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Foundations of UML
Winter term 2009
– Assignment 5 –

Hand in the solutions before the exercise class on December 2nd.

Exercise 1 (5 points)

Prove that *deadlock-free CFMs are strictly weaker than CFMs.*

Exercise 2 (10 points)

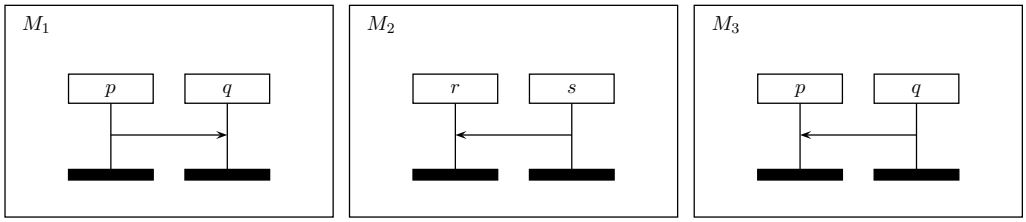
For well-formed language $L \subseteq Act^*$, and proper word $w \in Act^*$, i.e., w is a prefix of a well-formed word, let: $L \models^{df} w$ iff $(\forall p \in \mathcal{P}.\ \exists v \in L.\ w{\restriction}p$ is a prefix of $v{\restriction}p)$. Language L is closed under $\models^{df}$ iff $L \models^{df} w$ implies $w \in \mathit{Pref}(L)$.

A language $L \subseteq Act^*$ is closed under $\vdash^{df}$ iff for all $v, w \in \mathit{Pref}(L)$ and all processes $p \in \mathcal{P}$: $\big(v{\restriction}p = w{\restriction}p$ and $vx \in \mathit{Pref}(L)$ for $x \in Act_p$ and wx is prefix of a well-formed word$\big)$ implies $wx \in \mathit{Pref}(L)$.

Prove the following statement: *A language L is closed under $\models^{df}$ iff L is closed under $\vdash^{df}$.*

Exercise 3 (10 points)

Check (i.e., by using the definitions) whether language L_i $(i \in \{1, 2\})$ is closed under $\models$ and $\models^{df}$:



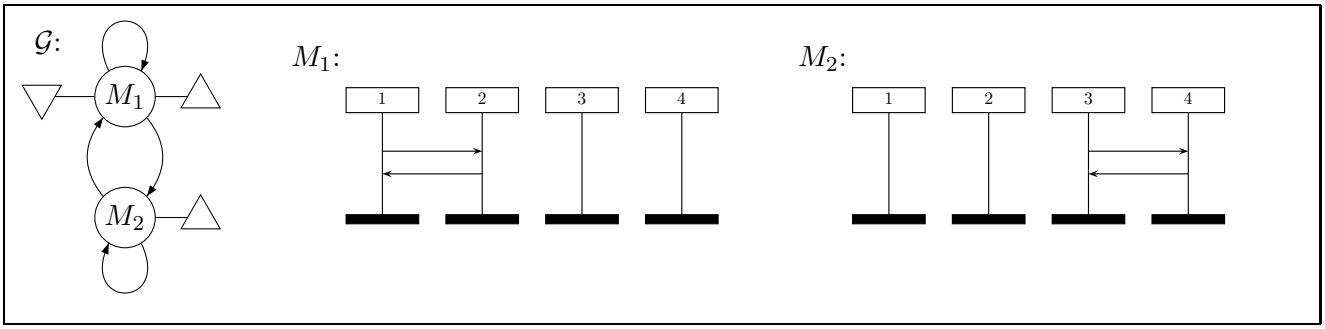
$L_1 = \{w \mid w \in \mathit{Lin}(\{M_1, M_2\})\}$ and $L_2 = \{w \mid w \in \mathit{Lin}(\{M_1, M_3\})\}$

Which of the languages is realizable or even safely realizable? Justify your answers.

(Note that $\mathit{Lin}(\{M, M'\}) = \mathit{Lin}(M{\cdot}M') \cup \mathit{Lin}(M'{\cdot}M)$.)

Exercise 4 (5 points)

Reconsider the MSG $\mathcal{G}$ from the lecture:



$\mathcal{G}$ is not communication-closed but the set of traces $Lin(\mathcal{G})$ is regular. Find a regular expression $\mathfrak{A}$ over $\{M_1, M_2\}$ such that the MSG $\mathcal{G}'$ induced by $\mathfrak{A}$ is communication-closed and recognizes the same language as $\mathcal{G}$. For your solution write down $\mathfrak{A}$, $\mathcal{G}'$ and argue why $\mathcal{G}'$ is communication-closed and $L(\mathcal{G}) = L(\mathcal{G}')$.