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\_\_ \_计算机 \_\_学院 \_\_\_\_专业 \_\_班

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实验题目\_\_\_\_\_\_\_\_\_\_\_\_基于实验箱的数字逻辑实验\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |
| --- | --- | --- |
| 序号 | 实验内容 | 完成情况 |
| 1 | 基本门电路及门电路综合实验 |  |
| 2 | 组合逻辑电路实验 |  |
| 3 | 时序逻辑电路实验 |  |
| 4 | 组合及时序逻辑电路综合实验 |  |
| 5 | 小考核：在规定时间内完成老师布置的题目 |  |

**实验报告**

## 基本门电路及门电路综合实验

**一、实验目的**

1. 了解基本门电路的主要用途以及验证它们的逻辑功能。

2. 熟悉数字电路实验箱的使用方法。

3. 掌握利用基本门电路来实现具体电路的方法。

4. 掌握电路变换的方法。

**二、实验仪器及元器件**

1. 数字逻辑与系统设计实验箱。

2. 元器件：与非门74HC00、或非门74HC02、非门74HC04、与门74HC08、或门74HC32、异或门74HC86。

**三、实验原理**

数字电路研究的对象是电路的输入与输出之间的逻辑关系，这些逻辑关系是由逻辑门电路的组合来实现的。门电路是数字电路的基本逻辑单元。要实现基本逻辑运算和复合逻辑运算可用这些单元电路（门电路）进行搭建。门电路以输入量作为条件，输出量作为结果，输入与输出量之间满足某种逻辑关系（即“与、或、非、异或”等关系）。

电路输入与输出量均为二值逻辑的1和0两种逻辑状态。实验中用高低电平分别表示为正逻辑的1和0两种状态。

输出端的1和0两种逻辑状态可用两种方法判定：①将电路的输出端接实验箱的某一位LED，当某一位的LED灯亮时，该位输出高电平，表示逻辑“1”；LED灯不亮时，输出低电平，表示逻辑“0”。②用逻辑笔功能区可以测量输出端的逻辑值。

**四、实验预习:**

**画出以下电路的真值表、逻辑图、实验箱上的芯片连线图（左边输入，右边输出）。**

1、与非门74HC00

2、或非门74HC02

3、非门74HC04

4、与门74HC08

5、或门74HC32

6、异或门74HC86

7、举重比赛裁判表决电路（方案一）

**真值表、逻辑表达式、逻辑图、实验箱上的芯片连线图。**

8、举重比赛裁判表决电路（方案二）

**真值表、逻辑表达式、逻辑图、实验箱上的芯片连线图。**

9、交通灯故障检测电路

**真值表、逻辑表达式、逻辑图、实验箱上的芯片连线图。**

**五、实验结果和数据处理:** 在实验箱上连线、测试、记录数据、拍照（典型数据）。

请将实验数据填到表2-1至表2-10中。

表2-1 74HC00输入输出状态

|  |  |  |  |
| --- | --- | --- | --- |
| 输入端 | | 输出端Y | |
| A | B | LED（亮/灭） | 逻辑状态 |
| 0 | 0 |  |  |
| 0 | 1 |  |  |
| 1 | 0 |  |  |
| 1 | 1 |  |  |

表2-2 74HC02输入输出状态

|  |  |  |  |
| --- | --- | --- | --- |
| 输入端 | | 输出端Y | |
| A | B | LED（亮/灭） | 逻辑状态 |
| 0 | 0 |  |  |
| 0 | 1 |  |  |
| 1 | 0 |  |  |
| 1 | 1 |  |  |

表2-3 74HC04输入输出状态

|  |  |  |
| --- | --- | --- |
| 输入端 | 输出端Y | |
| A | LED（亮/灭） | 逻辑状态 |
| 0 |  |  |
| 1 |  |  |

表2-4 74HC08输入输出状态

|  |  |  |  |
| --- | --- | --- | --- |
| 输入端 | | 输出端Y | |
| A | B | LED（亮/灭） | 逻辑状态 |
| 0 | 0 |  |  |
| 0 | 1 |  |  |
| 1 | 0 |  |  |
| 1 | 1 |  |  |

表2-5 74HC32输入输出状态

| 输入端 | | 输出端Y | |
| --- | --- | --- | --- |
| A | B | LED（亮/灭） | 逻辑状态 |
| 0 | 0 |  |  |
| 0 | 1 |  |  |
| 1 | 0 |  |  |
| 1 | 1 |  |  |

表2-6 74HC86输入输出状态

|  |  |  |  |
| --- | --- | --- | --- |
| 输入端 | | 输出端Y | |
| A | B | LED（亮/灭） | 逻辑状态 |
| 0 | 0 |  |  |
| 0 | 1 |  |  |
| 1 | 0 |  |  |
| 1 | 1 |  |  |

