

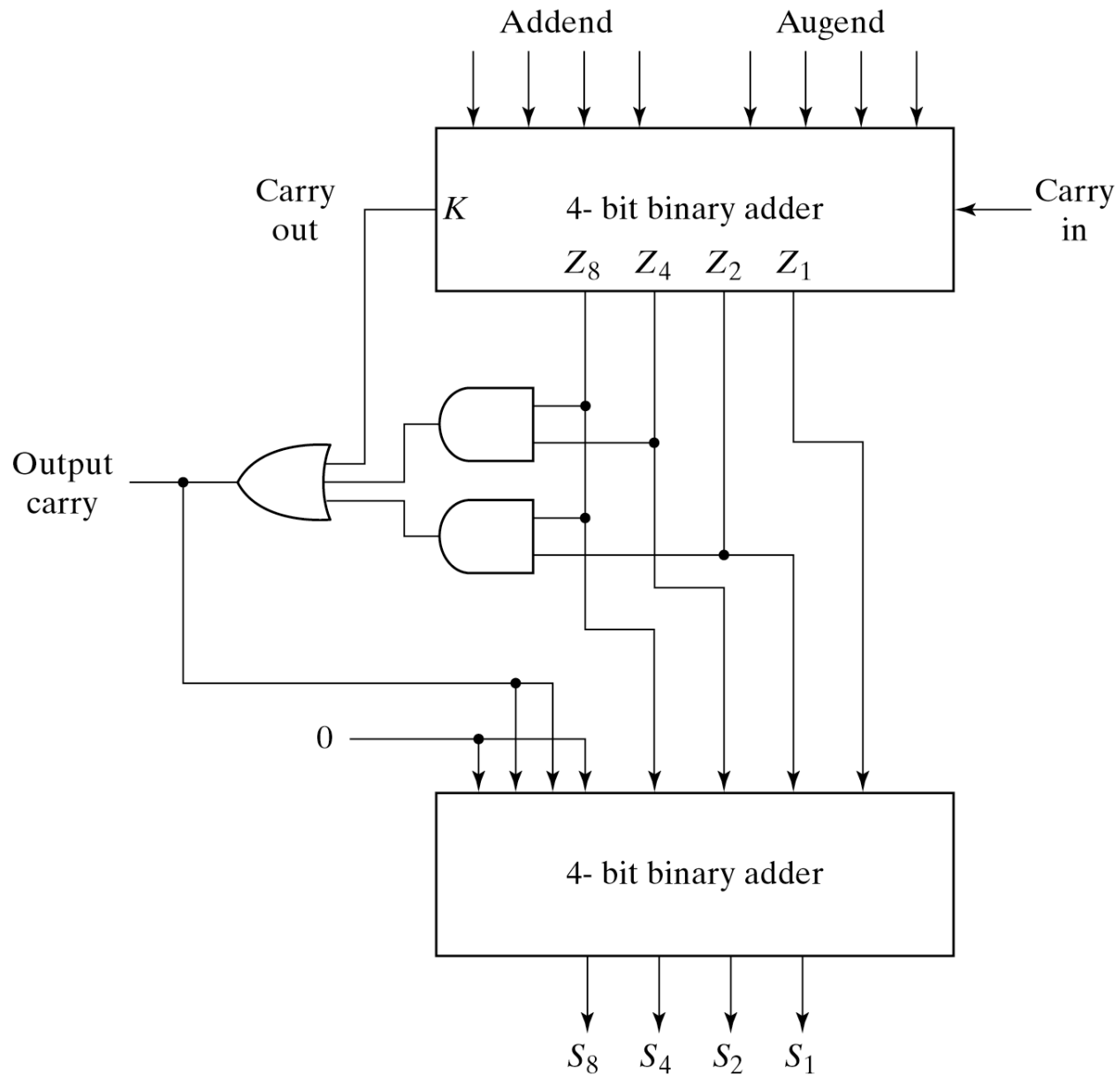


Fig. 4-14 Block Diagram of a BCD Adder

$$\begin{array}{r}
 \begin{array}{cc}
 B_1 & B_0 \\
 A_1 & A_0 \\
 \hline
 A_0B_1 & A_0B_0 \\
 A_1B_1 & A_1B_0 \\
 \hline
 C_3 & C_2 & C_1 & C_0
 \end{array}
 \end{array}$$

