Quantitative logics
Exercises on CTMC model checking

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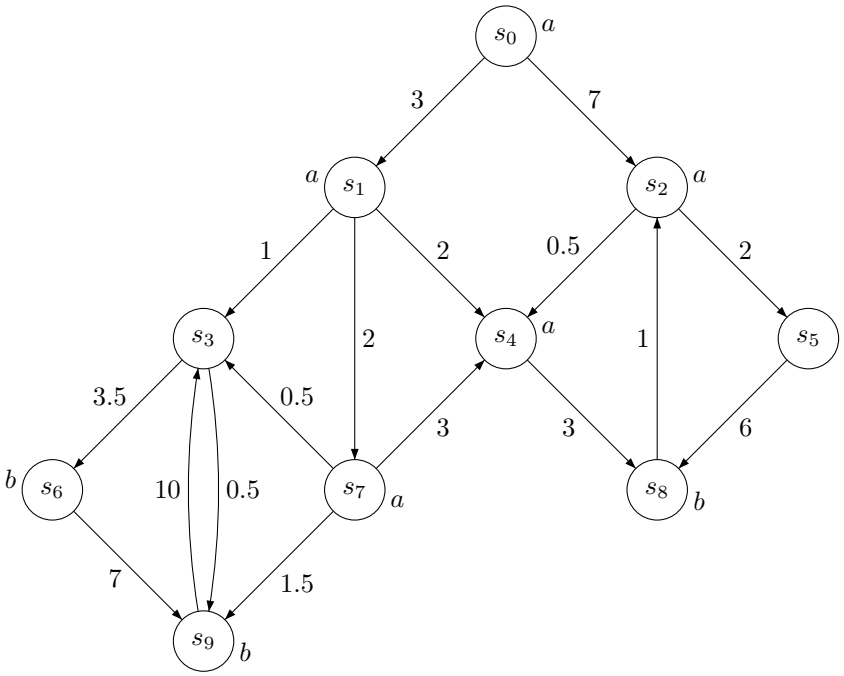
1. Consider the CTMC below. Explain how you would verify the formula $\mathbf{P}_{\geq 0.3}(a\ U^{[0,2)}\ b)$.



2. One can calculate Poisson distributions using a spreadsheet program. For example, in Excel, there is even a function POISSON() that can be used to calculate the (non-cumulative and cumulative) Poisson distribution function.

   Estimate, using your favourite spreadsheet program, which summands are needed to approximate the following sum up to 10^{-6} for $t = 2$ and $E = 10$.

$$\sum_{i=0}^{\infty} \frac{e^{-Et}(Et)^i}{i!} \mathbf{P}^i(s_0, Sat(b))$$

3. Regard the first class cabin of the aeroplane described in last week's exercise again. (Its CTMC is also drawn below.) Your task is to estimate the probability of the paths in $Sat(true\ U^{[0,0.125]}\ queue)$. Approximate $\sum_{i=0}^{\infty} poi(i) P^i \mathbf{1}_{queue} \approx \sum_{i=0}^{7} poi(i) P^i \mathbf{1}_{queue}$ by calculating the vectors $\mu_7, \mu_6, \ldots, \mu_0$. It is ok to use a spreadsheet program.

   Hint: The slides of last lecture contain some extra explanation on μ_i.