Problem Sheet 10: Verification of Real-Time Systems

Chris Poskitt and Carlo A. Furia

Starred exercises (*) are more challenging than the others.

The following exercises are based on the lectures about verifying real-time systems:


Assume that the time domain consists of exactly the non-negative real numbers.

1 MTL Property Checking

Consider first the following timed automaton:

Do the following properties hold?

i. $\square a$

ii. $\square (\diamond = 1 a)$

iii. $\square (\square = 1 a)$
Consider now the following timed automaton:

Do the following properties hold?

iv. $\Box (a \rightarrow \Diamond (0,1) c)$

v. $\Box (a \rightarrow \Diamond (0,1) b)$

vi. $\Box (a \rightarrow (a \lor b) U (0,1) c)$

vii. $\Box (a \rightarrow (a \lor b) U (1,2) c)$

2 Region Automaton Construction

i. Construct the region automaton for the first timed automaton in Section 1.

ii. Construct the region automaton for the second timed automaton in Section 1.

iii. (⋆) Construct the region automaton for the following timed automaton (exercise taken from Alur & Dill, 1994):

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*Example from: Alur & Dill, 1994*
3 Semantics of MTL Formulae

i. Is the formula $\Box \Diamond 0$ true satisfied by any timed word?

ii. Is the formula $\Box \Diamond \geq 0$ true satisfied by any timed word?

iii. Is $\Diamond [a, b] \Diamond [c, d] q$ equivalent or non-equivalent to $\Diamond [a + c, b + d] q$ for all $0 \leq a \leq b \leq c \leq d$?