Problem Sheet 10: Verification of Real-Time Systems

Chris Poskitt and Carlo A. Furia

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

The exercises in this problem sheet are all based on the third set of lecture slides on model checking:


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. □ a

ii. □ (◊ = 1 a)

iii. □ (□ = 1 a)
Consider now the following timed automaton:

![Timed Automaton Diagram](image)

Do the following properties hold?

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

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

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 (from Alur & Dill, 1994):

![Region Automaton Diagram](image)
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 $0 \leq a \leq b \leq c \leq d$?