## 实验三 编码器和译码器

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1. 实验目的

1.掌握编码器和译码器的基本设计方法

2. 掌握集成译码器的功能

1. 实验设备和器材

数字逻辑试验箱 1台

4输入二与非门 （7420） 2片

2输入四或门 （7432） 1片

2输入四与非门 （7400） 1片

1. 四译码器 （74LS139） 1片
2. 八译码器 （74LS138） 1片
3. 实验内容
4. 二-八进制编码器设计

8个输入端代表0~7这8个数字（用8个逻辑开关来表示）； 3个输出端代表对应的3位二进制代码。其真值表如表3.1所示。由真值表可知不允许两个或两个以上数字同时输入，则除真值表中的9种输入组合外，其余组合均为无效组合。要求由真值表直接写出输出函数，画出电路图。

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 十进制数 | 输入 | | | | | | | | 输出 | | |  |
| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | A | B | C | S |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 |
| 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 |
| 3 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| 4 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| 5 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 |
| 6 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 |
| 7 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |

表3.1

1. 用门电路实现二-四译码器，其真值表如表 3.2 所示。要求由真值表求出输出函数，画出电路图。

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 输入 | | 输出 | | | |
| A | B | Y0 | Y1 | Y2 | Y3 |
| 0 | 0 | 0 | 1 | 1 | 1 |
| 0 | 1 | 1 | 0 | 1 | 1 |
| 1 | 0 | 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 | 1 | 0 |

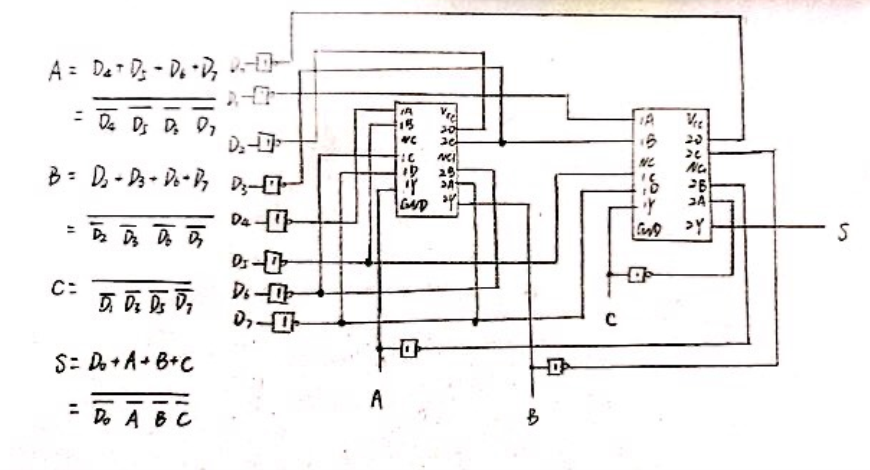
表3.2

1. 集成译码器 74139 和 74138 的功能测试。

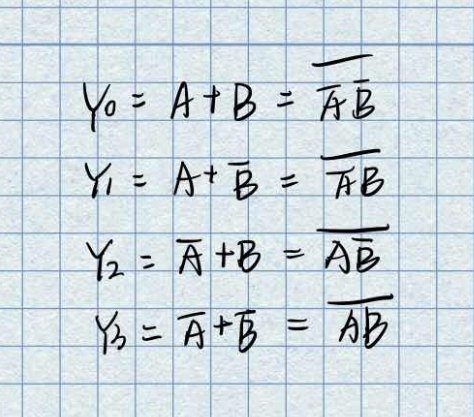
四、实验步骤

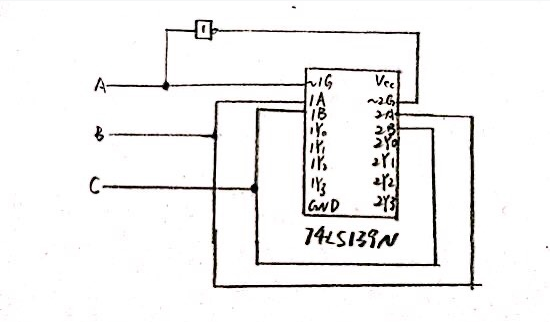
1. 完成二-八进制编码器和二-四译码器的逻辑设计，注意可提供的器件为四输入二与非门（74LS20）、二输入四或门（74LS32）和二输入四与非门（74LS00）。

