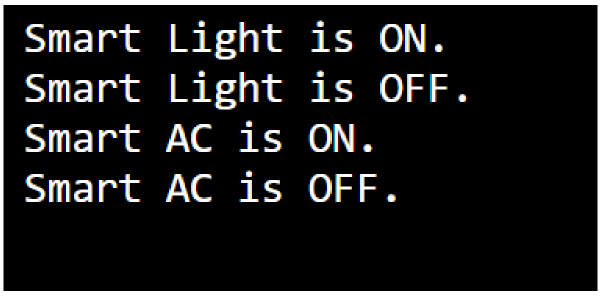
```
Paid $100.5 using Credit Card.
Paid $75.25 using PayPal.
```

12 b) smart home devices

```
interface SmartDevice {
    void turnOn();
    void turnOff();
}

class SmartLight implements SmartDevice {
    public void turnOn() {
        System.out.println("Smart Light is ON.");
    }

    public void turnOff() {
        System.out.println("Smart Light is OFF.");
    }
}
```

```
class SmartAC implements SmartDevice {
  public void turnOn() {
    System.out.println("Smart AC is ON.");
  }

  public void turnOff() {
    System.out.println("Smart AC is OFF.");
  }
}

public class InterfaceExample2 {
  public static void main(String[] args) {
    SmartDevice light = new SmartLight();
    light.turnOn();
    light.turnOff();

    SmartDevice ac = new SmartAC();
    ac.turnOn();
    ac.turnOff();
  }
}
```

Output:

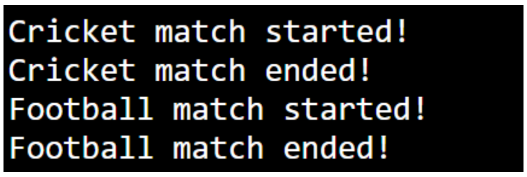


```
Smart Light is ON.
Smart Light is OFF.
Smart AC is ON.
Smart AC is OFF.
```

12 c) sports game

```
interface Game {
  void start();
  void end();
}

class Cricket implements Game {
  public void start() {
    System.out.println("Cricket match started!");
  }

  public void end() {
    System.out.println("Cricket match ended!");
  }
}

class Football implements Game {
  public void start() {
    System.out.println("Football match started!");
  }

  public void end() {
        System.out.println("Football match ended!");
    }
}

public class InterfaceExample3 {
    public static void main(String[] args) {
        Game g1 = new Cricket();
        g1.start();
        g1.end();

        Game g2 = new Football();
        g2.start();
        g2.end();
    }
}
```

Output:

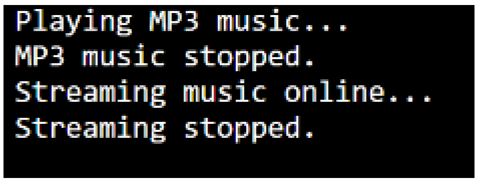


```
Cricket match started!
Cricket match ended!
Football match started!
Football match ended!
```

12 d) music playerinterface

```
 MusicPlayer {
    void play();
    void stop();
}

class MP3Player implements MusicPlayer {
    public void play() {
        System.out.println("Playing MP3 music...");
    }

    public void stop() {
        System.out.println("MP3 music stopped.");
    }
}

class StreamingPlayer implements MusicPlayer {
    public void play() {
        System.out.println("Streaming music online...");
    }

    public void stop() {
        System.out.println("Streaming stopped.");
    }
}

public class InterfaceExample4 {
    public static void main(String[] args) {
        MusicPlayer mp3 = new MP3Player();
        mp3.play();
        mp3.stop();

        MusicPlayer stream = new StreamingPlayer();
        stream.play();
        stream.stop();
    }
}
```

Output:



