Serie 9 - Objects and Types

1 Theoretical Questions (6 points)

1. What is the difference between subtyping and subclassing? Provide an example for your explanation.
2. Using the Java class-interface hierarchy given in Figure 1, explain what is the relationship between classes and interfaces.

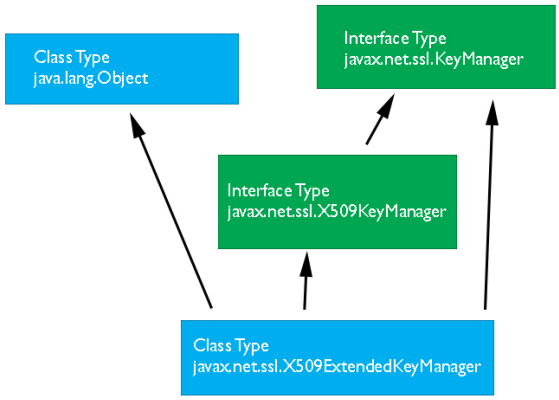

Figure 1: Java interface hierarchy

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

```
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

4. Use Java subclassing to better structure the code in Listing 2 and avoid code cloning.
5. In the code in q5.zip explain how covariant and contravariant are used in each code block. Why are there compile-time errors if you try to run the code?

```
   class Bicycle {
      private int frame_size;

      // the price of this bicycle
      public float price() { return 100 * 2; }

      // the sales tax on this bicycle
      public float salesTax() { return price() * .08; }
}

   class RacingBicycle {
      private int framesize;
      private int pieces_count;

      // the price of this bicycle
      public float price() { return 100 * 2; }

      // the sales tax on this bicycle
      public float salesTax() { return price() * .08; }

      // returns the weight of this bicycle
      public void calculateWeight();
}
```

Listing 2: Subclassing