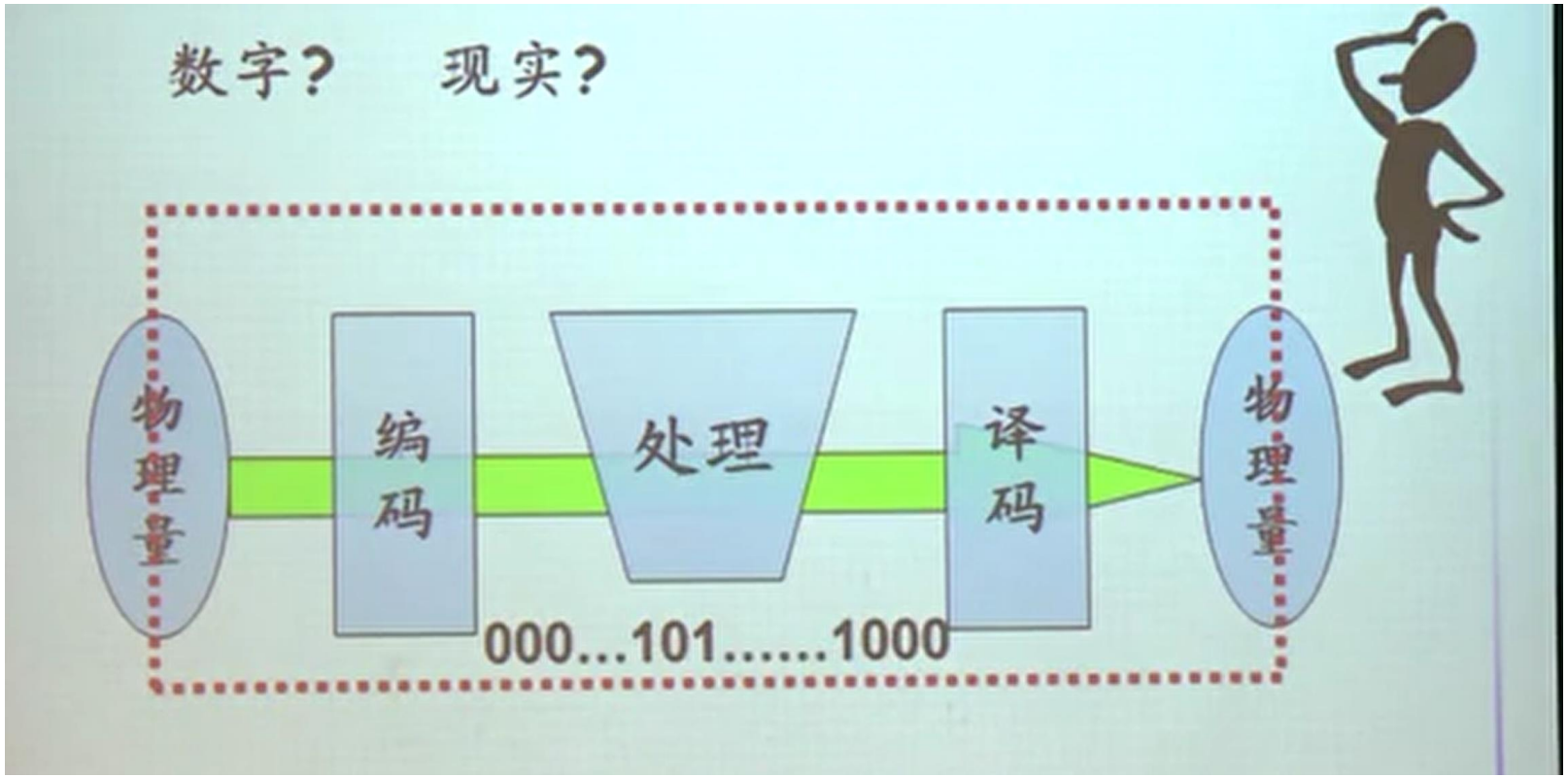
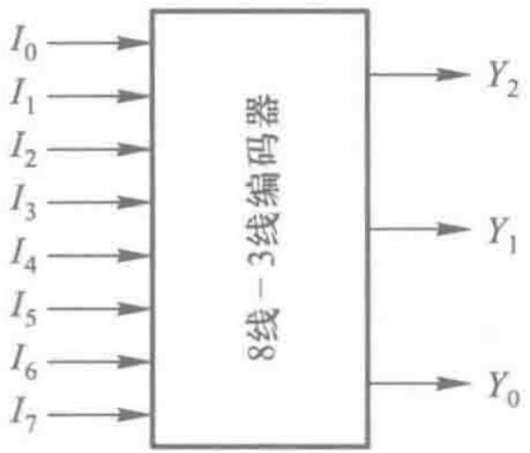
Encoder

