

Hardware/Software Codesign - HS 15

Exercise Sheet 1

Issue Date: 16. September 2015

Discussion Date: 23. September 2015

1.1 StateCharts

The lecture has introduced Harel's *StateChart* formalism. StateCharts are a popular specification model for embedded systems.

1.1.a) Advantages of StateCharts

What are the most important extensions of the StateChart model in comparison to an ordinary finite state machine (FSM)?

1.1.b) Disadvantages of StateCharts

What are the disadvantages of the StateChart formalism?

1.1.c) Tree of states for StateChart

Given the StateChart in Figure 1. Draw the state space of the StateChart as a tree, which shows the hierarchy

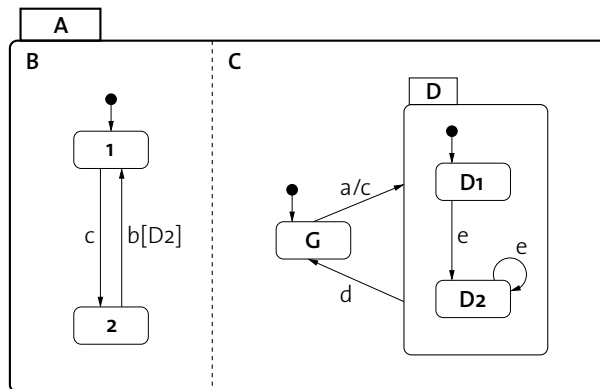


Figure 1: StateChart

of states and denotes the state types (basic state, sequential states, and parallel states).

1.1.d) Formal computation of state space

How would you formally compute the set of states? Compute the set of states for the hierarchical automata which is defined by the StateChart from Fig. 1.

1.1.e) Analysis

The automaton defined by the StateChart from Fig. 1 passes through a number of states, when external events are applied. Show the sequence of state that are passed through, starting from the initial state, for the following sequence of events: a,b,e,b,d,b. Use a table notation.

1.1.f) Conversion of StateChart to a finite state machine (FSM)

Draw a finite state machine which is equivalent to the StateChart from Fig. 1. Minimize the number of states.

1.1.g) StateChart model of a vending machine

The StateChart model of a simplified vending machine is shown in Figure 2.

Input events from the environment



coin_in



cancel



drink_ready



req_coffee



req_tea

Output events to the environment



start_coffee



start_tea



coin_out

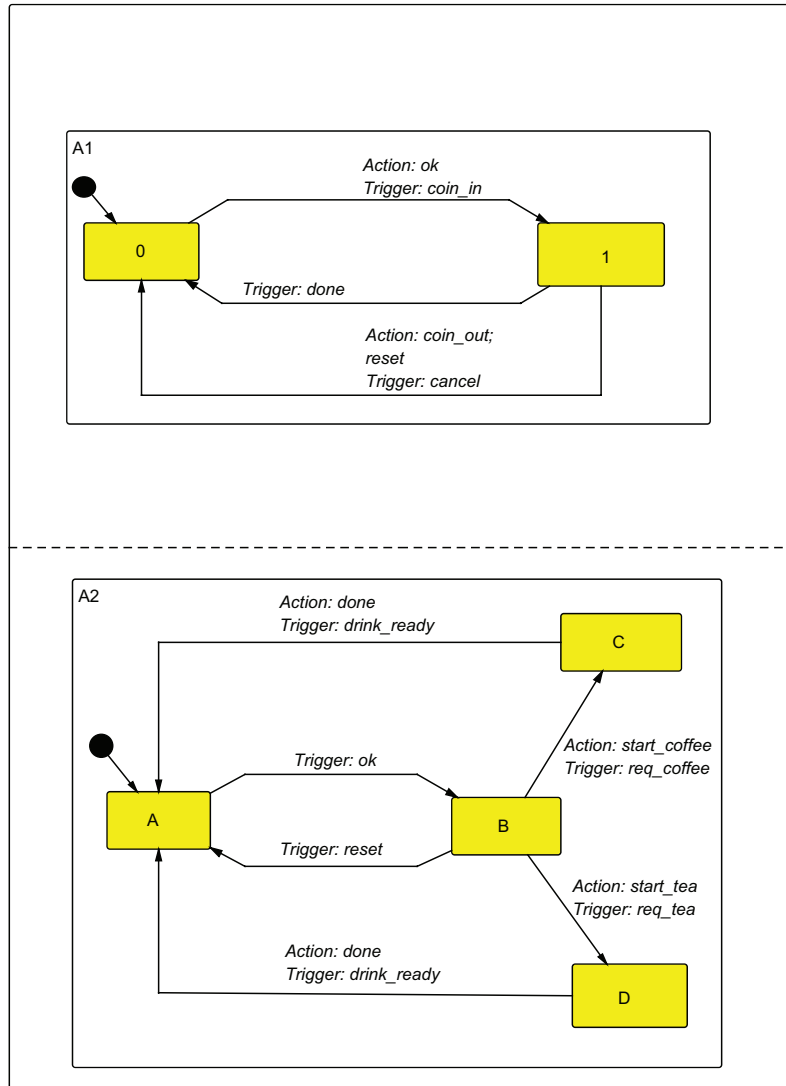


Figure 2: Vending Machine

- Describe the trace of transitions occurring when the user inserts a coin and orders a tea.
- The control of the vending machine has a bug that allows the user to cheat. Describe the trace of transitions that illustrate the bug.
- Draw the corresponding StateChart that fixes the bug.
- *Optional:* Extend the StateChart such that it accepts 0.05, 0.10, 0.20, and 0.50 coins. Coffee costs 0.75 and tea costs 0.50.