

Kemal Pulungan EE10a Set 1

1) Adsorption:

$$A \cdot (\bar{A} + B) = A \cdot B$$

$$A + (\bar{A} \cdot B) = A + B$$

$$(A \cdot \bar{A}) + (A \cdot B)$$

distributive

$$(A + \bar{A}) \cdot (A + B)$$

$$0 + A \cdot B$$

complement

$$1 \cdot (A + B)$$

$$A \cdot B$$

identity

$$A + B$$

$$\text{therefore, } A \cdot (\bar{A} + B) = A \cdot B \quad \text{and} \quad A + (\bar{A} \cdot B) = A + B$$

$$\textcircled{2} \quad \begin{array}{ccc} 0010_2 & \rightarrow & 1100_2 \\ D_3 D_2 D_1 D_0 \\ 2_{10} & \rightarrow & 12_{10} \end{array}$$

2, 3, 12 lose 7, 11 win

others neither

Design first null

input: 4 bits

Output: tells Win or Lose

neither \rightarrow both are inactive

Decimal	D ₃	D ₂	D ₁	D ₀	W	L
2	0	0	1	0	0	1
3	0	0	1	1	0	1
4	0	1	0	0	0	0
5	0	1	0	1	0	0
6	0	1	1	0	0	0
7	0	1	1	1	1	0
8	1	0	0	0	0	0
9	1	0	0	1	0	0
10	1	0	1	0	0	0
11	1	0	1	1	1	0
12	1	1	0	0	0	1

$$W = D_2 D_1 D_0 + D_3 D_1 D_0$$

$$= D_1 D_0 (D_2 + D_3)$$

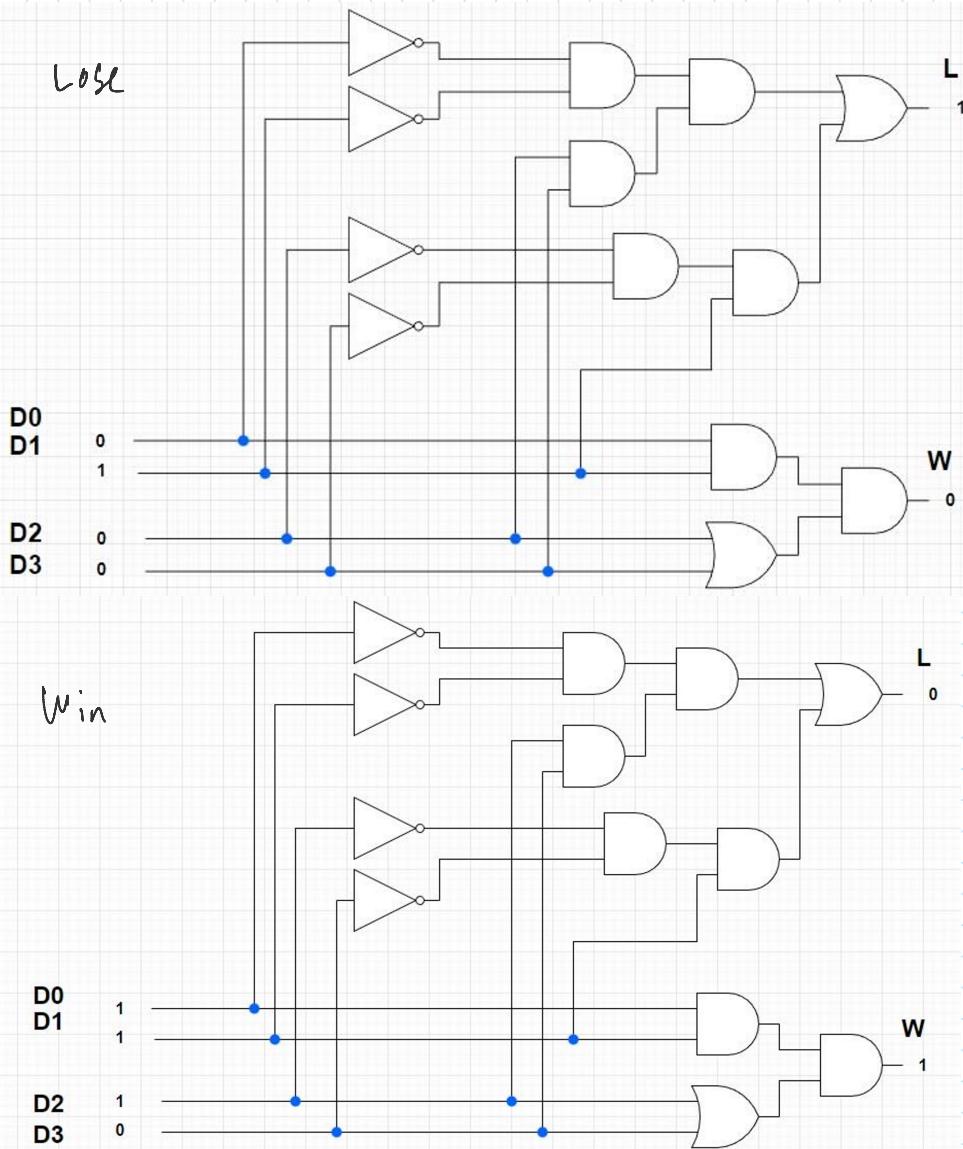
$D_3 D_2$	$D_2 D_1$	$D_1 D_0$	$D_3 D_0$	$D_3 D_2 D_0$	$D_2 D_1 D_0$	$D_1 D_0 D_0$	$D_3 D_2 D_1 D_0$
00	00	00	00	00	00	00	00
01	00	00	01	00	00	00	01
11	01	11	11	11	11	11	11
10	00	00	00	00	00	00	00

