

ESIR SPP – TP3 & 4 (Attention: TP noté)

Préparations:

- Assurez vous d'avoir accès au site Moodle du cours sur votre ENT (<https://ent.univ-rennes1.fr>, puis onglet "La Formation", "Cours en ligne").
- Vérifiez que vous avez bien accès à la page de soumission du TP 3 & 4.

Soumission et notation:

- Il vous est demandé de travailler en **binôme** pour ce TP.
- Après avoir enregistré les membres de votre binôme sur Moodle, vous devez **soumettre le code source Java des exercices du TP** avant la **date butoir** indiquée sur Moodle. Conseil: N'attendez pas cette date pour soumettre votre solution!
- Veuillez noter dans votre soumission **le binôme** avec lequel vous avez travaillé.
- Le TP **sera noté en classe** durant **la séance de TP 5** à partir du code source que vous aurez soumis.
- Pour recevoir une note pour devez impérativement: (i) **soumettre votre solution** avant la date butoir; et (ii) **être présent lors du TP 5**, et ce pour les deux étudiants de chaque binôme.

Note: Les étudiants d'un même binôme peuvent recevoir des notes différentes en fonction des réponses données lors de la notation.

Exercise 1:

The goal of this exercise is to implement an extended semaphore using **Java monitors**.

Your semaphore should implement the following interface (available in the lab's resources):

```
public interface SemaphoreInterface {
    public void up();
    public void down();
    public int releaseAll();
} // EndInterface SemaphoreInterface
```

up() and down() correspond to the traditional semaphore operations. releaseAll() is an extension that unblocks all threads waiting on the semaphore, and returns the number of threads that have just been unblocked.

In addition to the above interface, your implementation should provide a constructor that takes no parameters, and returns a semaphore that contains zero permits.

Testing your implementation:

To help you test your semaphore, you will find a JUnit test class in the lab's resources SemaphoreJUnitTest. You can run this test class in two ways:

- Directly from the command line (the easiest), in the same folder as your compiled classes (on Unix, **see below for changes on Windows**):

```
java -DSemaphoreImplClass=Foo -cp junit-4.11.jar:.
org.junit.runner.JUnitCore SemaphoreJUnitTest
```

where Foo is the name of your semaphore class. You will need to copy the junit-4.11.jar file accordingly. (Available at <http://www.junit.org/>, or on Moodle from the labs resources.)

Notes:

- On Windows, replace the colon (:) by a semi-colon (;) in “junit-4.11.jar;.”
 - There is a space between “junit-4.11.jar:.” and “org.junit.runner.JUnitCore”.
- From within Eclipse, which directly supports JUnit. See for instance the instructions from http://help.eclipse.org/juno/topic/org.eclipse.jdt.doc.user/gettingStarted/qs-junit.htm?cp=1_1_0_15 or <http://www.vogella.com/articles/JUnit/article.html> for more detail.

Notes:

- You will need to set “-DSemaphoreImplClass=Foo” (replacing Foo by the name of your semaphore implementation) as a VM parameter in Eclipse.

Alternatively, you can replace the call

```
Class.forName(System.getProperty("SemaphoreImplClass"))
```

by

```
Foo.class
```

(where Foo = your semaphore implementation) in SemaphoreJUnitTest.java.

Note: Passing all the tests does not guarantee that your code is correct, but will provide some level of confidence that it has the expected behaviour.

Marking scheme: Total: 15 points

- You are able to explain how your code solves the problem. 6 points
- Passing all test cases 4 points
- Code correct on manual analysis 5 points

Exercise 2:

The goal of this exercise is to learn to use the rendez-vous mechanism provided by Java.

Rendez-vous synchronisation is provided in Java by the Exchanger<V> class. We will use this class to implement a small ping-pong program in which two threads (called "Alice" and "Bob") repeatedly exchange two string objects ("Ping" and "Pong").

First, read the documentation for this class at

<http://docs.oracle.com/javase/7/docs/api/java/util/concurrent/Exchanger.html>.

Then implement a small multithreaded program so that:

- The main program launches two threads called "Alice" and "Bob" (add a field "name" to your Thread or Runnable class to store this name);
- "Alice" and "Bob" both hold a reference to a string. "Alice" starts with a reference to a string containing "Ping", and "Bob" to a string containing "Pong".
- "Alice" and "Bob" execute the following behaviour 3 times:
 - (1) print the number of the current iteration, followed by their name, followed by the content of the string to which they hold a reference;
 - (2) print that they are about to go to sleep;
 - (3) wait a random time between 0 and 5000 ms;
 - (4) print that they are about to use the exchanger;
 - (5) use Java's Exchanger mechanism to exchange the thread's current string with that of the other thread;

- (6) indicate that the exchange has completed.

The resulting output should look like the following:

```
Iteration: 0 Alice has Ping
Iteration: 0 Alice going to sleep.
Iteration: 0 Bob has Pong
Iteration: 0 Bob going to sleep.
Iteration: 0 Bob ready to exchange
Iteration: 0 Alice ready to exchange
Iteration: 0 Alice exchange completed
Iteration: 1 Alice has Pong
Iteration: 1 Alice going to sleep.
Iteration: 0 Bob exchange completed
Iteration: 1 Bob has Ping
Iteration: 1 Bob going to sleep.
Iteration: 1 Alice ready to exchange
Iteration: 1 Bob ready to exchange
Iteration: 1 Alice exchange completed
Iteration: 2 Alice has Ping
Iteration: 2 Alice going to sleep.
Iteration: 1 Bob exchange completed
Iteration: 2 Bob has Pong
Iteration: 2 Bob going to sleep.
Iteration: 2 Alice ready to exchange
Iteration: 2 Bob ready to exchange
Iteration: 2 Bob exchange completed
Iteration: 2 Alice exchange completed.
```

Marking scheme: Total: 5 points

- You are able to explain how your code solves the problem. 2 points
 - The code works. 3 points
- (0: no attempt; 1: some attempt but does not work; 2: solid effort, but some glitches; 3: works perfectly)