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Problem Set 3
Due: May 8, 2007, 9:14 am

Embedded Systems

Problem 1 (StateCharts) — 60 points

You are to develop a personal CD player system with StateCharts. The product should have the following features:

- capability to display the current time for Europeans, i.e., in hours (0-23) and minutes (0-59);
- capability to display the current time for Americans, i.e., in hours (0-11), minutes (0-59), and am/pm;
- capability to set the current time;
- capability to play music from a CD;
- the capability to select a song (or track) to play on a CD;
- capability to eject a CD;
- capability to check whether a CD is inserted or not;
- capability to start playing a CD;
- capability to stop playing a CD;
- capability to display for how long time a CD has been playing, for how long time a song/track has been playing, how long time still remains until the CD finishes playing, and how long time still remains until the current song/track finishes playing;
- capability to start the next song in the CD after the current one finishes playing;
- capability to be powered on;
- capability to be powered off;
- *Add one more new feature of your choice.*

Problem 2 (StateCharts) — 20 points

Consider the statechart in Figure 1. Using the asynchronous time model, assume that event EV is generated while the chart is in states S1/S4/S7 and $X = 0$.

(a) Compute the resulting superstep. Give the statuses and the single steps of the superstep;

(b) Does the transition between S8 and S9 ever fires? Why?

(c) At the end of the superstep, does the chart leave the AND-superstate? Why?

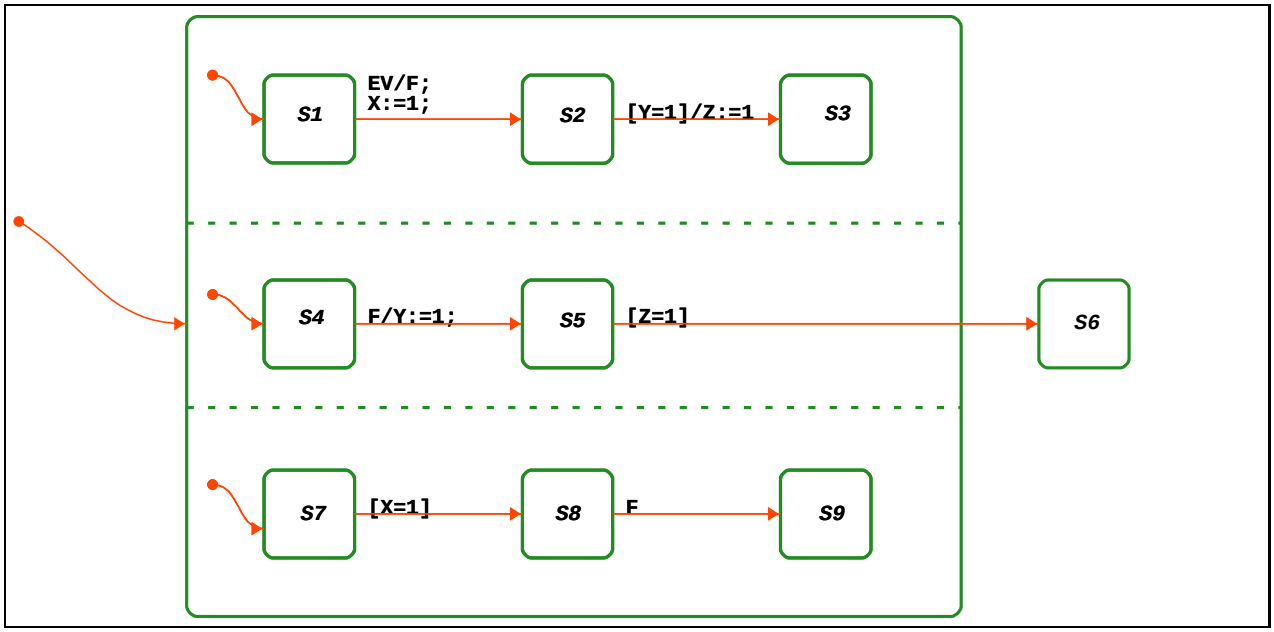

Figure 1: A statechart.

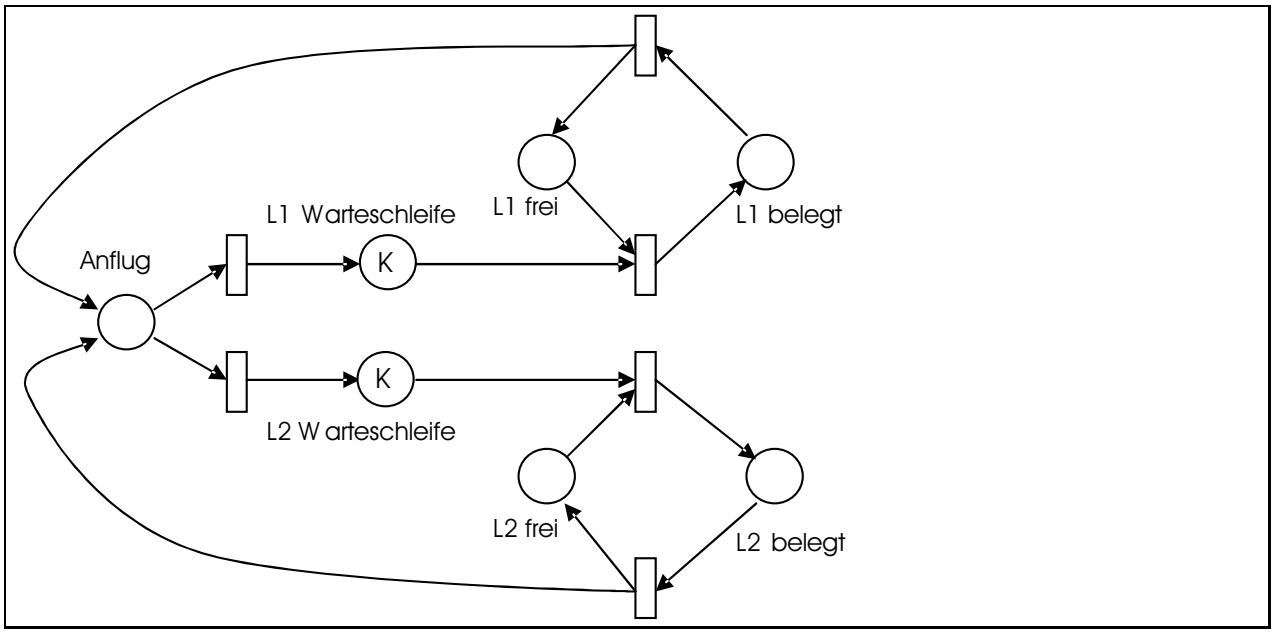

Figure 2: A Petri net.

Problem 3 (Petri nets) 20 points

Consider the net in Figure 2. It models the allocation of the landing strips of an airport. The airport has two strips exclusively reserved for landing airplanes. Each strip has a waiting list (Warteschleife) that can contain at most k airplanes. It is possible to use both strips at the same time. Initially, there are n airplanes flying.

1. Complete the net. Give the weights of the edges, the capacity of the places, and a meaningful initial marking.
2. Modify the net so that the maximal number of airplanes in one waiting list (Warteschleife) is coded not in the capacity of the places, but rather in the initial marking.