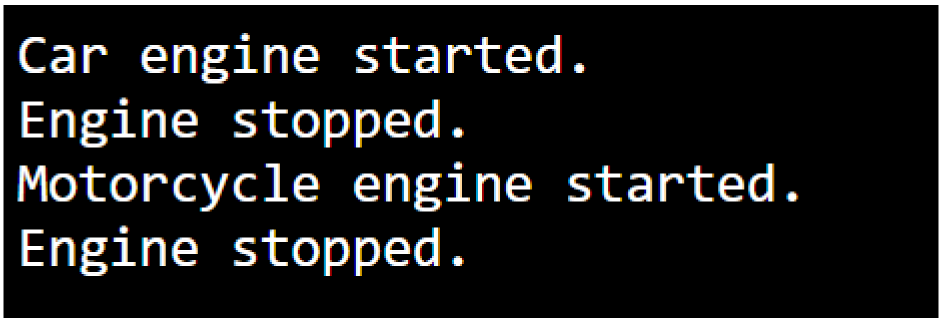
```
Playing MP3 music...
MP3 music stopped.
Streaming music online...
Streaming stopped.
```

13. Abstract class Programs

13 a) vehicle

```
abstract class Vehicle {
    abstract void startEngine();
    void stopEngine() {
        System.out.println("Engine stopped.");
    }
}

class Car extends Vehicle {
    void startEngine() {
        System.out.println("Car engine started.");
    }
}

class Motorcycle extends Vehicle {
    void startEngine() {
        System.out.println("Motorcycle engine started.");
    }
}

public class AbstractClassExample1 {
    public static void main(String[] args) {
        Vehicle car = new Car();
        car.startEngine();
        car.stopEngine();

        Vehicle bike = new Motorcycle();
        bike.startEngine();
        bike.stopEngine();
    }
}
```

Output:

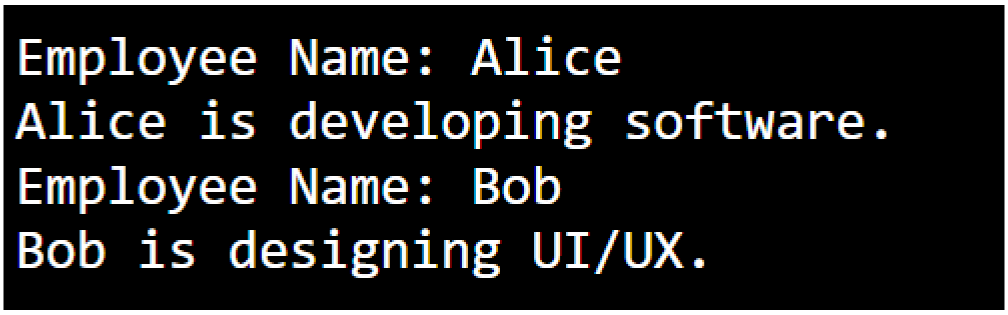


```
Car engine started.
Engine stopped.
Motorcycle engine started.
Engine stopped.
```

13 b) employee

```
abstract class Employee {
    String name;
    Employee(String name) {
        this.name = name;
    }

    abstract void work();

    void showDetails() {
        System.out.println("Employee Name: " + name);
    }
}

class Developer extends Employee {
    Developer(String name) {
        super(name);
    }

    void work() {
        System.out.println(name + " is developing software.");
    }
}

class Designer extends Employee {
    Designer(String name) {
        super(name);
    }
    void work() {
        System.out.println(name + " is designing UI/UX.");
    }
}

public class AbstractClassExample2 {
    public static void main(String[] args) {
        Employee dev = new Developer("Alice");
        dev.showDetails();
        dev.work();

        Employee des = new Designer("Bob");
        des.showDetails();
        des.work();
    }
}
```

Output:

