

## 第一章 开关理论基础

1. 将下列十进制数化为二进制数和八进制数

十进制	二进制	八进制
49	110001	61
53	110101	65
127	1111111	177
635	1001111011	1173
7.493	111.1111	7.74
79.43	10011001.0110111	231.334

2. 将下列二进制数转换成十进制数和八进制数

二进制	十进制	八进制
1010	10	12
111101	61	75
1011100	92	134
0.10011	0.59375	0.46
101111	47	57
01101	13	15

3. 将下列十进制数转换成 8421BCD 码

1997=0001 1001 1001 0111  
65.312=0110 0101.0011 0001 0010  
3.1416=0011.0001 0100 0001 0110  
0.9475=0.1001 0100 0111 0101

4. 列出真值表，写出 X 的真值表达式

A	B	C	X
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

$$X = \bar{A}BC + A\bar{B}C + AB\bar{C} + ABC$$

5. 求下列函数的值

当 A,B,C 为 0,1,0 时:  $\bar{A}B + BC = 1$

$$\begin{aligned}
 & (A+B+C)(\bar{A} + \bar{B} + \bar{C}) = 1 \\
 & (\bar{A} B + A \bar{C}) B = 1 \\
 \text{当 A,B,C 为 1,1,0 时:} & \quad \bar{A} B + BC = 0 \\
 & (A+B+C)(\bar{A} + \bar{B} + \bar{C}) = 1 \\
 & (\bar{A} B + A \bar{C}) B = 1 \\
 \text{当 A,B,C 为 1,0,1 时:} & \quad \bar{A} B + BC = 0 \\
 & (A+B+C)(\bar{A} + \bar{B} + \bar{C}) = 1 \\
 & (\bar{A} B + A \bar{C}) B = 0
 \end{aligned}$$

6. 用真值表证明下列恒等式

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

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

所以由真值表得证。

(2)  $\bar{A} \oplus \bar{B} \oplus \bar{C} = A \oplus B \oplus C$

A	B	C	$\bar{A} \oplus \bar{B} \oplus \bar{C}$	$A \oplus B \oplus C$
0	0	0	1	1
0	0	1	0	0
0	1	0	0	0
0	1	1	1	1
1	0	0	0	0
1	0	1	1	1
1	1	0	1	1
1	1	1	0	0

7. 证明下列等式

(1)  $A + \bar{A} B = A + B$

$$\begin{aligned}
 \text{证明: 左边} &= A + \bar{A} B \\
 &= A(B + \bar{B}) + \bar{A} B \\
 &= AB + A\bar{B} + \bar{A} B \\
 &= AB + A\bar{B} + AB + A\bar{B} \\
 &= A + B \\
 &= \text{右边}
 \end{aligned}$$

(2)  $ABC + A\bar{B}C + AB\bar{C} = AB + AC$

$$\begin{aligned}
 \text{证明: 左边} &= ABC + A\bar{B}C + AB\bar{C} \\
 &= ABC + A\bar{B}C + AB\bar{C} + ABC
 \end{aligned}$$

$$\begin{aligned}
 &= AC(B + \bar{B}) + AB(C + \bar{C}) \\
 &= AB + AC \\
 &= \text{右边}
 \end{aligned}$$

$$(3) \quad A + A\bar{B}\bar{C} + \bar{A}CD + (\bar{C} + \bar{D})E = A + CD + E$$

$$\text{证明: 左边} = A + A\bar{B}\bar{C} + \bar{A}CD + (\bar{C} + \bar{D})E$$

$$\begin{aligned}
 &= A + CD + A\bar{B}\bar{C} + \bar{C}\bar{D}E \\
 &= A + CD + \bar{C}\bar{D}E \\
 &= A + CD + E \\
 &= \text{右边}
 \end{aligned}$$

$$(4) \quad \bar{A}\bar{B} + \bar{A}\bar{B}\bar{C} + \bar{A}BC = \bar{A}\bar{B} + \bar{A}\bar{C} + \bar{B}\bar{C}$$

$$\begin{aligned}
 \text{证明: 左边} &= \bar{A}\bar{B} + \bar{A}\bar{B}\bar{C} + \bar{A}BC \\
 &= (\bar{A}\bar{B} + \bar{A}\bar{B}\bar{C}) + \bar{A}BC + \bar{A}\bar{B}\bar{C} \\
 &= \bar{A}\bar{B} + \bar{A}\bar{C} + \bar{B}\bar{C} = \text{右边}
 \end{aligned}$$

