

SCHOOL OF  
COMPUTING

Ganath Avinash  
CH.SC.U4CSE24118  
OBJECT ORIENTED PROGRAMMING  
(23CSE111)  
LAB RECORD



**SCHOOL OF  
COMPUTING**

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AMRITA SCHOOL OF COMPUTING, CHENNAI**

## **BONAFIDE CERTIFICATE**

This is to certify that the Lab Record work for 23CSE111- Object Oriented Programming Subject submitted by **CH.SC.U4CSE24118 – Ganath Avinash G.R** 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 held on

Internal Examiner 1

Internal Examiner 2

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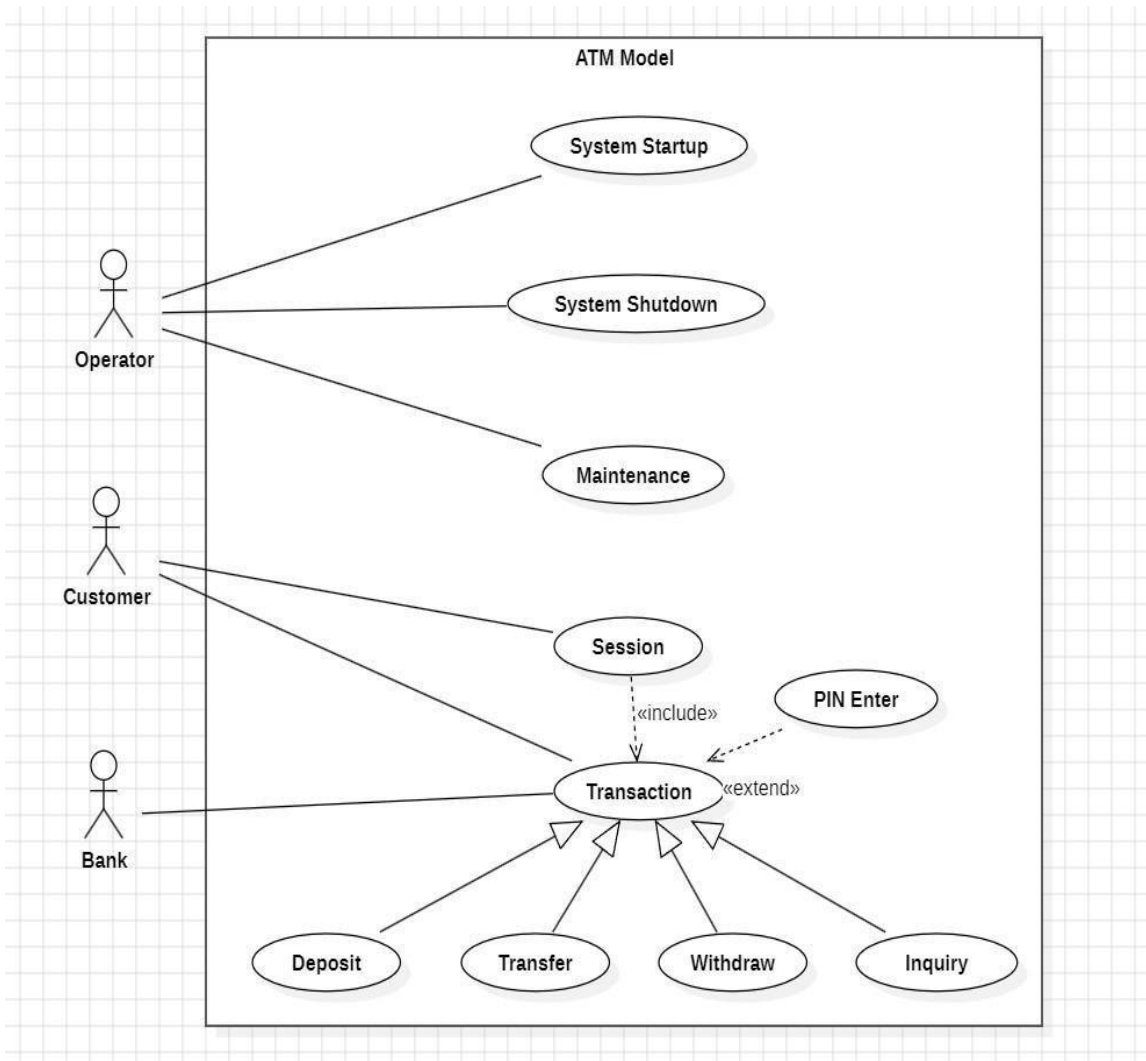
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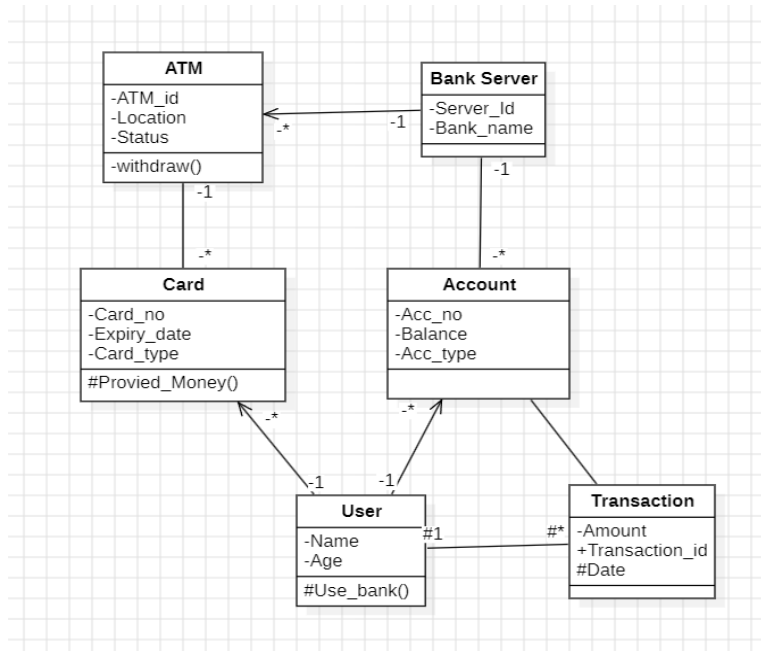
# UML DIAGRAMS

## 1. ATM Model Application

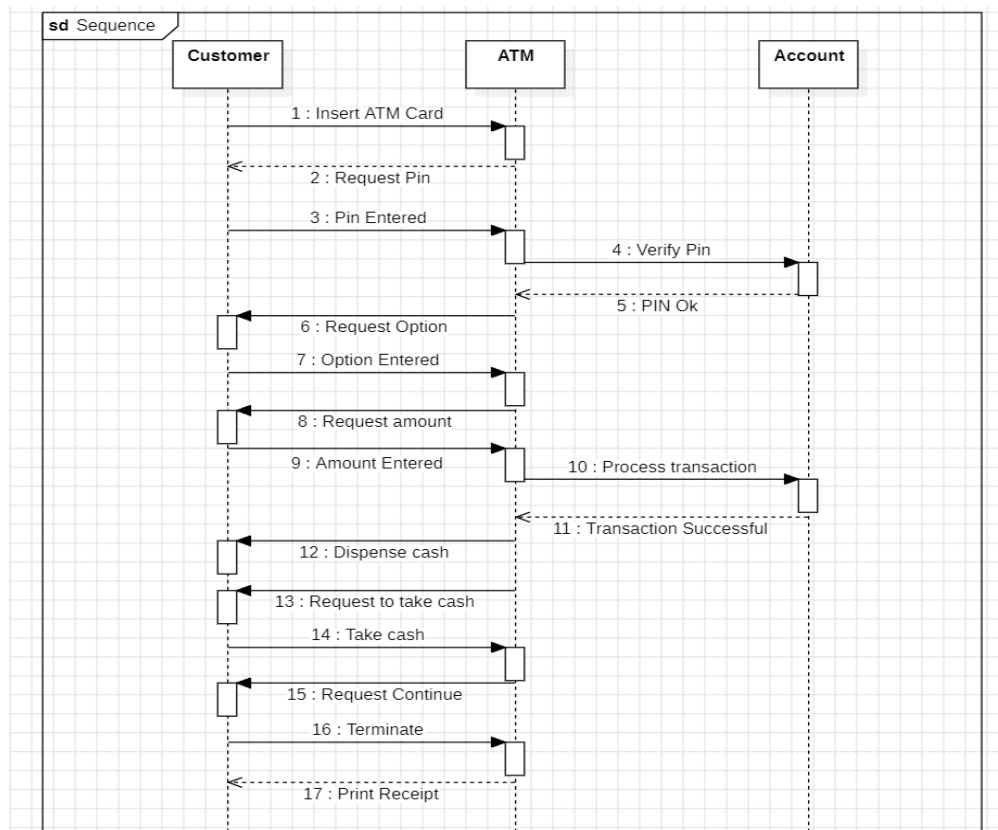
### 1.a) Use Case Diagram:



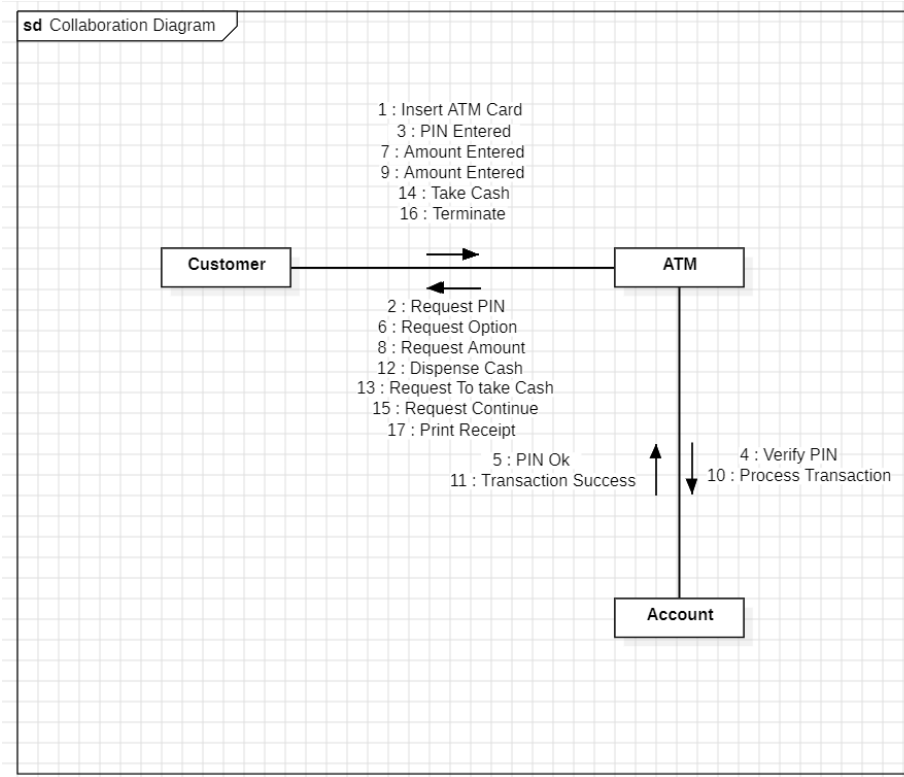
### 1.b) Class Diagram:



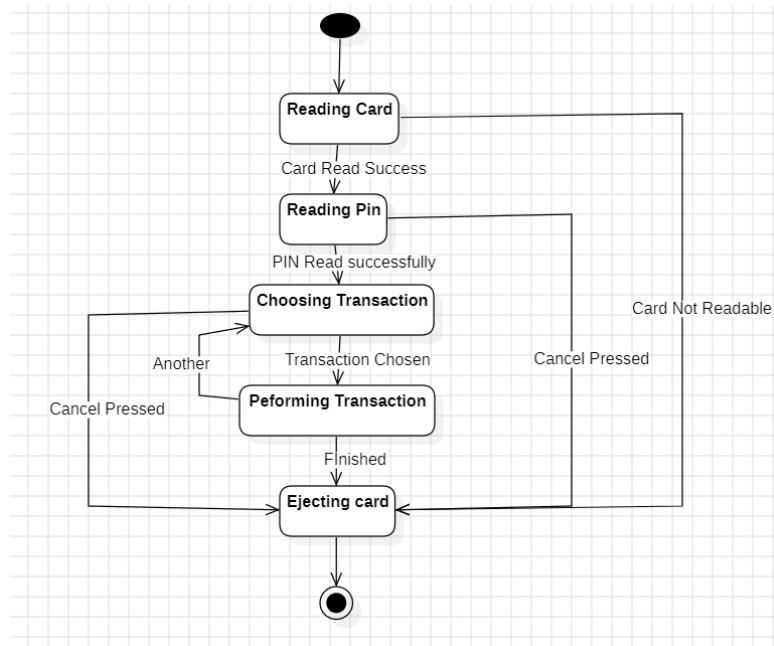
### 1.c) Sequence Diagram:



### 1.d) Collab Diagram:



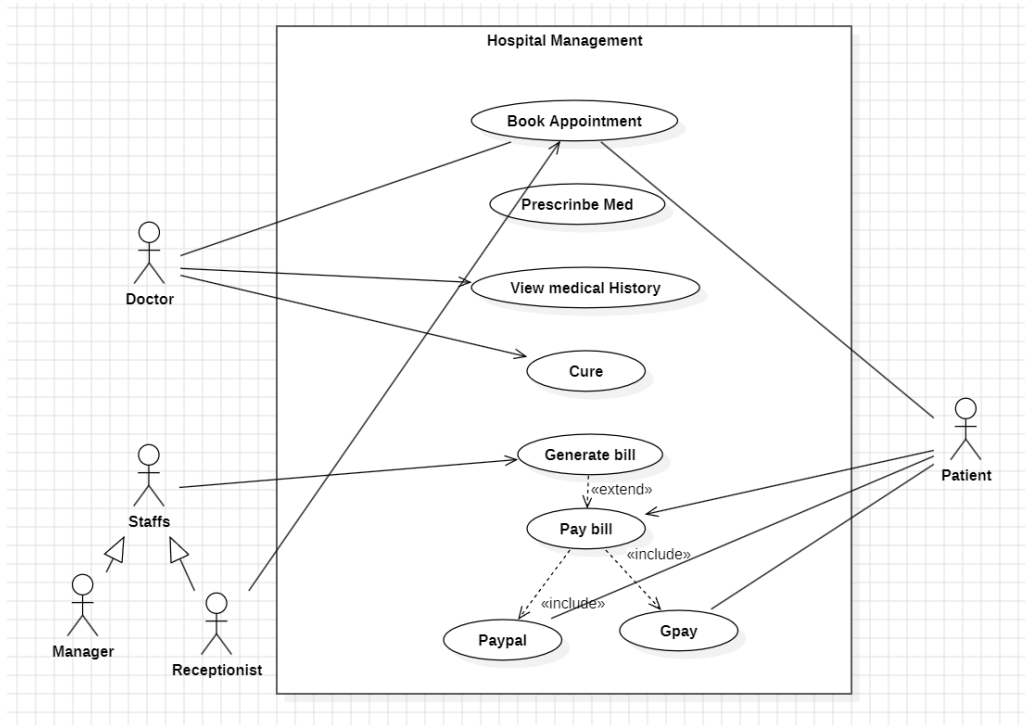
### 1.e) State Diagram:



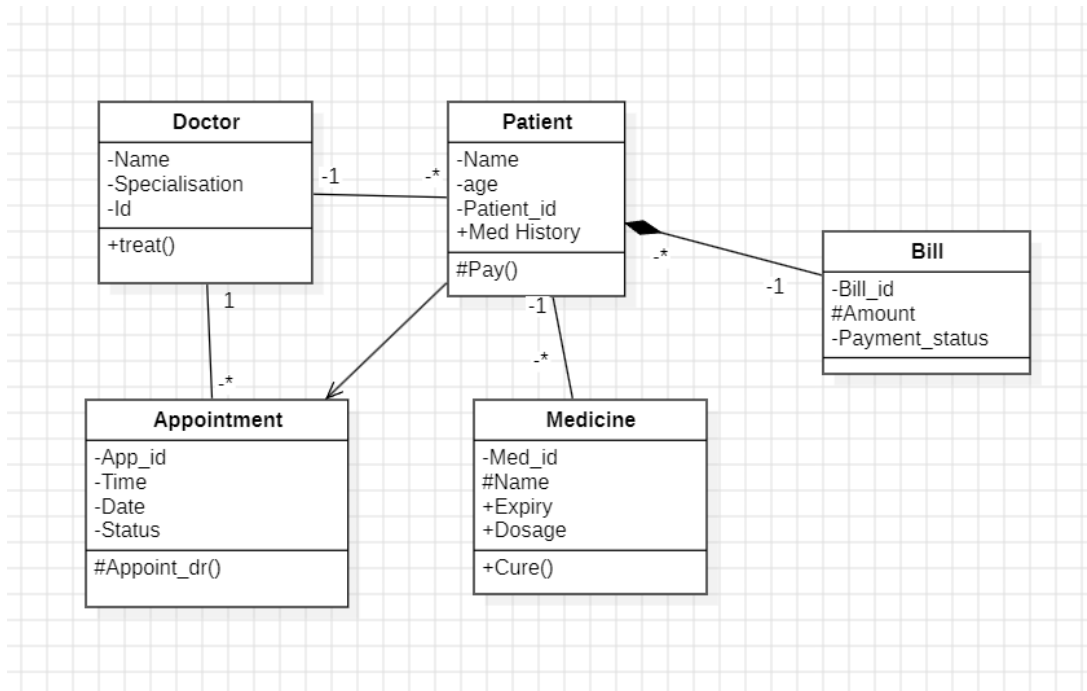


## 2. Hospital Management

### 2.a) Use Case Diagram:

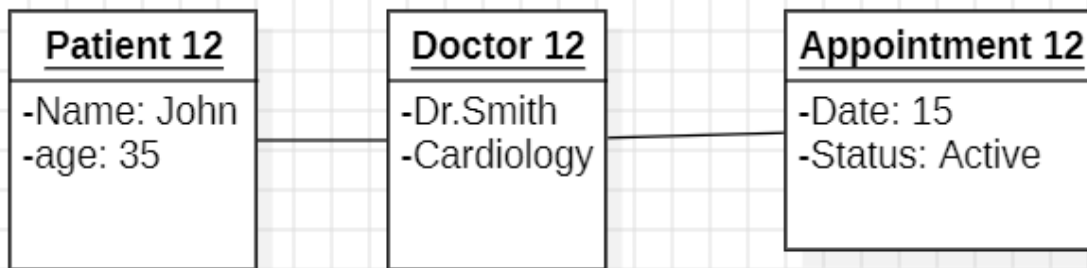


### 2.b) Class Diagram:



## 2c) Object Diagram:

Object Diagram

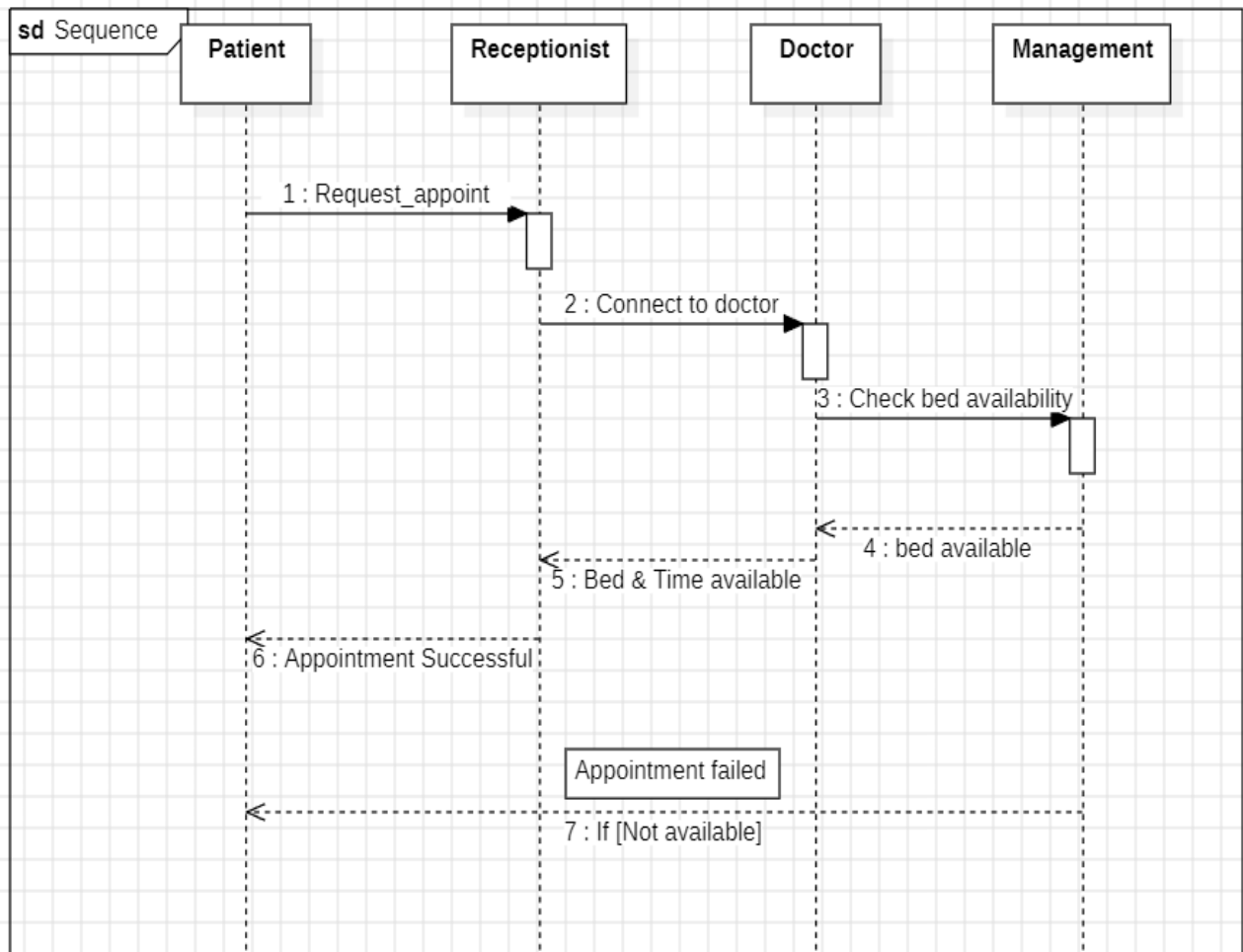


## 2d) State Diagram:

State Diagram



## 2e)Sequence Diagram:



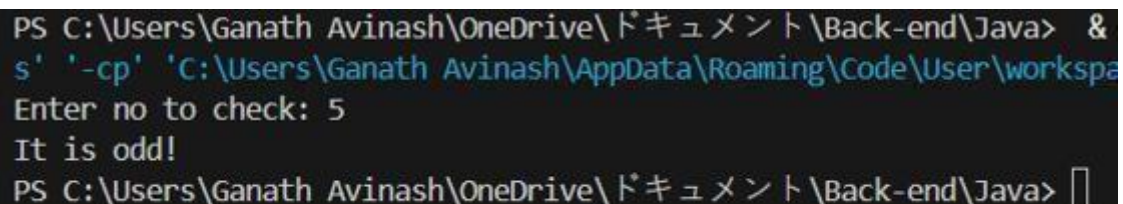
# Basic Java Questions

## 3a) Even Or Odd with Scanner:

### Code:

```
import java.util.Scanner;
public class even{
    public void find(int a){
        if(a>=0){
            if (a%2==0){
                System.out.println("It is even!");
            }
            else{
                System.out.println("It is odd!");
            }
        }
        else{
            System.out.println("Enter a number greater than or equal to 0!!");
        }
    }
    public static void main(String[]args){
        Scanner ip = new Scanner(System.in);
        even ob1=new even();
        System.out.print("Enter no to check: ");
        int a=ip.nextInt();
        ob1.find(a);
    }
}
```

