RWTH AACHEN

Theory of Hybrid Systems
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Modeling and Analysis of Hybrid Systems - SS 2015

Series 6

Exercise 1

Charlie Brown walks his dog Snoopy every day the same way:

- Both leave the house next to each other and start their walk.
- As Charlie (C) is thinking about important things (the girl with the red hair), he walks with continuous pace v_c.
- Curious Snoopy (S) is less steady and thus changes his pace between $-v_s$ and v_s, while $0 < v_c < v_s$ holds.
- The leach has only a length of 2 meters. Whenever Snoopy is left behind 2 meters, Charlie waits until Snoopy closes up to him and both continue the walk.

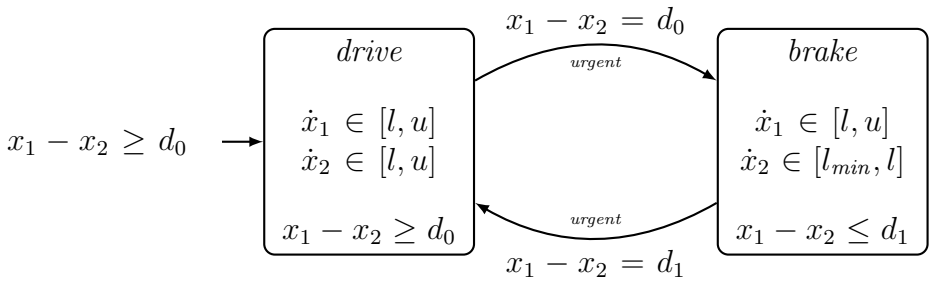
Please give a linear hybrid automaton, which models the position S and C of Snoopy and Charlie respectively.

Exercise 2

We consider a vehicle platoon, where two cars are driving with speeds $\dot{x}_i \in [l, u], i \in \{1, 2\}, 0 < l < u$ on a road, such that the 1^{st} car is in front of the 2^{nd} car. The goal is to keep the distance between two cars above some constant $d_0 > 0$. When the distance is at its boundary d_0, the rear car brakes, which limits its speed to the interval $\dot{x}_2 \in [l_{min}, l], 0 < l_{min} < l$. Additionally we utilize a second constant $d_1 > d_0 > 0$ to prolong the braking process until this target distance d_1 is reached. Initially the goal condition is satisfied.

Note that both transitions are *urgent transitions*, which means that they are taken as soon as they are enabled.

A linear hybrid automaton of the above system is given as follows:



a) Please calculate the forward time closure as presented in the lecture.