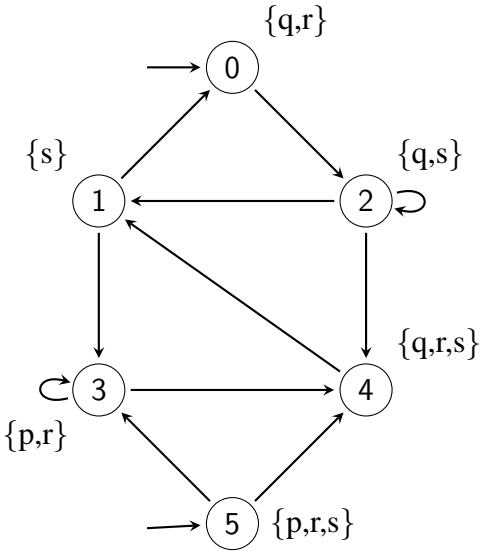
Formal Models SS 2018: Assignment 10

Institute for Formal Models and Verification, JKU Linz

Due 14.06.2018

To indicate that you solved an exercise and that you can present it in the exercise group, tick it off in our MOODLE course until **8am on the day of the exercise**. Unmarking and marking exercises at the begin of the exercise class is **not** possible.

Exercise 37



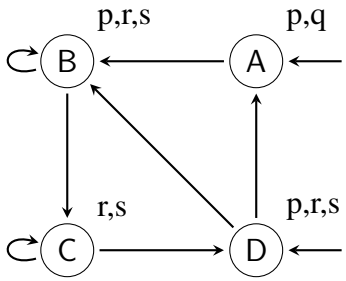
Which of the following CTL expressions holds for K?

- $\mathbf{EG}(q \vee s)$
- $\mathbf{A}(q\ \mathbf{U}\ p)$
- $\mathbf{AGEFEG}q$
- $\mathbf{AX}(q \rightarrow s)$
- $\mathbf{EFAX}s$

Exercise 38

Given Kripke structure K. Given trace π and LTL formula f, decide if f holds in π, i.e., $\pi \models f$. Justify your answers.

Trace π	Formula f	yes	no
$A,(B)^\omega$	$\mathbf{FG}r$	☐	☐
$A,B,(C)^\omega$	$\mathbf{GF}s$	☐	☐
$D,B,(C)^\omega$	$\mathbf{F}(\neg s)$	☐	☐
$(A,B,C,D)^\omega$	$\mathbf{G}((\mathbf{X}\neg r) \rightarrow (\mathbf{X}\neg s))$	☐	☐
$(D,B,C,D,A,B,C)^\omega$	$\mathbf{F}(p\ \mathbf{U}\ q)$	☐	☐



Exercise 39

Use a Markov chain to model the behavior of a single device for obtaining an IP address when entering a local network following the IPv4 zeroconf protocol that has the following specification.

Multiple devices communicate over a local network. When a new device enters a network, it needs an IP address that is currently not used. From a pool of a possible addresses, the new device randomly selects an address and broadcasts a probe message for checking if this address is already in use. If the network currently contains m devices, the probability that the chosen address is already in use is m/a. Hence, with a probability of $1-m/a$, the chosen address is not in use.

For several reasons, the probe message might get lost. With a probability of p no reply is received, even if the address is already in use. Hence, the new device sends 3 probes before ending up in an error state.

Exercise 40

Formulate a typical scenario of your everyday life in MDP (at least five states and at least one transition with multiple probabilities).