### Output:



```
PS C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java> &
s' '-cp' 'C:\Users\Ganath Avinash\AppData\Roaming\Code\User\workspa
Enter no to check: 5
It is odd!
PS C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java> █
```

### 3b) Count Number Of Digits :

#### Code:

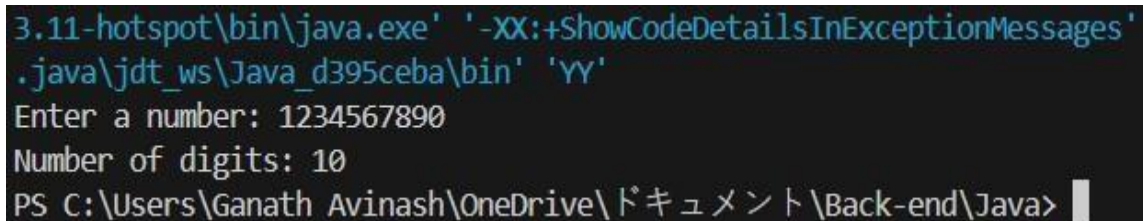
```
import java.util.Scanner;

public class CountDigits {
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter a number: ");
        int num = scanner.nextInt();

        int count = 0;
        while (num != 0) {
            num /= 10;
            count++;
        }

        System.out.println("Number of digits: " + count);
        scanner.close();
    }
}
```

#### Output:



```
3.11-hotspot\bin\java.exe' '-XX:+ShowCodeDetailsInExceptionMessages'
.java\jdt_ws\Java_d395ceba\bin' 'YY'
Enter a number: 1234567890
Number of digits: 10
PS C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java>
```

### 3c) Factorial:

#### Code:

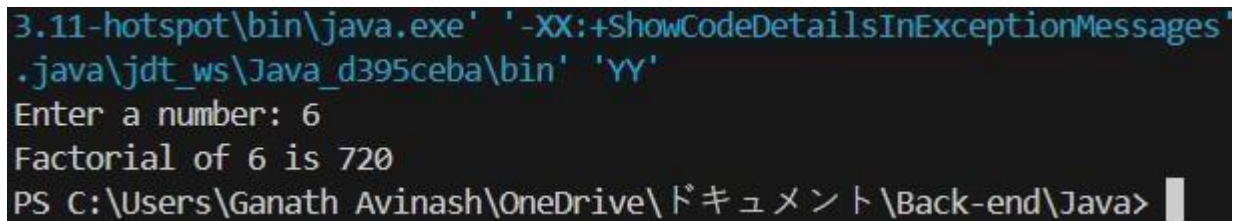
```
import java.util.Scanner;

public class FactorialLoop {
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter a number: ");
        int num = scanner.nextInt();

        int factorial = 1;
        for (int i = 1; i <= num; i++) {
            factorial *= i;
        }

        System.out.println("Factorial of " + num + " is " + factorial);
        scanner.close();
    }
}
```

#### Output:



```
3.11-hotspot\bin\java.exe' '-XX:+ShowCodeDetailsInExceptionMessages'
.java\jdt_ws\Java_d395ceba\bin' 'YY'
Enter a number: 6
Factorial of 6 is 720
PS C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java>
```

### 3d) Fibonacci Series:

**Code:**

**Code:**

```
import java.util.Scanner;

public class FactorialLoop {
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter a number: ");
        int num = scanner.nextInt();

        int factorial = 1;
        for (int i = 1; i <= num; i++) {
            factorial *= i;
        }

        System.out.println("Factorial of " + num + " is " + factorial);
        scanner.close();
    }
}
```

**Output:**

```
3.11-hotspot\bin\java.exe' '-XX:+ShowCodeDetailsInExceptionMessages'
.java\jdt_ws\Java_d395ceba\bin' 'YY'
Enter the number of terms: 8
Fibonacci Series: 0 1 1 2 3 5 8 13
PS C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java> □
```

### 3e) Largest Number Calculator:

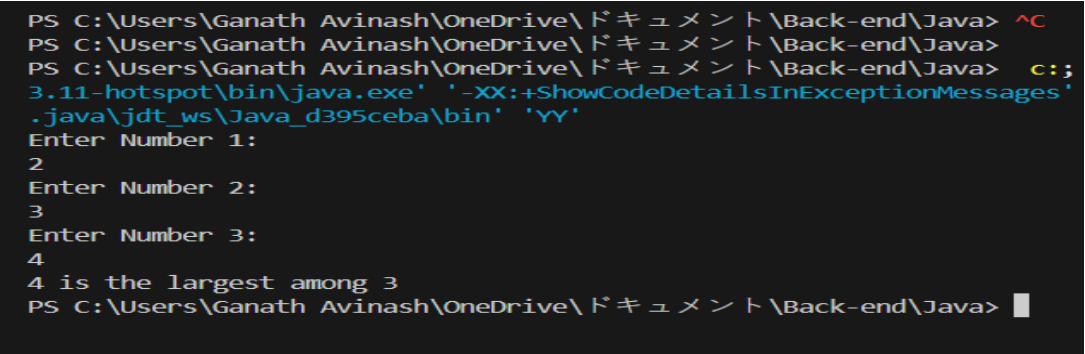
#### Code:

```
import java.util.Scanner;

public class Largest{
    int a,b,c;
    void lar(int a,int b, int c){
        if(a>b && a>c){
            System.out.println(a + "Is the largest among 3");
        }
        else if(b>a && b>c){
            System.out.println(b + "Is the largest among 3");
        }
        else if(c>a && c>b){
            System.out.println(c + "Is the largest among 3");
        }
        else{
            System.out.println("All are equal no larger number");
        }
    }
}

class call{
    public static void main(String[]args){
        Largest l1= new Largest();
        Scanner ip=new Scanner(System.in);
        System.out.println("Enter Number 1: ");
        int a=ip.nextInt();
        System.out.println("Enter Number 2: ");
        int b=ip.nextInt();
        System.out.println("Enter Number 3: ");
        int c=ip.nextInt();
        l1.lar(a,b,c);
    }
}
```

#### Output:



```
PS C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java> ^C
PS C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java>
PS C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java> c:;
3.11-hotspot\bin\java.exe' '-XX:+ShowCodeDetailsInExceptionMessages'
.java\jdt_ws\Java_d395ceba\bin' 'yy'
Enter Number 1:
2
Enter Number 2:
3
Enter Number 3:
4
4 is the largest among 3
PS C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java> █
```



### 3f) Multiplication Table :

#### Code:

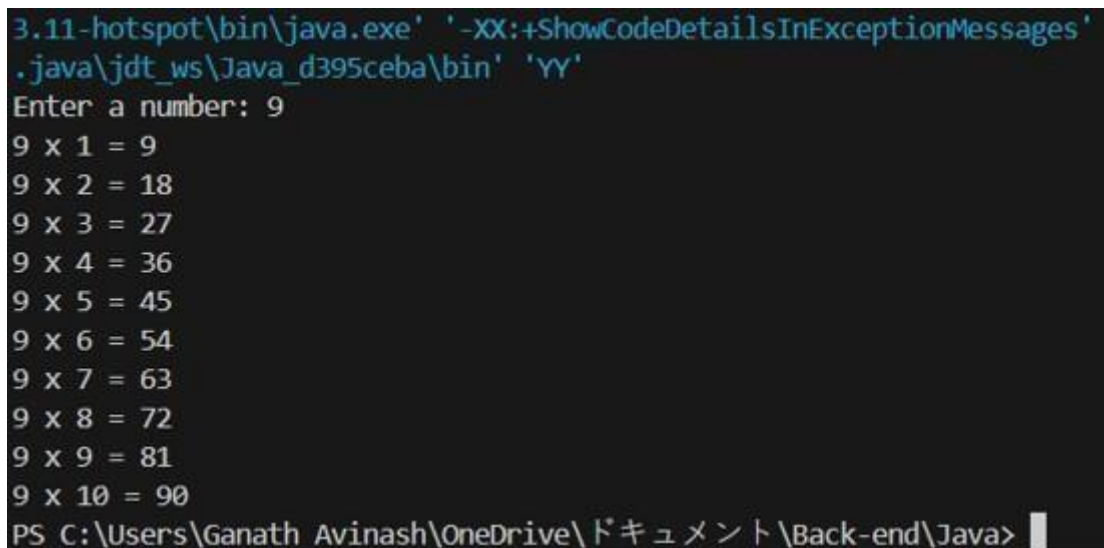
```
import java.util.Scanner;

public class MultiplicationTable {
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter a number: ");
        int num = scanner.nextInt();

        for (int i = 1; i <= 10; i++) {
            System.out.println(num + " x " + i + " = " + (num * i));
        }

        scanner.close();
    }
}
```

#### Output:



```
3.11-hotspot\bin\java.exe' '-XX:+ShowCodeDetailsInExceptionMessages'
.java\jdt_ws\Java_d395ceba\bin' 'YY'
Enter a number: 9
9 x 1 = 9
9 x 2 = 18
9 x 3 = 27
9 x 4 = 36
9 x 5 = 45
9 x 6 = 54
9 x 7 = 63
9 x 8 = 72
9 x 9 = 81
9 x 10 = 90
PS C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java>
```

