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Foundations of UML
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– Assignment 2 –

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Exercise 1 (5 points)

As presented in the second lecture, the (weak) concatenation of two MSCs M_1 and M_2 (with $M_i = \langle \mathcal{P}_i, E_i, \mathcal{C}_i, \ell_i, m_i, <_i \rangle$ for $i \in \{1, 2\}$) intuitively is realized by gluing the process lines together such that M_1 is situated on top of MSC M_2 (cf. Figure 1).

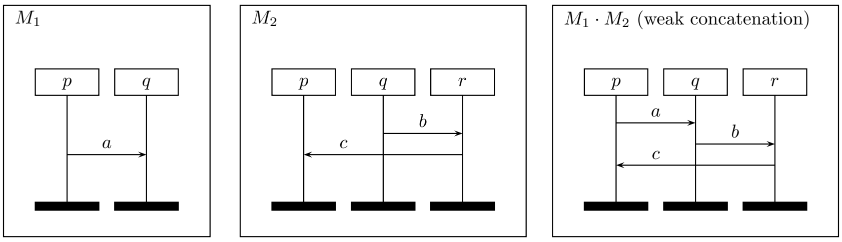

Abbildung 1: Two MSCs and their weak concatenation

Define the so-called *strong concatenation* $\cdot_s$ of two MSCs M_1 and M_2, i.e., all events of MSC M_1 have to be executed before the first event of M_2. For this purpose determine a structure $M = M_1 \cdot_s M_2 = \langle \mathcal{P}, E, \mathcal{C}, \ell, m, < \rangle$, that (in terms of M_1 and M_2) results from concatenating the two MSCs strongly.

Exercise 2 ($7 \times 0.5 + 7 \times 0.5 = 7$ points)

Formally prove or disprove the correctness of the following statements for i) MSGs (i.e., $M_i \in \mathbb{M}$, $i \in \{1, 2, 3\}$) and ii) CMSGs (i.e., $M_i \in \mathbb{CM}$, $i \in \{1, 2, 3\}$):
(remember: $|$ $\widehat{=}$ choice, $\times$ $\widehat{=}$ (weak) sequence, * $\widehat{=}$ iteration, $=$ $\widehat{=}$ language equality)

a) $M_1 | M_2 = M_2 | M_1$

b) $M_1 \times M_2 = M_2 \times M_1$

c) $(M_1 \times M_2) \times M_3 = M_1 \times (M_2 \times M_3)$

d) $(M_1 | M_2) | M_3 = M_1 | (M_2 | M_3)$

e) $(M_1 \times M_2) | M_3 = (M_1 | M_3) \times (M_2 | M_3)$

f) $(M_1 | M_2) \times M_3 = (M_1 \times M_3) | (M_2 \times M_3)$

g) $M_1^* | M_2^* = (M_1 | M_2)^*$

Exercise 3 ($1 + 1 + 1 + 1 + 1 + 1 = 6$ points)

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

Let $\mathcal{W} = ActLin(\mathbb{M})$ be the set of so-called *well-formed and complete* words over Act. Define a function $MSC : \mathcal{W} \to \mathbb{M}$ which determines for $w \in \mathcal{W}$ the corresponding MSC $MSC(w)$ such that, for any MSC M and any $w \in ActLin(M)$, we have $MSC(w) = M$

(Hint: the function MSC has to calculate all MSC components $\langle \mathcal{P}, E, \mathcal{C}, \ell, m, < \rangle$ subject to w).