

# T-106.420 Concurrent programming

## Homework assignment 1 (Sep. 29, 2003)

The deadline for this exercise is Friday, Oct. 10, 2003, 04:00 pm (16:00).

1. Consider the following three statements:

$S_1 : x = x + y;$

$S_2 : y = x - y;$

$S_3 : x = x - y;$

Assume that  $x$  is initially 2 and that  $y$  is initially 5. For each of the following, what are the possible final values of  $x$  and  $y$ ? Explain your answers.

(a)  $S_1; S_2; S_3;$

(b) **co**  $\langle S_1; \rangle \parallel \langle S_2; \rangle \parallel \langle S_3; \rangle$  **oc**

(c) **co**  $\langle \text{await } (x > y) S_1; S_2 \rangle \parallel \langle S_3; \rangle$  **oc**

2. Consider the following program:

```
int  $x = 0;$   
co  $\langle \text{await } (x \neq 0) \ x = x - 2; \rangle \ / * S_1 * /$   
   $\parallel \langle \text{await } (x \neq 0) \ x = x - 3; \rangle \ / * S_2 * /$   
   $\parallel \langle \text{await } (x == 0) \ x = x + 5; \rangle \ / * S_3 * /$   
oc
```

- (a) Does the program terminate? If so, what are the possible final values of  $x$ ? If not, why not?
- (b) Suppose the atomic `await` statements are changed to non-atomic `if` statements. Does the program terminate then? If so, what are the possible final values of  $x$ ? If not, why not?

3. Consider the following program:

```
co  $\langle \text{await } (x > 0) \ x = x - 1; \rangle \ / * S_1 * /$   
   $\parallel \langle \text{await } (x < 0) \ x = x + 2; \rangle \ / * S_2 * /$   
   $\parallel \langle \text{await } (x == 0) \ x = x - 1; \rangle \ / * S_3 * /$   
oc
```

For what initial values of  $x$  does the program terminate, assuming scheduling is weakly fair? What are the corresponding final values? Explain your answer.