Objects and Types

- Exercises are given every week on the PL page of the SCG website (http://scg.unibe.ch/teaching/pl)
- Solutions to each assignment must be sent to mohammadreza.hazhirpasand@inf.unibe.ch
- The solutions of the assignments are to be delivered before every Thursday at 11 PM. Solutions handed in later than the specified time will not be accepted. In case of serious reasons send an e-mail to mohammadreza.hazhirpasand@inf.unibe.ch

Exercise (6 points)

1. What is the difference between subtyping and subclassing? Provide an example for your explanation. (1.5 pts)

2. Using the Java class-interface hierarchy given in Figure 1, explain what is the relationship between classes and interfaces. (1.5 pts)

![Figure 1: Java interface hierarchy](image)

3. Which forms of polymorphism are used in the Java code in Listing 1? Explain each of the forms. (1.5 pts)

4. In the Java code Listing 2, explain what concept (covariance or contravariance) exists and why. (1.5 pts)
```java
public class Bern<TT> { // Hint 2
    private TT var1;
    public void set(TT mh) { this.var1 = mh; }
    public TT get() { return var1; }

    public static void main(String[] args) {
        int a = 3;
        float b = 2F;
        b = a; // Hint 1
        System.out.println(b);
        Bern<Integer> mj = new Bern();
        mj.set(12);
        System.out.println(mj.get());
    }
}
```

Listing 1: Forms of polymorphism

```java
Double[] mh = new Double[2];
mh[0] = 100.2;
mh[1] = 200.2;

Number[] nm = mh;
nm[0] = 1000.5;
System.out.println(nm[0]);
```

Listing 2: Forms of polymorphism