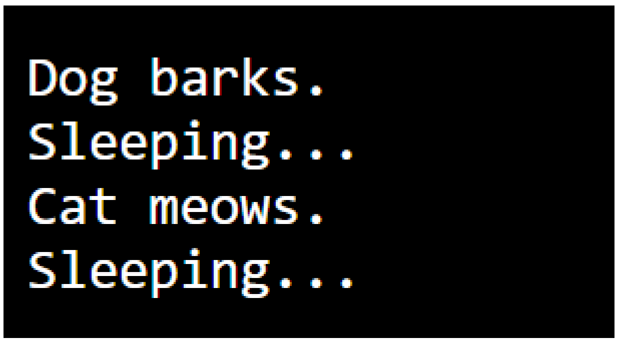


```
Employee Name: Alice
Alice is developing software.
Employee Name: Bob
Bob is designing UI/UX.
```

13 c) animal

```
abstract class Animal {
    abstract void makeSound();
    void sleep() {
        System.out.println("Sleeping...");
    }
}

class Dog extends Animal {
    void makeSound() {
        System.out.println("Dog barks.");
    }
}

class Cat extends Animal {
    void makeSound() {
        System.out.println("Cat meows.");
    }
}

public class AbstractClassExample3 {
    public static void main(String[] args) {
        Animal dog = new Dog();
        dog.makeSound();
        dog.sleep();

        Animal cat = new Cat();
        cat.makeSound();
        cat.sleep();
    }
}
```

Output:



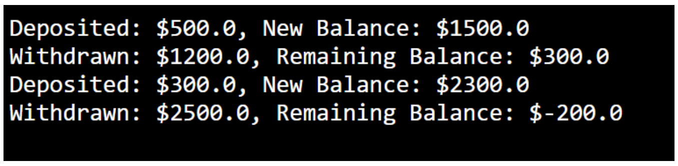
```
Dog barks.
Sleeping...
Cat meows.
Sleeping...
```

13 d) bank account

```
abstract class BankAccount {
    double balance;

    BankAccount(double balance) {
        this.balance = balance;
    }

    abstract void withdraw(double amount);

    void deposit(double amount) {
        balance += amount;
        System.out.println("Deposited: $" + amount + ", New Balance: $" +
balance);
    }
}

class SavingsAccount extends BankAccount {
    SavingsAccount(double balance) {
        super(balance);
    }

    void withdraw(double amount) {
        if (balance >= amount) {
            balance -= amount;
            System.out.println("Withdrawn: $" + amount + ", Remaining Balance: 
$" + balance);
        } else {
            System.out.println("Insufficient balance.");
        }
    }
}

class CurrentAccount extends BankAccount {
    CurrentAccount(double balance) {
        super(balance);
    }

    void withdraw(double amount) {
        balance -= amount;
        System.out.println("Withdrawn: $" + amount + ", Remaining Balance: $" 
+ balance);
    }
}
```

```
public class AbstractClassExample4 {
  public static void main(String[] args) {
    BankAccount savings = new SavingsAccount(1000);
    savings.deposit(500);
    savings.withdraw(1200);

    BankAccount current = new CurrentAccount(2000);
    current.deposit(300);
    current.withdraw(2500);
  }
}
```

Output:



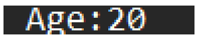
```
Deposited: $500.0, New Balance: $1500.0
Withdrawn: $1200.0, Remaining Balance: $300.0
Deposited: $300.0, New Balance: $2300.0
Withdrawn: $2500.0, Remaining Balance: $-200.0
```

14.Encapsulation Programs

14 a) Encapsulation with Age Validation

```
class Student {
  private int age;

  public void setAge(int a) {
    if (a > 0 && a < 150)
      age = a;
    else
      System.out.println("Invalid age");
  }

  public int getAge() {
        return age;
    }
}

public class Main2 {
    public static void main(String[] args) {
        Student s = new Student();
        s.setAge(20);
        System.out.println("Age: " + s.getAge());
    }
}
```

Output:

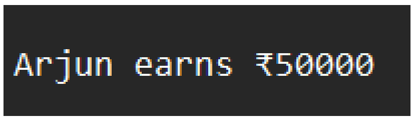


```
Age:20
```

14 b) Multiple Fields

```
class Employee {
    private String name;
    private int salary;

    public void setDetails(String n, int s) {
        name = n;
        salary = s;
    }

    public String getName() {
        return name;
    }
    public int getSalary() {
        return salary;
    }
}

public class Main3 {
    public static void main(String[] args) {
        Employee e = new Employee();
        e.setDetails("Arjun", 50000);
        System.out.println(e.getName() + " earns ₹" + e.getSalary());
    }
}
```

Output:



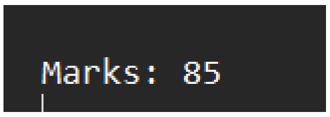
```
Arjun earns ₹50000
```

14 c) Report Card Marks

```
class ReportCard {
    private int marks;

    public void setMarks(int m) {
        if (m >= 0 && m <= 100)
            marks = m;
    }

    public int getMarks() {
        return marks;
    }
}
```

```
public class Main7 {
    public static void main(String[] args) {
        ReportCard r = new ReportCard();
        r.setMarks(85);
        System.out.println("Marks: " + r.getMarks());
    }
}
```

Output:

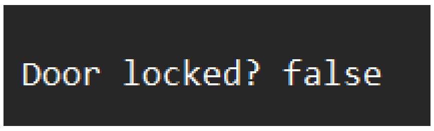


```
Marks: 85
```

14 d) Door Lock System

```
class Door {
    private boolean isLocked = true;
 public void unlock() {
 isLocked = false;
    }

    public boolean isLocked() {
        return isLocked;
    }
}

public class Main8 {
    public static void main(String[] args) {
        Door d = new Door();
        d.unlock();
        System.out.println("Door locked? " + d.isLocked());
    }
}
```

Output:



```
Door locked? false
```

15. packages Programs

15 a) Custom pakage

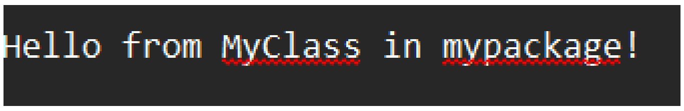
Package file:

```
package mypackage;
public class MyClass {
   public void showMessage() {
      System.out.println("Hello from MyClass in mypackage!");
   }
}
```

Main class:

```
import mypackage.MyClass;
public class Main {
   public static void main(String[] args) {
      MyClass obj = new MyClass();
      obj.showMessage();
   }
}
```

Output:



```
Hello from MyClass in mypackage!
```

15 b) user defined package

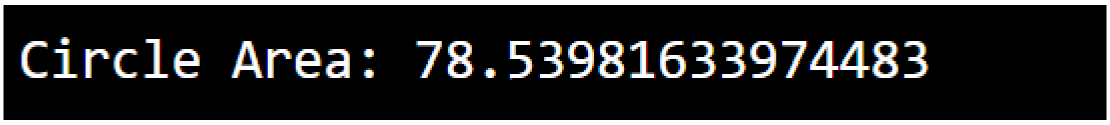
Package file: package shapes;

```
public class Circle {
   private double radius;

   public Circle(double radius) {
      this.radius = radius;
   }

   public double area() {
      return Math.PI * radius * radius;
   }
}
```

Main class:

```
import shapes.Circle;

public class UserPackageExample2 {
   public static void main(String[] args) {
      Circle c = new Circle(5);
      System.out.println("Circle Area: " + c.area());
   }
}
```

Output:

