Combinational Logic Circuit Synthesis

Task

1. Find minimal sum and minimal product for the logical functions y1 and y2 (Table 1). Variant correspond to the order number in the register of the group.

2. Design the logic circuits for both functions according to the minimal sum using NAND gates (apply De Morgan theorem).

3. Design the logic circuits for both functions according to the minimal product using NOR gates (apply De Morgan theorem).

4. Design the logic circuit for function y1 according to the canonical sum using NAND gates (apply De Morgan theorem).

5. For all circuits calculate the cost and delay time.

Report

The report for the laboratory work will include:

1. Individual task according to the variant;
2. Minimization of logic functions for 1s and 0s (4 minimizations);
3. Designed logic circuits (5 logic circuits). For each circuit calculate the cost and delay time;
4. Conclusions

Tabel 1

Nr. Var.	Logic functions
1	2
1	$y_1=\vee(0,1,2,4,5,7,9,10,11,14,15)$ $y_2=\vee(2,3,4,5,8,9,12,13)$
2	$y_1=\vee(1,3,4,7,8,10,12,13,14)$ $y_2=\vee(3,4,5,7,9,11,13,14,15)$
3	$y_1=\vee(0,2,4,5,8,10,12,14)$ $y_2=\vee(1,2,3,4,7,8,9,12,13,14)$
4	$y_1=\vee(0,2,3,5,6,7,9,11,12,13,14)$ $y_2=\vee(1,2,4,5,6,8,9,11,14,15)$
5	$y_1=\vee(2,4,5,7,8,9,12,14,15)$ $y_2=\vee(0,1,2,7,8,10,11,14)$
6	$y_1=\vee(1,2,4,5,6,8,10,14,15)$ $y_2=\vee(0,1,2,5,6,7,9,11,12,13)$
7	$y_1=\vee(0,1,5,6,7,8,10,12,14,15)$ $y_2=\vee(1,2,4,8,9,10,11,12)$

Tabel 1 (continuation)

1	2
8	$y_1=\vee(0,1,2,4,6,8,11,12,15)$ $y_2=\vee(0,1,2,5,6,7,8,9,12,13)$
9	$y_1=\vee(0,2,4,5,7,8,10,12,15)$ $y_2=\vee(2,3,4,5,7,8,9,11,12,14)$
10	$y_1=\vee(0,3,4,5,6,8,10,12,13)$ $y_2=\vee(4,5,6,7,9,11,12,13,14)$
11	$y_1=\vee(1,2,4,5,8,9,10,12,13,14,)$ $y_2=\vee(3,4,5,7,8,9,11,12,13)$
12	$y_1=\vee(0,1,2,4,5,8,9,12,14,)$ $y_2=\vee(1,2,3,5,6,8,10,11,12)$
13	$y_1=\vee(0,2,4,5,6,7,9,12,13,15)$ $y_2=\vee(2,3,4,5,7,8,9,10,11,)$
14	$y_1=\vee(0,2,3,4,6,9,10,11,13,14,15)$ $y_2=\vee(3,4,5,7,8,10,11,14,15,)$

Tabel 1 (continuation)

1	2
15	$y_1=\vee(0,1,4,5,7,8,10,11,12)$ $y_2=\vee(1,3,5,6,7,9,10,12,15)$
16	$y_1=\vee(0,2,3,4,6,7,9,11,12,13)$ $y_2=\vee(3,4,5,8,9,11,12,14)$
17	$y_1=\vee(0,3,4,5,7,8,12,13,14)$ $y_2=\vee(2,4,5,6,8,10,11,15)$
18	$y_1=\vee(1,2,3,4,6,7,8,9,10)$ $y_2=\vee(2,3,5,6,7,10,12,15)$
19	$y_1=\vee(0,1,2,5,6,7,14,15)$ $y_2=\vee(2,3,4,7,8,9,10,12,13,14,15)$
20	$y_1=\vee(3,4,5,6,7,8,10,12,13)$ $y_2=\vee(0,1,2,5,6,8,9,11,12,14)$
21	$y_1=\vee(1,2,6,7,9,11,12,13, 14)$ $y_2=\vee(2,3,4,6,7,8,9,11,14, 15)$

Tabel 1 (continuation)

1	2
22	$y_1=\vee(4,5,7,8,9,10,12,13)$ $y_2=\vee(1,2,3,4,5,6,7,12,14)$
23	$y_1=\vee(0,1,2,6,7,9,11,12,14)$ $y_2=\vee(1,3,4,5,7,9,11,13,14)$
24	$y_1=\vee(0,2,3,4,6,7,8,12,15)$ $y_2=\vee(2,3,4,5,7,9,11,13)$
25	$y_1=\vee(0,1,2,3,5,6,7,8,11,12, 13)$ $y_2=\vee(1,2,3,8,9,10,12,13,15)$
26	$y_1=\vee(0,1,2,5,6,7,10,11,14)$ $y_2=\vee(0,2,3,4,7,8,9,10,12,13)$
27	$y_1=\vee(1,3,4,5,6,7,8,10,11,13)$ $y_2=\vee(0,1,2,4,6,8,9,11,12,13)$