T-79.186 **Spring 2005**
Reactive Systems
Home Exercise 3
Deadline 14.3 16.15

Return your answers by email (Postscript or PDF) to Misa.Keinanen@hut.fi, or on paper to the lecture. Remember to include your name *and* student number.

For this home exercise round use the automata definition used in the lecture slides.

1.) (a) Given atomic propositions *TRY0* and *CR0*, create an automaton S_1, which accepts all (finite) sequences of valuations such that if *CR0* holds at some index, then *TRY0* has held at some earlier index.

(b) Given the atomics propositions P, Q and R, create an automaton S_2, which accepts all (finite) sequences of valuations such that P *precedes* Q *before* R. Tip: R and Q do not have to become true at any point.

2) Express the following properties in LTL. (First define the atomic propositions and their meaning.)

(a) If message "m1" is sent infinitely many times by eh sender, then the message "m1" is received infinitely often by the receiver.

(b) Only finitely many messages are lost by the data channel "d1".

(c) Always when process "p1" is in the critical section, it will go to non-critical in a finite amount of time steps.

(d) If a message "m2" is received by the receiver, then the message "m2" was sent before (or at the same time moment) by the sender.

(e) If an addition is fed to a pipelined ALU unit, then the result is ready four time units later (use the X-operator to denote one time unit).

3) Given $\Sigma = \{a, b\}$, consider the following two Büchi automata.

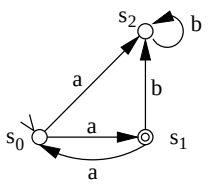

Figure 1: $\mathcal{A}_1$

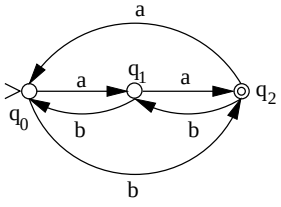

Figure 2: $\mathcal{A}_2$

(a) Is it true that $\mathcal{L}(\mathcal{A}_1) = \emptyset$?

(b) Does automaton $\mathcal{A}_1$ accept the infinite string $(a)^\omega$?

(c) Does automaton $\mathcal{A}_1$ accept the infinite string $a(b)^\omega$?

(d) Does automaton $\mathcal{A}_2$ accept the infinite string $(abb)^\omega$?

(e) Construct the product automaton $\mathcal{A}_e = \mathcal{A}_1 \times \mathcal{A}_2$.

(d) Is it true that $\mathcal{L}(\mathcal{A}_e) = \emptyset$?

Remember to justify your answer. Answering only yes/no or true/false will get you no points!