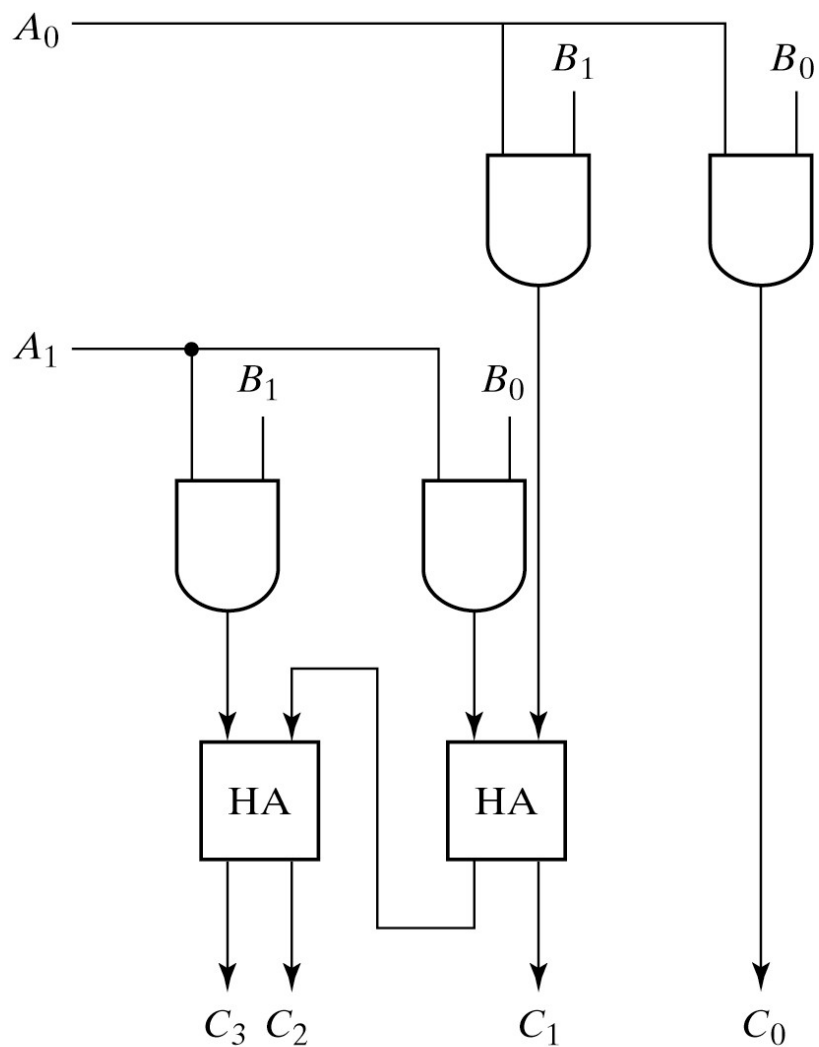


Fig. 4-15 2-Bit by 2-Bit Binary Multiplier

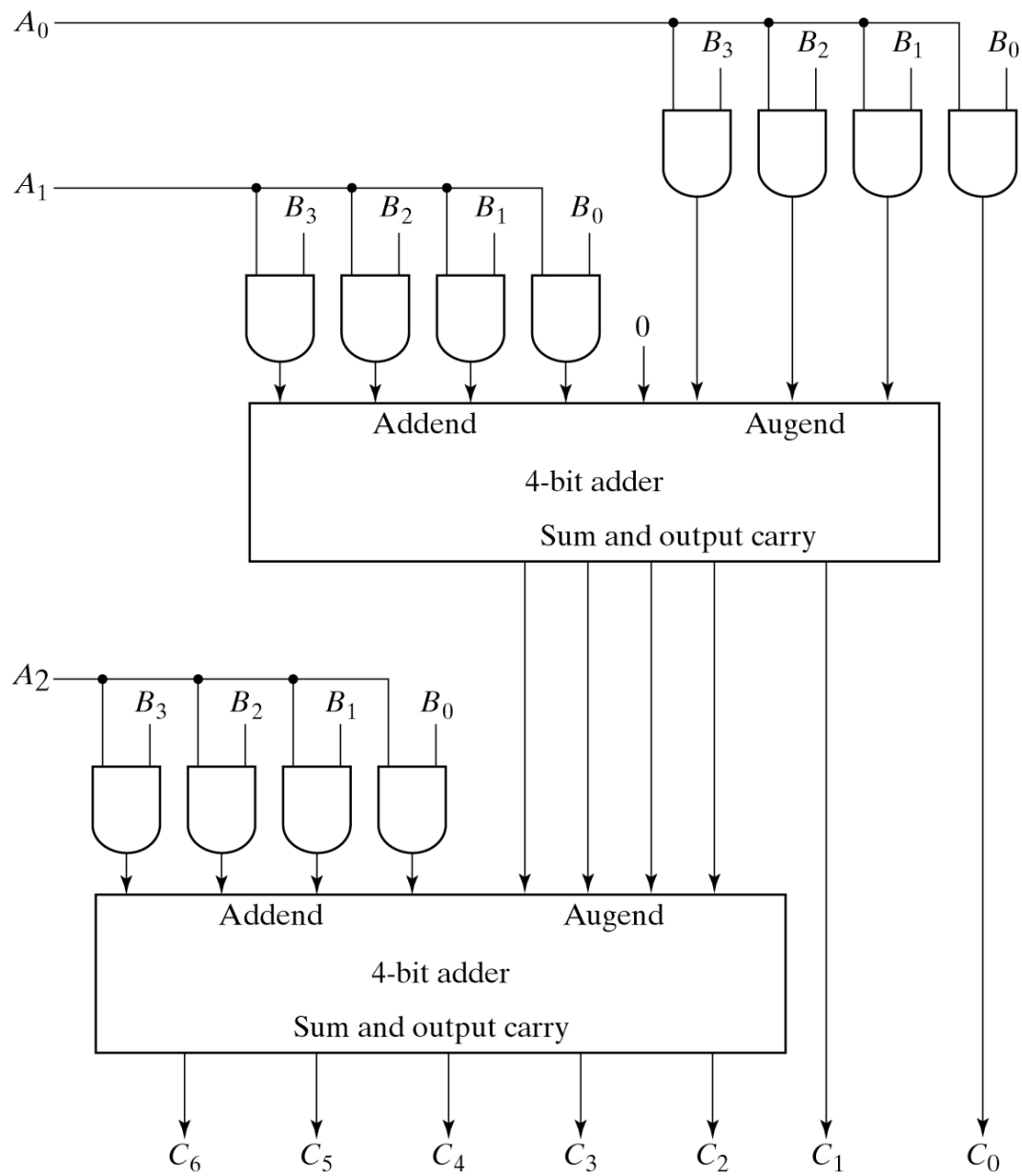


