**练习三**

**3.1**

A

电路

F

输入有高，输出为低

输入全低，输出为高

B

C

正逻辑 负逻辑

|  |  |  |  |
| --- | --- | --- | --- |
| A | B | C | F |
| 0 | 0 | 0 | 1 |
| 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 0 |
| 1 | 0 | 0 | 0 |
| 1 | 0 | 1 | 0 |
| 1 | 1 | 0 | 0 |
| 1 | 1 | 1 | 0 |

|  |  |  |  |
| --- | --- | --- | --- |
| A | B | C | F |
| 1 | 1 | 1 | 0 |
| 1 | 1 | 0 | 1 |
| 1 | 0 | 1 | 1 |
| 1 | 0 | 0 | 1 |
| 0 | 1 | 1 | 1 |
| 0 | 1 | 0 | 1 |
| 0 | 0 | 1 | 1 |
| 0 | 0 | 0 | 1 |

F== F==

A

A

F

+

F

B

B

C

C

3.2 Z/+ Z/- Z/+ Z/-

   

X/+ Y/- X/+ Y/- X/- Y/+ X/- Y/+

与非 与 或 或非

**3.3**

表达式：F=(x1+x2)(+x2+)(x1+x3)

=(x1x2+x1)(x1+x3)

=x1

=x1

Z=x1

真值表：

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| X1 | X2 | X3 | F | Z |
| 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 | 0 |
| 0 | 1 | 0 | 0 | 0 |
| 0 | 1 | 1 | 1 | 1 |
| 1 | 0 | 0 | 1 | 1 |
| 1 | 0 | 1 | 0 | 1 |
| 1 | 1 | 0 | 1 | 1 |
| 1 | 1 | 1 | 1 | 0 |

**3.4**

表达式：

L=

=+B+C

=

=)+C(

=

=

=

真值表

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

|  |  |  |  |
| --- | --- | --- | --- |
| A | B | C | L |
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 |
| 0 | 1 | 0 | 1 |
| 0 | 1 | 1 | 1 |
| 1 | 0 | 0 | 0 |
| 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 0 |

**3.5**

表达式：

|  |  |  |
| --- | --- | --- |
| S2 | S1 | Di |
| 0 | 0 | Qi |
| 0 | 1 | Qi+1 |
| 1 | 0 | Qi-1 |
| 1 | 1 | Pi |

**3.6**

Y4=X4

Y3=X3⊕X4

Y2=X2⊕

=X2⊕(MX3+

=X2⊕(MX3+X4+X3)

**3.10**

（1）F1=

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| AB  CD | 00 | 01 | 11 | 10 |
| 00 |  | 0 | 1 | 1 |
| 01 |  | 1 | 1 | 1 |
| 11 |  | 1 | 0 | 1 |
| 10 |  | 1 | 1 | 1 |

（3）F3=

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| AB  CD | 00 | 01 | 11 | 10 |
| 00 |  | 1 |  | 1 |
| 01 | 1 | 1 |  | 1 |
| 11 | 1 | 1 |  |  |
| 10 | 1 | 1 |  |  |

**3.7优先编码器**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| + | - | × | ÷ | A | B | C |
| 1 | \* | \* | \* | 1 | 1 | 1 |
| 0 | 1 | \* | \* | 1 | 1 | 0 |
| 0 | 0 | 1 | \* | 1 | 0 | 1 |
| 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**3.8二进制编码器**

（1）5-32 单级 5\*32=160

双级（2,3）双级 （2\*4+3\*8）+2\*32=96

（2）6-64 单级 6\*64=384

双级（3-8,3-8） 双级 （3\*8\*2）+2\*64=176

（3）4096个输入为 12-4096

单级 12\*4096=49152

双级 （6,6） （6\*64\*2）+2\*4096=8960

（4）14-16384 译码器

单级 14\*16384=229376

**3.9**

（1）F=

（2）F(ABCD)=∑（3,5,6,9,10,12）

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| AB  CD | 00 | 01 | 11 | 10 |
| 00 |  |  | 1 |  |
| 01 |  | 1 |  | 1 |
| 11 | 1 |  |  |  |
| 10 |  | 1 |  | 1 |

（3）F(ABCD)=∑（1,2,4,7,8,11,13,14）

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| AB  CD | 00 | 01 | 11 | 10 |
| 00 |  | 1 |  | 1 |
| 01 | 1 |  | 1 |  |
| 11 |  | 1 |  | 1 |
| 10 | 1 |  | 1 |  |

**3.10** 设计电路 判别 X=ABCD

(2)6≤X≤12

变量：输入A，B，C，D为四位二进制数

输出F2=

图表：

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| AB  CD | 00 | 01 | 11 | 10 |
| 00 |  |  | 1 | 1 |
| 01 |  |  |  | 1 |
| 11 | 0 | 1 |  | 1 |
| 10 | 0 | 1 |  | 1 |

