

数字电路基础 第三周作业：张悦老师

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日期：2020 年 10 月 3 日

作业内容：2.1-(2,6,7); 2.15-(2,5,8,9); 2.20-(c,d); 2.10-(2,4); 2.11-(4,5); 2.18-(6,7); 2.18-(8); 2.19-(2,5); 2.2-(2,3); 2.12-(1,3); 2.13-(2,3) 2.22-(1,4)

Problem 2.1

SubProblem 2

表 1: 2.1.2

A	0	1
$A \oplus 1$	1	0

表 3: 2.1.7

A	B	$(A \oplus B)'$	$A \oplus B \oplus 1$
0	0	1	1
0	1	0	0
1	0	0	0
1	1	1	1

SubProblem 6

表 2: 2.1.6

A	B	C	$A(B \oplus C)$	$AB \oplus AC$
0	0	0	0	0
0	0	1	0	0
0	1	0	0	0
0	1	1	0	0
1	0	0	0	0
1	0	1	1	1
1	1	0	1	1
1	1	1	0	0

$$\begin{aligned}
 Y &= AB'C + A' + B + C' \\
 &= B'C + A' + B + C' \\
 &= C + A' + B + C' \\
 &= 1
 \end{aligned}$$

SubProblem 5

$$\begin{aligned}
 Y &= AB'(A'CD + (AD + B'C')')(A' + B) \\
 &= (AB'A'CD + AB'((A' + D')(B + C)))(A' + B) \\
 &= AB'D'(B + C)(A' + B) \\
 &= AB'CD'(A' + B) \\
 &= 0
 \end{aligned}$$

SubProblem 7

Problem 2.15

SubProblem 2

SubProblem 8

$$\begin{aligned}
Y &= A + (B + C')(A + B' + C)(A + B + C) \\
&= A + (B'C)(A + B' + C)(A + B + C) \\
&= A + (B'C)(A + AB' + AC + \\
&\quad AB + BC + AC + B'C + C) \\
&= A + (B'C)(A + BC + B'C + C) \\
&= A + B'C(A + C) \\
&= A + AB'C + B'C \\
&= A + B'C
\end{aligned}$$

SubProblem 9

$$\begin{aligned}
Y &= BC' + ABC'E + B'(A'D' + AD)' \\
&\quad + B(AD' + A'D) \\
&= BC' + B'(A + D)(A' + D') \\
&\quad + B(AD' + A'D) \\
&= BC' + B'(A'D + AD') + B(AD' + A'D) \\
&= BC' + AD' + A'D
\end{aligned}$$

Problem 2.20

SubProblem c

$$\begin{aligned}
Y_1 &= ((AB')'(AD'C'))' \\
&= ((A' + B)(A' + C' + D))' \\
&= (A' + A'B + A'C' + BC' + A'D + BD)' \\
&= (A' + BC' + BD)' \\
&= A(BC')'(BD)' \\
&= A(B' + C)(B' + D') \\
&= (AB' + ACD') \\
&= \sum m(8, 9, 10, 11, 14)
\end{aligned}$$

$$\begin{aligned}
Y_2 &= ((AB')'(AC'D'))'(A'C'D)(ACD)' \\
&= (AB') + (AC'D') + (A'C'D) + (ACD) \\
&= \sum m(1, 5, 8, 9, 10, 11, 12, 15)
\end{aligned}$$

SubProblem d

$$\begin{aligned}
Y_1 &= (AB) + (C(A \oplus B)) \\
&= AB + C(A'B + AB') \\
&= AB + A'BC + AB'C \\
&= \sum m(3, 5, 6, 7)
\end{aligned}$$

$$Y_2 = A \oplus B \oplus C$$

(真值为 1 时, 输入为 001 111 101 011)

$$= \sum m(1, 3, 5, 7)$$

Problem 2.10 实际上还是求与或形式

SubProblem 2

$$\begin{aligned}
Y &= ABC'D + BCD + A'D \\
&= \sum m(1, 3, 5, 7, 9, 15)
\end{aligned}$$

SubProblem 4

$$\begin{aligned}
Y &= AB + ((BC)'(C' + D'))' \\
&= AB + (BC + CD) \\
&= \sum m(3, 6, 7, 11, 12, 13, 14, 15)
\end{aligned}$$

Problem 2.11

SubProblem 4

$$\begin{aligned}
Y &= BCD' + C + A'D \\
&= C + A'D \\
&= \prod M(0, 4, 8, 9, 12, 13)
\end{aligned}$$

SubProblem 5

$$Y = \prod M(0, 3, 5)$$

Problem 2.18

SubProblem 6

即在输入为 000, 001, 010, 101, 110, 111 时结果为 1。建立卡诺图, 如图 1, 结果为 $A'B' + AC + BC'$

SubProblem 7

即在输入为 0000, 0001, 0010, 0101, 1000, 1001, 1010, 1100, 1110 时结果为 1, 建立卡诺

A/BC	00	01	11	10
0	1	1		1
1		1	1	1

图 1: 2.18.6 卡诺图

图如图 2, 结果为 $B'C' + AC'D' + A'C'D + ACD' + B'CD'$ 。

AB/CD	00	01	11	10
00	1	1		1
01		1		
11	1			1
10	1	1		1

图 2: 2.18.7 卡诺图

SubProblem 8

即在输入为 001, 100, 111 时结果为 1, 建立卡诺图如图 3, 结果为 $A'B'C + AB'C' + ABC$ 。

A/BC	00	01	11	10
0		1		
1	1		1	

图 3: 2.18.8 卡诺图

Problem 2.19

SubProblem 2

$$\begin{aligned}
 Y &= A'(CD' + C'D) + BC'D + AC'D \\
 &\quad + A'CD' \\
 &= A'CD' + C'D
 \end{aligned}$$