8. 用布尔代数化简下列各逻辑函数表达式

$$(1) \quad F = A + ABC + A\bar{B}\bar{C} + CB + \bar{C}\bar{B} = A + BC + \bar{C}\bar{B}$$

$$(2) \quad F = (A + B + \bar{C})(A + B + C) = (A + B) + C\bar{C} = A + B$$

$$(3) \quad F = ABC\bar{D} + ABD + BC\bar{D} + ABCD + B\bar{C} = AB + BC + BD$$

$$(4) \quad F = \overline{AC + \bar{A}BC + \bar{B}C + ABC} = BC$$

$$(5) \quad F = \overline{(A + B) + (A + \bar{B}) + (\bar{A}B)(\bar{A}\bar{B})} = \bar{A}\bar{B}$$

9. 将下列函数展开为最小项表达式

$$(1) \quad F(A, B, C) = \Sigma(1, 4, 5, 6, 7)$$

$$(2) \quad F(A, B, C, D) = \Sigma(4, 5, 6, 7, 9, 12, 14)$$

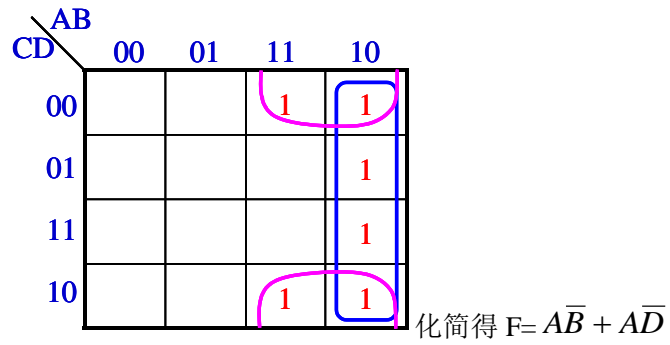
10. 用卡诺图化简下列各式

$$(1) \quad F = \overline{AC + \bar{A}BC + \bar{B}C + ABC}$$

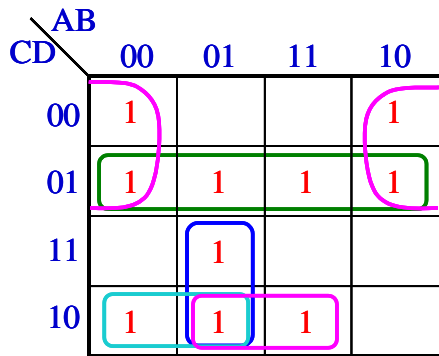
		AB			
		C	00	01	11
C	0	1	1	1	1
	1	0	0	0	0

化简得  $F = \bar{C}$

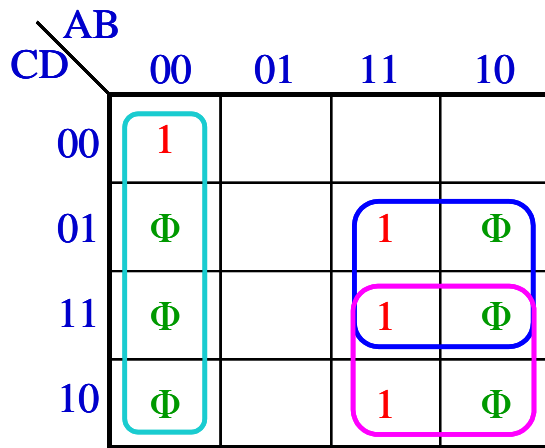
$$(2) \quad F = \bar{A}\bar{B}CD + \bar{A}BC\bar{D} + \bar{A}\bar{B} + \bar{A}\bar{D} + \bar{A}\bar{B}\bar{C}$$



