Prof. Dr. Ir. Dr. h. c. Joost-Pieter Katoen
Tim Quatmann, Matthias Volk

Theoretical Foundations of the UML WS 17/18
— Exercise Sheet 8 —

Hand in until January 9th before the exercise class.

General Remarks

- The exercises should be solved in groups of *three* students.
- You may hand in your solutions for the exercises just before the exercise class starts at 15:30 or by dropping them into the "TFUML" box at our chair. Do *not* hand in your solutions via L2P.
- As already announced (e.g. on the website) *every* registered student is *automatically admitted* to the exam. The threshold of 40% of the points is not valid anymore. However the rule for bonus points *still* applies and we also firmly believe that *actively solving* the exercises is truly important so as to pass the exam.

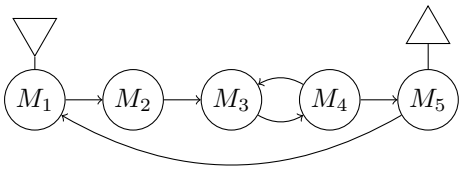
Exercise 1 (2 Points)

Let $\mathcal{P}$ be a set of at most three processes ($1 \leq |\mathcal{P}| \leq 3$) and let $\mathcal{G}$ be an MSG over $\mathcal{P}$, i.e., each MSC associated to a vertex of $\mathcal{G}$ considers only processes in $\mathcal{P}$. Show that $\mathcal{G}$ is realizable.

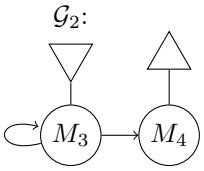
Exercise 2 (2+2+2+2+1+1=10 Points)

We consider the following MSGs:

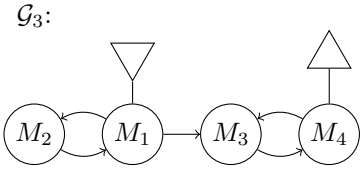
$\mathcal{G}_1$:



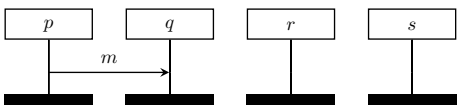
$\mathcal{G}_2$:



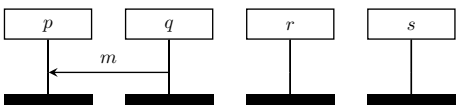
$\mathcal{G}_3$:



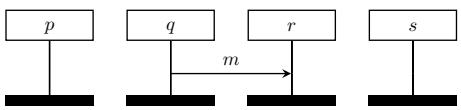
M_1



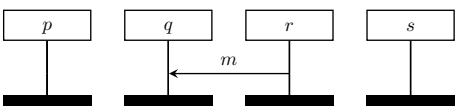
M_2



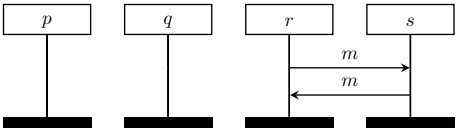
M_3



M_4



M_5



Decide for each MSG $\mathcal{G}_i$, $i \in \{1, 2, 3\}$ whether it is ...

a) communication-closed

b) locally communication-closed

c) local choice

d) regular

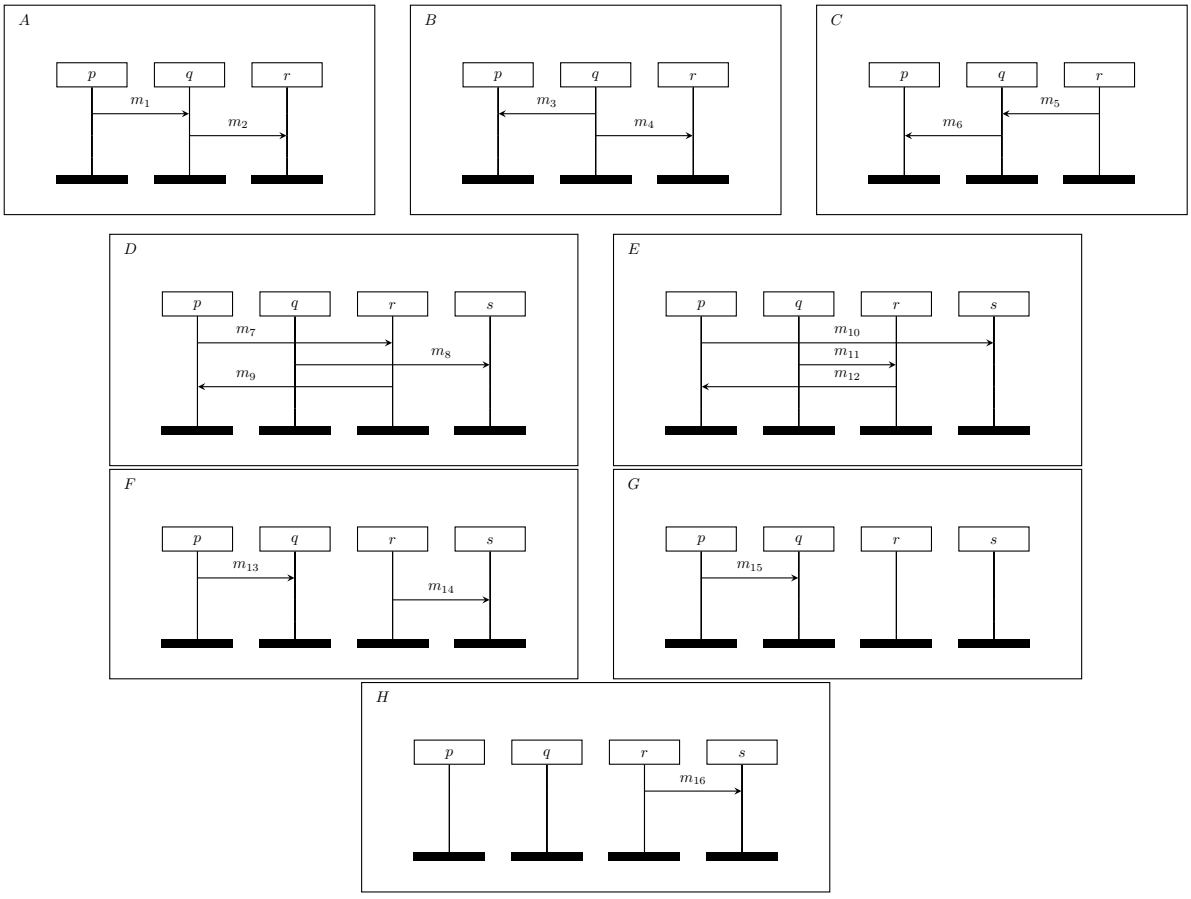
e) finitely generated

f) realizable

Justify each (positive or negative) answer.

Exercise 3 (2+2+2+2=8 Points)

Consider the following MSCs. Note that the message for all MSCs is m. The index $i \in \{1, \ldots, 16\}$ is just added to give the send/receive events an unique identifier.



Check whether the languages of the following regular expressions $\mathcal{L}(\alpha_i)$ are realisable or not. If a language is realizable, also check, whether it can be realized by a universally or existentially bounded CFM. Justify your answers.

a) $\alpha_3 = (A \cdot B \cdot C)^*$

b) $\alpha_2 = D^* + E^*$

c) $\alpha_3 = (D \cdot E)^*$

d) $\alpha_4 = (F^* + G^* + H^*)^*$

We wish you a merry Christmas and a Happy New Year!