Lab Work #03

CPL102: Object-Oriented Programming

SS2024

These exercises will cover the concept of constructor, overloading methods, this/super keyword and inheritance.

1. Write a Java program to demonstrate method overloading with two methods named "add" - one that takes two integers as arguments and returns their sum, and another that takes three integers as arguments and returns their sum.
2. Write a Java program that demonstrates method overloading with two methods named "findMax" - one that takes two integers as arguments and returns the maximum of the two, and another that takes three integers as arguments and returns the maximum of the three.
3. Write a Java program that demonstrates method overloading with two methods named "printArray" - one that takes an integer array as an argument and prints all the elements in the array, and another that takes a string array as an argument and prints all the elements in the array.
4. Write a Java program to create a class named "Person" with a parameterized constructor that takes a string "name" and an integer "age" as arguments, and initializes the instance variables with these values. Display the name and age of the person using a method named "displayInfo".
5. Write a Java program to create a class named "Rectangle" with a parameterized constructor that takes two integers "length" and "breadth" as arguments, and initializes the instance variables with these values. Add a method named "calculateArea" that calculates and returns the area of the rectangle.
6. Write a Java program to demonstrate single inheritance by creating a superclass and a subclass. The superclass should have a method and the subclass should inherit the method and override it.
7. Write a Java program to demonstrate multilevel inheritance by creating a superclass, a subclass that inherits from the superclass, and another subclass that inherits from the first subclass. Each class should have its own method and implement to execute for different purposes.
8. You are required to write a Java program that demonstrates the use of "this" and "super" keywords in a real-world scenario. Create a class hierarchy for a Vehicle rental system that includes a superclass "Vehicle" and three subclasses "Car", "Truck", and "Motorcycle".

   The superclass should have the following instance variables:

a. make (string)
b. model (string)
c. year (integer)
d. rental_price (double)

The superclass should have a parameterized constructor that initializes the instance variables. The subclasses should have the following instance variables and methods:

a. Car
    1. numSeats (integer)
    2. drive() method that outputs "Driving a car”
    3. a parameterized constructor that calls the superclass constructor and initializes the numSeats variable
b. Truck
    1. cargoCapacity (double)
    2. load() method that outputs "Loading a truck”
    3. a parameterized constructor that calls the superclass constructor and initializes the cargoCapacity variable.
c. MotorCycle
    1. engineSize (double
    2. ride() method that outputs "Riding a motorcycle”
    3. a parameterized constructor that calls the superclass constructor and initializes the engineSize variable.

In the main method, create instances of each subclass and call their methods to demonstrate their functionalities. Also, demonstrate the use of "this" and "super" keywords in the program by setting instance variables and calling constructors and methods from the superclass and subclass using these keywords.

For example, set the *rental_price* instance variable in the superclass constructor using "this" keyword and call the superclass constructor in each subclass constructor using "super" keyword. Ensure that your program compiles without errors and produces the expected output.

9. Write a Java program that demonstrates the use of the Math class to perform various mathematical operations. The program should prompt the user to enter two numbers and then output the result of the following operations:
    a. Addition of the two numbers
    b. Subtraction of the second number from the first
    c. Multiplication of the two numbers
    d. Division of the first number by the second number
    e. The remainder after dividing the first number by the second number
    f. The square root of the first number
    g. The maximum value between the two numbers
    h. The minimum value between the two numbers
    i. A random number between 0 and 1
    j. A random number between 0 and 100

    The program should use the Math class methods to perform the above operations, such as Math.addExact(), Math.subtractExact(), Math.multiplyExact(), Math.divideExact(), Math.sqrt(), Math.max(), Math.min(), Math.random(), etc.

    Ensure that your program handles any potential errors, such as dividing by zero, and displays appropriate error messages to the user. (Not allowed to use Exception handling). Also, ensure that your program outputs the results in a clear and organized manner.