- An encoder accepts an active level on one of its inputs representing a digit, such as a decimal or octal digit, and converts it to a coded output, such as BCD or binary



8–3 Encoder

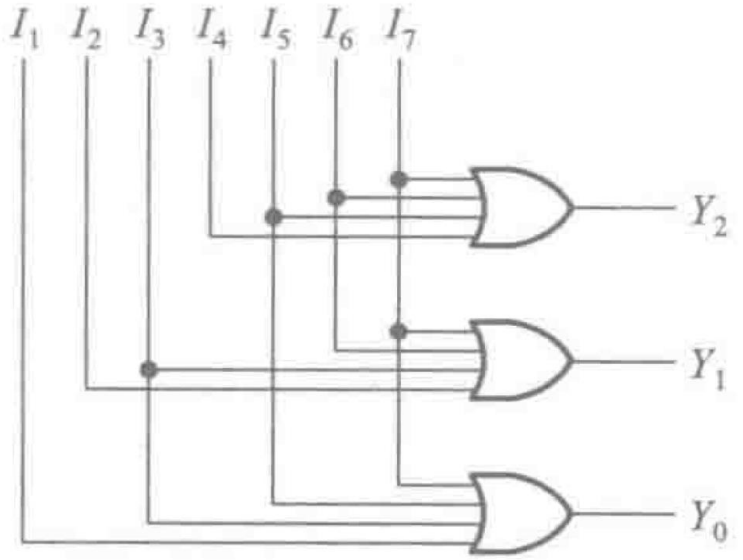
- Only one input is allowed at a time
- Inputs: I_7 (MSB) to I_0(LSB)
- Outputs: Y_2(MSB) to Y_0(LSB)



输入								输出		
I_0	I_1	I_2	I_3	I_4	I_5	I_6	I_7	Y_2	Y_1	Y_0
1	0	0	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0	1
0	0	1	0	0	0	0	0	0	1	0
0	0	0	1	0	0	0	0	0	1	1
0	0	0	0	1	0	0	0	1	0	0
0	0	0	0	0	1	0	0	1	0	1
0	0	0	0	0	0	1	0	1	1	0
0	0	0	0	0	0	0	1	1	1	1

8–3 Encoder

$$
\begin{cases}
Y_2 = I_0' I_1' I_2' I_3' I_4 I_5' I_6' I_7' + I_0' I_1' I_2' I_3' I_4' I_5 I_6' I_7' \\
\qquad + I_0' I_1' I_2' I_3' I_4' I_5' I_6 I_7' + I_0' I_1' I_2' I_3' I_4' I_5' I_6' I_7 \\
Y_1 = I_0' I_1' I_2 I_3' I_4' I_5' I_6' I_7' + I_0' I_1' I_2' I_3 I_4' I_5' I_6' I_7' \\
\qquad + I_0' I_1' I_2' I_3' I_4' I_5' I_6 I_7' + I_0' I_1' I_2' I_3' I_4' I_5' I_6' I_7 \\
Y_0 = I_0' I_1 I_2' I_3' I_4' I_5' I_6' I_7' + I_0' I_1' I_2' I_3 I_4' I_5' I_6' I_7' \\
\qquad + I_0' I_1' I_2' I_3' I_4' I_5 I_6' I_7' + I_0' I_1' I_2' I_3' I_4' I_5' I_6 I_7'
\end{cases}
$$



