Saarland University
Department 6.2 - Computer Science
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Computer Architecture II - WS 08/09

Exercise Sheet 11 (due: 28.01.09)

Excercise 1: (Lemma 6.5) (5 Points)
In the lecture the proof of Lemma 6.5 was shown. At the very last step of the proof we concluded from:

$$cy(8*3) - 2 \leq str(2) + 1 \leq cy(8*3) + 3$$

the following:

$$sy(1) \in cy(8*3) + [3:4]$$

Give arguments to: why it is possible to conclude that.

Excercise 2: (Majority Voter) (5+5 Points)
Let:

$$n \in \mathbb{N}, \qquad a \in \{0,1\}^{2 \cdot n+1}, \qquad b \in \{0,1\}$$

For a given bit-vector a the function $major$ is defined as:

$$major(a) = \begin{cases} 1: & \text{if } (\sum_{i=0}^{2 \cdot n} a[i]) \geq (n+1) \\ 0: & \text{o.w.} \end{cases}$$

A 'majority voter' is a circuit with input a and output b satisfying:

$$b = major(a)$$

In this exercise you need to construct a majority voter and prove the correctness of your contstruction.

Excercise 3: (Lemma 6.6: Base Case) (10 Points)
Assumptions:

- for all byte indices $i \in [0 : L-1]$, and
- for all bit indices $y \in [0:9]$ if $i < L-1$ and $y \in [0:10]$ if $i = L-1$

Claim:

1. receiver syncs in the correct cycle range:

$$sy(i+1) \in cy(8*(3+10i)) + [3:4]$$

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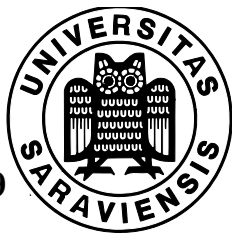

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2. receiver votes the correct bit:

$$v^{3+10i+y} = f(m)_{3+10i+y}$$

3. receiver strobes the correctly voted bit:

$$str(3+10i+y) = sy(i+1) + 8y + 4$$

4. receiver steps correctly through automaton until the next sync:

$$z^{str(3+10i+y)+1} = \begin{cases} BSS1: & y = 0 \\ b_0: & y = 1 \\ \dots & \\ b_7: & y = 8 \\ BSS0: & y = 9 \\ FES: & y = 9 \wedge i = L-1 \\ TES: & y = 10 \wedge i = L-1 \end{cases}$$

The proof of this lemma is done over sync intervals i. In this exercise you need to show the base case, i.e. prove the claim for $i = 0$.