

Переходите на сайт, смотрите больше примеров или закажите свою работу

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### Задание

Составить таблицу истинности. Упростить выражение и снова составить таблицу истинности

$$((c \rightarrow a) - (a + \bar{c})) \vee ((d - b) \downarrow (b \sim d)) = ((a \downarrow b) \downarrow (c - b)) \wedge ((d \rightarrow a) - (c \wedge d))$$

### Решение

1) Расставим скобки согласно приоритету операции

$$F = (((c \rightarrow a) - (a + \bar{c})) \vee ((d - b) \downarrow (b \sim d))) = (((a \downarrow b) \downarrow (c - b)) \wedge ((d \rightarrow a) - (c \wedge d)))$$

Обозначим

$$F_1 = c \rightarrow a, F_2 = a + \bar{c}, F_3 = d - b, F_4 = b \sim d, F_5 = a \downarrow b, F_6 = c - b, F_7 = d \rightarrow a, F_8 = c \wedge d$$

$$G_1 = F_1 - F_2, G_2 = F_3 \downarrow F_4, G_3 = F_5 \downarrow F_6, G_4 = F_7 - F_8$$

$$H_1 = G_1 \vee G_2, H_2 = G_3 \wedge G_4$$

$$F = H_1 = H_2$$

Составим таблицу истинности

$$a - b = \overline{a \rightarrow b}$$

$a$	$b$	$c$	$d$	$\bar{c}$	$F_1$	$F_2$	$F_3$	$F_4$	$F_5$	$F_6$	$F_7$	$F_8$	$G_1$	$G_2$	$G_3$	$G_4$	$H_1$	$H_2$	$F$
0	0	0	0	1	1	1	0	1	1	0	1	0	0	0	0	1	0	0	1
0	0	0	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	1
0	0	1	0	0	0	0	0	1	1	1	1	0	0	0	0	1	0	0	1
0	0	1	1	0	0	0	1	0	1	1	0	1	0	0	0	0	0	0	1
0	1	0	0	1	1	1	0	0	0	0	1	0	0	1	1	1	1	1	1
0	1	0	1	1	1	1	0	1	0	0	0	0	0	0	1	0	0	0	1
0	1	1	0	0	0	0	0	0	0	0	1	0	0	1	1	1	1	1	1
0	1	1	1	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	1
1	0	0	0	1	1	0	0	1	0	0	1	0	1	0	1	1	1	1	1
1	0	0	1	1	1	0	1	0	0	0	1	0	1	0	1	1	1	1	1
1	0	1	0	0	1	1	0	1	0	1	1	0	0	0	0	1	0	0	1
1	0	1	1	0	1	1	1	0	0	1	1	1	0	0	0	0	0	0	1
1	1	0	0	1	1	0	0	0	0	0	1	0	1	1	1	1	1	1	1
1	1	0	1	1	1	0	0	1	0	0	1	0	1	0	1	1	1	1	1
1	1	1	0	0	1	1	0	0	0	0	1	0	0	1	1	1	1	1	1
1	1	1	1	0	1	1	0	1	0	0	1	1	0	0	1	0	0	0	1

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Получаем, что функция истинна

Упростим выражение

$$F = \left( ((c \rightarrow a) - (a + \bar{c})) \vee ((d - b) \downarrow (b \sim d)) \right) = \left( ((a \downarrow b) \downarrow (c - b)) \wedge ((d \rightarrow a) - (c \wedge d)) \right)$$

$$\begin{aligned} G_1 = F_1 - F_2 = \overline{F_1 - F_2} = F_1 \wedge \overline{F_2} &= (c \rightarrow a) \wedge \overline{a + \bar{c}} = (\bar{c} \vee a) \wedge (\overline{a + \bar{c}}) = (\bar{c} \vee a) \wedge (\overline{a} \wedge c) = \\ &= \overline{\bar{c} \wedge a} \wedge \overline{a} \wedge c = \overline{\bar{c} \wedge a} \wedge \overline{a} \wedge c = \overline{\bar{c} \wedge a} \wedge \overline{a} \wedge c \end{aligned}$$

