

Concurrency theory

Exercise sheet 8

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Out: December 7

Due: December 12

Submit your solutions until Tuesday, December 12, during the lecture. You may submit in groups up to three persons.

Exercise 1: Loop acceleration

Let \preceq_{swap}^* and \preceq_m^* the word orderings for SREs given in class for proving the lemma:

Let p be a product and ops a sequence of operations. There is a natural number n (linear in the size of p) and a product p' such that either $\mathcal{L}(p \oplus ops^n) = \emptyset$ or $\mathcal{L}(p') = \bigcup_{j \geq n} \mathcal{L}(p \oplus ops^j)$.

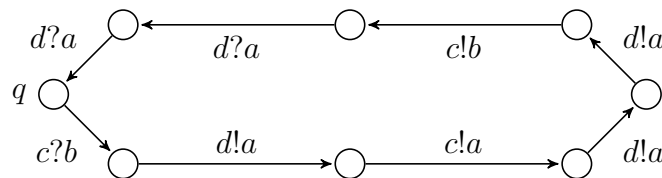
Find n and p' when $p = (a + b)^*(c + \epsilon)b^*$ and ops is each of:

- ?a!b?c
- !a!b?c?a
- !a?c!b?a!c
- ?c!c!a?a!b!c!a

Don't forget to specify to which of the four cases discussed in class each sequence belongs and argue the correctness of your findings.

Exercise 2: Coverability of loop

Consider the following control loop in a lossy channel system:



Set up the sequences of channel operations ops_c and ops_d and determine

$$\left(q, \left(\begin{array}{c} ((b + \epsilon).(a + b)^* \oplus ops_c^*) \\ b^* \oplus ops_d^* \end{array} \right) \right).$$

State and justify the case (1)-(4) that applies for the acceleration of ops_c and ops_d , respectively. Give numbers n after which the effect of ops_c and ops_d stabilises.

Exercise 3: Undecidability

Prove that the recurrent state reachability problem for LCS is undecidable even with a single channel.