### 3g) Prime Check:

**Code:**

```
import java.util.Scanner;

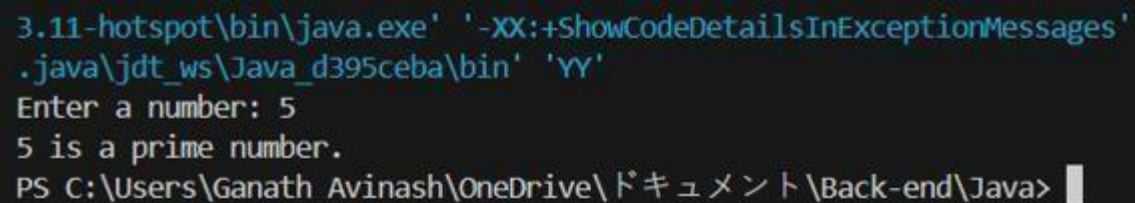
public class PrimeCheck {
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter a number: ");
        int num = scanner.nextInt();
        boolean isPrime = true;

        if (num <= 1) {
            isPrime = false;
        } else {
            for (int i = 2; i <= num / 2; i++) {
                if (num % i == 0) {
                    isPrime = false;
                    break;
                }
            }
        }

        if (isPrime)
            System.out.println(num + " is a prime number.");
        else
            System.out.println(num + " is not a prime number.");

        scanner.close();
    }
}
```

**Output:**



```
3.11-hotspot\bin\java.exe' '-XX:+ShowCodeDetailsInExceptionMessages'
.java\jdt_ws\Java_d395ceba\bin' 'YY'
Enter a number: 5
5 is a prime number.
PS C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java>
```

### 3h) Reverse Number:

#### Code:

```
import java.util.Scanner;

public class ReverseNumber {

    public static void main(String[] args) {

        Scanner scanner = new Scanner(System.in);

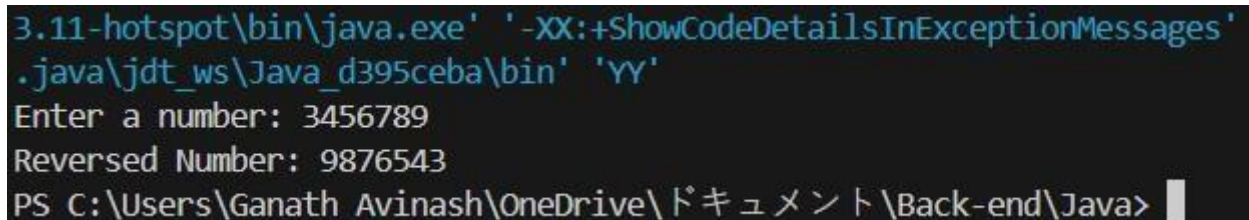
        System.out.print("Enter a number: ");

        int num = scanner.nextInt();

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

        System.out.println("Reversed Number: " + reversed);
        scanner.close();
    }
}
```

#### Output:



```
3.11-hotspot\bin\java.exe' '-XX:+ShowCodeDetailsInExceptionMessages'
.java\jdt_ws\Java_d395ceba\bin' 'YY'
Enter a number: 3456789
Reversed Number: 9876543
PS C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java>
```

### 3i) Sum Of N Natural Numbers:

#### Code:

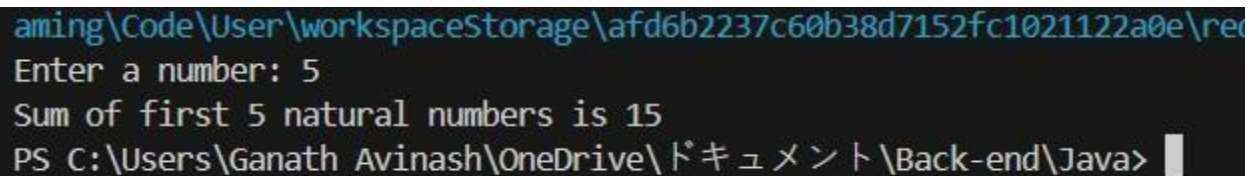
```
import java.util.Scanner;

public class SumNaturalNumbers {
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter a number: ");
        int n = scanner.nextInt();

        int sum = 0, i = 1;
        while (i <= n) {
            sum += i;
            i++;
        }

        System.out.println("Sum of first " + n + " natural numbers is " +
sum);
        scanner.close();
    }
}
```

#### Output:



```
aming\Code\User\workspaceStorage\afd6b2237c60b38d7152fc1021122a0e\re
Enter a number: 5
Sum of first 5 natural numbers is 15
PS C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java>
```

### 3j) Sum of Digits:

#### Code:

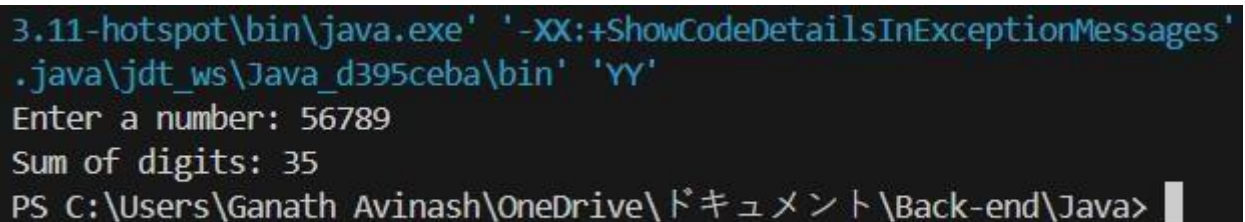
```
import java.util.Scanner;

public class SumOfDigits {
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        System.out.print("Enter a number: ");
        int num = scanner.nextInt();

        int sum = 0;
        while (num != 0) {
            sum += num % 10;
            num /= 10;
        }

        System.out.println("Sum of digits: " + sum);
        scanner.close();
    }
}
```

#### Output:



```
3.11-hotspot\bin\java.exe' '-XX:+ShowCodeDetailsInExceptionMessages'
.java\jdt_ws\Java_d395ceba\bin' 'YY'
Enter a number: 56789
Sum of digits: 35
PS C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java>
```

EXP: 4,5,6,7	INHERITANCE	OOPS
--------------	-------------	------

4a)

Code:

```

public class I1{
    public static void main(String[]args){
        Car c1=new BMW();
        BMW b1=new BMW();
        Car c2=new Car();
        c1.stt();
        b1.stt();
        b1.drive();
    }
}

class Car{
    void stt(){
        System.out.println("Car Starts");
    }
}

class BMW extends Car{
    void drive(){
        System.out.println("BMW Is Driven");
    }
}

```

Screenshot:

```

C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Inherit>javac I1.java
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Inherit>java I1.java
Car Starts
Car Starts
BMW Is Driven
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Inherit>

```

4b)

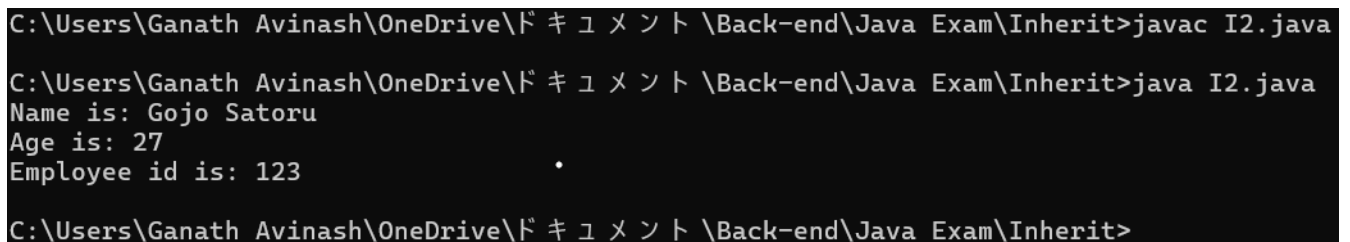
Code:

```
public class I2{
    public static void main (String[]args){
        emp e1=new emp(123,"Gojo Satoru",27);
        e1.di();
        e1.emdi();
    }
}

class Person{
    int age;
    String name;
    Person(String name,int age){
        this.name=name;
        this.age=age;
    }
    void di(){
        System.out.println("Name is: "+name);
        System.out.println("Age is: "+age);
    }
}

class emp extends Person{
    int emid;
    emp(int emid,String name,int age){
        super(name,age);
        this.emid=emid;
    }
    void emdi(){
        System.out.println("Employee id is: "+emid);
    }
}
```

Screenshot:



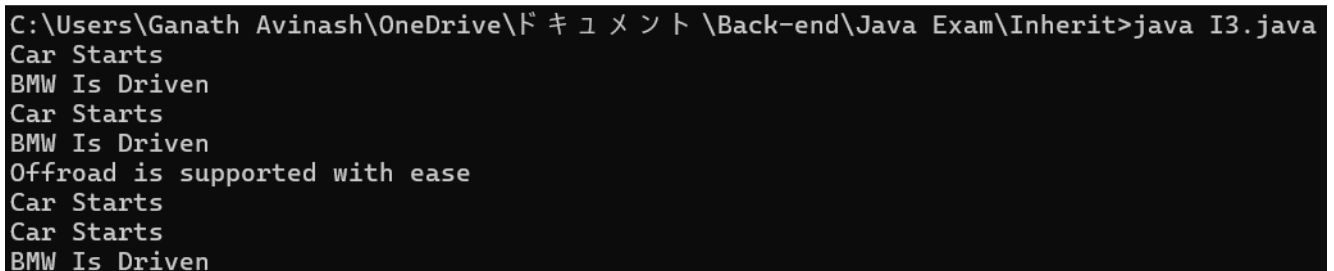
```
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Inherit>javac I2.java
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Inherit>java I2.java
Name is: Gojo Satoru
Age is: 27
Employee id is: 123
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Inherit>
```

**5a)**

**Code:**

```
public class I3{
public static void main(String[]args){
Car c1=new BMW();
BMW b1=new BMW();
Car c2=new Car();
BMW t3=new BMWTruck();
BMWTruck t4=new BMWTruck();
t3.stt();
t3.drive();
t4.stt();
t4.drive();
t4.offroad();
c1.stt();
b1.stt();
b1.drive();
}
}
class Car{
void stt(){
System.out.println("Car Starts");
}
}
class BMW extends Car{
void drive(){
System.out.println("BMW Is Driven");
}
}
class BMWTruck extends BMW{
void offroad(){
System.out.println("Offroad is supported with ease");
}}
}
```

**Screenshot:**



```
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Inherit>java I3.java
Car Starts
BMW Is Driven
Car Starts
BMW Is Driven
Offroad is supported with ease
Car Starts
Car Starts
BMW Is Driven
```



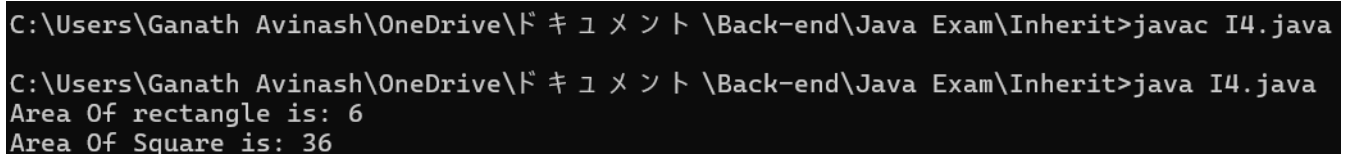
**5b)**

**Code:**

```
public class I4{
public static void main(String[]args){
rect r1=new rect();
r1.area(2,3);
square s1=new square();
s1.area(6);
}
}

class Shape{
void area(){
System.out.println("This can Calculate area of rectangle and square");
}
}
class rect extends Shape{
void area(int a,int b){
System.out.println("Area Of rectangle is: "+(a*b));
}
}
class square extends rect{
void area(int a){
System.out.println("Area Of Square is: "+(a*a));
}
}
```

