

## Exercise Sheet 6 (Block B - 2)

(16 points)

Submission until Wednesday, 2nd December 2015, 16:00 pm

Discussion begins on Tuesday, 8th December 2015

Please see notes at the end of the document for the submission.

### 6.1 PLAs (4 points)

Let the following three functions  $f_1, f_2, f_3 : B^4 \rightarrow B^1$  be defined over the variables  $x_1, x_2, x_3, x_4$ . Construct one PLA with 5 columns that displays this three functions.

$$f_1 = (x_1 \wedge \bar{x}_2 \wedge x_4) \vee (x_2 \wedge \bar{x}_3 \wedge x_4) \vee (\bar{x}_1 \wedge \bar{x}_2 \wedge \bar{x}_4)$$

$$f_2 = (x_2 \wedge \bar{x}_3 \wedge x_4) \vee (\bar{x}_1 \wedge x_2)$$

$$f_3 = (x_2 \wedge x_4) \vee (x_1 \wedge \bar{x}_2 \wedge x_4)$$

### 6.2 von Neumann Addierwerk (4 points)

Use a von Neumann-Adder to add up two 8 Bit absolute binary values. Let  $x$  be the first summand and  $y$  be the second summand. For each pair of numbers please write down:

- The pair of numbers saved in the adder at the beginning of each calculation step.
- The number of needed calculation steps. Importing the numbers into the adder does not count as a step.
- If the result is valid or not.

a.  $01000101 + 00110100$

b.  $10110001 + 01010001$

### 6.3 Mealy Automate (4 points)

A spam-filter should scan a text file for appearances of the string "ANANAS". Construct and sketch a Mealy automate that will display a red light (red) every time "ANANAS" was found. The input has to be read character by character. While "ANANAS" was not found a green light should be displayed (gr). A final state after recognizing "ANANAS" is not necessary. To make the problem simpler we assume that all characters that do not appear in "ANANAS" will be replaced by "-" in a preprocessing step.

- a. Please write down the input alphabet  $\Sigma$ , the output alphabet  $\Delta$  the set of states  $S$  of the Mealy Automate. Please use expressive names.
- b. Sketch the diagram representing the Mealy Automate according to the notation in the lecture. Multiple edges with the same start and destination can be represented by one edge with multiple annotations.

### 6.4 Mealy Automate (4 points)

Design a Mealy automate that for every point in time displays if for a consecutive binary sequence (a sequence of numbers, where each number is from the input set  $\{0, 1\}$ ) the last two input values are equal. For each input step the automate will display **e** for equal if the last two numbers are the same or **n** for not equal if the last two numbers are not the same. When only one value is read after the starting state the output should be **n**.

- Please write down the input alphabet  $\Sigma$ , the output alphabet  $\Delta$  the set of states  $S$  of the Mealy Automate. Please use expressive names.
- Display the state transition function  $\delta$  and the output function  $\lambda$  in the following tables.

state transition function $\delta$		
$q \in Q$	$w \in \Sigma$	$\delta(q, w)$

output function $\lambda$		
$q \in Q$	$w \in \Sigma$	$\lambda(q, w)$

- Sketch the diagram representing the Mealy Automate according to the notation in the lecture. Multiple edges with the same start and destination can be represented by one edge with multiple annotations.

**Notes:**

Submission until Wednesday, 2nd December 2015, 16:00 pm in the mailbox number 46 at Otto-Hahn-Straße 12.

You can find the mailboxes in the first floor of the Otto-Hahn-Straße 12 near the transition to the ground floor of the Otto-Hahn-Straße 14. The mailboxes are labeled with "Rechnerstrukturen", the exercise group number and time/place of the exercise. The English exercise group is number 30 and the mailbox is number 46.

Please write your **name**, your **student registration number** and your **exercise group number** at the top right corner of your submission. You can make submissions in teams with up to two more students. To make a team submission put names, student registrations numbers and group numbers of all members of the team on the submission. Only one submission per team has to be made.

Tack you submission. Please do not fold your submission and do not put it into an envelope. Use the correct mailbox, you will need your exercise group number for that.

In total there are 12 exercises in 3 blocks (A, B, C). In each block you have to achieve at least 30 points of 64 possible ones to get access to the exam.