表2-7 举重比赛裁判表决电路输入输出状态（方案一）

|  |  |  |  |
| --- | --- | --- | --- |
| 输入端 | | | 输出端 |
| A | B | C | Y |
| 0 | 0 | 0 |  |
| 0 | 0 | 1 |  |
| 0 | 1 | 0 |  |
| 0 | 1 | 1 |  |
| 1 | 0 | 0 |  |
| 1 | 0 | 1 |  |
| 1 | 1 | 0 |  |
| 1 | 1 | 1 |  |

表2-8 举重比赛裁判表决电路输入输出状态（方案二）

|  |  |  |  |
| --- | --- | --- | --- |
| 输入端 | | | 输出端 |
| A | B | C | Y |
| 0 | 0 | 0 |  |
| 0 | 0 | 1 |  |
| 0 | 1 | 0 |  |
| 0 | 1 | 1 |  |
| 1 | 0 | 0 |  |
| 1 | 0 | 1 |  |
| 1 | 1 | 0 |  |
| 1 | 1 | 1 |  |

表2-10 交通灯故障检测电路输出状态

|  |  |  |  |
| --- | --- | --- | --- |
| R | Y | G | Z |
| 0 | 0 | 0 |  |
| 0 | 0 | 1 |  |
| 0 | 1 | 0 |  |
| 0 | 1 | 1 |  |
| 1 | 0 | 0 |  |
| 1 | 0 | 1 |  |
| 1 | 1 | 0 |  |
| 1 | 1 | 1 |  |

**五、问题与讨论（记录实验过程中的问题及解决办法）**

**建议：包括不成功的过程并分析原因。**

## 组合逻辑电路

**一、实验目的**

1. 了解和掌握编码器的工作原理，并测试其逻辑单元。

2. 了解和掌握译码器的工作原理，并测试其逻辑功能。

3. 了解和掌握数据选择器的工作原理及逻辑功能。

4. 了解和掌握数值比较器的工作原理及如何比较大小。

5. 了解全加器的工作原理及其典型的应用，并验证4位全加器功能。

6. 了解集成数码显示译码器的工作原理及其典型的应用，并实现七段数码管的驱动。

**二、实验仪器及元器件**

1. 数字逻辑与系统设计实验箱。

2. 元器件：8-3编码器74HC148、3-8译码器74HC138、4选1数据选择器74HC153、4位数值比较器74HC85、4位全加器74HC283、集成数码显示译码器74HC4511、4数字共阴极八段显示数码管LN3461Ax。

**三、实验预习: 画出以下电路在实验箱上的芯片连线图（左边输入，右边输出）。**

1、8-3编码器74HC148

2、3-8译码器74HC138

3、4选1数据选择器74HC153

4、4位数值比较器74HC85

5、4位全加器74HC283

6、集成数码显示译码器74HC4511、4数字共阴极八段显示数码管LN3461Ax

**四、实验结果和数据处理:** 在实验箱上连线、测试、记录数据、拍照（典型数据）。

请将实验数据填到表2-11至表2-16中。

表2-11 74HC148输入/输出状态

| 控制 | 十进制数字信号输入 | | | | | | | | 二进制数码输出 | | | 状态输出 | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | X | X | X | X | X | X | X | X |  |  |  |  |  |
| 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |  |  |
| 0 | X | X | X | X | X | X | X | 0 |  |  |  |  |  |
| 0 | X | X | X | X | X | X | 0 | 1 |  |  |  |  |  |
| 0 | X | X | X | X | X | 0 | 1 | 1 |  |  |  |  |  |
| 0 | X | X | X | X | 0 | 1 | 1 | 1 |  |  |  |  |  |
| 0 | X | X | X | 0 | 1 | 1 | 1 | 1 |  |  |  |  |  |
| 0 | X | X | 0 | 1 | 1 | 1 | 1 | 1 |  |  |  |  |  |
| 0 | X | 0 | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |  |  |
| 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |  |  |

注：X为任意状态

表2-12 74HC138输入/输出状态

| 使能输入 | | | 数据输入 | | | 译码输出 | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | E3 | A2 | A1 | A0 |  |  |  |  |  |  |  |  |
| 1 | X | X | X | X | X |  |  |  |  |  |  |  |  |
| X | 1 | X | X | X | X |  |  |  |  |  |  |  |  |
| X | X | 0 | X | X | X |  |  |  |  |  |  |  |  |
| 0 | 0 | 1 | 0 | 0 | 0 |  |  |  |  |  |  |  |  |
| 0 | 0 | 1 | 0 | 0 | 1 |  |  |  |  |  |  |  |  |
| 0 | 0 | 1 | 0 | 1 | 0 |  |  |  |  |  |  |  |  |
| 0 | 0 | 1 | 0 | 1 | 1 |  |  |  |  |  |  |  |  |
| 0 | 0 | 1 | 1 | 0 | 0 |  |  |  |  |  |  |  |  |
| 0 | 0 | 1 | 1 | 0 | 1 |  |  |  |  |  |  |  |  |
| 0 | 0 | 1 | 1 | 1 | 0 |  |  |  |  |  |  |  |  |
| 0 | 0 | 1 | 1 | 1 | 1 |  |  |  |  |  |  |  |  |