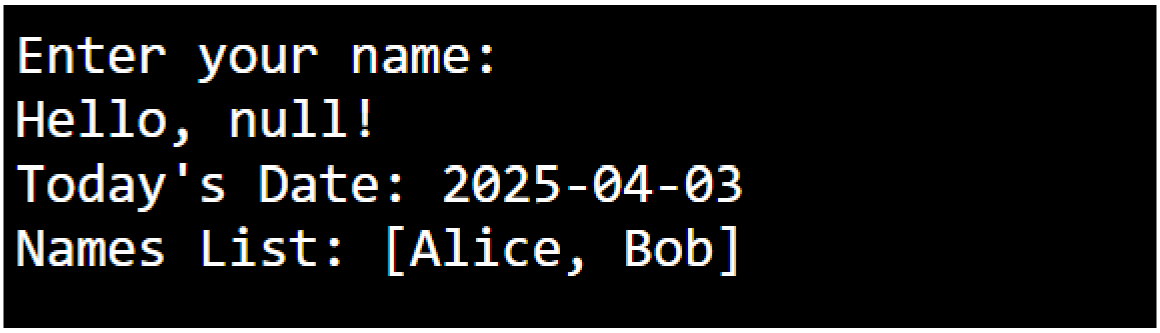


```
Circle Area: 78.53981633974483
```

15 c) built in packages

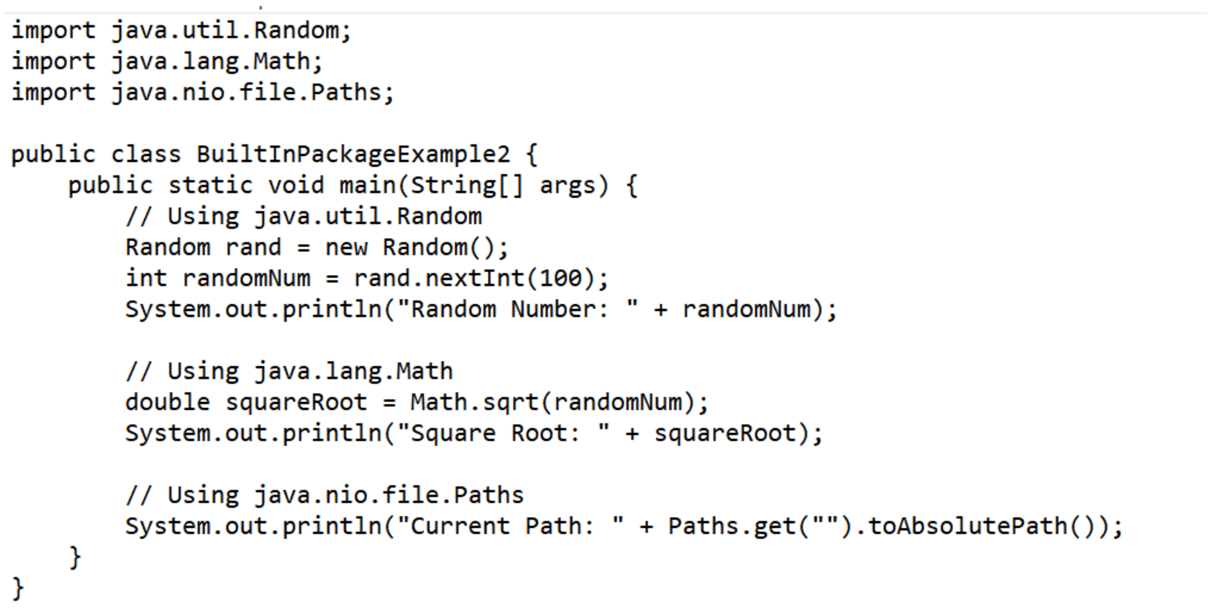
```java
import java.util.ArrayList;
import java.io.BufferedReader;
import java.io.InputStreamReader;
import java.time.LocalDate;

public class BuiltInPackageExample1 {
    public static void main(String[] args) throws Exception {
        // Using java.util.ArrayList
        ArrayList<String> names = new ArrayList<>();
        names.add("Alice");
        names.add("Bob");

        // Using java.io.BufferedReader
        BufferedReader br = new BufferedReader(new InputStreamReader(System.in));
        System.out.println("Enter your name: ");
        String userName = br.readLine();

        // Using java.time.LocalDate
        LocalDate today = LocalDate.now();

        System.out.println("Hello, " + userName + "!");
        System.out.println("Today's Date: " + today);
        System.out.println("Names List: " + names);
    }
}
```

