Theoretical Foundations of the UML SS 2016
— Series 5 —

Hand in until June 9 before the exercise class.

Exercise 1 (Boundedness of Words) (1+1 Points)

1. Provide an example of a word $w \in Act^*$, such that w is 3–bounded but not 2–bounded.
2. Can you reorder w, i.e. permute the symbols of w, such that the word w you provided in 1. is 2–bounded? If so, provide such a reordering. If not, formally argue why this is not possible.

Exercise 2 (Defining a New Sort of CFM) (3+3 Points)

1. Formally define a communicating finite state machine with lossy channels. Such a machine shall be able to perform (next to the "sending a message" and "receipt of a message") also a "loose messages" global step. This global step shall have the effect that per channel any number of messages that are currently on the channel can be lost, i.e. they disappear from the channel.
2. Formally define a communicating finite state machine with probabilistic lossy message sending. For such a machine the "sending a message" global step shall loose the message that is to be send with some probability that depends on the message content, i.e. with some probability (depending on the message content) the message is not pushed onto the channel.

Hint: Go over *all* necessary notions (e.g. message contents, communication actions, local transitions, global steps, etc.) that are needed to formally define what a standard communicating finite state machine (the one we defined in the lecture) and its formal semantics is. Then think about which notions need to be *adapted* and which concepts can *remain unchanged* in oder to precisely capture the new models described above.

Exercise 3 (Boundedness of CFMs) (1+1 Points)

1. Prove or disprove: For all $B \in \mathbb{N}$ holds: If CFM $\mathcal{A}$ is universally B–bounded, then $\mathcal{A}$ is existentially B–bounded.
2. Prove or disprove: For all $B \in \mathbb{N}$ holds: If CFM $\mathcal{A}$ is universally B–bounded, then $\mathcal{A}$ is existentially $B+1$–bounded.