注：X为任意状态

表2-13 74 HC153输入/输出状态

| 选择输入 | | 数据输入 | | | | 输出使能输入 | 输出 |
| --- | --- | --- | --- | --- | --- | --- | --- |
| S1 | S0 | 1I0 | 1I1 | 1I2 | 1I3 |  | 1Y |
| X | X | X | X | X | X | 1 |  |
| 0 | 0 | 0 | X | X | X | 0 |  |
| 0 | 0 | 1 | X | X | X | 0 |  |
| 1 | 0 | X | X | 0 | X | 0 |  |
| 1 | 0 | X | X | 1 | X | 0 |  |
| 0 | 1 | X | 0 | X | X | 0 |  |
| 0 | 1 | X | 1 | X | X | 0 |  |
| 1 | 1 | X | X | X | 0 | 0 |  |
| 1 | 1 | X | X | X | 1 | 0 |  |

注：X为任意状态

表2-14 74HC85输入/输出状态

| 比较输入 | | | | | | | | 级联输入 | | | 输出 | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| A3 | A2 | A1 | A0 | B3 | B2 | B1 | B0 | IA>B | IA=B | IA<B | OA>B | OA=B | OA<B |
| 1 | X | X | X | 0 | X | X | X | X | X | X |  |  |  |
| 0 | X | X | X | 1 | X | X | X | X | X | X |  |  |  |
| 1 | 1 | X | X | 1 | 0 | X | X | X | X | X |  |  |  |
| 0 | 0 | X | X | 0 | 1 | X | X | X | X | X |  |  |  |
| 1 | 0 | 1 | X | 1 | 0 | 0 | X | X | X | X |  |  |  |
| 0 | 0 | 0 | X | 0 | 0 | 1 | X | X | X | X |  |  |  |
| 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | X | X | X |  |  |  |
| 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | X | X | X |  |  |  |
| 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |  |  |  |
| 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |  |  |  |
| 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 |  |  |  |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |  |  |  |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |  |  |  |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | X | 1 | X |  |  |  |

注：X为任意状态

表2-15 74HC283输入/输出状态

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 4位被加数输入 | | | | 4位加数输入 | | | | 输出加法结果和进位 | | | | |
| A4 | A3 | A2 | A1 | B4 | B3 | B2 | B1 | COUT | S4 | S3 | S2 | S1 |
| 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |  |  |  |  |  |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |  |  |
| 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 |  |  |  |  |  |
| 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 |  |  |  |  |  |
| 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 |  |  |  |  |  |
| 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |  |  |  |  |  |
| 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |

思考：如增加Cin，输出结果会如何？请自行在表上增加，并验证其他取值的加法结果，填入表中。

表2-16 74HC4511输入/输出状态

| 使能输入 | | | 数据输入 | | | | 译码输出 | | | | | | | 字形 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | LE | D | C | B | A | a | b | c | d | e | f | g |
| 0 | X | X | X | X | X | X |  |  |  |  |  |  |  |  |
| 1 | 0 | X | X | X | X | X |  |  |  |  |  |  |  |  |
| 1 | 1 | 0 | 0 | 0 | 0 | 0 |  |  |  |  |  |  |  |  |
| 1 | 1 | 0 | 0 | 0 | 0 | 1 |  |  |  |  |  |  |  |  |
| 1 | 1 | 0 | 0 | 0 | 1 | 0 |  |  |  |  |  |  |  |  |
| 1 | 1 | 0 | 0 | 0 | 1 | 1 |  |  |  |  |  |  |  |  |
| 1 | 1 | 0 | 0 | 1 | 0 | 0 |  |  |  |  |  |  |  |  |
| 1 | 1 | 0 | 0 | 1 | 0 | 1 |  |  |  |  |  |  |  |  |
| 1 | 1 | 0 | 0 | 1 | 1 | 0 |  |  |  |  |  |  |  |  |
| 1 | 1 | 0 | 0 | 1 | 1 | 1 |  |  |  |  |  |  |  |  |
| 1 | 1 | 0 | 1 | 0 | 0 | 0 |  |  |  |  |  |  |  |  |
| 1 | 1 | 0 | 1 | 0 | 0 | 1 |  |  |  |  |  |  |  |  |
| 1 | 1 | 0 | 1 | 0 | 1 | 0 |  |  |  |  |  |  |  |  |
| 1 | 1 | 0 | 1 | 0 | 1 | 1 |  |  |  |  |  |  |  |  |
| 1 | 1 | 0 | 1 | 1 | 0 | 0 |  |  |  |  |  |  |  |  |
| 1 | 1 | 0 | 1 | 1 | 0 | 1 |  |  |  |  |  |  |  |  |
| 1 | 1 | 0 | 1 | 1 | 1 | 0 |  |  |  |  |  |  |  |  |
| 1 | 1 | 0 | 1 | 1 | 1 | 1 |  |  |  |  |  |  |  |  |

注：X为任意状态

思考：如果要同时显示4个数字，应如何处理？

**四、问题与讨论（记录实验过程中的问题及解决办法）**

**建议：包括不成功的过程并分析原因。**