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Department 6.2 - Computer Science
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Computer Architecture I - SS09

Exercise Sheet 10 (due: 20.07.09)

Exercise 1: (control automata) (4 points + 4 bonus points)

In the lecture we considered two kinds of control automata. In this exercise you are supposed to study a section "2.6 Control Automata" in the book S. Müller, W. Paul, "Computer Architecture, Complexity and Correctness" for more details and design on the gate level a Moore automation given on Figure 1. Describe all computations (functions, sets, DNFs, etc.) required for designing the automation as it is explained in the book.

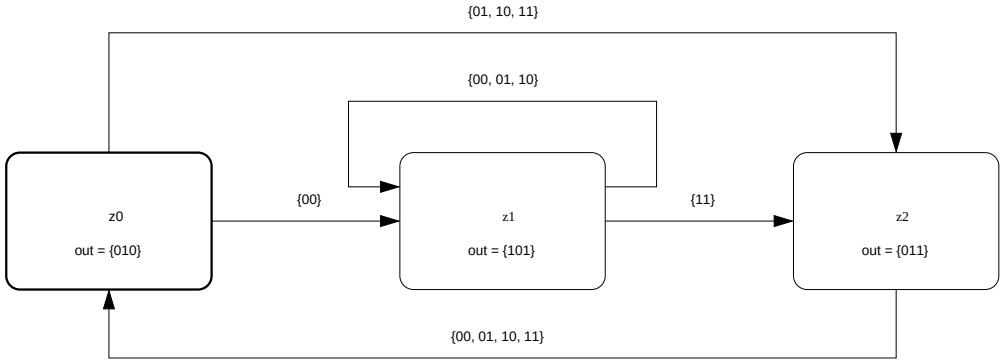

Figure 1: Moore automation

You can get bonus points if you provide the cost, delay and cycle time of this realization (see the book for details).

Exercise 2: (self-modifying code) (7 points)

In class, you saw the software convention that between an instruction writing to some address a and an instruction reading from a there has to be an instruction that empties the pipeline. Formally:

$$\forall i, j\ \forall a.\ i < j \wedge (I_i \text{ writes to } m(a)) \wedge (I_j \text{ fetched from } m(a)))$$

$$\Rightarrow \exists k.\ i < k < j \wedge (I_k \text{ drains the pipe})$$

where a is an address in the code region.

Assume that this software convention does not hold. Then, one has to speculate that the convention is fulfilled. Hence, in case it is not fulfilled, we have to rollback the computation and drain the pipe.

Implement a circuit that checks for misspeculation, performs a rollback in case of a misspeculation, and drains the pipe.

Exercise 3: (control automata) (10 bonus points)

Specify the FSD for an automation with a state register S that represents an integer in $\{0, 1, 2, 3\}$. A 2-bit input line is used to feed binary numbers a into the automation. The next state S' is defined as $S' = S + \langle a \rangle$. The output of the automation is the binary representation of the number currently stored in S. Is your automation a Moore or a Mealy automation?