Fig. 4-16 4-Bit by 3-Bit Binary Multiplier

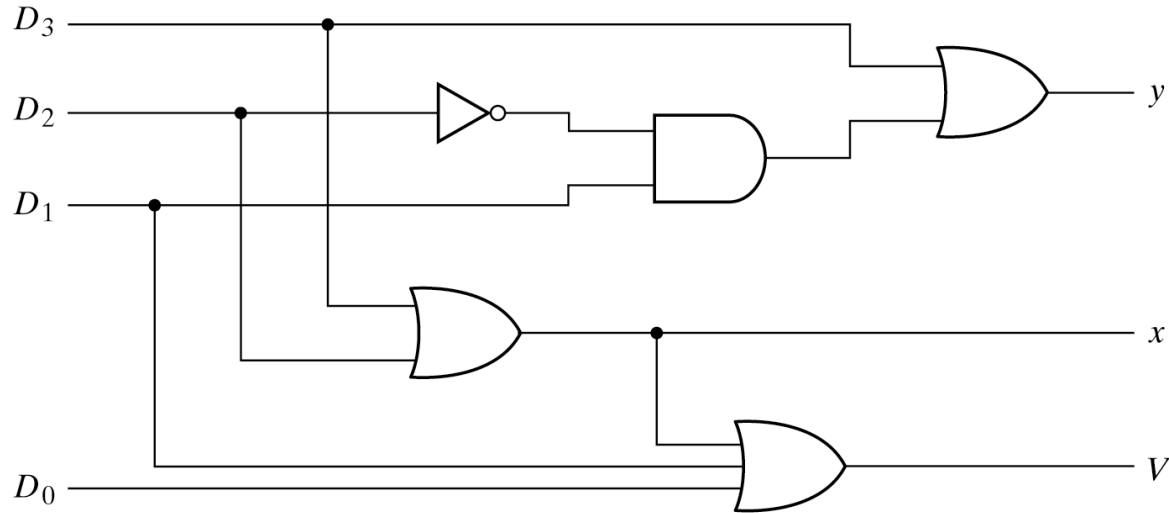


