RHEINISCH-
WESTFÄLISCHE
TECHNISCHE
HOCHSCHULE
AACHEN

LEHRSTUHL FÜR INFORMATIK 2
RWTH Aachen · D-52056 Aachen
http://www-i2.informatik.rwth-aachen.de/

Prof. Dr. Ir. J.-P. Katoen
N. Jansen & B. Kaminiski

Modeling and Verification of Probabilistic Systems
Summer term 2014

– Series 2 –

Hand in on April 30 in room 4230

Exercise 1 (4 points)

Reconsider the ZEROCONF protocol as presented in the lecture. We fix p as the probability for loosing a message and q as the probability for choosing an already occupied address. $n \in \mathbb{N}$ is the maximal number of probes to be sent.

a) Give a closed form of the probability to in the long run receive a free address depending on an arbitrary n.

b) Compute the long-run probability to receive a free address for $n = 10, p = 0.1$ and $q = 0.5$.

c) How could your result from a) be used to model an instance of this protocol, if the designers are not sure how to choose the parameters p and q and want to ensure that the probability of failure is less than a certain value $\lambda \in \mathbb{Q}$? What problems have to be considered for arbitrary problems like this?

Exercise 2 (3 points)

Consider a finite DTMC $D = (S, \mathbf{P}, s_{init}, AP, L)$. Proof the following fact or give a counterexample: It holds that if two state $s, s' \in S$ are connected, i. e., s is reachable from s' and vice versa, both states are either transient or recurrent.

Exercise 3 (3 points)

Consider a finite DTMC $D = (S, \mathbf{P}, s_{init}, AP, L)$ and subsets of states $A, B \subseteq S$. Show that the following two sets of paths are measurable, i.e. contained in the σ-algebra of D:

a) the set of paths starting in state s_{init} and remaining forever in states from A;

b) the set of paths starting in state s_{init}, remaining forever in states from A and passing through a state in B after exactly 5 time-steps.