$$\begin{aligned} G_2 = F_3 \downarrow F_4 = \overline{F_3 \vee F_4} = \overline{(d - b) \vee (b \sim d)} &= \overline{d - b} \wedge \overline{b \sim d} = (d \rightarrow b) \wedge \overline{bd \vee \bar{b}\bar{d}} = \\ &= (d \vee \bar{b}) \wedge (\bar{b} \vee \bar{d}) \wedge (b \vee d) = (d\bar{b} \vee \bar{b}\bar{d} \vee d\bar{b} \vee \bar{b}\bar{d}) \wedge (b \vee d) = (d\bar{b} \vee \bar{b}\bar{d}) \wedge (b \vee d) = \\ &= \bar{b}(b \vee d) = \bar{b}b \vee \bar{b}d = \bar{b}d \end{aligned}$$

$$H_1 = G_1 \vee G_2 = \overline{\bar{c} \wedge a} \wedge \overline{a} \wedge c \vee \bar{b}d$$

$$\begin{aligned} H_2 = G_3 \wedge G_4 = (F_5 \downarrow F_6) \wedge (F_7 - F_8) &= (\overline{F_5 \vee F_6}) \wedge (\overline{F_7} \wedge F_8) = \overline{F_5 F_6 F_7 F_8} = \\ &= \overline{a \downarrow bc - bd} \rightarrow a(c \wedge d) = (a \vee b)(c \rightarrow b)(\bar{d}a)(c \wedge d) = (a \vee b)(c \vee \bar{b})(\bar{d}a)(c \wedge d) = \\ &= (ac \vee bc \vee ab \vee b\bar{b})(c\bar{d}a \wedge d\bar{d}a) = (ac \vee bc \vee ab) c\bar{d}a = acc\bar{d}a \vee bcc\bar{d}a \vee abc\bar{d}a = \\ &= ac\bar{d} \vee abc\bar{d} \vee abc\bar{d} = ac\bar{d} \end{aligned}$$

$$\begin{aligned} H_1 = H_2 &= (\overline{\bar{c} \wedge a} \wedge \overline{a} \wedge c \vee \bar{b}d) ac\bar{d} \vee (\overline{\bar{c} \wedge a} \wedge \overline{a} \wedge c \vee \bar{b}d) ac\bar{d} = \overline{\bar{c} \wedge a} \wedge \overline{a} \wedge c \vee \bar{b}d \wedge ac\bar{d} \vee \overline{\bar{c} \wedge a} \wedge \overline{a} \wedge c \vee \bar{b}d \wedge ac\bar{d} \vee \\ &\vee (a \vee c)(\bar{a} \vee \bar{c})(\bar{d} \vee b)(\bar{a} \vee \bar{c} \vee d) = ac\bar{d} \vee (a\bar{a} \vee c\bar{a} \vee a\bar{c} \vee c\bar{c})(\bar{a}\bar{d} \vee \bar{c}\bar{d} \vee d\bar{d} \vee \bar{a}b \vee \bar{c}b \vee db) = \\ &= ac\bar{d} \vee (c\bar{a} \vee a\bar{c})(\bar{a}\bar{d} \vee \bar{c}\bar{d} \vee \bar{a}b \vee \bar{c}b \vee db) = ac\bar{d} \vee \bar{a}\bar{d}c\bar{a} \vee \bar{c}\bar{d}c\bar{a} \vee \bar{a}b\bar{c}\bar{a} \vee \bar{c}b\bar{c}\bar{a} \vee db\bar{c}\bar{a} \vee \\ &\vee \bar{a}\bar{d}a\bar{c} \vee \bar{c}\bar{d}a\bar{c} \vee \bar{a}b\bar{a}\bar{c} \vee \bar{c}b\bar{a}\bar{c} \vee db\bar{a}\bar{c} \vee \bar{a}\bar{c}\bar{b} = ac\bar{d} \vee \bar{d}c\bar{a} \vee \bar{d}c\bar{a} \vee b\bar{c}\bar{a} \vee db\bar{c}\bar{a} \vee \\ &\vee \bar{d}a\bar{c} \vee b\bar{a}\bar{c} \vee db\bar{a}\bar{c} \vee \bar{a}\bar{c}\bar{b} = c\bar{a}(\bar{d}c \vee \bar{d} \vee b \vee db) \vee ac(\bar{d} \vee d) \vee \bar{a}\bar{c}(b \vee \bar{b}) \vee \bar{a}\bar{c} = \\ &= c\bar{a} \vee ac \vee \bar{a}\bar{c} \vee \bar{a}\bar{c} = 1. \end{aligned}$$

Верно.