Concurrency Theory
Exercise Sheet 8

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1 Dining Philosophers in CCS

Fork definition:

$$F_i = up_i.down_i.F_i, \; i \in \{0, ..., 4\}$$

Philosopher definition:

$$P_i = think.P_i + up_i.up_{(i+1) mod \; 5}.eat.down_i.down_{(i+1) mod \; 5}.P_i, \; i \in \{0, ..., 4\}$$

2 Effective Pred-basis for Lossy Channel Systems

Input:to cover (M, C), startconfiguration $(\hat{M}, \hat{C})$
$S \leftarrow (M, C)$
$S' \leftarrow \varnothing$
while $S \neq S'$ **do**
  $S' \leftarrow S$
  for $(M, C) \in S$ **do**
    for Transition t s.t. $\exists (M', C') \rightarrow^t (M, f(C, t))$ **do**
      $S \leftarrow S \cup (M', C')$
    end for
  end for
end while
return $\exists S \ni (M, C) \leqslant (\hat{M}, \hat{C})$

$f(C, t)$ is a function computing the smallest $\hat{C}$ for which transition t can be fired. I.e. it adds a message to some channel in C if t writes this message, otherwise it does nothing and returns C.

This algorithm attempts to add to the basis in each step looking for some element it can add. It makes sure to check every possible configuration and only adds smallest configurations with $f(C, t)$

3 CSM with Insertion Error

Let $(\Sigma, M_1, \dots, M_n)$ be a system of communicating state machines with insertion error. For control-state reachability we have to check, whether machine M_i can reach local state $s_i \in S_i$ from the initial state s_{0_i}.

Fist we check with DFS whether there is a path from s_{0_i} to s_i by using the transition relation $\rightarrow_i$. If there is such a path, s_i is already reachable in the CSM with insertion Error:

Let $(a_1, \dots, a_m)$ be the sequence of sending and receiving actions of a path from s_{0_i} to s_i. In the k-th step, M_i sends the message a to machine M_j if $a_k = j!a$ and if $a_k = ?a$ we insert a to the beginning of any channel of M_i and M_i receives a. Thus, after m steps, M_i reaches the state s_i.

If DFS does not find a path from s_{0_i} to s_i, the state s_i is not reachable in the CSM.