technische universität dortmund

fakultät für informatik

CS 12 computer science 12

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Exercise Sheet 6 (Block B - 2)

(16 points)

Submission until Wednesday, 7th December 2016, 16:00 o'clock
Discussion begins on Monday, 12th December 2016

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.

$f_1 = (x_2 \wedge x_4) \vee (x_1 \wedge \overline{x_2} \wedge \overline{x_4})$
$f_2 = (x_1 \wedge x_3) \vee (x_1 \wedge \overline{x_2} \wedge x_4) \vee (x_2 \wedge \overline{x_3} \wedge x_4)$
$f_3 = (x_1 \wedge x_3) \vee (x_1 \wedge \overline{x_2} \wedge x_4) \vee (x_1 \wedge \overline{x_2} \wedge \overline{x_4})$

6.2 PLA als Speicher (4 points)

You need to store the following four 8-bit words using PLA-based PROM (Programmable Read-Only Memory), which should be addressed using 2 bits.

Addresse	Wort
00	01010101
01	10101010
10	11111111
11	00001111

a. How big should the PLA size be at least? Write the minimum number of rows and columns (1 point)

b. Sketch the PLA and specify the type of each building block (or cell). Furthermore, identify each row/column of the PLA. (3 points)

6.3 Moore Automata (4 points)

A spam-filter should scan a text file for appearances of the string "KAKADU". Construct and sketch a Moore automata that will display a red light (r) every time "KAKADU" was found. The input has to be read character by character. While "KAKADU" was not found a green light should be displayed (g). To make the problem simpler we assume that all characters that do not appear in "KAKADU" will be replaced by "-" in a preprocessing step.

a. Please write down the input alphabet Σ, the output alphabet Δ the set of states S of the Moore Automata. Please use expressive names.

b. Sketch the diagram representing the Moore Automata 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 Automata (4 points)

Design a Mealy automata 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 automata 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**.

a. Please write down the input alphabet Σ, the output alphabet Δ the set of states S of the Mealy Automata. Please use expressive names.

b. Display the state transition function δ and the output function λ in the following tables.

state transition function δ			output function λ		
$q \in Q$	$w \in \Sigma$	$\delta(q,\ w)$	$q \in Q$	$w \in \Sigma$	$\lambda(q,\ w)$

c. Sketch the diagram representing the Mealy Automata 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, 7th December 2016, 16:00 pm in the mailbox number 40 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 31 and the mailbox is number 40.

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 <u>not</u> fold your submission and do <u>not</u> 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.