Output:



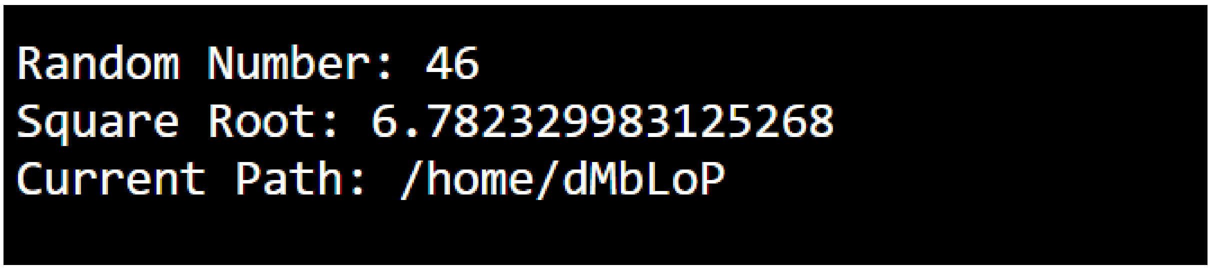
```
Enter your name:
Hello, null!
Today's Date: 2025-04-03
Names List: [Alice, Bob]
```

15 d) built in packages



```
import java.util.Random;
import java.lang.Math;
import java.nio.file.Paths;

public class BuiltInPackageExample2 {
    public static void main(String[] args) {
        // Using java.util.Random
        Random rand = new Random();
        int randomNum = rand.nextInt(100);
        System.out.println("Random Number: " + randomNum);

        // Using java.lang.Math
        double squareRoot = Math.sqrt(randomNum);
        System.out.println("Square Root: " + squareRoot);

        // Using java.nio.file.Paths
        System.out.println("Current Path: " + Paths.get("").toAbsolutePath());
    }
}
```

Output:



```
Random Number: 46
Square Root: 6.782329983125268
Current Path: /home/dMbLoP
```

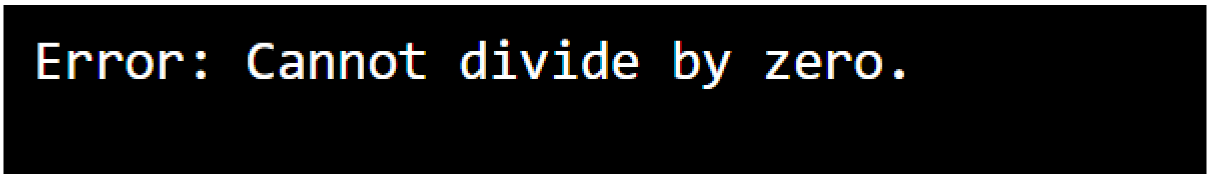
16 <u>exception handling Programs</u>

16 a) divide by zero

```
public class ExceptionExample1 {
  public static void main(String[] args) {
    try {
      int num1 = 10, num2 = 0;
      int result = num1 / num2; // This will throw an exception
```

```
            System.out.println("Result: " + result);
        } catch (ArithmeticException e) {
            System.out.println("Error: Cannot divide by zero.");
        }
    }
}
```

Output:

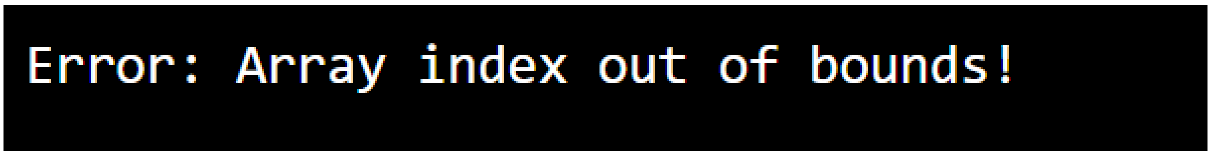


```
Error: Cannot divide by zero.
```

16 b) array index out of bound

```
public class ExceptionExample2 {
    public static void main(String[] args) {
        try {
            int[] numbers = {1, 2, 3};
            System.out.println("Accessing invalid index: " + numbers[5]); // Error!
        } catch (ArrayIndexOutOfBoundsException e) {
            System.out.println("Error: Array index out of bounds!");
        }
    }
}
```

Output:

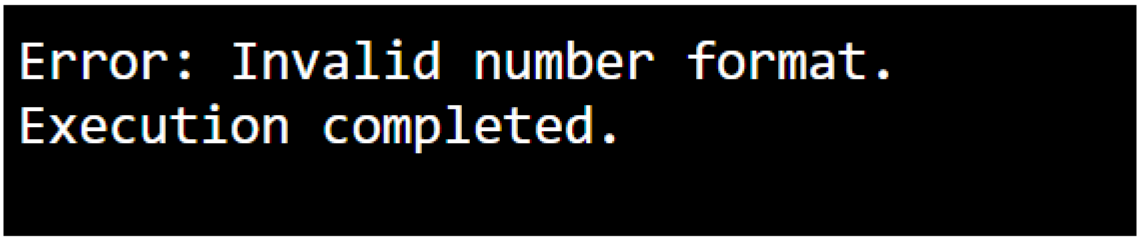


```
Error: Array index out of bounds!
```

16 c) invalid number format

```
public class ExceptionExample3 {
   public static void main(String[] args) {
      try {
         int num = Integer.parseInt("abc"); // NumberFormatException
         int result = 10 / 0; // ArithmeticException
      } catch (NumberFormatException e) {
         System.out.println("Error: Invalid number format.");
      } catch (ArithmeticException e) {
         System.out.println("Error: Division by zero.");
      } finally {
         System.out.println("Execution completed.");
      }
   }
}
```

Output:



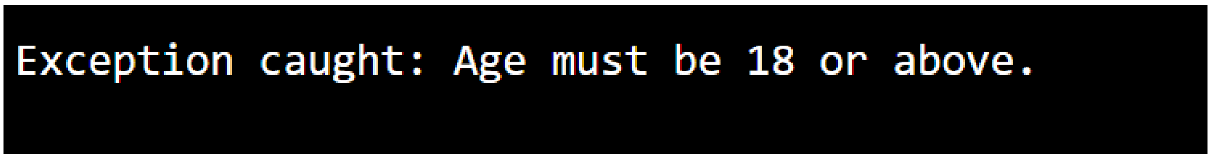
```
Error: Invalid number format.
Execution completed.
```

16 d) age exception

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

```java
    }
}

public class ExceptionExample4 {
    public static void validateAge(int age) throws AgeException {
        if (age < 18) {
            throw new AgeException("Age must be 18 or above.");
        } else {
            System.out.println("Valid age: " + age);
        }
    }

    public static void main(String[] args) {
        try {
            validateAge(15);
        } catch (AgeException e) {
            System.out.println("Exception caught: " + e.getMessage());
        }
    }
}
```

Output:



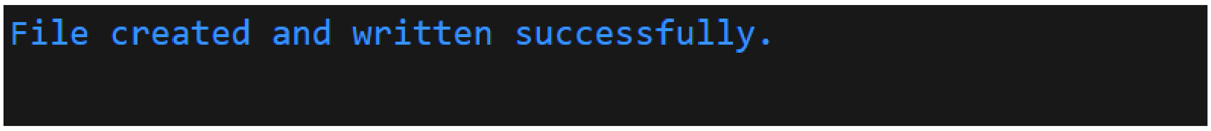
```
Exception caught: Age must be 18 or above.
```

