CS 228 : Lab 4

18 February 2021 23:27

Q2 FullbitComp

⇒ Truth table for input 'a' and 'b' and outputs 'g', 'l' and 'e'

a	b	g (a>b)	l (a<b)	e (a==b)
00	00	0	0	1
00	01	0	1	0
00	10	0	1	0
00	11	0	1	0
01	00	1	0	0
01	01	0	0	1
01	10	0	1	0
01	11	0	1	0
10	00	1	0	0
10	01	1	0	0
10	10	0	0	1
10	11	0	1	0
11	00	1	0	0
11	01	1	0	0
11	10	1	0	0
11	11	0	0	1

K-Map reductions:–

g

$b_1b_0 \backslash a_1a_0$	00	01	11	10
00	0	1	1	1
01	0	0	1	1
11	0	0	0	0
10	0	0	1	0

1-implicant
2-implicant
1 implicant

$g = \sum m(1,2,3,6,7,11)$

$g = a_1\bar{b}_1 + a_0 a_1 \bar{b}_0 + a_0 \bar{b}_0 \bar{b}_1$ (using K-map)

l

$b_1b_0 \backslash a_1a_0$	00	01	11	10
00	0	0	0	0
01	1	0	0	0
11	1	1	0	1
10	1	1	0	0

1-implicant
2-implicant

$l = \sum m(4,8,9,12,13,14)$

$l = \bar{a}_1 b_1 + \bar{a}_0 \bar{a}_1 b_0 + \bar{a}_0 b_0 b_1$ (using K-map)

e

$b_1b_0 \backslash a_1a_0$	00	01	11	10
00	1	0	0	0
01	0	1	0	0
11	0	0	1	0
10	0	0	0	1

All are 0 implicants. So, no reduction possible using K-Maps.

$e = \sum m(0, 5, 10, 15)$

But we can write e as follows to reduce the no. of MUXs required

By sum of min-terms, we know that

$$1 = g + l + e = \sum_{i=0}^{15} m_i \quad \text{— (1)}$$

and $ge = 0$, $le = 0$ (as they have 0 common min-terms)

$$(g+l)e = 0 \quad \text{— (2)}$$

Multiplying $\overline{(g+l)}$ in (1) —

$$\overline{(g+l)} = 0 + e\cdot\overline{(g+l)} \quad (\text{using } p\cdot\bar{p} = 0)$$

$$e\cdot\overline{(g+l)} = \overline{g+l}$$

$$e(\underbrace{g+l + \overline{g+l}}_{1}) = \overline{g+l} \quad (\text{Adding (2)})$$

$$\boxed{e = \bar{g}\cdot\bar{l}}$$