Fig. 4-23 4-Input Priority Encoder

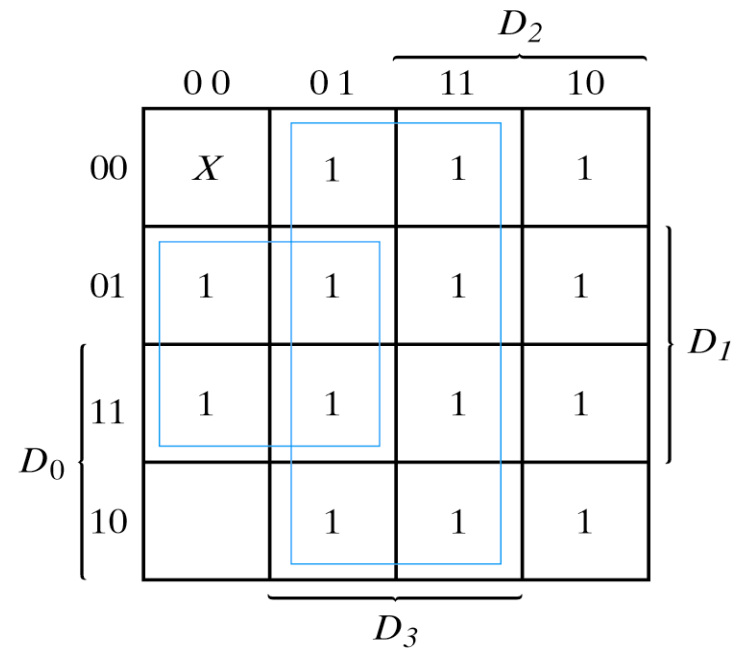
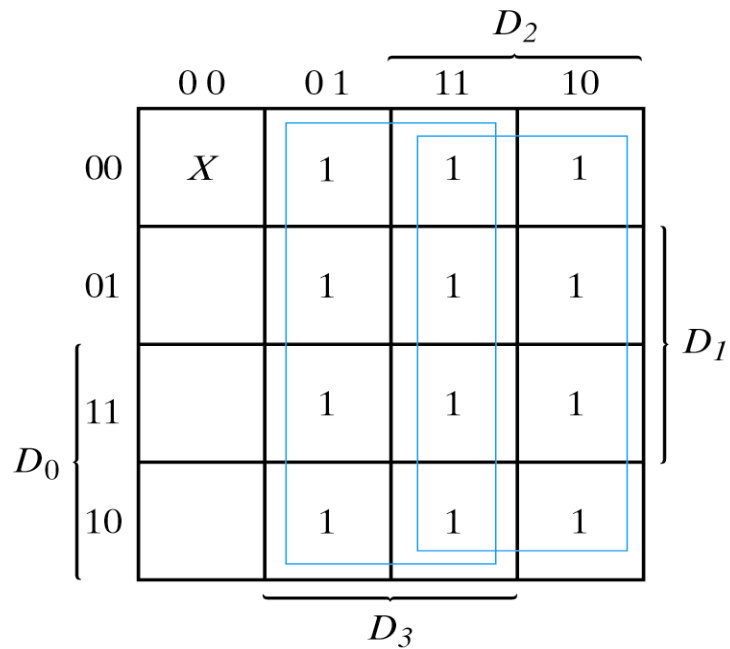


