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Please hand in your solution until
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Tutorials for “Formal methods for Java” Exercise sheet 11

Exercise 1: Install, Configure, Run JPF

- (a) Install the Java Pathfinder. You can download the binary at <http://babelfish.arc.nasa.gov/trac/jpf/attachment/wiki/projects/jpf-core/jpf-core-r32.zip>. Unzip the file, remember the directory.
- (b) Create a folder called `.jpf` in your home directory (`C:\Users\yourname\.jpf`, or `/home/yourname/.jpf` typically, in Windows you may need to use the command line). Inside that folder create a file named `site.repository`. Its contents should be as follows.

```
jpf.home=<the directory you unzipped to, contains subdir "jpf-core">  
jpf-core=${jpf.home}/jpf-core
```

```
extensions=${jpf-core}
```

- (c) On the website you can find the files `PriorityQueue.java`, `Heap.java`, and `Test.java`. Copy these files into a directory called “ex11”. You will also find a file `ex11.jpf`, copy it into the directory directly above the `ex11`-directory. Compile the three java files with the standard Java compiler.
- (d) Do a test run of JPF. In the directory containing `ex11.jpf`, execute the following command.

```
<jpf-dir>/jpf-core/bin/jpf ex11.jpf
```

The output should contain the output from `Test.java`, but also some more information (system under test, results, statistics,...).

Exercise 2: Find a hard-to-find bug with JPF

`Heap.java` contains a subtle bug: After certain enqueue-sequences, it may happen that the dequeue operation does not return the contents of the Queue in the right order (i.e. lowest Priorities first).

In principle, the test harness `Test.java` may find this bug through random testing (it throws an `AssertionError` in that case). However the probability that a run hits the bug is very very low.

- (a) Find the bug with Java pathfinder.
- (b) Find the shortest possible error trace (If you haven't done so in (a)).

Hint: Out of the box Java pathfinder will not find the bug (reports “no errors found”). There are several parameters you can play with, to change that.

- Change JPF's search strategy by commenting in one of the `search-class`-lines from `ex11.jpf`.
- Change the options of JPF's choice generator. You can find the default settings and descriptions in the file `jpf.properties` in your `jpf-core` directory (under “3. CG part”). You can overwrite those setting by adding corresponding lines to your `ex11.jpf` file.
- Change `Test.java` intelligently.