**Screenshot:**



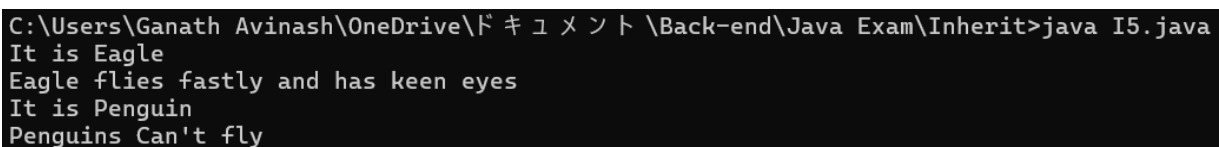
```
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Inherit>javac I4.java
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Inherit>java I4.java
Area Of rectangle is: 6
Area Of Square is: 36
```

6a)

Code:

```
public class I5{
public static void main(String[]args){
eagle e1=new eagle("Eagle");
pen p1=new pen("Penguin");
e1.dis();
e1.fly();
p1.dis();
p1.fly();
}
}
class Bird{
String type;
void fly(){
System.out.println("Birds fly in various speeds");
}
void dis(){
System.out.println("It is "+type);
}
}
class eagle extends Bird{
eagle(String typ){
super.type=typ;
}
void fly(){
System.out.println("Eagle flies fastly and has keen eyes");
}
}
class pen extends Bird{
pen(String typ){
super.type=typ;
}
void fly(){
System.out.println("Penguins Can't fly");
}
}
}
```

Screenshot:



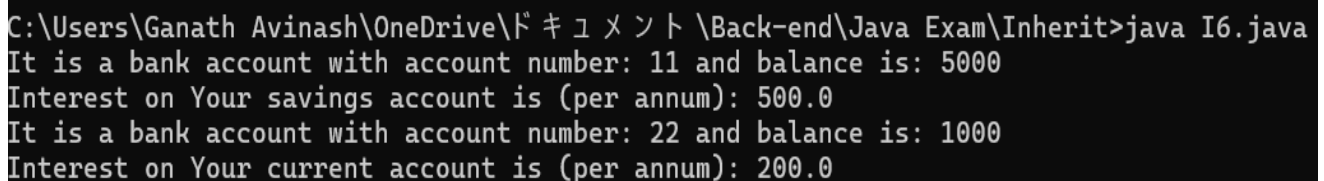
```
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Inherit>java I5.java
It is Eagle
Eagle flies fastly and has keen eyes
It is Penguin
Penguins Can't fly
```

**6b)**

**Code:**

```
public class I6{
public static void main(String[]args){
sacc s1=new sacc(11,5000);
cacc c1=new cacc(22,1000);
s1.bb();
s1.calci();
c1.bb();
c1.calca();}}
class BankAcc{
int accno;
int balance;
BankAcc(int accno,int balance){
this.accno=accno;
this.balance=balance;}
void bb(){
System.out.println("It is a bank account with account number: "+accno+" and balance is:
"+balance);}}
class sacc extends BankAcc{
sacc(int accno,int balance){
super(accno,balance);}
void calci(){
System.out.println("Interest on Your savings account is (per annum): "+balance*0.1);
}}
class cacc extends BankAcc{
cacc(int accno,int balance){
super(accno,balance);
}
void calca(){
System.out.println("Interest on Your current account is (per annum): "+balance*0.2);
}}
```

**Screenshot:**



```
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Inherit>java I6.java
It is a bank account with account number: 11 and balance is: 5000
Interest on Your savings account is (per annum): 500.0
It is a bank account with account number: 22 and balance is: 1000
Interest on Your current account is (per annum): 200.0
```

**7a)**

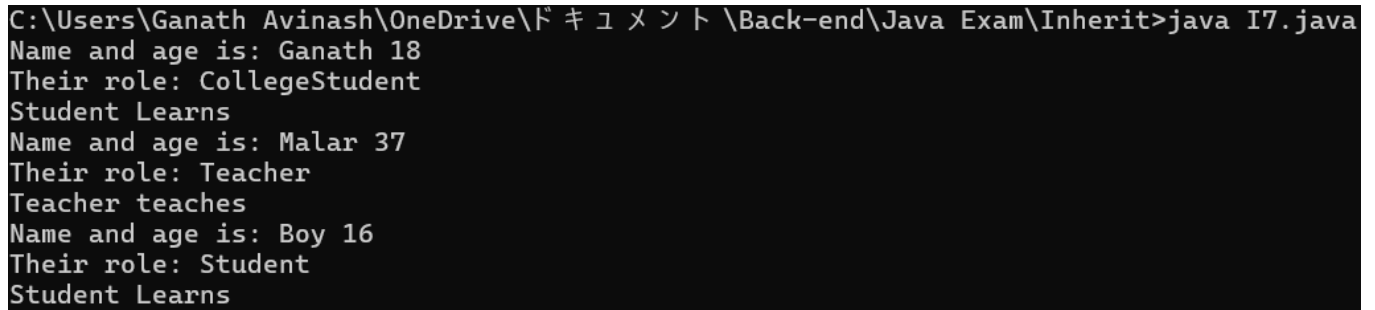
**Code:**

```
public class I7{
public static void main(String[]args){
cstudent c1=new cstudent("Ganath",18,"CollegeStudent");
teacher t1=new teacher("Malar",37,"Teacher");
student s1=new student("Boy",16,"Student");
c1.dis();
c1.learn();
t1.dis();
t1.teach();
s1.dis();
s1.learn();
}
}
```

```
class Person{
String name;
int age;
Person(String name,int age){
this.name=name;
this.age=age;
}
void dis(){
System.out.println("Name and age is: "+name+" "+age);
}
}
class teacher extends Person{
String role;
teacher(String name,int age,String role){
super(name,age);
this.role=role;
}
void teach(){
System.out.println("Their role: "+role);
System.out.println("Teacher teaches");
}
}
class student extends Person{
String role;
student(String name,int age,String role){
super(name,age);
this.role=role;
}
void learn(){
System.out.println("Their role: "+role);
```

```
System.out.println("Student Learns");
}
}
class cstudent extends student{
cstudent(String name,int age,String role){
super(name,age,role);
}
}
```

**Screenshot:**



```
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Inherit>java I7.java
Name and age is: Ganath 18
Their role: CollegeStudent
Student Learns
Name and age is: Malar 37
Their role: Teacher
Teacher teaches
Name and age is: Boy 16
Their role: Student
Student Learns
```

7b)

Code:

```
public class I8 {
    public static void main(String[] args) {
        // Hybrid inheritance demonstration
        SportsCar sportsCar = new SportsCar();
        sportsCar.start();
        sportsCar.driveFast();
        Bike bike = new Bike();
        bike.start();
    }
}

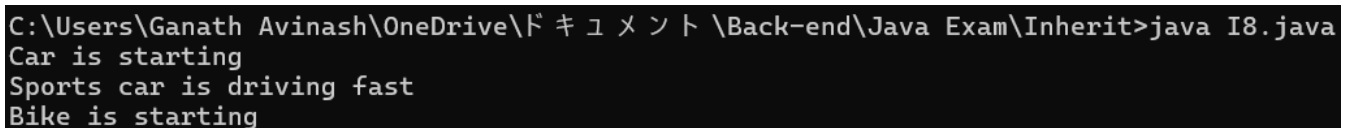
class Vehicle {
    void start() {
        System.out.println("Vehicle is starting");
    }
}

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

class SportsCar extends Car {
    void driveFast() {
        System.out.println("Sports car is driving fast");
    }
}

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

Screenshot:



```
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Inherit>java I8.java
Car is starting
Sports car is driving fast
Bike is starting
```

EXP: 8,9,10,11	POLYMORPHISM	OOPS
----------------	--------------	------

8a)

Code:

```

public class C1{
    public static void main (String[]args){
        emp e1=new emp(123,"Gojo Satoru",27);
        e1.di();
        e1.emdi();
    }
    class Person{
        int age;
        String name;
        Person(String name,int age){
            this.name=name;
            this.age=age;
        }
        void di(){
            System.out.println("Name is: "+name);
            System.out.println("Age is: "+age);
        }
        class emp extends Person{
            int emid;
            int yrss;
            emp(int emid,String name,int age){
                super(name,age);
                this.emid=emid;
            }
            void emdi(){
                System.out.println("Employee id is: "+emid);
            }
        }
    }
}

```

Screenshot:

```

C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Poly>javac C1.java
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Poly>java C1.java
Name is: Gojo Satoru
Age is: 27
Employee id is: 123

```

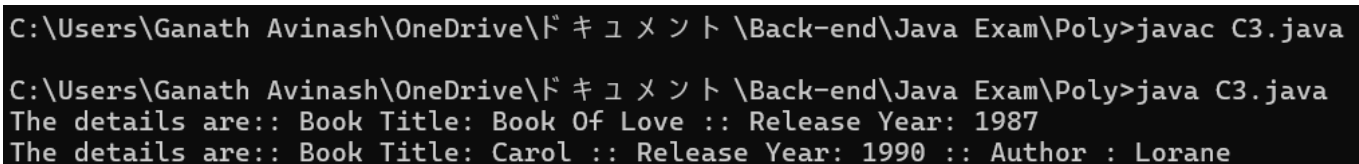
**9a)**

**Code:**

```
public class C3{
public static void main(String[]args){
Book b1=new Book(1987,"Book Of Love");
Book b2=new Book(1990,"Carol","Lorane");
b1.dis();
b2.dis1();
}
}
```

```
class Book{
int yr;
String title;
String Author;
Book(int yr,String title){
this.title=title;
this.yr=yr;
}
Book(int yr,String title,String Author){
this.title=title;
this.yr=yr;
this.Author=Author;
}
void dis(){
System.out.println("The details are:: Book Title: "+title+" :: Release Year: "+yr);
}
void dis1(){
System.out.println("The details are:: Book Title: "+title+" :: Release Year: "+yr+" :: Author : "+Author);
}
}
```

**Screenshot:**



```
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Poly>javac C3.java
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Poly>java C3.java
The details are:: Book Title: Book Of Love :: Release Year: 1987
The details are:: Book Title: Carol :: Release Year: 1990 :: Author : Lorane
```

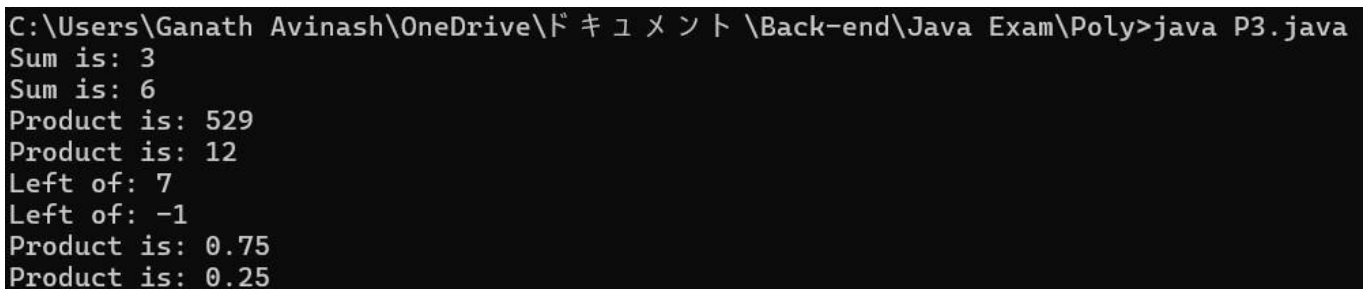


10a)

Code:

```
public class P3{
public static void main(String[]args){
Calculator c1=new Calculator();
c1.add(1,2);c1.add(1,2,3);
c1.mul(23,23);
c1.mul(2,3,2);
c1.sub(9,2);
c1.sub(8,4,5);
c1.div(3,4);
c1.div(3,4,3);
}}
class Calculator{
void add(int a,int b){
System.out.println("Sum is: "+(a+b));
}
void add(int a,int b,int c){
System.out.println("Sum is: "+(a+b+c));}
void mul(int a,int b){
System.out.println("Product is: "+(a*b));}
void mul(int a,int b,int c){
System.out.println("Product is: "+(a*b*c));}
void sub(int a,int b){
System.out.println("Left of: "+(a-b));}
void sub(int a,int b,int c){
System.out.println("Left of: "+(a-b-c));}
void div(double a,double b){
System.out.println("Product is: "+(a/b));}
void div(double a,double b,double c){
System.out.println("Product is: "+((a/b)/c));
}}
```

Screenshot:



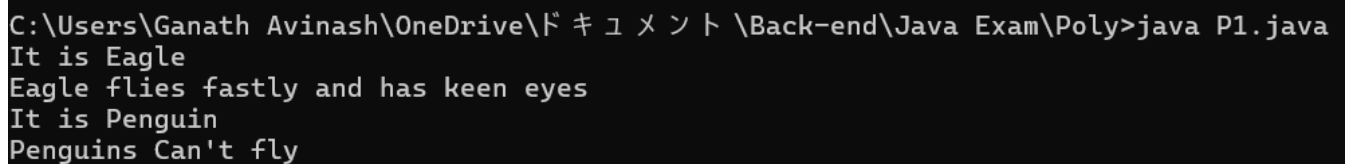
```
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Poly>java P3.java
Sum is: 3
Sum is: 6
Product is: 529
Product is: 12
Left of: 7
Left of: -1
Product is: 0.75
Product is: 0.25
```

**11a)**

**Code:**

```
public class P1{
public static void main(String[]args){
eagle e1=new eagle("Eagle");
pen p1=new pen("Penguin");
e1.dis();e1.fly();
p1.dis();p1.fly();
}}
class Bird{
String type;
void fly(){
System.out.println("Birds fly in various speeds");
}
void dis(){
System.out.println("It is "+type);
}
}
class eagle extends Bird{
eagle(String typ){
super.type=typ;}
void fly(){
System.out.println("Eagle flies fastly and has keen eyes");
}
}
class pen extends Bird{
pen(String typ){
super.type=typ;
}
void fly(){
System.out.println("Penguins Can't fly");
}
}
```

**Screenshot:**



```
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Poly>java P1.java
It is Eagle
Eagle flies fastly and has keen eyes
It is Penguin
Penguins Can't fly
```

**11b)**

**Code:**

```
public class I8 {
    public static void main(String[] args) {
        SportsCar sportsCar = new SportsCar();
        sportsCar.start();
        sportsCar.driveFast();
        Bike bike = new Bike();
        bike.start(); }}

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

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

class SportsCar extends Car {
    void driveFast() {
        System.out.println("Sports car is driving fast");
    }
}

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

**Screenshot:**



```
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Poly>java P2.java
Car is starting
Sports car is driving fast
Bike is starting
```

<b>EXP: 12,13</b>	<b>ABSTRACTION</b>	<b>OOPS</b>
-------------------	--------------------	-------------

**12a)**

**Code:**

```
public class A1{
public static void main(String[]args){
Add a1=new Add();
Sub s1=new Sub();
Mul m1=new Mul();
Div d1=new Div();
a1.add(2,3);
s1.sub(3,4);
m1.mul(8,7);
d1.div(6,6);
}
}
```

```
abstract class Calculator{
abstract void add(int a,int b);
abstract void mul(int a,int b);
abstract void sub(int a,int b);
abstract void div(int a,int b);
}
```

```
class Add extends Calculator{
void add(int a,int b){
System.out.println("Sum is: "+(a+b));
}
void sub(int a,int b){}
void mul(int a,int b){}
void div(int a,int b){}
}
```

```
class Sub extends Calculator{
void add(int a,int b){}
void sub(int a,int b){
System.out.println("Subtracted value is: "+(a+b));
}
void mul(int a,int b){}
void div(int a,int b){}
}
```

```
class Mul extends Calculator{
void add(int a,int b){}
void sub(int a,int b){}
```

```
void mul(int a,int b){  
System.out.println("Product is: "+(a+b));  
}  
void div(int a,int b){}  
}
```

```
class Div extends Calculator{  
void add(int a,int b){}  
void sub(int a,int b){}  
void mul(int a,int b){}  
void div(int a,int b){  
System.out.println("Divided answer is: "+(a+b));  
}  
}
```

**Screenshot:**

A screenshot of a command prompt window showing the execution of a Java program. The command 'java A1.java' has been executed, resulting in four lines of output: 'Sum is: 5', 'Subtracted value is: 7', 'Product is: 15', and 'Divided answer is: 12'. The file path is visible in the command line.

```
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Abs>java A1.java  
Sum is: 5  
Subtracted value is: 7  
Product is: 15  
Divided answer is: 12
```

12b)

Code:

```
public class A2{
public static void main(String[]args){
Circle c1=new Circle(3);c1.calc();
Rect r1=new Rect(3,4);r1.calc();
Square s1=new Square(2);
s1.calc();}}
abstract class Shape{
abstract void calc();
void dis(){
System.out.println("Its a shape");
}}
class Circle extends Shape{
int a;
Circle(int a){
this.a=a;
}void calc(){
System.out.println("Area is: "+(3.14*a));
}}
class Square extends Shape{
int a;
Square(int a){
this.a=a;
}
void calc(){
System.out.println("Area is: "+(a*a));}}
class Rect extends Shape{
int a;int b;
Rect(int a,int b){
this.a=a;this.b=b;}
void calc(){
System.out.println("Area is: "+(b*a));
}}
```

Screenshot:



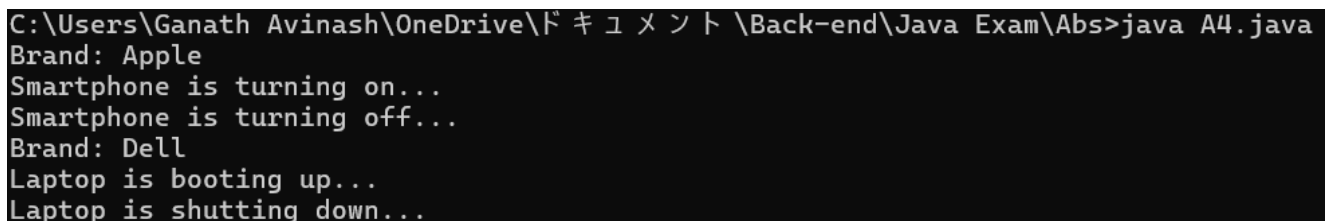
```
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Abs>java A2.java
Area is: 9.42
Area is: 12
Area is: 4
```

12C)

Code:

```
public class A4{
    public static void main(String[] args) {
        ElectronicDevice phone = new Smartphone();
        ElectronicDevice laptop = new Laptop();
        phone.displayBrand("Apple");
        phone.turnOn();
        phone.turnOff();
        laptop.displayBrand("Dell");
        laptop.turnOn();
        laptop.turnOff(); } }
abstract class ElectronicDevice {
    abstract void turnOn();
    abstract void turnOff();
    void displayBrand(String brand) {
        System.out.println("Brand: " + brand);
    }
}
class Smartphone extends ElectronicDevice {
    void turnOn() {
        System.out.println("Smartphone is turning on...");
    }
    void turnOff() {
        System.out.println("Smartphone is turning off...");
    }
}
class Laptop extends ElectronicDevice {
    void turnOn() {
        System.out.println("Laptop is booting up...");
    }
    void turnOff() {
        System.out.println("Laptop is shutting down...");
    }
}
```

Screenshot:



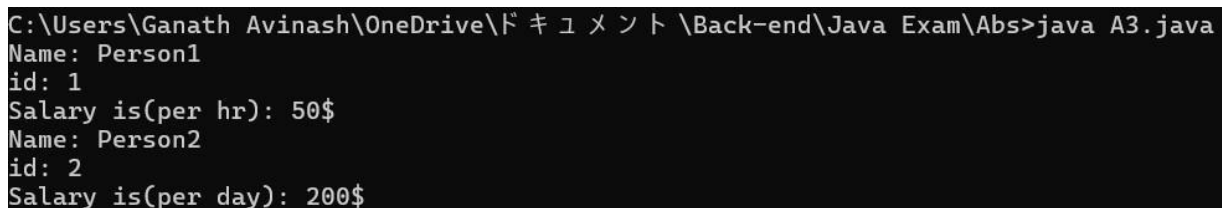
```
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Abs>java A4.java
Brand: Apple
Smartphone is turning on...
Smartphone is turning off...
Brand: Dell
Laptop is booting up...
Laptop is shutting down...
```

12d)

Code:

```
public class A3{
public static void main(String[]args){
part p1=new part("Person1",1);
full f1=new full("Person2",2);
p1.dis();p1.cs();
f1.dis();f1.cs();
}}
abstract class Emp{
abstract void cs();
int id;
String Name;
Emp(String Name,int id){
this.Name=Name;
this.id=id;
}
void dis(){
System.out.println("Name: "+Name);
System.out.println("id: "+id);
}}
class part extends Emp{
part(String nam,int id){
super(nam,id);
}
void cs(){
System.out.println("Salary is(per hr): 50$");
}}
class full extends Emp{
full(String nam,int id){
super(nam,id);}
void cs(){
System.out.println("Salary is(per day): 200$");
}}
```

Screenshot:



```
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Abs>java A3.java
Name: Person1
id: 1
Salary is(per hr): 50$
Name: Person2
id: 2
Salary is(per day): 200$
```

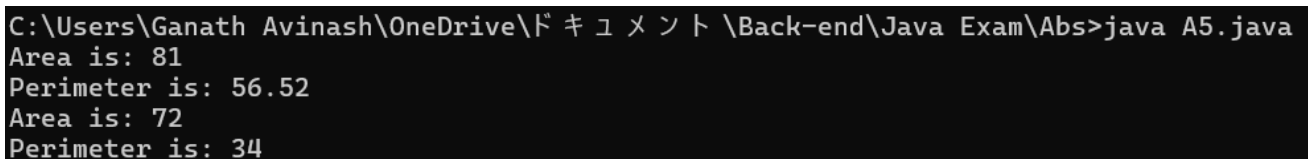


**13a)**

**Code:**

```
public class A5{
public static void main(String[]args){
circle c1=new circle(9);
rect r1=new rect(8,9);
c1.area();c1.per();
r1.area();r1.per();
}}
interface shape{
void area();
void per();
}
class circle implements shape{
int a;
circle(int a){
this.a=a;
}
public void area(){
System.out.println("Area is: "+(a*a));
}
public void per(){
System.out.println("Perimeter is: "+(2*3.14*a));
}}
class rect implements shape{
int a;int b;
rect(int a,int b){
this.a=a;
this.b=b;
}
public void area(){
System.out.println("Area is: "+(a*b));
}
public void per(){
System.out.println("Perimeter is: "+(2*(a+b)));
}
}
```

