lab 3: August 21, 2025:

Hamming weight detector.

$y = f(x_0, x_1, x_2, x_3, x_4)$

K-map:

$x_4 = 1$

x_2x_3 \ x_0x_1	00	01	11	10
00	0	0	1	0
01	0	1	0	1
11	1	0	0	0
10	0	1	0	1

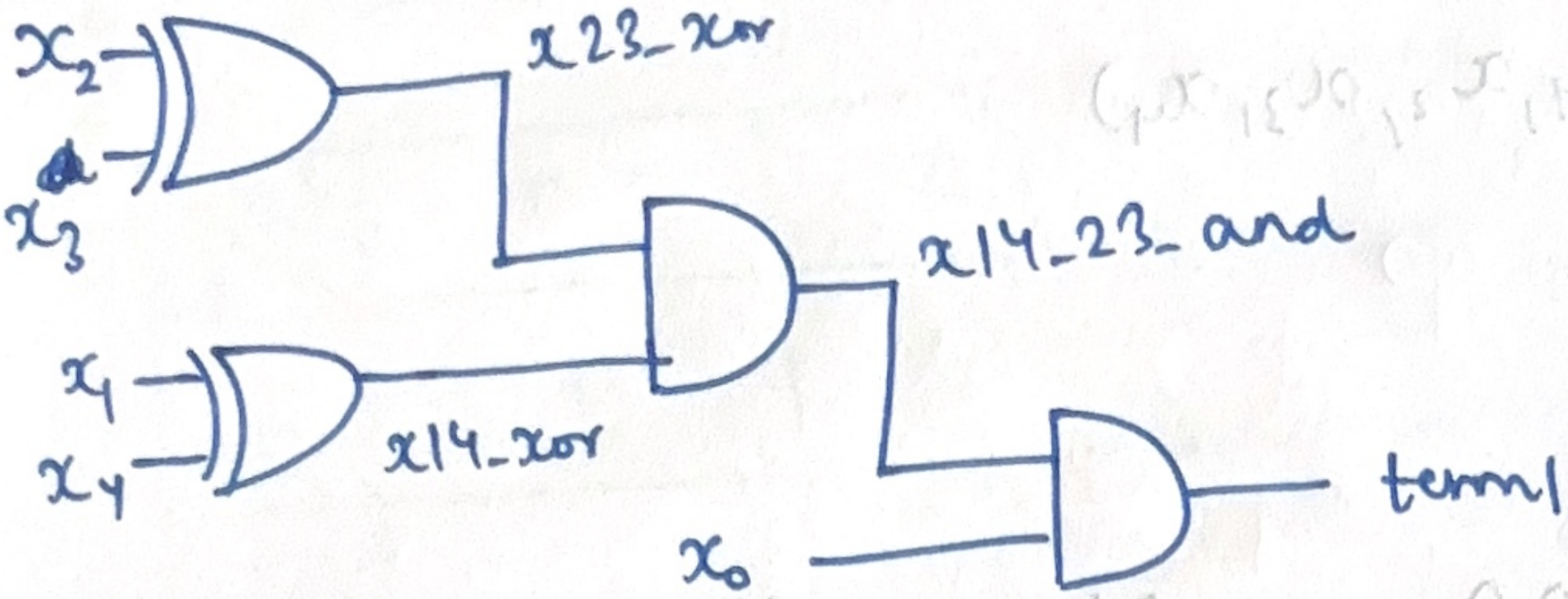
$x_4 = 0$

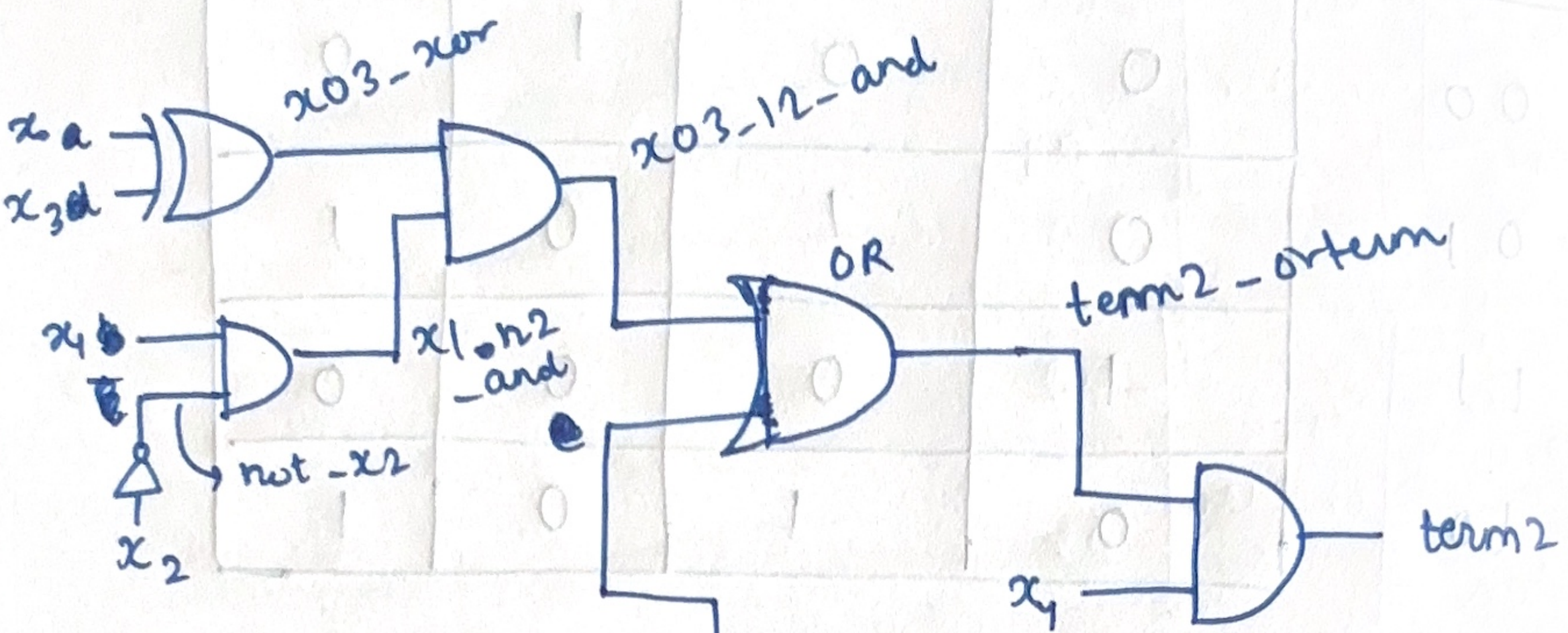
x_2x_3 \ x_0x_1	00	01	11	10
00	0	0	0	0
01	0	0	1	0
11	0	1	0	1
10	0	0	1	0

