INF2270, exercise on combinational logic: solution

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A

$$[a \oplus b] \vee [(b \wedge c) \oplus (c \wedge a))] \tag{1}$$

Truth table:

a	b	c	F
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	0

Karnaugh map:

$_{bc}\backslash^{a}$	0	1
00	0	1
01	0	1
11	1	0
10	1	0

Resulting Boolean function:

$$(a \wedge \bar{b}) \vee (\bar{a} \wedge b) \tag{2}$$

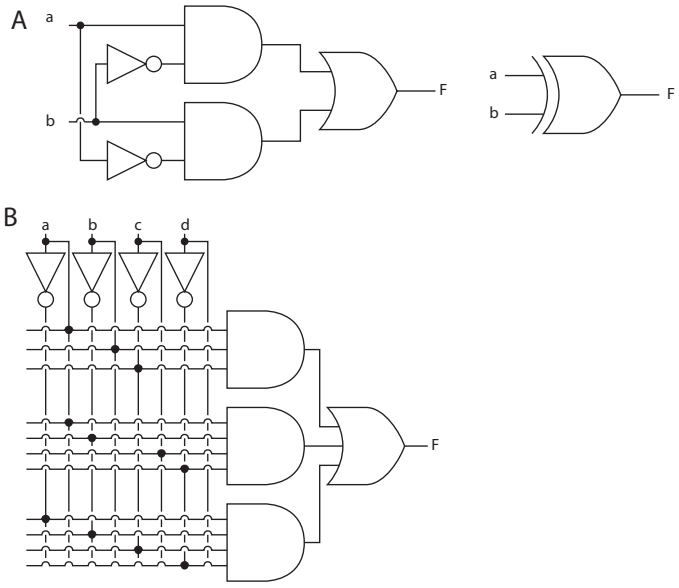

Figure 1: The resulting simplified circuits

B

Boolean function:

$$[((a \wedge b) \vee c) \vee (c \wedge (b \vee d))] \oplus [(c \wedge (b \vee d)) \oplus (\overline{(b \vee d) \vee a})] \tag{3}$$

Truth table:

a	b	c	d	F
0	0	0	0	1
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	0
1	1	0	0	1
1	1	0	1	1
1	1	1	0	0
1	1	1	1	0

Karnaugh map:

$_{\text{cd}}\backslash^{\text{ab}}$	00	01	11	10
00	1	0	1	0
01	0	0	1	0
11	0	0	0	0
10	0	0	0	1

Resulting Boolean function:

$$(\mathrm{a} \wedge \mathrm{b} \wedge \bar{\mathrm{c}}) \vee (\mathrm{a} \wedge \bar{\mathrm{b}} \wedge \mathrm{c} \wedge \bar{\mathrm{d}}) \vee (\bar{\mathrm{a}} \wedge \bar{\mathrm{b}} \wedge \bar{\mathrm{c}} \wedge \bar{\mathrm{d}}) \tag{4}$$