

CS2100 Tutorial 6
AY 24/25 Sem 2 — github/omgeta

Q1.

$$\begin{aligned}
 x \cdot y + x' \cdot z + y \cdot z &= x \cdot y + x' \cdot z + 1 \cdot y \cdot z && \text{(Identity)} \\
 &= x \cdot y + x' \cdot z + (x + x') \cdot y \cdot z && \text{(Complement)} \\
 &= x \cdot y + x' \cdot z + x \cdot y \cdot z + x' \cdot y \cdot z && \text{(Distributive)} \\
 &= x \cdot y + x \cdot y \cdot z + x' \cdot z + x' \cdot y \cdot z && \text{(Commutative)} \\
 &= (x \cdot y + x \cdot y \cdot z) + (x' \cdot z + x' \cdot y \cdot z) && \text{(Associative)} \\
 &= x \cdot y + x' \cdot z && \text{(Absorption 1)}
 \end{aligned}$$

Q2. (a.)

$$\begin{aligned}
 F(x, y, z) &= (x + y \cdot z') \cdot (y' + y) + x' \cdot (y \cdot z' + y) \\
 &= (x + y \cdot z') \cdot 1 + x' \cdot (y \cdot z' + y) && \text{(Complement law)} \\
 &= (x + y \cdot z') + x' \cdot (y \cdot z' + y) && \text{(Identity law)} \\
 &= x + y \cdot z' + x' \cdot y && \text{(Absorption 1)} \\
 &= x + x' \cdot y + y \cdot z' && \text{(Commutative law)} \\
 &= x + y + y \cdot z' && \text{(Absorption 2)} \\
 &= x + y && \text{(Absorption 1)}
 \end{aligned}$$

(b.)

$$\begin{aligned}
 G(p, q, r, s) &= \Pi M(5, 9, 13) \\
 &= (p + q' + r + s') \cdot (p' + q + r + s') \cdot (p' + q' + r + s') && \text{(Defn of maxterm)} \\
 &= ((p \cdot p') + (q' + r + s')) \cdot (p' + q + r + s') && \text{(Distributive law)} \\
 &= (0 + (q' + r + s')) \cdot (p' + q + r + s') && \text{(Complement law)} \\
 &= (q' + r + s') \cdot (p' + q + r + s') && \text{(Identity law)} \\
 &= (q' \cdot (p' + q)) + (r + s') && \text{(Distributive law)} \\
 &= (p' \cdot q') + (r + s') && \text{(Absorption 2)}
 \end{aligned}$$

Q3. (a.)

m0	m1	m5	m4
m2	m3	m7	m6
m10	m11	m15	m14
m8	m9	m13	m12

(b.) $T(A, B, C, D) = \Sigma m(0, 1, 2, 4, 5, 9) + X(6, 11, 14, 15)$

(c.)

1	1	1	1
1	0	0	X
0	X	X	X
0	1	0	0

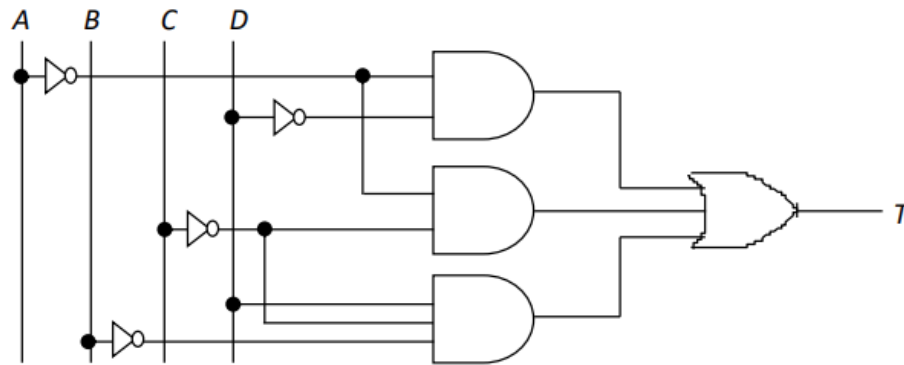
(d.) 4 : $A' \cdot D', A' \cdot C', A \cdot B' \cdot D, B' \cdot C' \cdot D$

(e.) 2 : $A' \cdot D', A' \cdot C'$

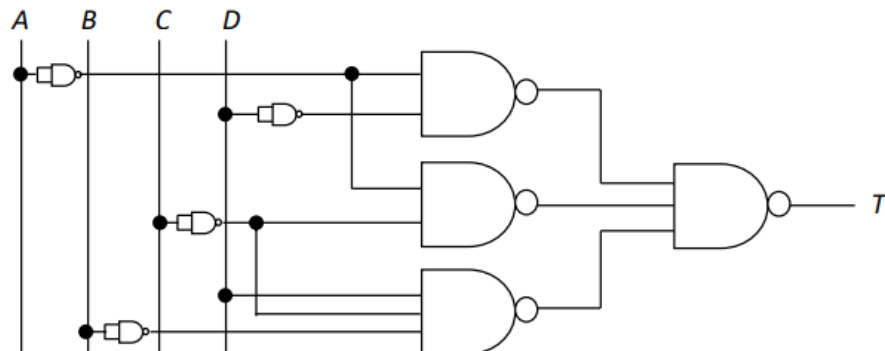
(f.) $A' \cdot D' + A' \cdot C' + B' \cdot C' \cdot D$ or $A' \cdot D' + A' \cdot C' + A \cdot B' \cdot D$

(g.) $(A' + D) \cdot (C' + D') \cdot (A' + B')$

(h.) 2-level AND-OR:



2-level NAND:



Q4. (a.)

K	L	M	N	X	Y	Z
0	0	0	1	0	1	1
0	0	1	0	0	0	1
0	0	1	1	0	0	1
0	1	0	0	0	1	1
0	1	0	1	0	1	1
0	1	1	0	0	0	1
0	1	1	1	0	0	1
1	0	0	0	0	0	0
1	0	0	1	0	0	0
1	0	1	0	0	0	0
1	0	1	1	0	0	0
1	1	0	0	1	1	0
1	1	0	1	0	1	0
1	1	1	0	0	1	0
1	1	1	1	1	1	0

(b.)

KL/MN	00	01	11	10
00	0	0	0	0
01	0	0	0	0
11	1	0	1	0
10	0	0	0	0

KL/MN	00	01	11	10
00	1	1	0	0
01	1	1	0	0
11	1	1	1	1
10	0	0	0	0

KL/MN	00	01	11	10
00	1	1	1	1
01	1	1	1	1
11	0	0	0	0
10	0	0	0	0

(c.) $X = K' \cdot L \cdot M' \cdot N + K \cdot L' \cdot M \cdot N' + K \cdot L \cdot M \cdot N$
 $Y = M \cdot N + K' \cdot N + K' \cdot M + L' \cdot M$
 $Z = K'$

(d.) $XYZ = 001$