UNIVERSITÄT DES SAARLANDES

Fachrichtung 6.2 — Informatik
Prof. Dr. Ing. Holger Hermanns

Homework DN-2/V-2

Deadline: April 1, 2005 3 pm SST

General advice:

- Choose one of the two exercises below.
- Perform the task described in the exercise as elaborate as possible.
- Do not form groups, because this homework determines your individual grade.
- Write a report of a few pages describing your modelling experiences, the model and the conclusions drawn.
- Deliver the solution to `hermanns@cs.uni-sb.de`.

Exercise 1 *MoDeST and MoToR*

(a) Model an $M/M/1$ queue with arrival rate λ, service rate μ and queue length n in MoDeST. The model will contain three processes: PRODUCER, QUEUE and CONSUMER. Process PRODUCER models the generation of data packets; process QUEUE models the queue; and process CONSUMER models the server of the queue. Simulate the model and measure the average queue length for certain values of λ, μ and n. Compare with analytical results known for this queue type.

(b) Now connect the $M/M/1$ queue and the Alternating Bit Protocol (rdt3.0) such that the protocol is placed in between the QUEUE and the CONSUMER. In other words, the arrivals to the SENDER in rdt3.0 are taken out of the process QUEUE, while correctly received data packets at the RECEIVER in rdt3.0 are delivered to the process CONSUMER. Simulate the model and measure the average queue length for the certain values of λ, μ and n. Experiment with different loss characteristics and delay characteristics for the channel.

Exercise 2 *Uppaal*

(a) Study the information in `http://www.cs.ru.nl/research/reports/info/NIII-R0455.html`

(b) Build template automata for the three different recipes depicted in Figure 1.
(see `http://depend.cs.uni-sb.de/fileadmin/hh_daten/dn2v2/colfig.jpg` for a colour version)

(c) Consider a scenario, where at $t = 20$, a customer places orders to buy some freshly brewed laquer as soon as possible. The customer orders three batches of *metallic* laquer, two batches of *bronce* laquer and one batch *uni* laquer.

- First imagine you have all the resources required to produce the recipes as fast as possible. How fast? Build the Uppaal model, but also do some thinking to justify the observation.
- Next, assume that each resource is only available once. Use a global variable for each ressource to model shared, but mutually exclusive access. Build the Uppaal model to assess the minimum time needed to satisfy the orders. Can you again validate the result with an educated guess?
- Now model a scenario where there are two mixing vessels *uni*, and two disperging lines, while the other resources are only available once. Build the Uppaal model to assess the minimum time needed to satisfy the orders. What if you only have one disperging line?