SubProblem 5

$$\begin{aligned}
 Y &= (AB'C'D + AC'DE + B'DE' + AC'D'E)' \\
 &= (AB'C'D + B'DE' + AC'E)' \\
 &= (AC'(B'D + E) + B'DE)' \\
 &= ((AC')' + (B'D)'E')((B'D)' + E') \\
 &= (A' + C)(B + D') + (A' + C)E' \\
 &\quad + (B + D')E' \\
 &= A'B + A'D' + A'E' + BC + BE' \\
 &\quad + CD' + CE' + D'E'
 \end{aligned}$$

Problem 2.2

SubProblem 2

$$\begin{aligned}
 &(A + C')(B + D)(B + D') \\
 &= (A + C')(B + BD + BD') \\
 &= (A + C')B \\
 &= AB + BC'
 \end{aligned}$$

SubProblem 3

$$\begin{aligned}
 &((A + B + C')'C'D)' \\
 &\quad + (B + C')(AB'D + B'C') \\
 &= (A'B'CC'D)' \\
 &\quad + (AB'C'D + B'C') \\
 &= 1 + (AB'C'D + B'C') \\
 &= 1
 \end{aligned}$$

Problem 2.12

本题目的电路图通过 logisim 进行绘制

SubProblem 1

如图 4

$$\begin{aligned}
 Y &= (AB + BC + AC)'' \\
 &= ((AB)'(BC)'(AC'))'
 \end{aligned}$$

SubProblem 3

如图 5

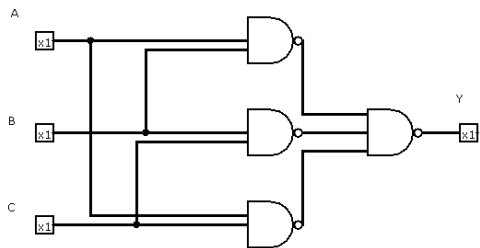


图 4: 2.12.1 电路

$$Y = ((ABC')'(AB'C')(A'BC)')''$$

$$= (((ABC')'(AB'C')(A'BC)')'1)'$$

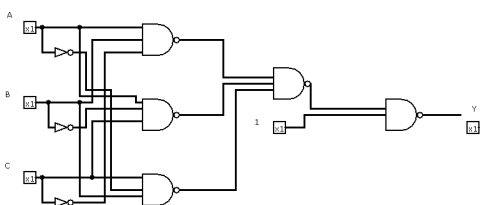


图 5: 2.12.3 电路

Problem 2.13

本题目的电路图通过 logisim 进行绘制

SubProblem 2

如图 6

$$Y = ((A + C)(A' + B + C')(A' + B' + C))''$$

$$= ((A + C)' + (A' + B + C')'$$

$$+ (A' + B' + C))'$$

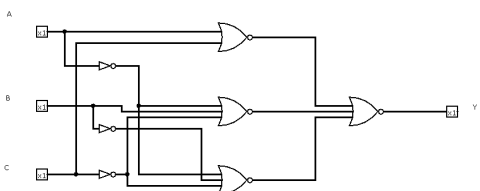


图 6: 2.13.2 电路

SubProblem 3

如图 7

$$Y = ((ABC' + B'C)'D' + A'B'D)''$$

$$= (((ABC' + B'C)'D')'(A'B'D)')'$$

$$= ((ABC' + B'C + D)(A + B + D'))'$$

$$= (ABC' + B'C + D)' + (A + B + D')'$$

$$= (((A' + B' + C)' + (B + C')' + D)'$$

$$+ (A + B + D')' + 0)'$$

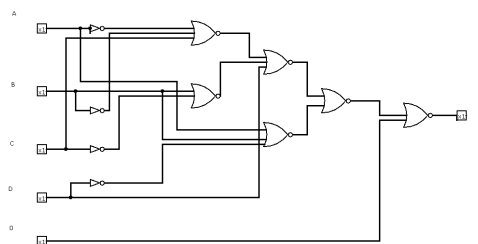


图 7: 2.13.3 电路

Problem 2.22

SubProblem 1

$$Y_1 = AB'C' + ABC + A'B'C + A'BC'$$

$$+ A'B'C' + A'BC + A'B'C' + A'BC$$

$$= B'C' + BC + A'B' + A'B$$

SubProblem 4

$$Y_4 = (AB' + B)CD' + ((A + B)(B' + C))'$$

$$= AB'CD' + BCD' + A'B' + BC'$$

$$= AB'CD' + BCD' + A'B' + BC'$$

$$+ ABCD' + ACD + BCD$$

$$= AC + BC + A'B' + BC'$$

$$= AC + B + A'B'$$