(1)二-八进制编码器



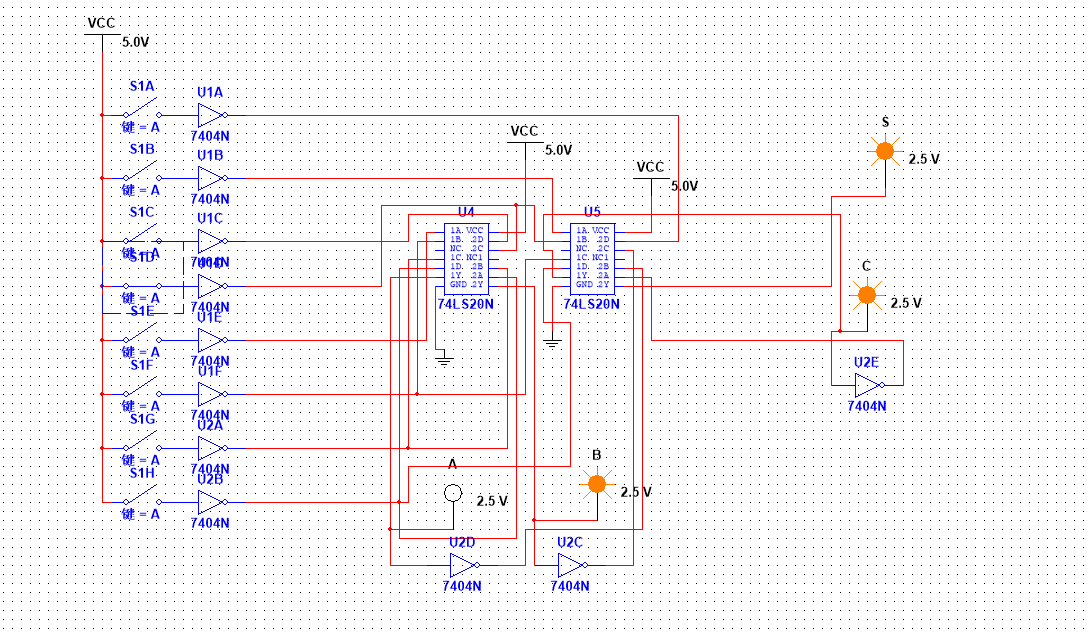
(2)二-四译码器



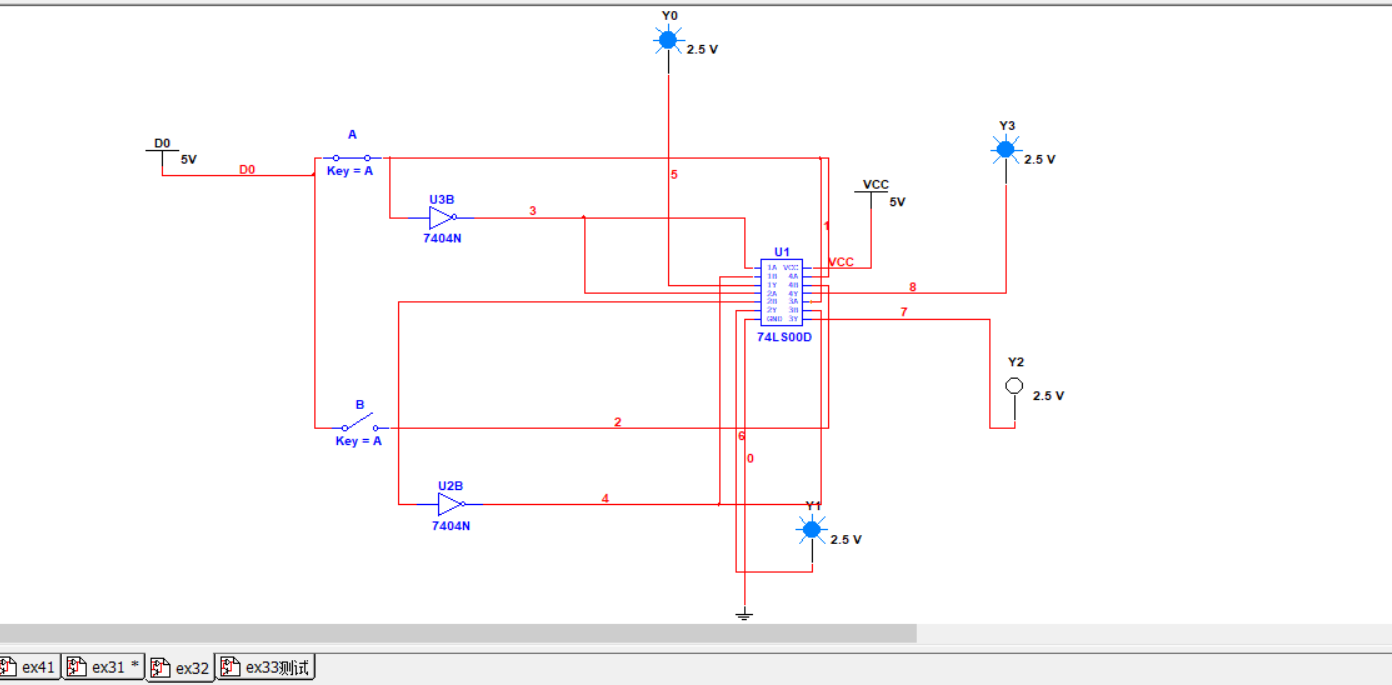


2. 画出电路图，并标上引脚标号。

(1)二-八进制编码器



(2)二-四译码器



3．连接二—八进制编码器电路，输入逻辑电平用开关提供，输出结果用 LED 来显示。在检查电路连接正确后，接通电源，进行实验，根据实验结果填写真值表，并和原真值表进行比较，检查实验结果是否正确。

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 十进制数 | 输入 | | | | | | | | 输出 | | |  |
| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | A | B | C | S |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 |
