Exercise Paper 2

1. Can the following Java program be compiled? Does it throw a runtime error? Why?

```java
interface I1 {}
interface I2 {}
final class C1 implements I1 {}

public class Ex1 {
    public static void main( String[] args ) {
        C1 c1 = new C1();
        I2 i2 = (I2) c1;
    }
}
```

2. Can the following Java program be compiled? Does it throw a runtime error? Why?

```java
interface I1 {}
interface I2 {}
class C1 implements I1 {}
final class C2 extends C1 {}

public class Ex2 {
    public static void main( String[] args ) {
        C1 c1 = new C2();
        I2 i2 = (I2) c1;
    }
}
```

3. Can the following Java program be compiled? Does it throw a runtime error? What output is generated? What is overwritten? What methods are overloaded? How many attributes does a C2 object store?

```java
class C1 {
    int age = 99;
    int getAge() { return age; }
}
class C2 extends C1 {
    int age = 22;
    int getAge() { return age; }
}

public class Ex3 {
    public static void main( String[] args ) {
        C1 c1 = new C1();
        C2 c2 = new C2();

        System.out.println("C1.age: " + c1.age);
        System.out.println("C1.getAge: " + c1.getAge());

        System.out.println("C2.age: " + c2.age);
        System.out.println("C2.getAge: " + c2.getAge());

        c1 = c2;
        System.out.println("C1=C2.age: " + c1.age);
        System.out.println("C1=C2.getAge: " + c1.getAge());
    }
}
```

4. **This question was asked in last years exam!**
    Subtyping
    - What is behavioral subtyping?
    - Describe the three main rules of behavioral subtyping.
    - Write a small Java program that illustrates one of the problems that might occur, if two classes are subtypes, but not behavioral subtypes.