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Theoretisches Aufgabenblatt 2

Abgabetermin: 03 - 05.11.2014

1. Suppose there are two boolean functions P and Q:

$$P = \left(X + \overline{Y}\right)(Y \oplus Z)$$
$$Q = \overline{Y}Z + XY\overline{Z}.$$

   a) Design a network of gates, consisting solely of AND, OR and NOT-Gates realizing P und Q out of the inputs X, Y und Z!

   b) Are the boolean functions P and Q equivalent?

   c) Discuss speed(latency) and costs of the subnets for P and Q!

2. Derive from the truth table of the boolean function $Y(a, b, c)$ the „min“ and „max“ terms. Use these to derive the disjuntive normal form as well as the conjunctive normal form. Simplify the resulting formulas and show their equivalenz.

a	b	c	Y
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

3. To develop a drain control system a network of gates shall be developed. the drain system consists of four individual pipes.

   - Two incoming drains have a capacity of $30\frac{l}{min}$
   - One incoming drain has a capacity of $60\frac{l}{min}$
   - One overflow drain is opened only if the incoming capacity is bigger then $70\frac{l}{min}$

   Model the system as boolean Input- and Output-Variables. Derive a helper variable y depending on the incoming drains x_1, x_2, x_3. Develop the final boolean function $y = f(x_1, x_2, x_3)$.

4. Implement a 4:1 Multiplexer with 4 Inputs e_0, e_1, e_2 und e_3 controlled by s_0, s_1 towards towards the output a. Create a
   a) Thruth Table,
   b) Gate-network consisting solely of NAND-Gates.
   c) ein Schaltbild aus 2:1 Multiplexern.

5. Mimic a traffic light using a decoder. Use the two input signals x_0 und x_1 to control three output values $Y = \{y_0, y_1, y_2\}$ to indicate four states „red“, „yellow-red“, ‘yellow“ und „green“.
   a) Create a thruth table for this functionality.
   b) Derive the boolean function $Y = \{y_0, y_1, y_2\}$.