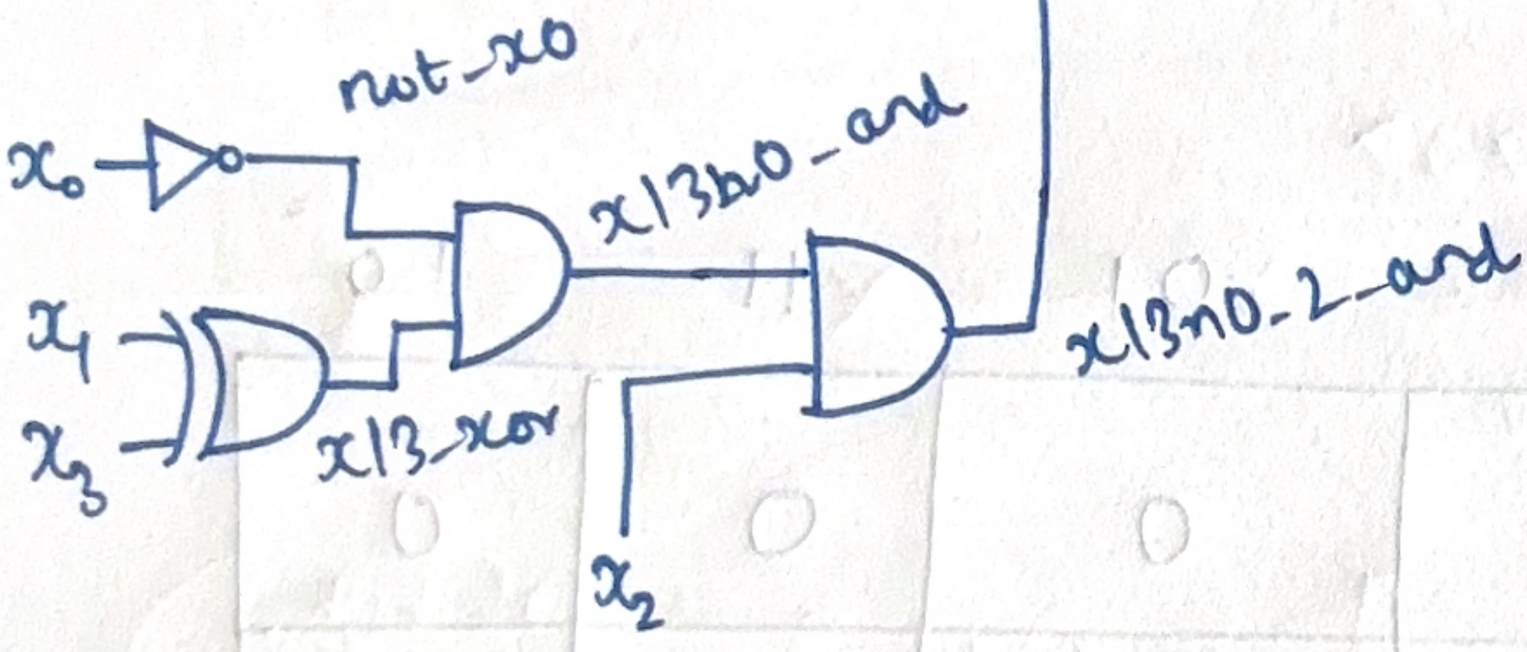
K-maps cannot reduce much but using XOR gates we can write:

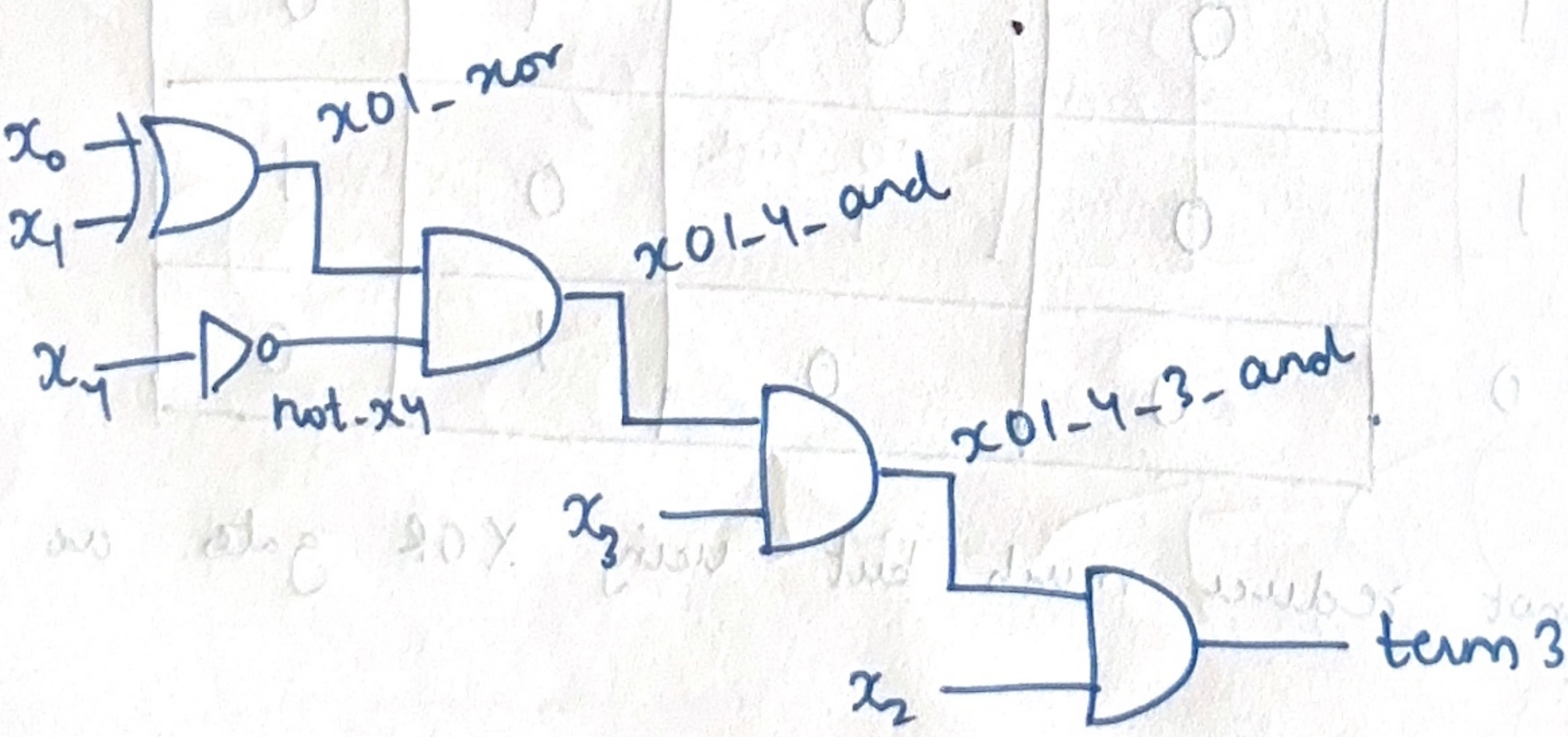
$$y = x_0(x_2 \oplus x_3)(x_1 \oplus x_4) + x_4(x_1\overline{x}_2(x_0 \oplus x_3) + \overline{x}_0 x_2(x_1 \oplus x_3)) + x_2x_3\overline{x}_4(x_0 \oplus x_1)$$

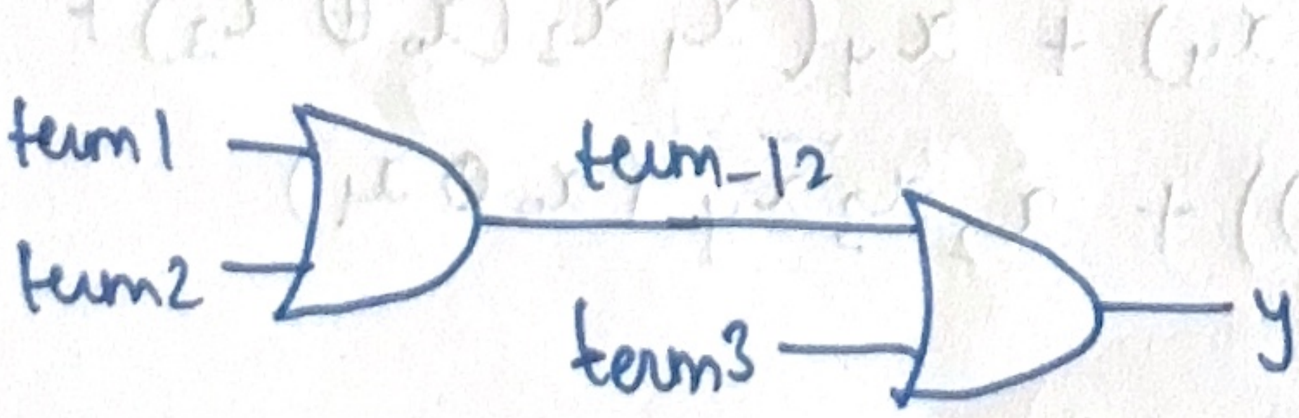
circuit diagram:











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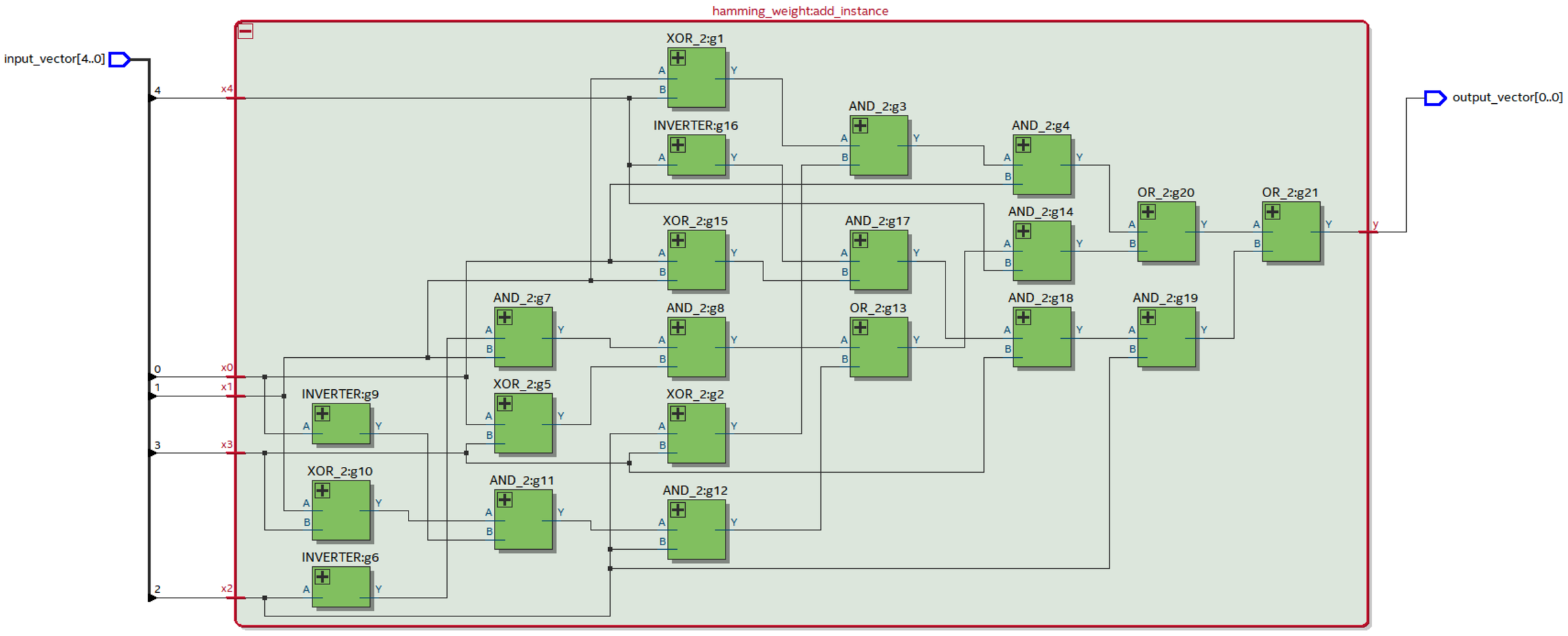
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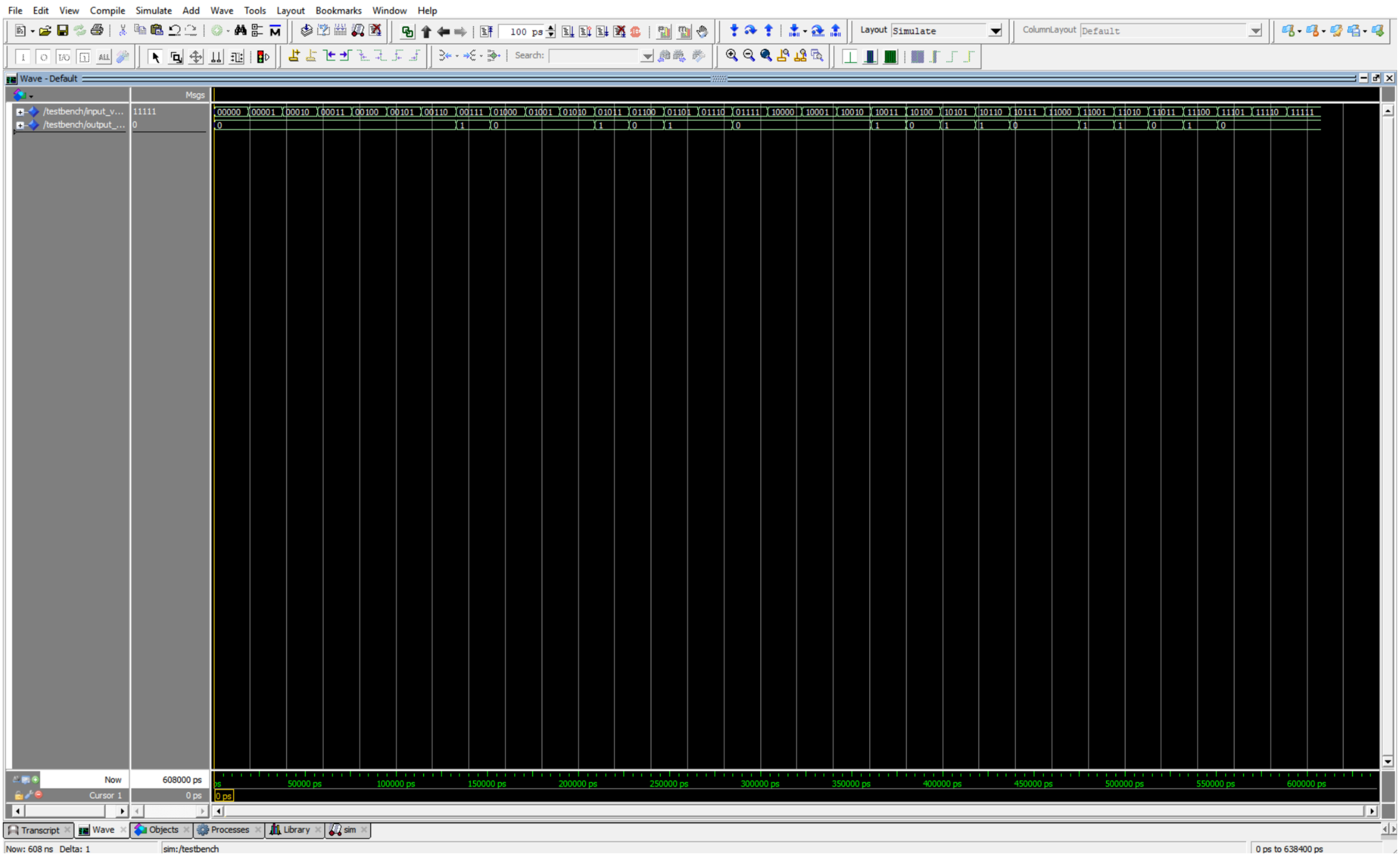
output_vector[0..0]
4
x4
0
x0
1
x1
3
x3
2
x2
XOR_2:g1
INVERTER:g16
AND_2:g3
AND_2:g4
OR_2:g20
OR_2:g21
XOR_2:g15
AND_2:g17
AND_2:g14
AND_2:g7
AND_2:g8
OR_2:g13
AND_2:g18
AND_2:g19
INVERTER:g9
XOR_2:g5
XOR_2:g2
XOR_2:g10
AND_2:g11
AND_2:g12
INVERTER:g6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Search:
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/testbench/output_...
11111
0
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0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1
Now
608000 ps
Cursor 1
0 ps
50000 ps 100000 ps 150000 ps 200000 ps 250000 ps 300000 ps 350000 ps 400000 ps 450000 ps 500000 ps 550000 ps 600000 ps
0 ps
Transcript
Wave
Objects
Processes
Library
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Now: 608 ns Delta: 1
sim:/testbench
0 ps to 638400 ps