(3)  $F(A,B,C,D) = \Sigma m(0,1,2,5,6,7,8,9,13,14)$

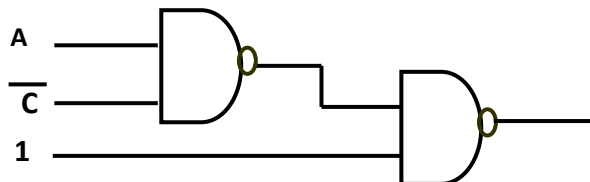


(4)  $F(A,B,C,D) = \Sigma m(0,13,14,15) + \Sigma \phi(1,2,3,9,10,11)$

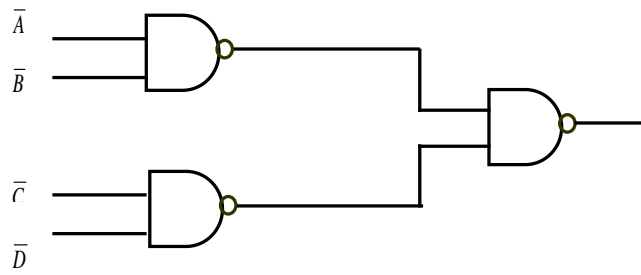


11. 利用与非门实现下列函数，并画出逻辑图。

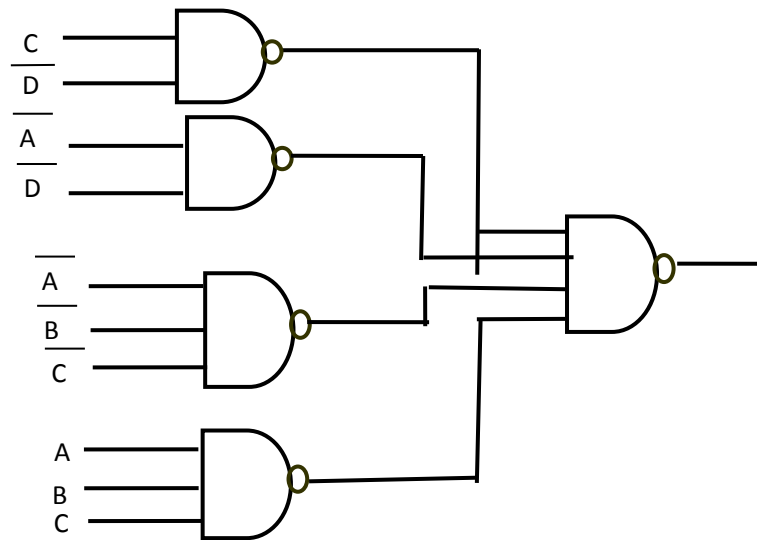
(1)  $F = ABC\bar{C} + A\bar{B}\bar{C} = \overline{\overline{A}\bar{C}} \cdot 1$   
 $F \Leftarrow (A \text{ nand } (\text{not } C)) \text{ nand } 1$



$$(2) F = \overline{(A+B)(C+D)} = \overline{\overline{\overline{A}\overline{B}}\overline{\overline{C}\overline{D}}}$$



$$(3) F(A,B,C,D) = \sum m(0, 1, 2, 4, 6, 10, 14, 15) = \overline{(CD)(AD)(ABC)(ABC)}$$



12. 已知逻辑函数  $X = \overline{A}\overline{B} + \overline{B}\overline{C} + \overline{C}\overline{A}$ ，试用以下方法表示该函数

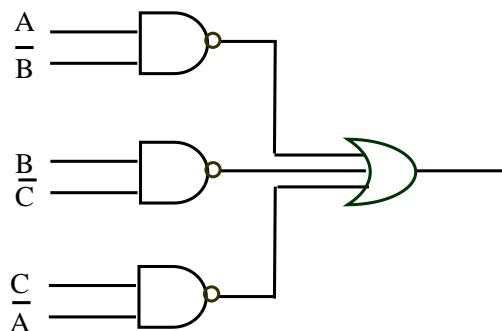
真值表：

A	B	C	X
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

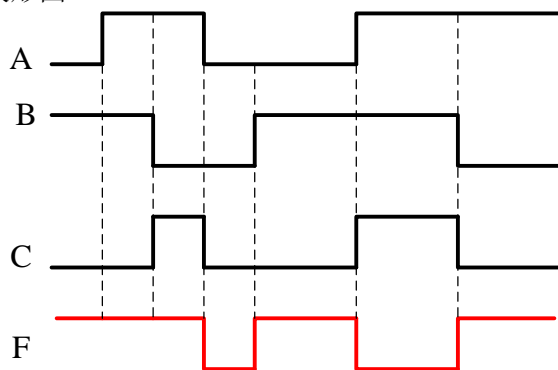
卡诺图：

AB					
C		00	01	11	10
0			1	1	1
1		1	1		1

逻辑图:



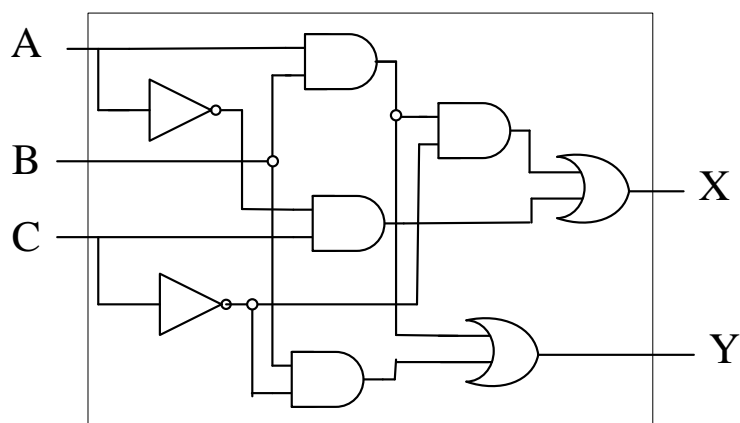
波形图



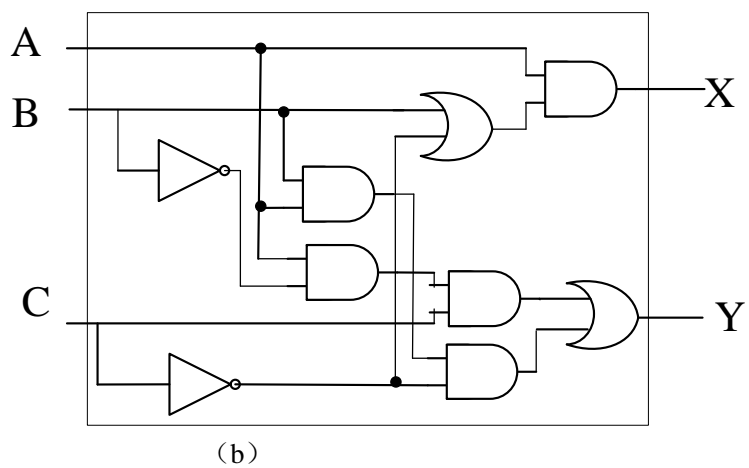
VHDL 语言

$X \leq (A \text{ and not } B) \text{ or } (B \text{ and not } C) \text{ or } (C \text{ and not } A)$

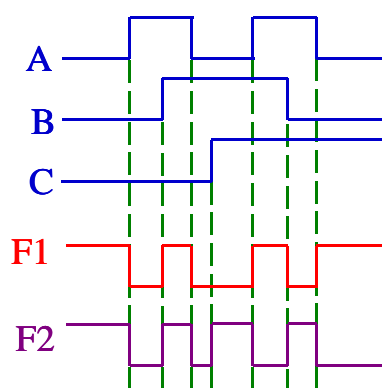
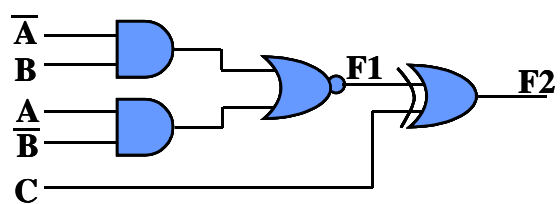
13. 根据要求画出所需的逻辑电路图。



(a)



14..画出 F1,F2 的波形



解：

$$F1 = \overline{A} \oplus B$$

$$F2 = F1 \oplus C$$