Fig. 4-22 Maps for a Priority Encoder

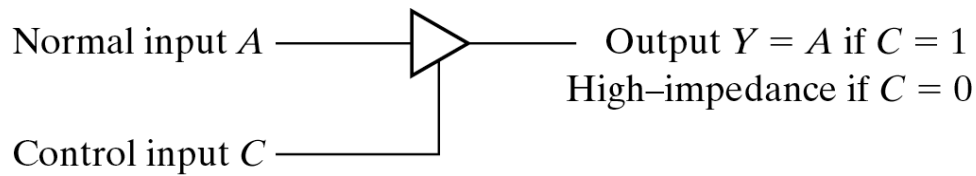
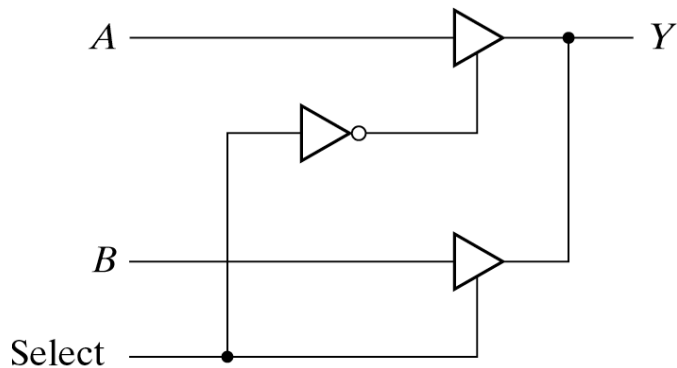
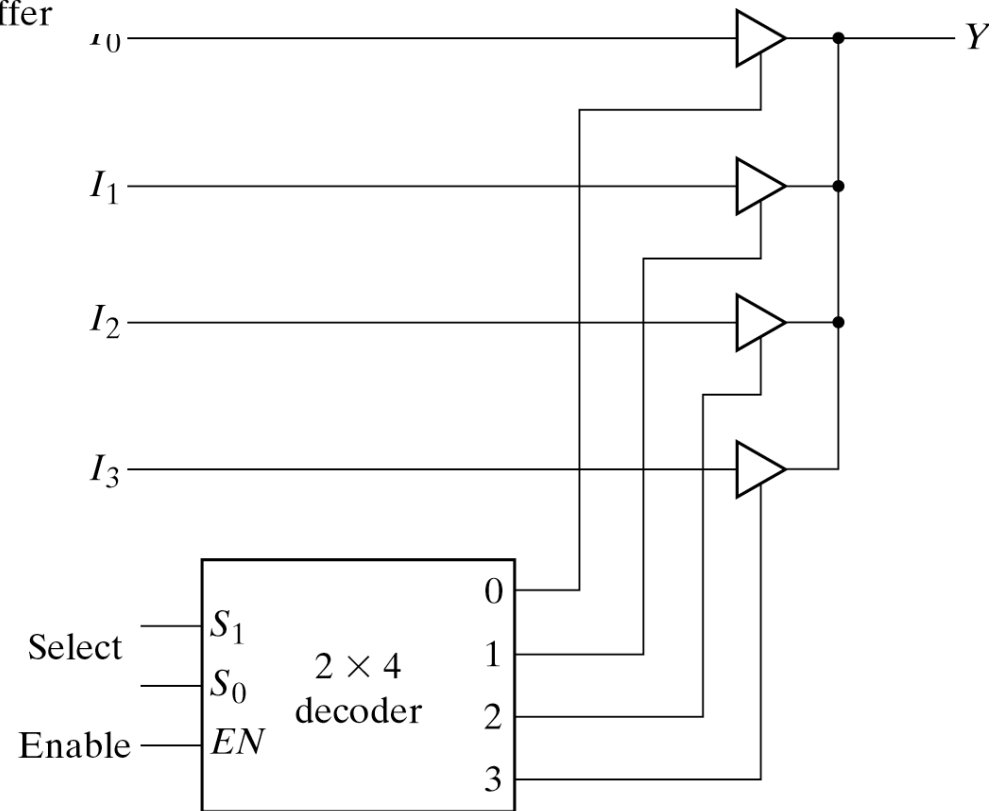


