

T-79.186

Spring 2004

Reactive Systems

Bonus Home Exercise

Deadline 28.4 16.15

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

- 1.) Which of the properties specified below are safety properties (see Bérard et al: Chapter 7, p. 83–89 and the lecture slides)? Remember to motivate your answer.
 - (a) $\mathbf{F}q \Rightarrow p\mathbf{U}q$.
 - (b) $((p\mathbf{R}q)\mathbf{R}r)$.

- 2) Give a Kripke structure and an execution where the LTL formula
 - (a) $p\mathbf{R}q$ holds but $q\mathbf{U}(p \wedge q)$ does not;
 - (b) $\mathbf{GF}p$ holds but $\mathbf{FG}p$ does not.

- 3.) Consider the Kripke structure $M = (S, T, 1, l)$, where $S = \{1, 2, 3\}$, $T = \{(1, 2), (2, 1), (1, 3), (3, 1), (2, 3)\}$ and $l(1) = \{p\}, l(2) = \{r\}, l(3) = \{p, r\}$ (p and r are atomic propositions). Give the states of the Kripke structure where the CTL formula $\mathbf{E}[p\mathbf{U}\mathbf{A}[(\mathbf{E}\mathbf{X}r)\mathbf{U}\neg p]]$ holds.