17.file handling Programs

17 a) create and write to a file

```
import java.io.FileWriter;

import java.io.IOException;


public class FileHandlingExample1 {

  public static void main(String[] args) {

    try {

      FileWriter writer = new FileWriter("sample.txt");

      writer.write("Hello, this is a sample file!");

      writer.close();

      System.out.println("File created and written successfully.");

    } catch (IOException e) {

      System.out.println("Error writing to the file.");

    }

  }

}
```

Output:



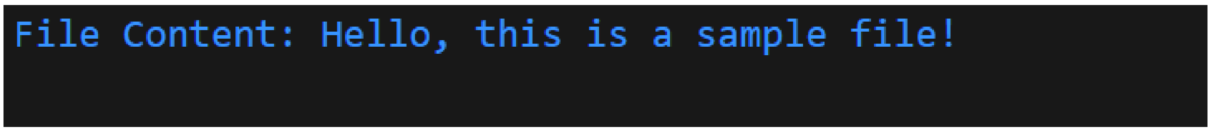
```
File created and written successfully.
```

17 b) read a file

```
import java.io.File;

import java.io.FileNotFoundException;

import java.util.Scanner;
```

```
public class FileHandlingExample2 {
    public static void main(String[] args) {
        try {
            File file = new File("sample.txt");
            Scanner reader = new Scanner(file);
            while (reader.hasNextLine()) {
                String data = reader.nextLine();
                System.out.println("File Content: " + data);
            }
            reader.close();
        } catch (FileNotFoundException e) {
            System.out.println("File not found.");
        }
    }
}
```

Output:



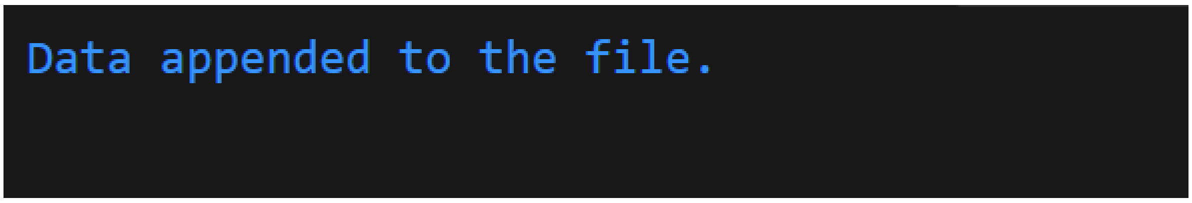
```
File Content: Hello, this is a sample file!
```

17 c)

```
import java.io.FileWriter;
import java.io.IOException;


public class FileHandlingExample3 {
    public static void main(String[] args) {
        try {
```

```
      FileWriter writer = new FileWriter("sample.txt", true);
      writer.append("\nAppending new text.");
      writer.close();
      System.out.println("Data appended to the file.");
    } catch (IOException e) {
      System.out.println("Error appending to the file.");
    }
  }
}
```

Output:

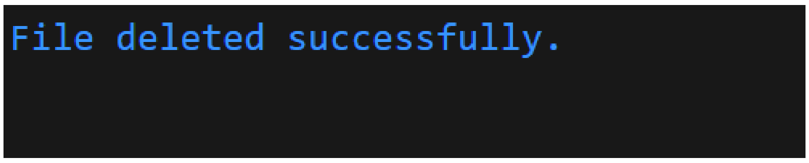


```
Data appended to the file.
```

17 d)

```
import java.io.File;

public class FileHandlingExample4 {
  public static void main(String[] args) {
    File file = new File("sample.txt");
    if (file.delete()) {
      System.out.println("File deleted successfully.");
    } else {
      System.out.println("Failed to delete the file.");
    }
  }
}
```

Output:



```
File deleted successfully.
```