| 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 |
| 3 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| 4 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| 5 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 |
| 6 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 |
| 7 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |

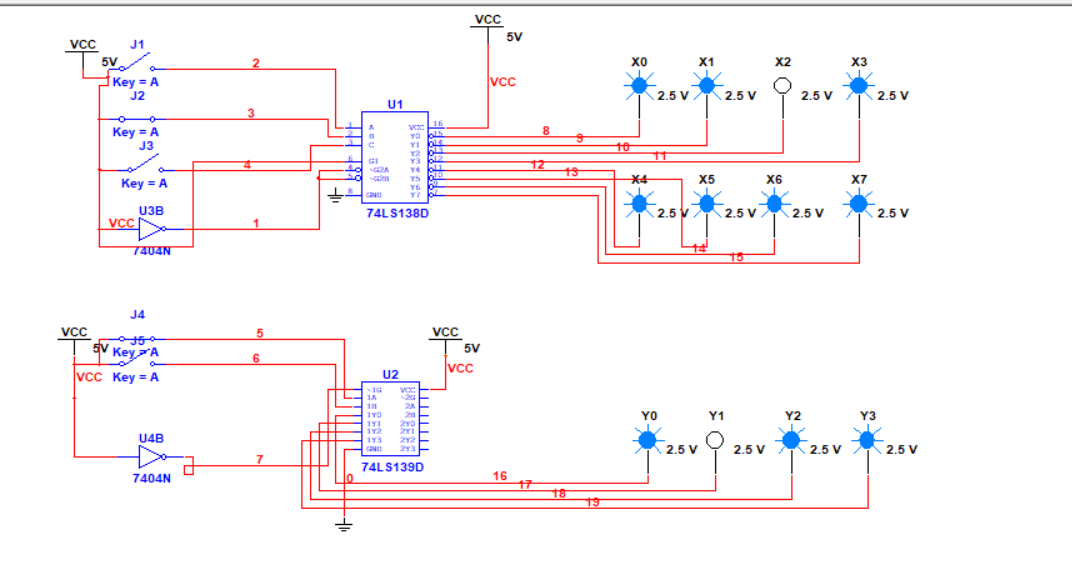
4．连接译码器电路，输入逻辑电平用开关提供，输出结果用 LED 来显示。在检查电路连接正确后，接通电源，进行实验，根据实验结果填写真值表，并和原真值表进行比较，检查实验结果是否正确。

