Technische Universität München (I7) **Winter Semester 2021-22**
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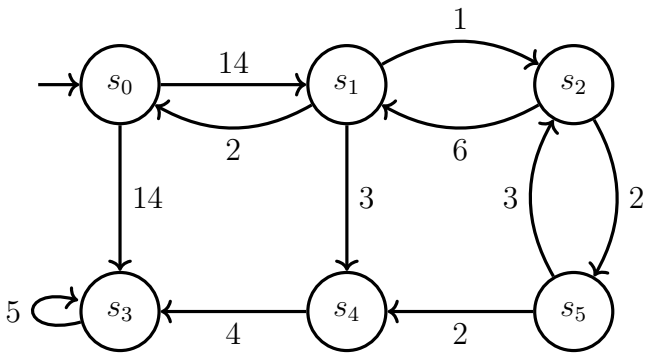
Quantitative Verification – Exercise sheet 12

Exercise 12.1
Draw the embedded DTMC of the following CTMC.



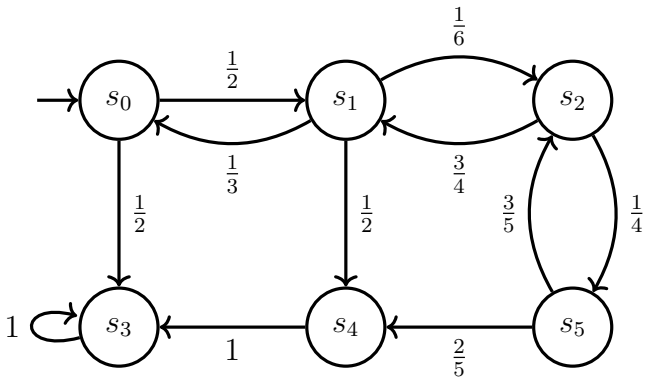
Exercise 12.2
Model the following scenario as a CTMC and uniformize it.

> We consider a printer in a local network. Four printing jobs arrive consecutively with a rate of 2 and are placed in the printer's queue. It has a queue of size two. The jobs are handled with a rate of 1. If the queue overflows, the (buggy) firmware of the printer crashes.

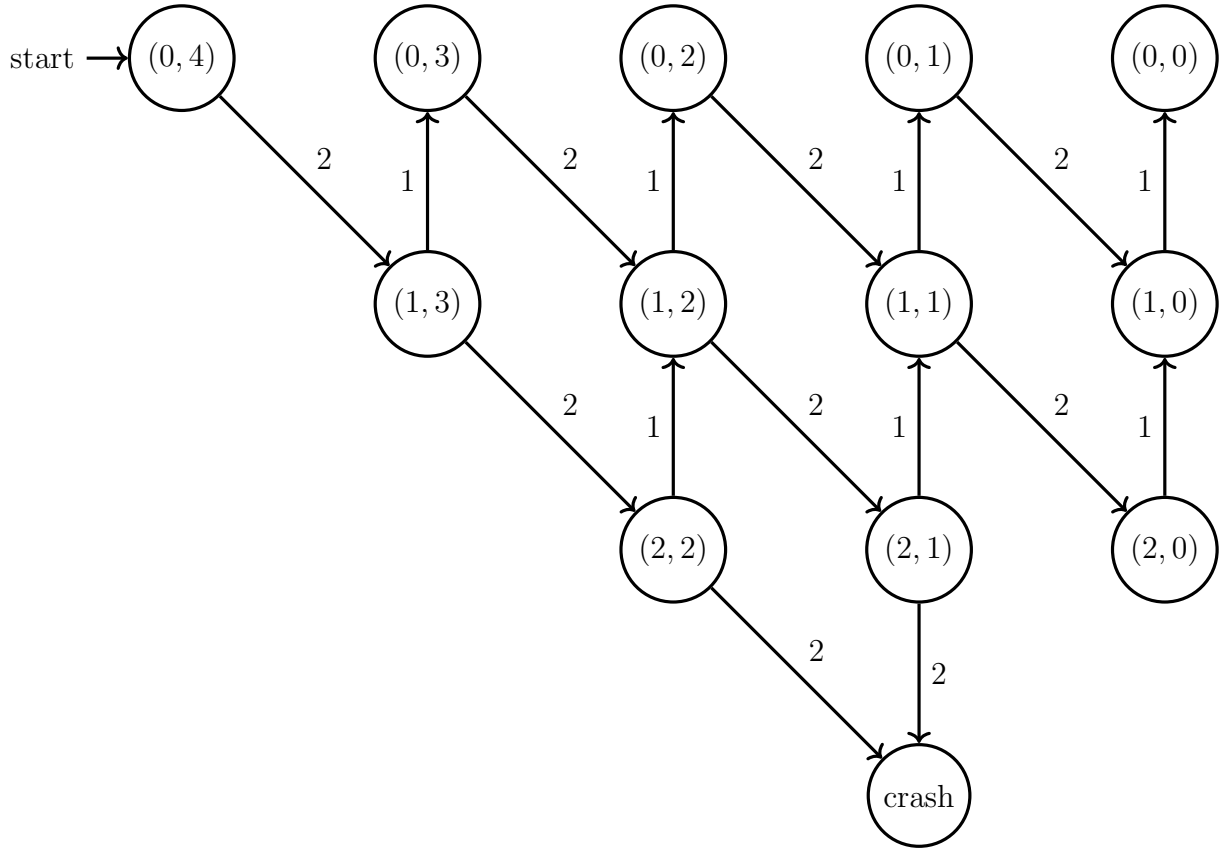
Exercise 12.3
Set $\mathsf{AP} = \{a, b\}$. Model the following specifications as CSL formulae.

- With probability at least 0.5, the system reaches a state where a holds within 5 to 10 time units.
- The probability to reach a state, that in the long run b holds with at least 0.9 probability, is at most 0.2.
- With probability at most 0.1, we have b for the first 100 time steps.

Solution 12.1
Embedded DTMC:



Solution 12.2
Our state space has two variables, namely the printer's queue size and the number of remaining jobs. Furthermore, there is a special *crash* state. Uniformizing with rate $q = 3$ divides all transitions by 3 and adds self-loops in states with $E(s) < 3$.



Solution 12.3

- $\mathcal{P}_{[0.5,1]}\ (\mathbf{F}^{[5,10]}\ a)$
- $\mathcal{P}_{[0,0.2]}\ (\mathbf{F}\ \mathbf{S}_{[0.9,1]}\ (b))$
- $\mathcal{P}_{[0,0.1]}\ (\mathbf{G}^{[0,100]}\ b)$