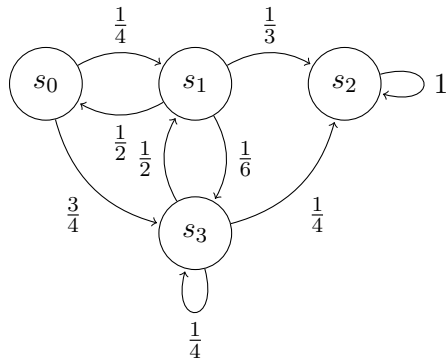


Exercise 1 (Probabilities in DTMCs) [3 points]

Consider the following DTMC:



a) Write a Python or MATLAB program that computes the answers from Exercise 1 (Probabilities in DTMCs) of Assignment 2 by:

- i) trace distribution
- ii) system of linear equations
- iii) transient
- iv) iterative method

b) Write a PRISM program that computes the answers.

Exercise 2 (Duelling Cowboys) [5 points]

We consider the following scenario:

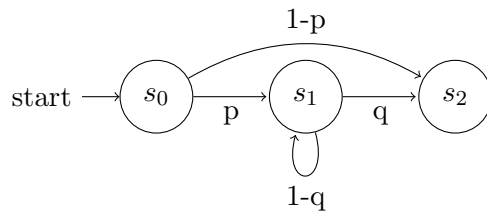
Three Cowboys: “The Good” (G), “The Bad” (B), and “The Ugly” (U) meet each other in the desert for a famous duel.

- 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 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 with probability p . If The Ugly is already dead, then he surely aims at The Good.
- The Ugly hits The Good with a chance of q . If he does not hit The Good or The Good is already dead, he hits The Bad.

a) Write a PRISM program for the Duelling Cowboys.

b) What is the distribution of winners (G, B or U) for $p = 0.5$ and $q = \{0.1, 0.5, 0.8\}$.

Exercise 3 [5 points]



What is the probability of event:

- a) $\Diamond\{s_2\}$
- b) $\Box\{s_2\}$
- c) $\Diamond\Box\{s_1\}, \Diamond\Box\{s_2\}$
- d) $\Box\Diamond\{s_2\}, \Box\Diamond\{s_1\}$
- e) $\overline{\{s_1\} \cup \{s_2\}}$

Exercise 4 (The Craps Gambling Game) [7 points]

Please refer to Example 10.4 (pg: 750-751 in pdf) of the book Principles of Model Checking (available for download under 'Books' in ILIAS).

Use the PRISM to model the Craps game and find out the winning probability (if the dice is fair).