**Screenshot:**



```
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Abs>java A5.java
Area is: 81
Perimeter is: 56.52
Area is: 72
Perimeter is: 34
```

**13b)**

**Code:**

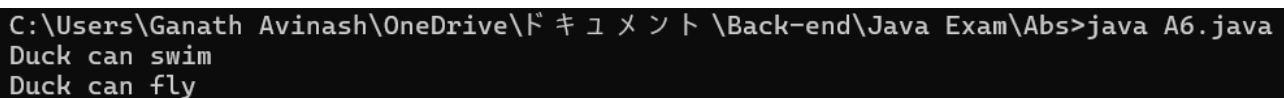
```
public class A6{
public static void main(String[]args){
duck d1=new duck();
d1.swim();
d1.fly();
}
}

interface swims{
void swim();
}

interface flyable{
void fly();
}

class duck implements swims,flyable{
public void swim(){
System.out.println("Duck can swim");
}
public void fly(){
System.out.println("Duck can fly");
}
}
```

**Screenshot:**

A screenshot of a Windows command prompt window. The title bar shows the file path: C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Abs. The command prompt shows the command 'java A6.java' being executed. The output of the program is displayed on two lines: 'Duck can swim' and 'Duck can fly'.

```
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Abs>java A6.java
Duck can swim
Duck can fly
```

13c)

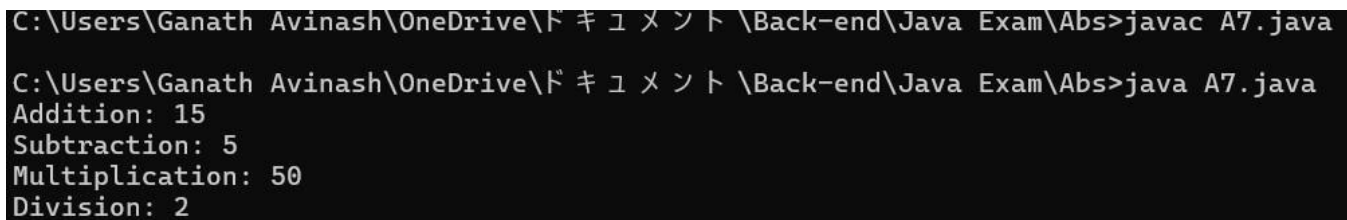
Code:

```
public class A7 {
    public static void main(String[] args) {
        Calculator add = (a, b) -> a + b;
        Calculator subtract = (a, b) -> a - b;
        Calculator multiply = (a, b) -> a * b;
        Calculator divide = (a, b) -> a / b;

        System.out.println("Addition: " + add.calculate(10, 5));
        System.out.println("Subtraction: " + subtract.calculate(10, 5));
        System.out.println("Multiplication: " + multiply.calculate(10, 5));
        System.out.println("Division: " + divide.calculate(10, 5));
    }
}

interface Calculator {
    int calculate(int a, int b);
}
```

Screenshot:



```
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Abs>javac A7.java
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Abs>java A7.java
Addition: 15
Subtraction: 5
Multiplication: 50
Division: 2
```

13d)

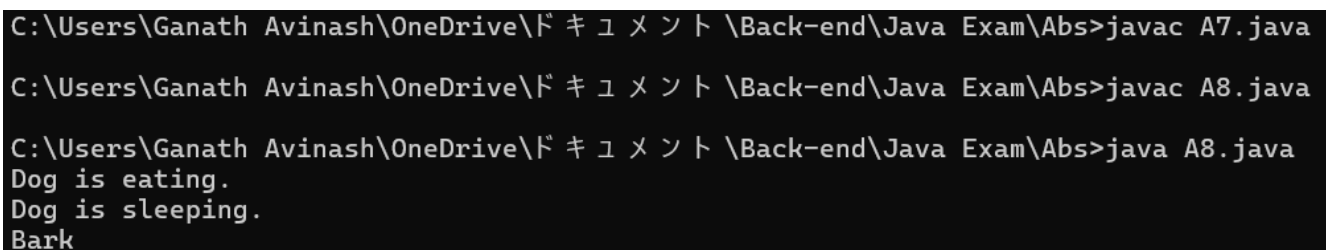
Code:

```
public class A8{
public static void main(String[]args) {
Dog dog = new Dog();
dog.eat();
dog.sleep();
dog.makeSound();
}
}
```

```
interface Animal {
void eat();
void sleep();
default void makeSound() {
System.out.println("Animal sound");
}
}
```

```
class Dog implements Animal {
public void eat() {
System.out.println("Dog is eating.");
}
public void sleep() {
System.out.println("Dog is sleeping.");
}
public void makeSound() {
System.out.println("Bark");
}
}
```

Screenshot:



```
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Abs>javac A7.java
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Abs>javac A8.java
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Abs>java A8.java
Dog is eating.
Dog is sleeping.
Bark
```

<b>EXP: 14</b>	<b>ENCAPSULATION</b>	<b>OOPS</b>
----------------	----------------------	-------------

**14a)**

**Code:**

```

public class E1{
public static void main(String[]args){
Person p1=new Person();
p1.set("Ganath",18);
p1.disp();
}
}

class Person{
private String name;
private int age;
void set(String a,int b){
name=a;
age=b;
}
void disp(){
System.out.println("Person name is: "+name+" and age is: "+age);
}
}

```

**Screenshot:**

```

C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Encap>javac E1.java
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Encap>java E1.java
Person name is: Ganath and age is: 18
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Encap>|

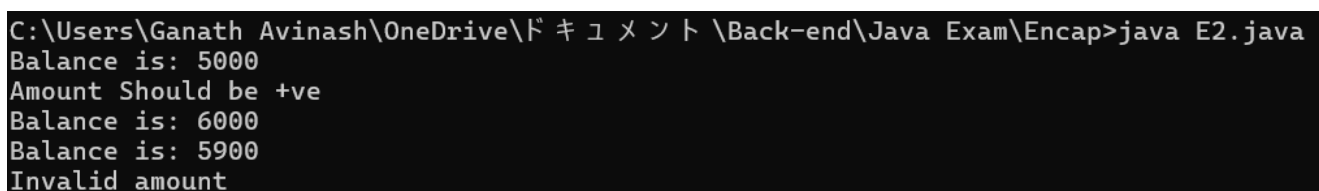
```

**14b)**

**Code:**

```
public class E2{
public static void main(String[]args){
Bankacc b1=new Bankacc(123,5000);
b1.show();
b1.deposit(-1);
b1.deposit(1000);
b1.withdraw(100);
b1.withdraw(8000);}}
class Bankacc{
private int accno;
private long balance;
Bankacc(int accno,long balance){
this.accno=accno;
this.balance=balance;
}
void deposit(int a){
if (a>0){
balance+=a;
System.out.println("Balance is: "+balance);
}
else{
System.out.println("Amount Should be +ve");
}}
void withdraw(int a){
if (a>0 && balance>=a){
balance-=a;
System.out.println("Balance is: "+balance);
}
else{
System.out.println("Invalid amount");
}}
void show(){
System.out.println("Balance is: "+balance);
}}
```

**Screenshot:**



```
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Encap>java E2.java
Balance is: 5000
Amount Should be +ve
Balance is: 6000
Balance is: 5900
Invalid amount
```

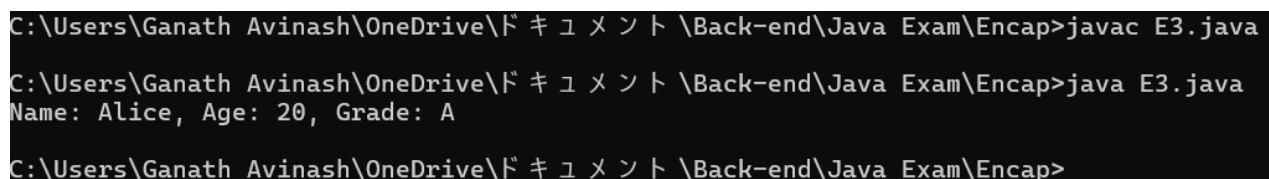
14c)

Code:

```
public class E3 {
    public static void main(String[] args) {
        Student student = new Student();
        student.setName("Alice");
        student.setAge(20);
        student.setGrade('A');
        System.out.println("Name: " + student.getName() + ", Age: " + student.getAge() + ", Grade: " +
            student.getGrade());
    }
}

class Student {
    private String name;
    private int age;
    private char grade;
    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 cannot be negative.");
        }
    }
    public char getGrade() {
        return grade;
    }
    public void setGrade(char grade) {
        this.grade = grade;
    }
}
```

Screenshot:



```
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Encap>javac E3.java
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Encap>java E3.java
Name: Alice, Age: 20, Grade: A
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Encap>
```

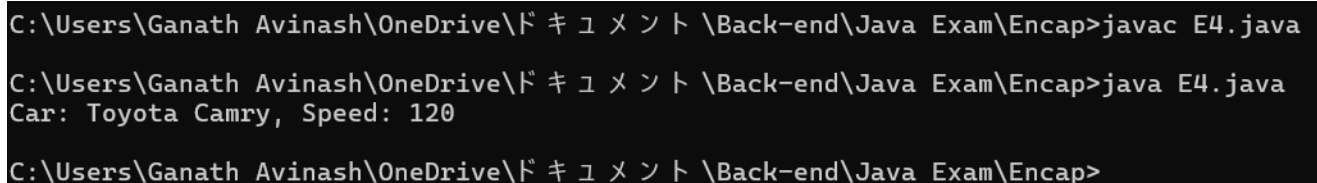
14d)

Code:

```
public class E4 {
    public static void main(String[] args) {
        Car car = new Car("Toyota", "Camry");
        car.setSpeed(120);
        System.out.println("Car: " + car.getBrand() + " " + car.getModel() + ", Speed: " +
car.getSpeed());    }}

class Car {
    private String brand;
    private String model;
    private int speed;
    public Car(String brand, String model) {
        this.brand = brand;
        this.model = model;
        this.speed = 0; // Default speed
    }
    public String getBrand() {
        return brand;
    }
    public String getModel() {
        return model;
    }
    public int getSpeed() {
        return speed;
    }
    public void setSpeed(int speed) {
        if (speed >= 0 && speed <= 200) {
            this.speed = speed;
        } else {
            System.out.println("Speed must be between 0 and 200.");
        }
    }
}
```

Screenshot:



```
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Encap>javac E4.java
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Encap>java E4.java
Car: Toyota Camry, Speed: 120
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Encap>
```



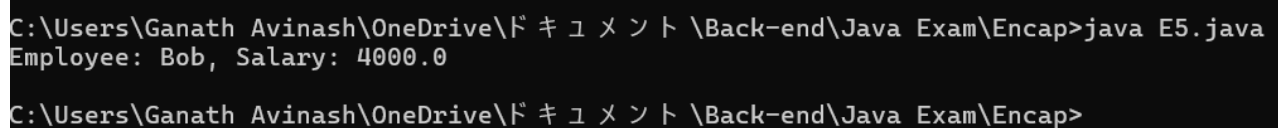
14e)

