Exercise 5

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Design by contract in Java

- Adding pre-conditions, post-conditions and invariant checking to *interfaces*
- The assertion injecting is done in two ways:
  - Dynamic Proxy
  - Aspect (using AspectWerkz)

Example

```
interface PositiveDouble {
  public void setValue(double val);
  public double getValue();
  public double getSqrt();
  public double getSum(double e);
  public void add(double e);
}
```


Assertion Example

```
class PositiveDoubleAssertion
  implements Assertion {
    private PositiveDouble pd;
    public void setObject(Object o) {
      pd = (PositiveDouble) o;
    }
    public boolean invariant() {
      return pd.getValue() >= 0;
    }
    public boolean pre_setValue(double d) {
      return d >= 0;
    }
}
```


The Assertion Interface

```
interface Assertion {

  public void setObject(Object o);

  public boolean invariant();

}
```


How to use the Assertion Class? (1)

- The name will always be **`<IntefaceName>Assertion`**
- Assume you know the package of the assertion
- Using these two, how do you instantiate the assertion?

How to use the Assertion Class? (2)

- The pre-condition and post-condition methods
  - Has the same name of the checked methods
  - Has the same argument list (and result in case of post-condition)
- How do you call the assertion methods?

Examples

- **`public boolean post_getSqrt( double result) ;`**
  - For **`public double getSqrt();`**
- **`public boolean post_getSum( double e, double result);`**
  - For **`public double getSum(double e);`**
- **`public boolean pre_add(double e);`**
  - For **`public void add(double e);`**

The Dynamic Proxy

```
class DBCProxy {

  public static void
    setAssertionsPackage(
      String packageName);

  public static Object
    getCheckedObject(
      Object objectImpl);

}
```

- Wait a minute, I get the implementation and I need the interfaces!

The Aspect

```
public class AssertionAspect {

  public Object checkPreConditionAdvice(
    JoinPoint joinPoint) throws Throwable;

  public Object checkPostConditionAdvice(
    JoinPoint joinPoint) throws Throwable;

  public Object checkInvariantAdvice(
    JoinPoint joinPoint) throws Throwable;

}
```


More Questions & Tips

- How to pass the method arguments to the pre/post-condition?
- Use the pre-maid project (in ex5.zip)
- Use packages
- Notice that the source is under the **`./src`** directory, class files under **`./bin`**

Good Luck !