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Foundations of UML
Winter term 2009

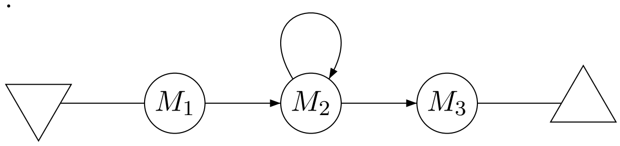
– Assignment 3a –

Hand in the solutions before the exercise class on November 18th.

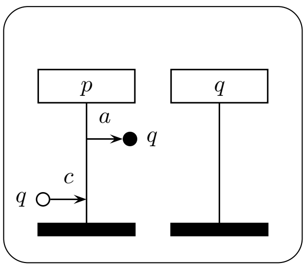
Exercise 1 (10 points)

Given the CMSG G as follows:

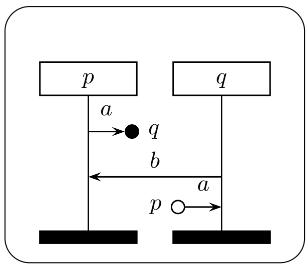
G :



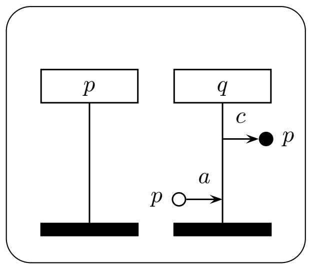
M_1 :



M_2 :



M_3 :



a) Construct the pushdown automata corresponding to G.

b) Determine whether all accepting paths of G are safe.

Exercise 2 (14 points)

Consider the (C)MSGs on the next page:

a) Prove or disprove the following properties for the MSGs $\mathcal{G}_1$, $\mathcal{G}_2$ and $\mathcal{G}_3$:

   (a) local-choice (as defined in the lecture)

   (b) regularity (as defined in Definition 3 at the end of this assignment)

b) Prove or disprove the following property for the CMSG $\mathcal{G}_4$:

   (a) safety (as defined in Definition 4 at the end of this assignment)

In each case justify your answer in detail. If there are several reasons why a property does not hold, state at least two of them.

Definition 1: Let $Act = \biguplus_{p \in \mathcal{P}} Act_p$ be the set of actions for an MSC M. If $w = w_1 \dots w_n$ is a linearization of M then we call $w' \in Act^*$ with $w' = l(w_1) \dots l(w_n)$ an *action linearization* of M.

The set of all action linearizations of an MSC M is called $ActLin(M)$.

Definition 2: The *communication graph* CG of a CMSC $M = \langle \mathcal{P}, E, \mathcal{C}, \ell, m, < \rangle$ is defined as the graph $CG(M) = \langle V, \rightarrow \rangle$ (with the set of nodes $V := \mathcal{P} \setminus \{p \in \mathcal{P} \mid E_p = \emptyset\}$ and the edge relation $\rightarrow := \{(p_1, p_2) \mid p_1!p_2(c),\, p_2?p_1(c) \in \ell(E),\, c \in \mathcal{C}\}$).

Definition 3: A Message Sequence Graph $\mathcal{G}$ is *regular* if each MSC labeling a loop in $\mathcal{G}$ has a strongly connected communication graph.

Definition 4: A compositional Message Sequence Graph $\mathcal{G}$ is called *safe* if every sequence of CMSCs (using the concatenation defined in the lecture) describing an accepting path of $\mathcal{G}$ results in an MSC.