Code:

```
public class E5 {
    public static void main(String[] args) {
        Employee emp = new Employee(101, "Bob", 4000);
        System.out.println("Employee: " + emp.getName() + ", Salary: " + emp.getSalary());
    }
}

class Employee {
    private int id;
    private String name;
    private double salary;
    public Employee(int id, String name, double salary) {
        this.id = id;
        this.name = name;
        setSalary(salary);
    }
    public int getId() {
        return id;
    }
    public String getName() {
        return name;
    }
    public double getSalary() {
        return salary;
    }
    public void setSalary(double salary) {
        if (salary >= 3000) {
            this.salary = salary;
        } else {
            System.out.println("Salary must be at least 3000.");
        }
    }
}
```

Screenshot:



```
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Encap>java E5.java
Employee: Bob, Salary: 4000.0
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Encap>
```

14f)

**Code:**

```
public class E6 {
    public static void main(String[] args) {
        Patient patient = new Patient(101, "David", "Flu");
        System.out.println("Patient ID: " + patient.getPatientID() + ", Name: " + patient.getName()
+ ", Disease: " + patient.getDisease());
    }
}
class Patient {
    private final int patientID;
    private String name;
    private String disease;

    public Patient(int patientID, String name, String disease) {
        this.patientID = patientID;
        this.name = name;
        this.disease = disease;
    }

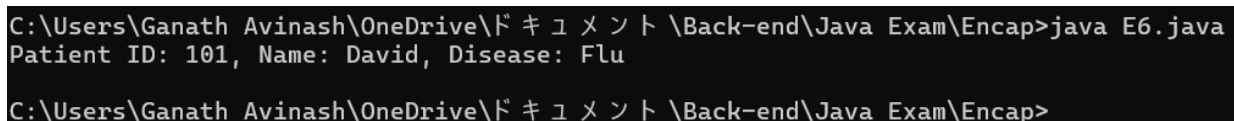
    public int getPatientID() {
        return patientID;
    }

    public String getName() {
        return name;
    }

    public String getDisease() {
        return disease;
    }

    public void setDisease(String disease) {
        this.disease = disease;
    }
}
```

**Screenshot:**



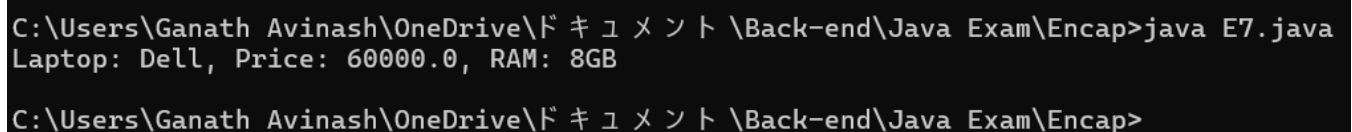
```
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Encap>java E6.java
Patient ID: 101, Name: David, Disease: Flu
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Encap>
```

14g)

Code:

```
public class E7{
    public static void main(String[] args) {
        Laptop laptop = new Laptop("Dell", 60000, 8);
        System.out.println("Laptop: " + laptop.getBrand() + ", Price: " + laptop.getPrice() + ", RAM: " + laptop.getRAM() + "GB");
    }
}
class Laptop {
    private String brand;
    private double price;
    private int RAM;
    public Laptop(String brand, double price, int RAM) {
        this.brand = brand;
        setPrice(price);
        setRAM(RAM);
    }
    public String getBrand() {
        return brand;
    }
    public double getPrice() {
        return price;
    }
    public void setPrice(double price) {
        if (price > 0) {
            this.price = price;
        } else {
            System.out.println("Price must be positive.");
        }
    }
    public int getRAM() {
        return RAM;
    }
    public void setRAM(int RAM) {
        if (RAM >= 4) {
            this.RAM = RAM;
        } else {
            System.out.println("RAM must be at least 4GB.");
        }
    }
}
```

Screenshot:



```
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Encap>java E7.java
Laptop: Dell, Price: 60000.0, RAM: 8GB
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Encap>
```

14h)

Code:

```
public class E8 {
    public static void main(String[] args) {
        Person person = new Person();
        person.setFirstName("Emily");
        person.setLastName("Clark");
        person.setAge(30);
        person.dis();
        System.out.println("Person Age: " + person.getAge());
    }
}
class Person {
    private String firstName;
    private String lastName;
    private int age;
    public void setFirstName(String firstName) {
        this.firstName = firstName;
    }
    public void setLastName(String lastName) {
        this.lastName = lastName;
    }
    public void dis() {
        System.out.println("Person 1st name: " + firstName );
        System.out.println("Person Last name: " + lastName );
    }
    public void setAge(int age) {
        if (age > 0 && age <= 120) {
            this.age = age;
        } else {
            System.out.println("Age must be between 1 and 120.");
        }
    }
    public int getAge() {
        return age;
    }
}
```

Screenshot:



```
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Encap>java E8.java
Person 1st name: Emily
Person Last name: Clark
Person Age: 30
```

EXP: 15	PACKAGES JAVA	OOPS
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15a)

Code:

```
import java.time.LocalDate;
import java.time.LocalDateTime;
import java.util.Random;
import java.util.Date;
import java.io.FileWriter;
import java.io.IOException;

public class Builtin {
    public static void main(String[] args) {
        LocalDate today = LocalDate.now();
        LocalDateTime now = LocalDateTime.now();
        System.out.println("Today's Date: " + today);
        System.out.println("Current Time: " + now);

        Random random = new Random();
        int randomNumber = random.nextInt(100);
        System.out.println("Random Number: " + randomNumber);

        // File
        try {
            FileWriter writer = new FileWriter("output.txt");
            writer.write("Date: " + today + "\n");
            writer.write("Time: " + now + "\n");
            writer.write("Random Number: " + randomNumber + "\n");
            writer.close();
            System.out.println("Data successfully written to file.");
        } catch (IOException e) {
            e.printStackTrace();
        }
    }
}
```

Screenshot:

Output.txt

```
Date: 2025-03-25
Time: 21:43:23.477120300
Random Number: 7
```

```
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Encap>java Builtin.java
Today's Date: 2025-03-25
Current Time: 21:43:23.477120300
Random Number: 7
Data successfully written to file.
```

14b)

Code:

```
import java.awt.*;
import java.awt.event.*;
import java.util.Date;

public class Builtin2 {
    public static void main(String[] args) {

        JFrame frame = new JFrame("Date & Time Display");
        frame.setSize(400, 200);
        frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
        frame.setLayout(null);

        JLabel label = new JLabel("Click the button to see date & time!");
        label.setBounds(50, 30, 300, 30);
        frame.add(label);

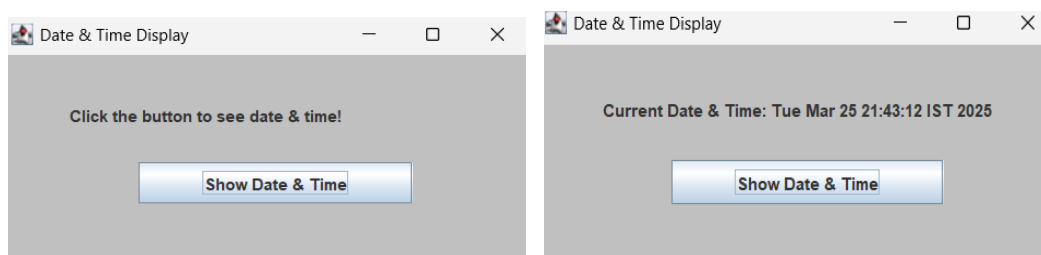
        JButton button = new JButton("Show Date & Time");
        button.setBounds(100, 80, 200, 30);
        frame.add(button);

        frame.getContentPane().setBackground(Color.LIGHT_GRAY);

        button.addActionListener(new ActionListener() {
            public void actionPerformed(ActionEvent e) {
                Date now = new Date();
                label.setText("Current Date & Time: " + now.toString());
            }
        });

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

Screenshot:



15c)

Code:

**Program 1:**

```
package calculator;
public class Calculator {
    public int add(int a, int b) {
        return a + b;    }
    public int subtract(int a, int b) {
        return a - b;    }
    public int multiply(int a, int b) {
        return a * b;    }
    public double divide(int a, int b) {
        if (b == 0) {
            System.out.println("Error: Cannot divide by zero.");
            return 0;
        }
        return (double) a / b;    }}

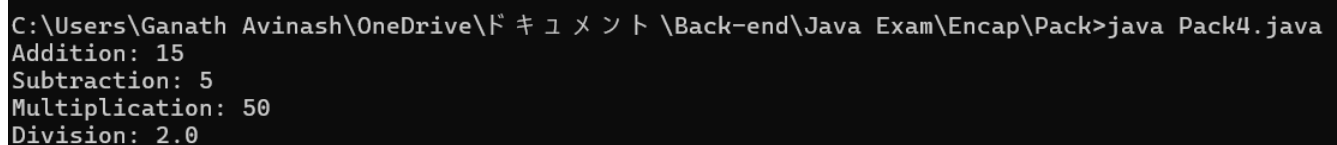
```

**Program 2:**

```
import calculator.Calculator;
public class Pack4{
    public static void main(String[] args) {
        Calculator calc = new Calculator();
        System.out.println("Addition: " + calc.add(10, 5));
        System.out.println("Subtraction: " + calc.subtract(10, 5));
        System.out.println("Multiplication: " + calc.multiply(10, 5));
        System.out.println("Division: " + calc.divide(10, 5));    }}

```

Screenshot:



```
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Encap\Pack>java Pack4.java
Addition: 15
Subtraction: 5
Multiplication: 50
Division: 2.0

```

**15d)**

**Code:**

Program 1:

```
package shapes;
public class Circle {
    private double radius;

    public Circle(double radius) {
        this.radius = radius;
    }
    public double getArea() {
        return Math.PI * radius * radius;
    }
}
```

Program 2:

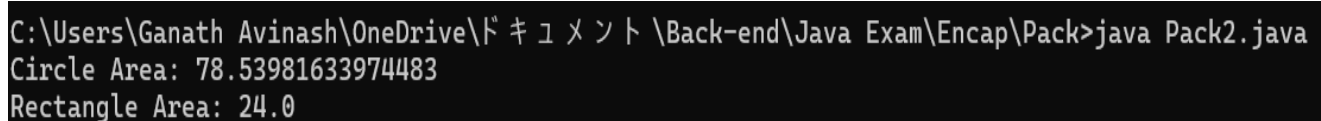
```
package shapes;
public class Rectangle {
    private double length, width;

    public Rectangle(double length, double width) {
        this.length = length;
        this.width = width;
    }
    public double getArea() {
        return length * width;
    }
}
```

Program 3:

```
import shapes.Circle;
import shapes.Rectangle;
public class Pack2 {
    public static void main(String[] args) {
        Circle c = new Circle(5);
        Rectangle r = new Rectangle(4, 6);
        System.out.println("Circle Area: " + c.getArea());
        System.out.println("Rectangle Area: " + r.getArea());
    }
}
```

**Screenshot:**



```
C:\Users\Ganath Avinash\OneDrive\ドキュメント\Back-end\Java Exam\Encap\Pack>java Pack2.java
Circle Area: 78.53981633974483
Rectangle Area: 24.0
```



THANK YOU

By Ganath Avinash G.R

CH.SC.U4CSE24118