Fig. 4-29 Graphic Symbol for a Three-State Buffer

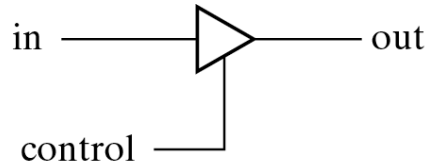


(a) 2-to-1- line mux

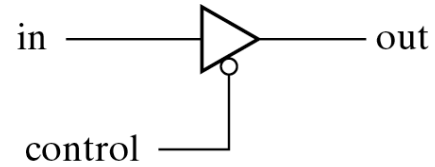


(b) 4 - to - 1 line mux

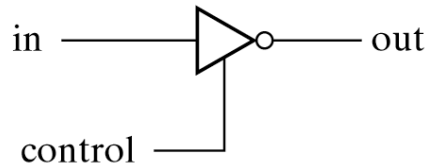
Fig. 4-30 Multiplexers with Three-State Gates



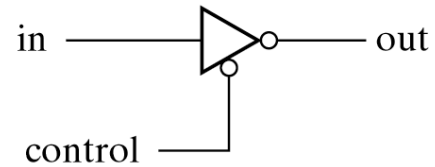
bufifl



bufif0



notifl



notif0

Fig. 4-31 Three-State Gates

BCD to seven-segment decoder

for decimal digits 2, 4, and 9

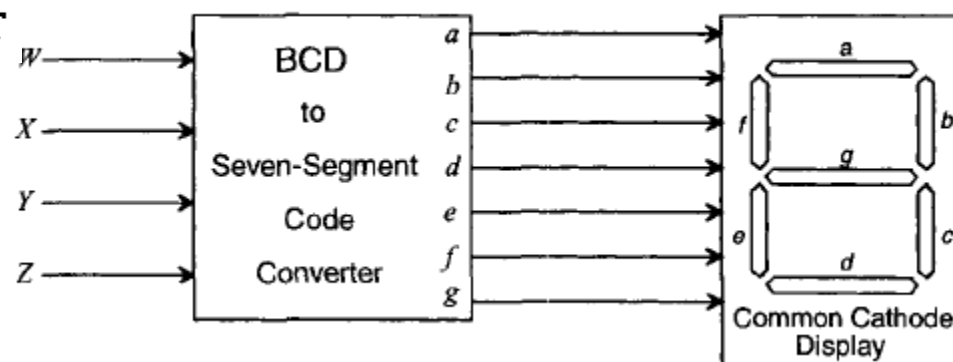
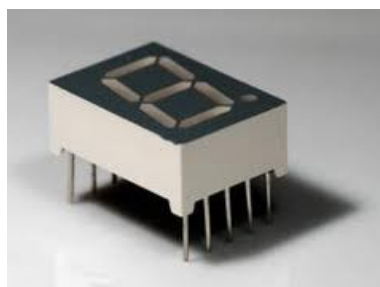
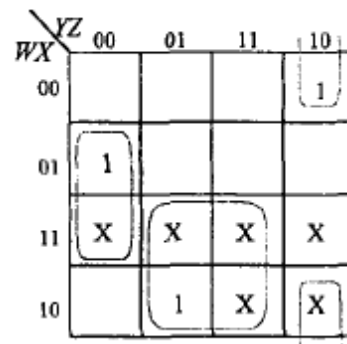
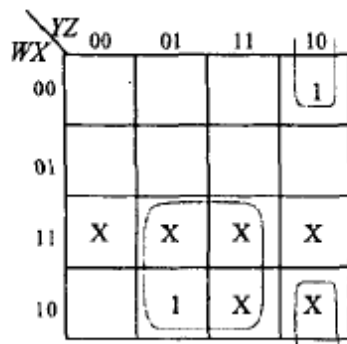