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 输入 | | 输出 | | | |
| A | B | Y0 | Y1 | Y2 | Y3 |
| 0 | 0 | 0 | 1 | 1 | 1 |
| 0 | 1 | 1 | 0 | 1 | 1 |
| 1 | 0 | 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 | 1 | 0 |

5．进行 74LS139 和 74LS138 功能测试。根据实验结果填写真值表，并检查实验数据是否正确。

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 74LS138 | | | | | | | | | | | | | | | | |
| 输入 | | | | | | 输出 | | | | | | | | | | |
| S1 | S2+S3 | A2 | A1 | A0 | |  |  | |  |  | |  |  | |  |  |
| 1 | 0 | 0 | 0 | 0 | | 0 | 1 | | 1 | 1 | | 1 | 1 | | 1 | 1 |
| 1 | 0 | 0 | 0 | 1 | | 1 | 0 | | 1 | 1 | | 1 | 1 | | 1 | 1 |
| 1 | 0 | 0 | 1 | 0 | | 1 | 1 | | 0 | 1 | | 1 | 1 | | 1 | 1 |
| 1 | 0 | 0 | 1 | 1 | | 1 | 1 | | 1 | 0 | | 1 | 1 | | 1 | 1 |
| 1 | 0 | 1 | 0 | 0 | | 1 | 1 | | 1 | 1 | | 0 | 1 | | 1 | 1 |
| 1 | 0 | 1 | 0 | 1 | | 1 | 1 | | 1 | 1 | | 1 | 0 | | 1 | 1 |
| 1 | 0 | 1 | 1 | 0 | | 1 | 1 | | 1 | 1 | | 1 | 1 | | 0 | 1 |
| 1 | 0 | 1 | 1 | 1 | | 1 | 1 | | 1 | 1 | | 1 | 1 | | 1 | 0 |
| 0 | d | d | d | D | | 1 | 1 | | 1 | 1 | | 1 | 1 | | 1 | 1 |
| d | 1 | d | d | d | | 1 | 1 | | 1 | 1 | | 1 | 1 | | 1 | 1 |
| 74LS139 | | | | | | | | | | | | | | | | |
| 输入 | | | | | 输出 | | | | | | | | | | | |
| A | | B | | | Y0 | | | Y1 | | | Y2 | | | Y3 | | |
| 0 | | 0 | | | 0 | | | 1 | | | 1 | | | 1 | | |
| 0 | | 1 | | | 1 | | | 0 | | | 1 | | | 1 | | |
| 1 | | 0 | | | 1 | | | 1 | | | 0 | | | 1 | | |
| 1 | | 1 | | | 1 | | | 1 | | | 1 | | | 0 | | |

测试图如下：



五、思考题

用八根地址线（A7、A6、A5、A4、A3、A2、A1、A0），试用 74LS138 及门电路设计一个地址译码电路，当输入地址为 30H 时， 输出 Y0 为 0，当输入地址为 31H 时，输出 Y1 为 0。

思路：只需要区分开后四位（0000 0001）的不同即可（前面的3=0011都是一样的） 实际上用一个2-4译码器即可.

