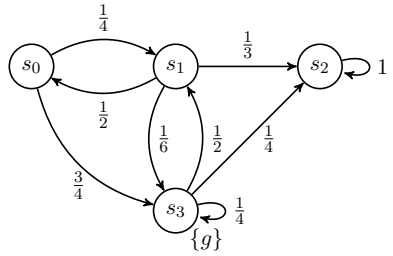
Model Checking SS22
Assignment 9
Due: June 2nd, 2022, 16:00

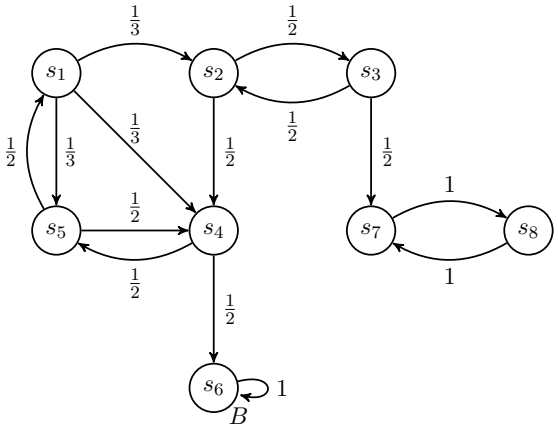
1. **[2 Points]** Consider the following Markov chain with initial state s_0:



   (a) State the finite path fragments $\hat{\pi}$ that satisfy $\varphi_a = \boldsymbol{F}g$

   (b) State the finite path fragments $\hat{\pi}$ that satisfy $\varphi_b = \boldsymbol{G}\neg g$

2. **[3 Points]** Consider the following Markov chain $\mathcal{M}$ with initial state s_1:



   Use the algorithm discussed in class to compute $Pr(\mathcal{M}, s_1 \models \boldsymbol{F}B)$, where $B = \{s_6\}$:

   - Compute the states $\widetilde{S}$.
   - State the matrix A and vector b.
   - Compute x (You may use your favourite tool to this step).

   List all steps of the computation in your solution.

3. **[5 Points]** We consider the following scenario. Three Cowboys: "The Good", "The Bad", and "The Ugly" meet each other in the desert for a famous duel.

   - The three may shoot as long as anyone else is still alive. Due to differences in (re)loading times, we assume that they shoot in turns. That is, The Good shoots first, then The Bad and finally The Ugly.
   - The Good has a chance of a half of hitting anyone. If he hits, he does so uniformly over the living contestants.
   - The Bad has a chance of 0.9 of hitting anyone. If The Ugly is alive, then he aims for him. If The Ugly already died, then he aims at The Good.
   - The Ugly hits either no one or one of the living contestants and he does so with a uniform probability over these events.

Model the *shootout* described in the text above in the **PRISM**-language and hand in your text file containing the model. You may use the following snippet a starting point.

```
dtmc

module shootout
  # define needed variables

  # define commands that model the different events described in the text
endmodule
```

Don't hesitate to discuss your ideas to model this problem with us and your colleagues via Discord!