TABLE 4.3 Truth Table for Converting Decimal Digits (Since common-cathode, a 1 will turn a segment ON and a 0 will turn it OFF)

Decimal Digit to be Displayed	BCD Input Bits				Seven-Segment Output Bits						
	<i>W</i>	<i>X</i>	<i>Y</i>	<i>Z</i>	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>
2	0	0	1	0	1	1	0	1	1	0	1
4	0	1	0	0	0	1	1	0	0	1	1
9	1	0	0	1	1	1	1	0	0	1	1



i) K-map for *a*: $a = WZ + \bar{X}Y\bar{Z}$

ii) K-map for *b*: $b = X\bar{Y}\bar{Z} + WZ + \bar{X}Y\bar{Z}$

$$= \bar{Z}(X\bar{Y} + \bar{X}Y) + WZ$$

$$= \bar{Z}(X \oplus Y) + WZ$$

$W \backslash YZ$	00	01	11	10
00				1
01				
11	X	X	X	X
10		1	X	X

i) K-map for a: $a = WZ + \bar{X}Y\bar{Z}$

$W \backslash YZ$	00	01	11	10
00				1
01	1			
11	X	X	X	X
10		1	X	X

ii) K-map for b: $b = X\bar{Y}\bar{Z} + WZ + \bar{X}Y\bar{Z}$

$$= \bar{Z}(X\bar{Y} + \bar{X}Y) + WZ$$

$$= \bar{Z}(X \oplus Y) + WZ$$

$W \backslash YZ$	00	01	11	10
00				
01	1			
11	X	X	X	X
10		1	X	X

iii) K-map for c: $c = X\bar{Y}\bar{Z} + WZ$

$W \backslash YZ$	00	01	11	10
00				1
01				
11	X	X	X	X
10			X	X