$$W = D_2 D_1 D_0 + D_3 D_0 D_0$$

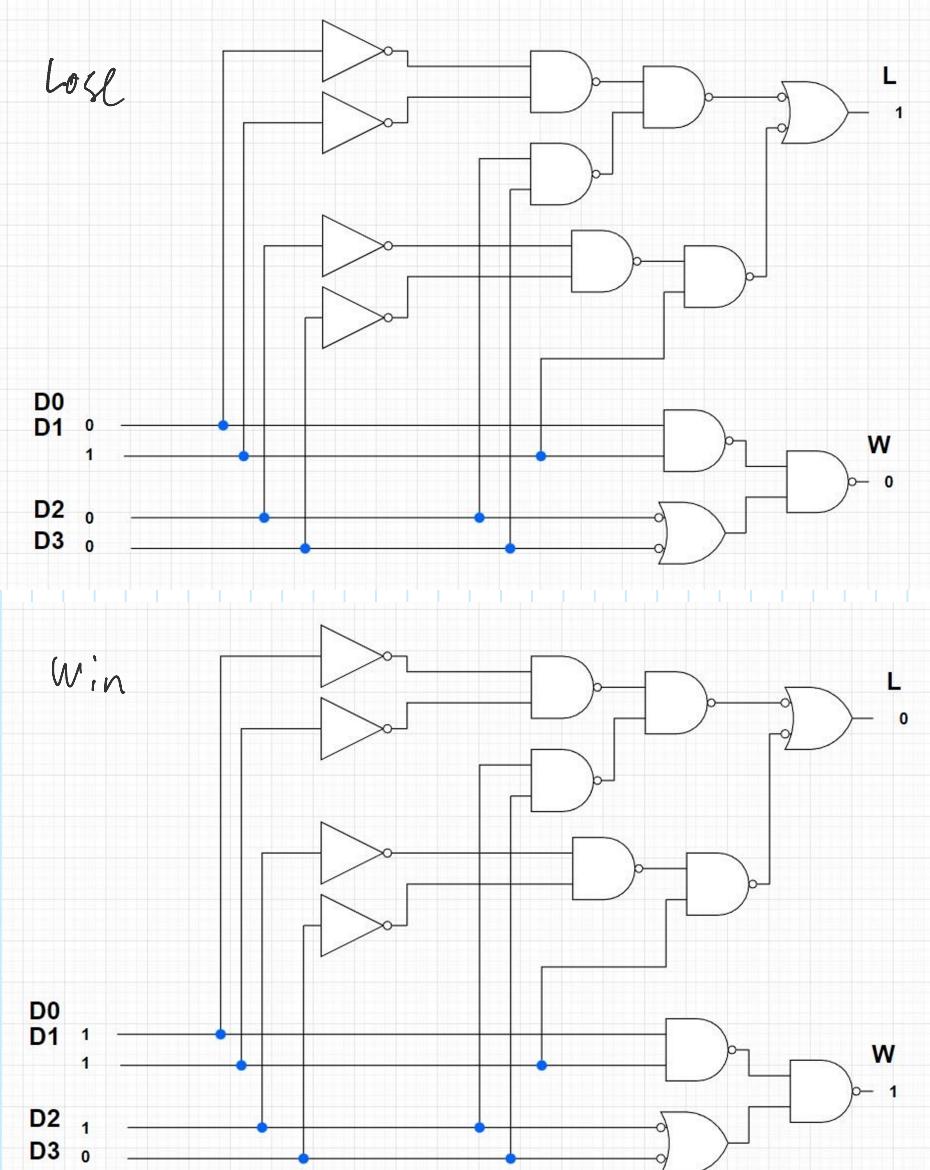
$D_3 D_2$	$D_2 D_1$	$D_1 D_0$	$D_3 D_0$	$D_3 D_2 D_0$	$D_2 D_1 D_0$	$D_1 D_0 D_0$	$D_3 D_2 D_1 D_0$
00	00	00	00	00	00	00	00
01	00	00	01	00	00	00	01
11	10	00	11	11	10	00	11
10	00	00	00	00	00	00	00