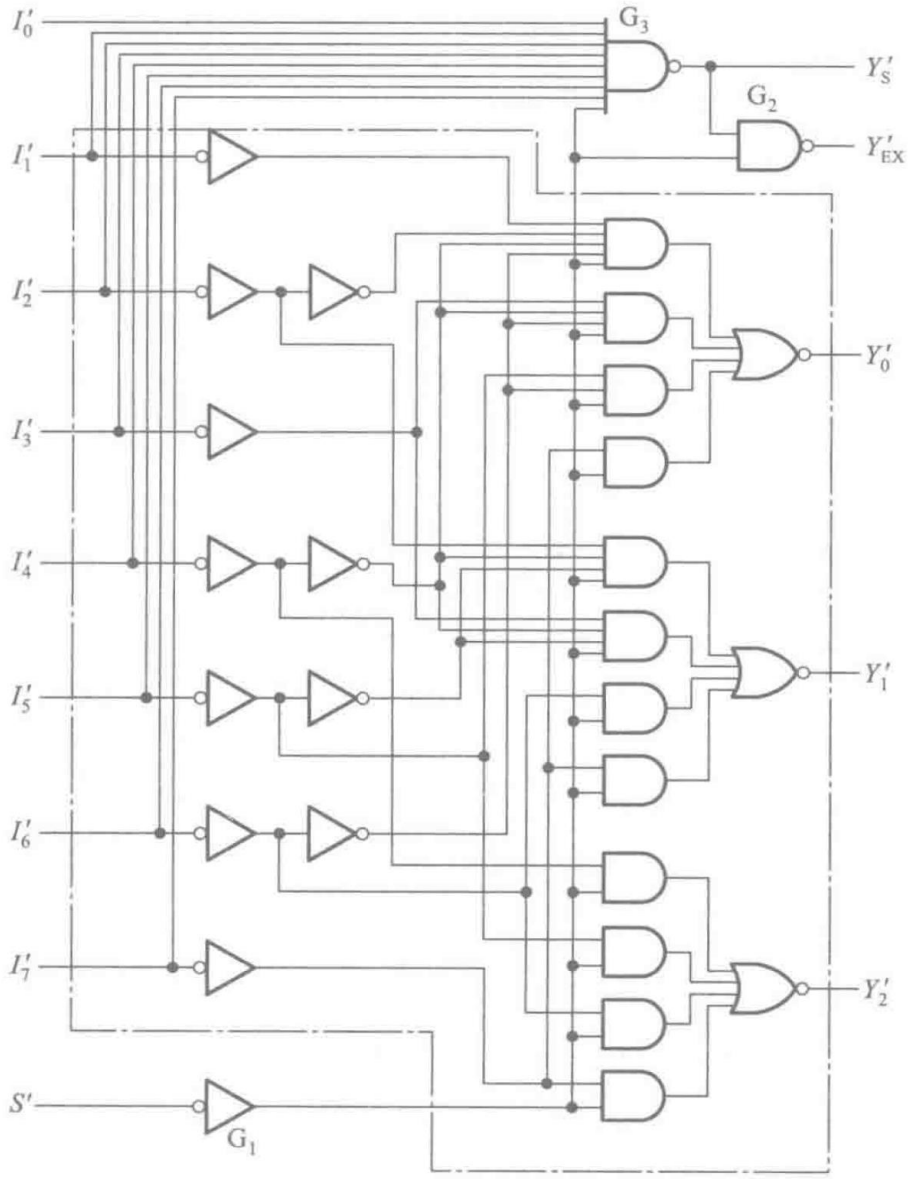
$$
\begin{cases}
Y_2 = I_4 + I_5 + I_6 + I_7 \\
Y_1 = I_2 + I_3 + I_6 + I_7 \\
Y_0 = I_1 + I_3 + I_5 + I_7
\end{cases}
$$

