T-79.186 **Spring 2003**
Reactive Systems
Home Exercise 4
Deadline 18.2-2003 8:45

Return your answer by email (Postscript or PDF) to Timo Latvala at Timo.Latvala@hut.fi, or on paper to the lecture. All rounds will be 6 points maximum.

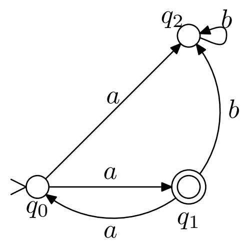
Please remember to include your name and student number to your answer.

For this home exercise use the automata definitions used in the Lecture slides.

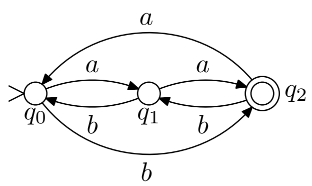
1.) For each LTL formula f_i below, using the semantics of LTL create a Büchi automaton $\mathcal{A}_i$, which accepts the language $\{w \in (\Sigma_i)^\omega \mid w \models f_i\}$, where $\Sigma_i = 2^{AP_i}$. (The language contains exactly those infinite words which are models of the formula.)

a) $AP_a = \{p\}, f_a = \Box\Diamond p$
b) $AP_b = \{p\}, f_b = \Diamond\Box\neg p$
c) $AP_c = \{p, q\}, f_c = p\,U\,q$
d) $AP_d = \{p, q\}, f_d = (\Diamond\Box p) \Rightarrow (\Diamond\Box q)$
e) $AP_e = \{p\}, f_e = XXp$
f) $AP_f = \{p, q\}, f_f = p\,R\,q$

2.) Given $\Sigma = \{a, b\}$, consider the following two Büchi automata $\mathcal{A}_1$:



and $\mathcal{A}_2$:



a) Is it true that $\mathcal{L}(\mathcal{A}_1) = \emptyset$?
b) Does the automaton $\mathcal{A}_1$ accept the infinite string $(a)^\omega$?
c) Does the automaton $\mathcal{A}_1$ accept the infinite string $a(b)^\omega$?
d) Does automaton $\mathcal{A}_2$ accept $(abb)^\omega$? If it does, give an accepting run of the automaton.
e) Construct the Büchi product automaton $\mathcal{A}_e = \mathcal{A}_1 \times \mathcal{A}_2$.
f) Is it true that $\mathcal{L}(\mathcal{A}_e) = \emptyset$? If not, give an accepting run of the automaton $\mathcal{A}_e$.