

T-106.420 Concurrent programming

Example solution for homework assignment 1

1. (a) $(x = 5 \wedge y = 2)$
 - (b) Six possible execution orders:
 - $S_1; S_2; S_3; \models (x = 5 \wedge y = 2)$
 - $S_1; S_3; S_2; \models (x = 2 \wedge y = -3)$
 - $S_2; S_1; S_3; \models (x = 2 \wedge y = -3)$
 - $S_2; S_3; S_1; \models (x = 2 \wedge y = -3)$
 - $S_3; S_1; S_2; \models (x = 2 \wedge y = -3)$
 - $S_3; S_2; S_1; \models (x = -11 \wedge y = -8)$
 - (c) The await statement never executes. The other statement sets x to -3 . The whole co statement deadlocks with $(x = -3 \wedge y = 5)$

2. (a) Yes. The final value of x is zero. The last statement executes first, then the other two (in either order).
 - (b) $S_1(\text{fails}); S_2(\text{fails}); S_3; \models (x = 5)$
 - $S_2(\text{fails}); S_1(\text{fails}); S_3; \models (x = 5)$
 - $S_1(\text{fails}); S_3; S_2; \models (x = 2)$
 - $S_2(\text{fails}); S_3; S_1; \models (x = 3)$
 - $S_3; S_1; S_2; \models (x = 0)$
 - $S_3; S_2; S_1; \models (x = 0)$

3. Initial values that work, and the corresponding final values:

$$x = \{-1, 0, 1\} \models x = \{-1, 0, 1\}$$

Altogether 6 possible histories.

 - $\{(x < -1)\} \models S_1 \text{ and } S_3 \text{ deadlocks}$
 - $\{(x > 1)\} \models S_2 \text{ and } S_3 \text{ deadlocks}$