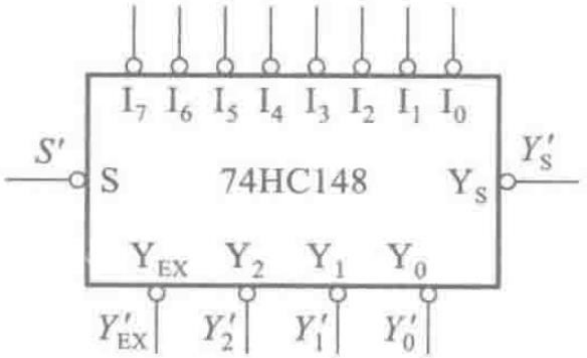
Priority Encoder – 74HC138

- Inputs: I_7 (MSB) to I_0(LSB)
- Outputs: Y_2(MSB) to Y_0(LSB)
- If multiple inputs available, take the one with highest priority

输入									输出				
S'	I'_0	I'_1	I'_2	I'_3	I'_4	I'_5	I'_6	I'_7	Y'_2	Y'_1	Y'_0	Y'_S	Y'_{EX}
1	×	×	×	×	×	×	×	×	1	1	1	1	1
0	1	1	1	1	1	1	1	1	1	1	1	0	1
0	×	×	×	×	×	×	×	0	0	0	0	1	0
0	×	×	×	×	×	×	0	1	0	0	1	1	0
0	×	×	×	×	×	0	1	1	0	1	0	1	0
0	×	×	×	×	0	1	1	1	0	1	1	1	0
0	×	×	×	0	1	1	1	1	1	0	0	1	0
0	×	×	0	1	1	1	1	1	1	0	1	1	0
0	×	0	1	1	1	1	1	1	1	1	0	1	0
0	0	1	1	1	1	1	1	1	1	1	1	1	0

Priority Encoder – 74HC138





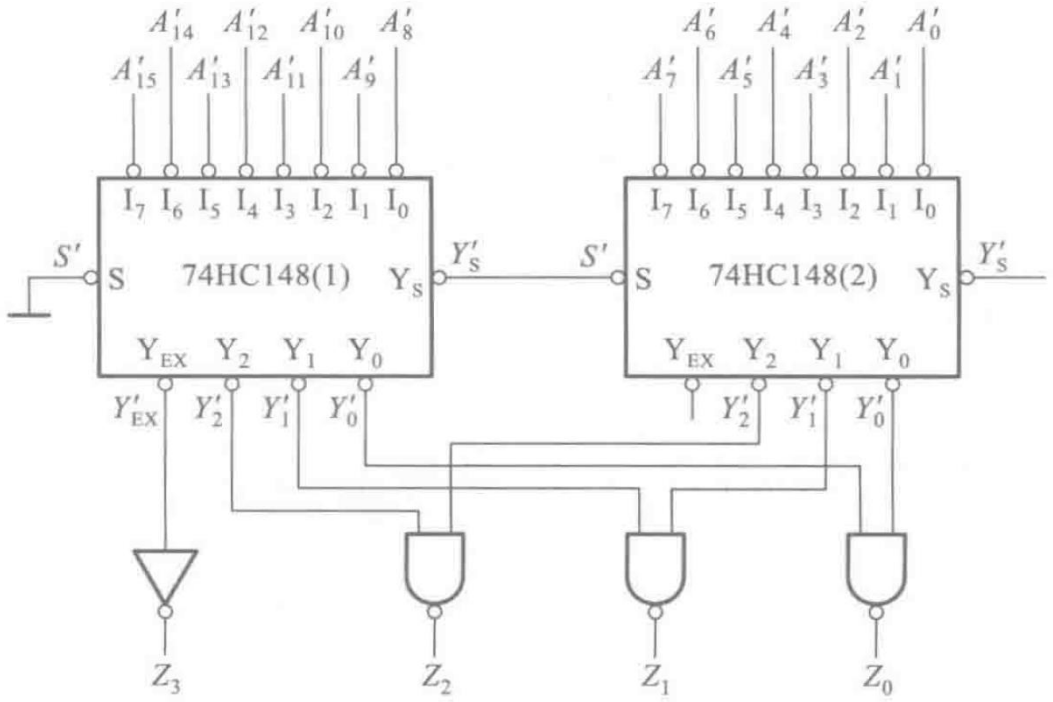
Y_S'	Y_{EX}'	状态
1	1	不工作
0	1	工作，但无输入
1	0	工作，且有输入
0	0	不可能出现