$$L = D_1 \overline{D_3} \overline{D_2} + D_3 D_2 \overline{D_1} \overline{D_0}$$

The following diagrams are the same AND/OR/Inverter circuit, just different inputs to give a Win and Lose scenario.



The following diagrams are the same NAND/NAND circuit, just different inputs to give a Win and Lose scenario.



Product of sums form - indicators at 0 mean win/loss

$$W = (\overline{D_2} + \overline{D_1} + \overline{D_0}) \cdot (\overline{D_3} + \overline{D_1} + \overline{D_0})$$

$$L = (\overline{D_1} + D_3 + D_2) \cdot (\overline{D_3} + \overline{D_2} + D_1 + D_0)$$

ie $W=1 \quad L=1$ neither

$W=0 \quad L=1$ win

$W=1 \quad L=0$ loss

W

$D_3 D_2$	$D_3 D_1$	$D_3 D_0$	$D_2 D_1$	$D_2 D_0$	$D_1 D_0$	W
00	01	11	10	11	11	1
01	11	11	11	11	11	1
11	11	11	11	11	11	1
10	11	11	11	11	11	1
11	11	11	11	11	11	1
00	01	11	10	11	11	1
01	11	11	11	11	11	1
11	11	11	11	11	11	1
10	11	11	11	11	11	1
11	11	11	11	11	11	1

$$W = \overline{D_1} + \overline{D_3} \overline{D_2} + D_1 \overline{D_3}$$

$$= D_1 \cdot (D_3 + D_2) \cdot (\overline{D_1} + D_0)$$

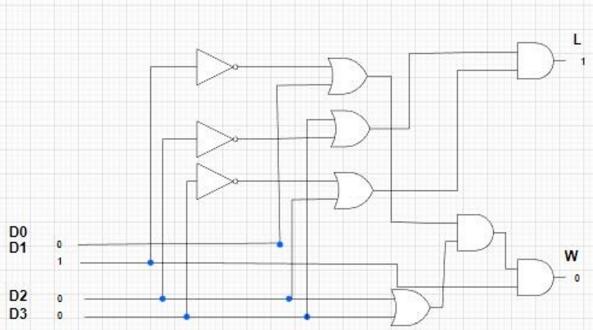
L

$D_3 D_2$	$D_3 D_1$	$D_3 D_0$	$D_2 D_1$	$D_2 D_0$	$D_1 D_0$	L
00	11	01	01	11	11	1
01	11	11	11	11	11	1
11	11	11	11	11	11	1
10	11	11	11	11	11	1
11	11	11	11	11	11	1
00	11	01	01	11	11	1
01	11	11	11	11	11	1
11	11	11	11	11	11	1
10	11	11	11	11	11	1
11	11	11	11	11	11	1

$$L = \overline{D_3} D_2 + D_3 \overline{D_2}$$

$$L = (D_3 + \overline{D_2}) \cdot (\overline{D_3} + D_2)$$

2b



2b N

