

Java Programming Pre-Test2

1. (20 points) Program Comprehension: Inheritance, Polymorphism, and Dynamic Binding

Consider the following Java code:

```
class Animal {
    public void speak() {
        System.out.println("Animal sound");
    }
}

class Dog extends Animal {
    @Override
    public void speak() {
        System.out.println("Woof");
    }
}

class Cat extends Animal {
    @Override
    public void speak() {
        System.out.println("Meow");
    }
}

public class Test {
    public static void main(String[] args) {
        Animal a1 = new Dog();
        Animal a2 = new Cat();
        Animal a3 = new Animal();

        a1.speak();
        a2.speak();
        a3.speak();
    }
}
```

- (a) (6 points) What is the output of this program?
- (b) (6 points) Explain why the output is determined by *dynamic binding*.
- (c) (8 points) Suppose we add a method `public void greet()` only inside `Dog`. Will `a1.greet()` compile? Justify your answer.

2. (20 points) Program Comprehension: Exceptions

Consider the following Java code:

```

public class ExceptTest {
    public static int foo(int x) {
        try {
            if (x == 0)
                throw new ArithmeticException("Zero!");
            return 10 / x;
        } catch (ArithmeticException e) {
            System.out.println("Caught: " + e.getMessage());
            return -1;
        } finally {
            System.out.println("Finally block executed");
        }
    }

    public static void main(String[] args) {
        System.out.println(foo(2));
        System.out.println(foo(0));
    }
}

```

- (a) (6 points) Write down the exact program output.
- (b) (8 points) Explain the role of the `finally` block in this program.
- (c) (6 points) If the `catch` block removed the `return -1;` line, what would the value of `foo(0)` be? Explain.

3. (20 points) **Programming: Inheritance and Polymorphism**

Define a class hierarchy for geometric objects:

- A superclass `Shape` with the method `public double area()`.
 - Subclasses `Circle` and `Rectangle`.
 - `Circle` stores a radius; `Rectangle` stores width and height.
- (a) (10 points) Write Java class definitions for `Circle` and `Rectangle` that correctly override the `area()` method.
 - (b) (10 points) Write a Java method `public static double totalArea(Shape[] list)` that returns the sum of the areas of all objects in the array using polymorphism.

4. (15 points) **Programming: Exceptions**

Write a Java method:

```
public static int readPositiveInt(String prompt)
```

The method should:

- display the given prompt,
- read a line from the keyboard,
- attempt to convert it to an integer,
- throw an `IllegalArgumentException` if the value is not a positive integer,
- otherwise return the value.

Write the full method implementation, including exception handling.

5. (25 points) **Programming: Text I/O**

Write a Java program that:

- Reads a text file containing one integer per line.
- Sums all integers.
- Writes the result to a new file called `"sum.txt"`.