$$\begin{cases} Y_2' = ((I_4+I_5+I_6+I_7)S)' \\ Y_1' = ((I_2I_4'I_5'+I_3I_4'I_5'+I_6+I_7)S)' \\ Y_0' = ((I_1I_2'I_4'I_6'+I_3I_4'I_6'+I_5I_6'+I_7)S)' \end{cases}$$

$$Y_S' = (I_0'I_1'I_2'I_3'I_4'I_5'I_6'I_7'S)'$$

$$\begin{aligned} Y_{EX}' &= ((I_0'I_1'I_2'I_3'I_4'I_5'I_6'I_7'S)'S)' \\ &= ((I_0+I_1+I_2+I_3+I_4+I_5+I_6+I_7)S)' \end{aligned}$$

16–4 Encoder


A'_{14} A'_{12} A'_{10} A'_8
A'_{15} A'_{13} A'_{11} A'_9
A'_6 A'_4 A'_2 A'_0
A'_7 A'_5 A'_3 A'_1
I_7 I_6 I_5 I_4 I_3 I_2 I_1 I_0
S'
S
74HC148(1)
Y_S
Y'_S
74HC148(2)
Y_{EX} Y_2 Y_1 Y_0
Y'_{EX} Y'_2 Y'_1 Y'_0
Z_3 Z_2 Z_1 Z_0

Binary-Decimal Priority Encoder

- Inputs: I_9'(MSB) to I_0'(LSB)
- Outputs: Y_3'(MSB) to Y_0'(LSB)

I_1'	I_2'	I_3'	I_4'	I_5'	I_6'	I_7'	I_8'	I_9'	Y_3'	Y_2'	Y_1'	Y_0'
1	1	1	1	1	1	1	1	1	1	1	1	1
×	×	×	×	×	×	×	×	0	0	1	1	0
×	×	×	×	×	×	×	0	1	0	1	1	1
×	×	×	×	×	×	0	1	1	1	0	0	0
×	×	×	×	×	0	1	1	1	1	0	0	1
×	×	×	×	0	1	1	1	1	1	0	1	0
×	×	×	0	1	1	1	1	1	1	0	1	1
×	×	0	1	1	1	1	1	1	1	1	0	0
×	0	1	1	1	1	1	1	1	1	1	0	1
0	1	1	1	1	1	1	1	1	1	1	1	0

$$
\begin{cases}
Y_3' = (I_8 + I_9)' \\
Y_2' = (I_7 I_8' I_9' + I_6 I_8' I_9' + I_5 I_8' I_9' + I_4 I_8' I_9')' \\
Y_1' = (I_7 I_8' I_9' + I_6 I_8' I_9' + I_3 I_4' I_5' I_8' I_9' + I_2 I_4' I_5' I_8' I_9')' \\
Y_0' = (I_9 + I_7 I_8' I_9' + I_5 I_6' I_8' I_9' + I_3 I_4' I_6' I_8' I_9' + I_1 I_2' I_4' I_6' I_8' I_9')'
\end{cases}
$$

Binary–Decimal Priority Encoder