表达式：

F2=BC+A

电路：

F

+

B C A A

**3.12** 全减器

变量 输入：被减数A,减数B，低位借位C

输出：差S，借位Cout

图表：

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

S=

=

=(A⊕B))C=A⊕B⊕C

Cout=C+

=

=

=⊕C)+BC

**3.13**

变量 输入：A，B，C，D为8421BCD码

输出：F=

图表：

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| AB  CD | 00 | 01 | 11 | 10 |
| 00 | 1 |  | \* | 1 |
| 01 | 1 |  | \* | 1 |
| 11 |  | 1 | \* | \* |
| 10 | 1 |  | \* | \* |

F=

F

̅ B C D

**3.14**变量 输入：X4,X3,X2,X1 四位二进制数，且X不大于9

输出：Y4,Y3,Y2,Y1

Y=Y4Y3Y2Y1=

图表：

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| X4X3  X2X1 | 00 | 01 | 11 | 10 |
| 00 | 0000 | 0100 | \* | 1011 |
| 01 | 0001 | 1000 | \* | 1100 |
| 11 | 0011 | 1010 | \* | \* |
| 10 | 0010 | 1001 | \* | \* |

表达式：

Y4=X3X1+X3X2+X4

Y3=X3·+X4X1

Y2=X2+X2X1+X4

Y1=

**3.16**设X=X2X1,设计电路实现

（1）Y=

变量 输入：X=X2X1

输出：Y==Y4Y3Y2Y1

图表：

|  |  |  |
| --- | --- | --- |
| X2  X1 | 0 | 1 |
| 0 | 0000 | 0100 |
| 1 | 0001 | 1001 |

表达式：Y4=X2X1,Y3=X2,Y2=0,Y1=X1

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（1）变量

输入 A,B,C,D为8421BCD码

输出 Fa, Fb, Fc,…=

（2）图表

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| AB  CD | 00 | 01 | 11 | 10 |
| 00 | 1111110 | 0110011 | \* | 1111111 |
| 01 | 0110000 | 1011011 | \* | 1111011 |
| 11 | 1111001 | 1110000 | \* | \* |
| 10 | 1101101 | 1011111 | \* | \* |

Fa Fb Fc

（3）表达式

Fa=+BD+A+C

Fb=++CD

Fc=B++D

Fd=+C+BD+A+C

Fe=+C

Ff=+B+B+A

Fg=+B+B+A

**3.17**设计七段显示译码器

输入：A,B,C,D为8421BCD码

输出：Fa，Fb,……=

Fa=+BD+A+C

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| AB  CD | 00 | 01 | 11 | 10 |
| 00 | 1 | 0 | \* | 1 |
| 01 | 0 | 1 | \* | 1 |
| 11 | 1 | 1 | \* | \* |
| 10 | 1 | 1 | \* | \* |

Fb=++CD

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| AB  CD | 00 | 01 | 11 | 10 |
| 00 | 1 | 1 | \* | 1 |
| 01 | 1 | 0 | \* | 1 |
| 11 | 1 | 1 | \* | \* |
| 10 | 1 | 0 | \* | \* |

Fc=B++D

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| AB  CD | 00 | 01 | 11 | 10 |
| 00 | 1 | 1 | \* | 1 |
| 01 | 1 | 1 | \* | 1 |
| 11 | 1 | 1 | \* | \* |
| 10 | 0 | 1 | \* | \* |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| A | B | C | D | 字形 | Fa | Fb | Fc | … |
| 0 | 0 | 0 | 0 | 口 | 1 | 1 | 1 | … |
| 0 | 0 | 0 | 1 | **|** | 0 | 1 | 1 | … |

**3.18** 设计求补码电路 4位

输入：X=X4X3X2X1 为4位原码

输出：Y=Y4Y3Y2Y1 为4位补码

（1）直接设计

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| X4X3  X2X1 | 00 | 01 | 11 | 10 |
| 00 | 0000 | 0100 | 1100 | 0000 |
| 01 | 0001 | 0101 | 1011 | 1111 |
| 11 | 0011 | 0111 | 1001 | 1101 |
| 10 | 0010 | 0110 | 1010 | 1110 |

Y4=X4

Y3=X3+X4X2+X4X1+X3

Y2=

Y1=X1

(2)模块法

Y4=X4

用加法器实现加1

用X4控制取反

Y4 Y3 Y2 Y1

FA

⊕

FA

FA

FA

⊕

⊕

X4

0 0 0 0

X4 X3 X2 X1