iv) K-map for d: $d = \bar{X}Y\bar{Z}$

$W \backslash YZ$	00	01	11	10
00				1
01				
11	X	X	X	X
10			X	X

v) K-map for e : $e = \bar{X}\bar{Y}\bar{Z}$

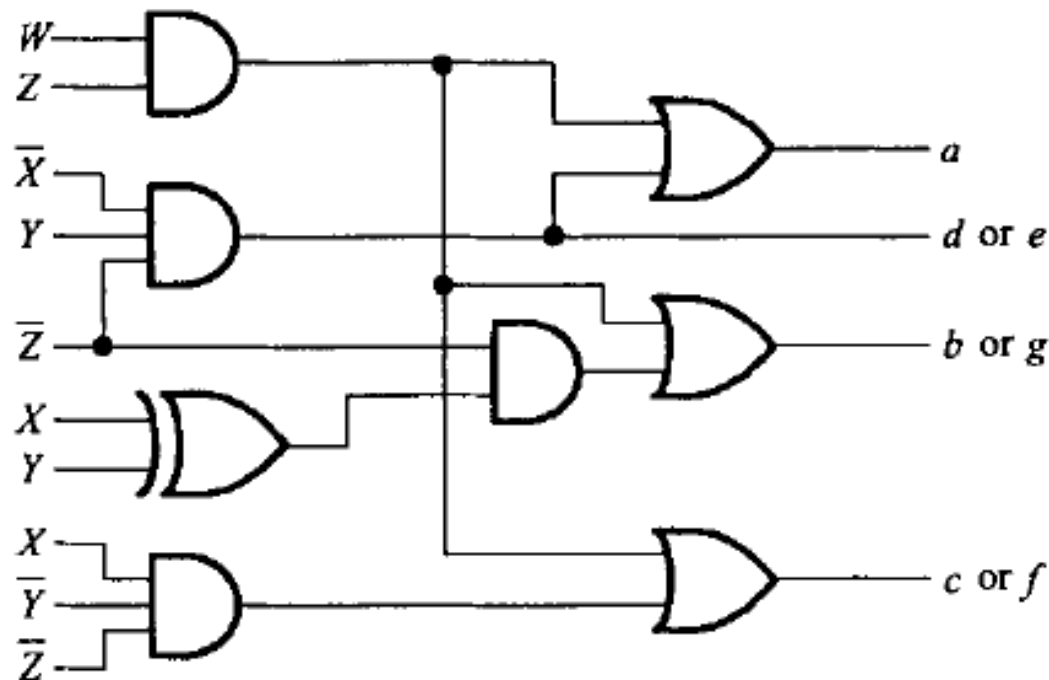
$W \backslash YZ$	00	01	11	10
00				
01	1			
11	X	X	X	X
10		1	X	X

vi) K-map for f : $f = X\bar{Y}\bar{Z} + WZ$

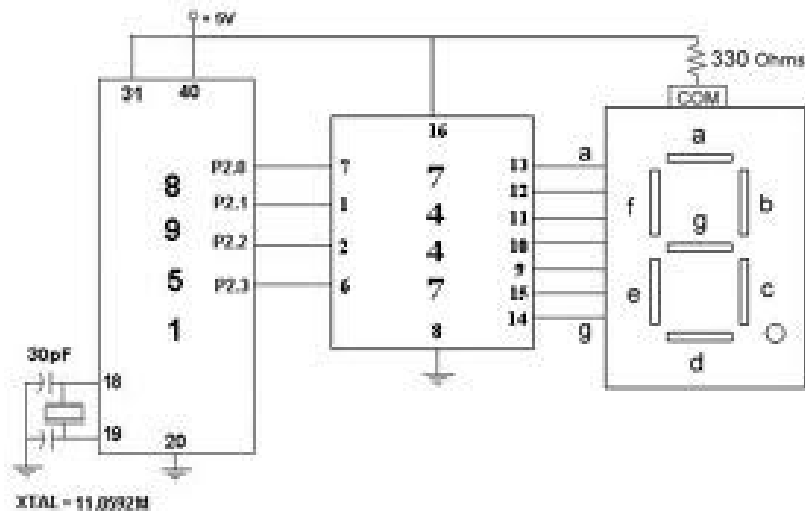
$W \backslash YZ$	00	01	11	10
00				1
01	1			
11	X	X	X	X
10		1	X	X

$$\begin{aligned}
 g &= X\bar{Y}\bar{Z} + WZ + \bar{X}\bar{Y}\bar{Z} \\
 &= \bar{Z}(X\bar{Y} + \bar{X}\bar{Y}) + WZ \\
 &= \bar{Z}(X \oplus Y) + WZ
 \end{aligned}$$

vii) K-map for g



BCD to seven-segment decoder for decimal digits 2, 4, and 9



Pushbutton /Switches

Normally Open Schematics



**Limit
Switch**



**Momentary
Contact
Pushbutton**



**Pressure
Switch**



**Manual
Switch**

Normally Closed Schematics



**Limit
Switch**



**Momentary
Contact
Pushbutton**



**Pressure
Switch**



**Manual
Switch**



Experiments 4.4 : Binary Coded Decimal (BCD) Counter with 7 Segment Display

<http://www.youtube.com/watch?v=RjN8ea5iyOw>