

Homework 4 Solutions From Roth Textbook

2.1) a.

$$X * (\bar{X} + Y)$$

$$X * \bar{X} + X * Y$$

$$0 + X * Y$$

$$X * Y$$

c.

$$X * Y + X * \bar{Y}$$

$$X * (Y + \bar{Y})$$

$$X * 1$$

$$X$$

2.3) a.

$$\bar{X} * \bar{Y} * Z + (\overline{\bar{X} * \bar{Y} * Z})$$

$$= 1 \quad , \text{ by Thm 1}$$

d.

$$A * (C + \bar{D} * B) + \bar{A}$$

$$(A + \bar{A}) * (\bar{A} + C + \bar{D} * B) \quad , \text{ by Thm 8d}$$

$$\bar{A} + C + D * B$$

2.4)

b.

$$Y = A + B * (A * \bar{B} + (B + A * B))$$

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

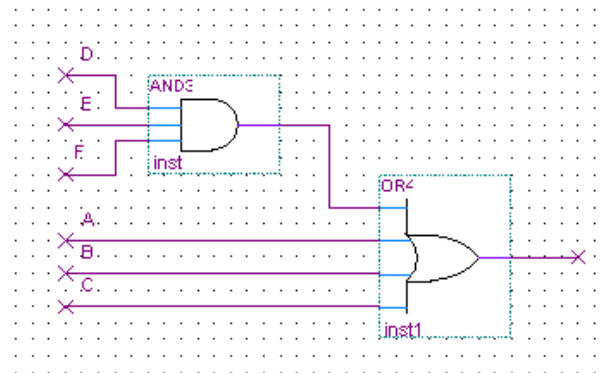
$$A + B * (A + B)$$

$$A + B$$

2.7) a.

$$(A + B + C + D) * (A + B + C + E) * (A + B + C + F)$$

$$(A + B + C) + D * E * F$$



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2.13)

a.

$$\begin{aligned} &(\bar{A} * A + B) + (B + B) \\ &0 + B + B + B \\ &B \end{aligned}$$

3.6)

b.

$$\begin{aligned} &(A + B + C + D) * (\bar{A} + \bar{B} + C + \bar{D}) * (\bar{A} + C) * (A + D) * (B + C + D) \\ &\text{rearrange...} \\ &\cancel{(A + B + C + D)} * \cancel{(B + C + D)} * \cancel{(\bar{A} + \bar{B} + C + \bar{D})} * (\bar{A} + C) * (A + D) \\ &(B + C + D) * (\bar{A} + C) * (A + D) \\ &(B + C + D) * (\bar{A} * D + A * C + C * D) \\ &(B + C + D) * (\bar{A} * D + A * C) \\ &\cancel{(\bar{A} * B * D + \bar{A} * C * D + \bar{A} * D)} + \cancel{(A * B * C + A * C + A * C * D)} \\ &\bar{A} * D + A * C \end{aligned}$$

3.9)

$$A \oplus B * C = (A \oplus B) * (A \oplus C)$$

Not true --> Counter example:

$$A = 1, B = 1, C = 0$$

$$\text{Left side: } 1 \oplus 1 * 0 = 1 \oplus 0 = 1$$

$$\text{Right side: } (1 \oplus 1) * (1 \oplus 0) = 0 * 1 = 0$$

3.14) a.

Roth 6th:
 3.15) a.

$$\begin{aligned} &\cancel{A * B * C * \bar{D}} + \cancel{\bar{A} * \bar{B} * C * D} + C * \bar{D} \\ &C * \bar{D} + \bar{A} * \bar{B} * C * D \\ &C * (\bar{D} + \bar{A} * \bar{B} * D) \\ &C * (\bar{D} + \bar{A} * \bar{B}) \\ &C * \bar{D} + \bar{A} * \bar{B} * C \end{aligned}$$

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3.18) b.

Roth 6th:
3.21) b.

$$\begin{aligned} & \overline{W}*\overline{Y} + W*Y*Z + X*\overline{Y}*Z + W*\overline{X}*Y \\ & \overline{W}*\overline{Y} + W*Y*Z + X*\overline{Y}*Z + W*\overline{X}*Y + W*X*Z \\ & \overline{W}*\overline{Y} + W*Y*Z + W*\overline{X}*Y + W*X*Z \\ & \overline{W}*\overline{Y} + W*\overline{X}*Y + W*X*Z \end{aligned}$$

3.27)

Roth 6th: 3.32)

a.

If $A + B = C$, then $A*\overline{D} + B*\overline{D} = C*\overline{D}$?

$A*\overline{D} + B*\overline{D}$	$C*\overline{D}$
$\overline{D}*(A + B)$	$(A + B)*\overline{D}$
$\overline{D}C$	$A*\overline{D} + B*\overline{D}$

b.

If $\overline{A}*B + \overline{A}*C = \overline{A}*D$, then $B + C = D$?

No --> Counterexample:

$A = 1, B = C = 0, D = 1$
If: $\overline{1}*0 + \overline{1}*0 = \overline{1}*1$
$0*0 + 0*0 = 0*1$
$0 = 0$
Then: $1 = 0 + 0$
$1 \neq 0$

c.

If $A + B = C$, then $A + B + D = C + D$

True:	$(A + B) + D$	$C + D$
	$C + D$	$(A + B) + D$

d.

if $A + B + C = C + D$, then $A + B = D$

No --> Counterexample:

$A = B = 0, C = 1, D = 1$

If:	$0 + 0 + 1 = 1 + 1$
	$1 = 1$
Then:	$0 + 0 = 1$
	$0 \neq 1$

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4.1) a.

J = Mr. Jones is in

E = Mr. Evans is in

U = Safe unlocked

B = Business hours

S = Security guard present

therefore, $U = (J + E) * B * S$

4.1) b.

O = Wear overshoes

R = Raining heavily

M = Mother says to

A = You are outside

S = Wearing suede shoes

therefore, $O = A * R * S + M$

4.6)

A	B	C	F	G
0	0	0	1	0
0	0	1	1	1
0	1	0	0	0
0	1	1	0	1
1	0	0	0	0
1	0	1	0	1
1	1	0	1	0
1	1	1	1	1

a.

$$F = (\bar{A} * \bar{B} * \bar{C} + \bar{A} * \bar{B} * C) + (A * B * \bar{C} + A * B * C)$$

$$F = \bar{A} * \bar{B} + A * B$$

b.

$$G = C$$

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4.7) a.

A	B	C	F
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	0

$$F = \bar{A} \cdot \bar{B} \cdot C + \bar{A} \cdot B \cdot \bar{C} + A \cdot \bar{B} \cdot \bar{C}$$

Prove that:

- a) $X \text{ xor } 0 = X$ **Ans:** If $X=0$, then $0 \text{ xor } 0 = 0=X$. If $X=1$, then $1 \text{ xor } 0 = 0-X$. QED
- b) $X \text{ xor } 1 = \bar{X}$ **Ans:** If $X=0$, then $0 \text{ xor } 1 = 1=\bar{X}$. If $X=1$, then $1 \text{ xor } 1 = 0 = \bar{X}$. QED