



Digital Systems Wintersemester 2017/2018

Serie 3

Assignment Date: Monday, 13.11.2017

Submission Date: Monday, 27.11.2017, 8 a.m. in the delivery cupboard in HRS 3

Presentation tasks

Task 1

Show for a Boolean algebra: $(A, +, \cdot) : \forall x_0, x_1 \in A : (x_0 + x_1) \cdot (x_0 + \bar{x}_1) = x_0$

Make use of the theorems and axioms on Boolean algebra in the lectures slides.

Task 2

(a) Determine the canonical disjunctive normal form of

$$f = (\bar{x}_2 x_0 + x_2 x_1 + \bar{x}_2 \bar{x}_0) \cdot (x_0 + x_1) \cdot (\bar{x}_2 x_1 + x_2 \bar{x}_1)$$

(b) Represent the minimized solution of a) as a combinatorial circuit.

Task 3

Minimize the following function using the Karnaugh map (in German: KV-Diagramm):

$$f = \bar{x}_2 x_1 x_0 + \bar{x}_2 x_1 \bar{x}_0 + x_2 \bar{x}_1 \bar{x}_0 + x_2 \bar{x}_1 x_0 + \bar{x}_2 \bar{x}_1 x_0$$

Homework

Task 1

Show for a Boolean algebra: $(A, +, \cdot) :$

(a) $\forall x_0, x_1 \in A : x_0 \cdot x_1 + (\bar{x}_0 + \bar{x}_1) = 1$

(b) $\forall x_0, x_1 \in A : \bar{x}_0 + \bar{x}_1 = \overline{x_0 \cdot x_1}$

Make use of the theorems and axioms on Boolean algebra in the lectures slides (without the theorem to be proven).

10, 20 points

Task 2

- (a) Determine the canonical disjunctive normal form of

$$f_1 = (\overline{x_2} \overline{x_0} + x_1 x_0) \cdot (x_1 + x_2 x_0) \cdot (x_2 \overline{x_1} \overline{x_0} + x_1 x_0 + x_2 x_1)$$

- (b) Determine the canonical conjunctive normal form of

$$f_2 = x_3 x_2 \overline{x_1} + x_3 \overline{x_2} \overline{x_0} + x_3 x_1 \overline{x_0} + \overline{x_3} \overline{x_2} \overline{x_1} x_0$$

- (c) Represent the minimized solutions of a) and b) as a combinatorial circuit.

10, 10, 20 points

Task 3

Minimize the following functions to the disjunctive minimal form (DMF) using the Karnaugh map:

(a) $f_1 = \overline{x_2} \overline{x_1} \overline{x_0} + \overline{x_2} x_1 \overline{x_0} + x_2 x_1 x_0 + x_2 \overline{x_1} \overline{x_0} + \overline{x_2} \overline{x_1} x_0$

(b) $f_2 = x_3 x_2 x_1 x_0 + x_3 \overline{x_2} \overline{x_1} x_0 + \overline{x_3} x_2 x_1 x_0 + x_3 x_2 x_1 \overline{x_0} + \overline{x_3} x_2 \overline{x_1} x_0 + \overline{x_3} \overline{x_2} x_1 x_0 + x_3 x_2 \overline{x_1} x_0 + \overline{x_3} x_2 x_1 \overline{x_0}$

10, 20 points