BCD Adder

$$\begin{array}{r} 239 \\ +\ 769 \\ \hline \end{array}$$

Decimal sum	Binary Sum (MSB → LSB)					BCD Sum				
	K	Z_3	Z_2	Z_1	Z_0	C	S_3	S_2	S_1	S_0
0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	1	0	0	0	0	1
2	0	0	0	1	0	0	0	0	1	0
3	0	0	0	1	1	0	0	0	1	1
4	0	0	1	0	0	0	0	1	0	0
5	0	0	1	0	1	0	0	1	0	1
6	0	0	1	1	0	0	0	1	1	0
7	0	0	1	1	1	0	0	1	1	1
8	0	1	0	0	0	0	1	0	0	0
9	0	1	0	0	1	0	1	0	0	1
10	0	1	0	1	0	1	0	0	0	0
11	0	1	0	1	1	1	0	0	0	1
12	0	1	1	0	0	1	0	0	1	0
13	0	1	1	0	1	1	0	0	1	1
14	0	1	1	1	0	1	0	1	0	0
15	0	1	1	1	1	1	0	1	0	1
16	1	0	0	0	0	1	0	1	1	0
17	1	0	0	0	1	1	0	1	1	1
18	1	0	0	1	0	1	1	0	0	0
19	1	0	0	1	1	1	1	0	0	1

$$= 1 \quad 9$$

BCD Adder (Cont.)

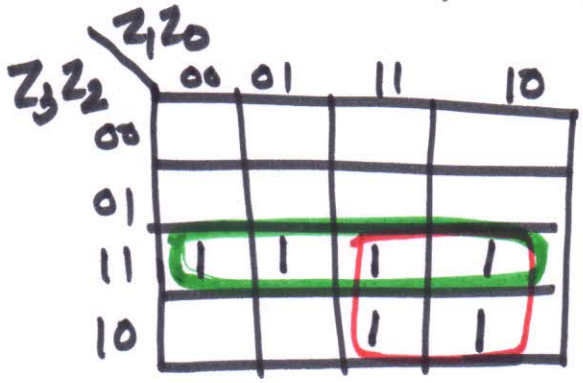
C

$$C = F(K, z_3, z_2, z_1, z_0)$$

$$= \sum m(10, 11, 12, 13, 14, \ldots, 19)$$

$$= K + f(z_3, z_2, z_1, z_0)$$

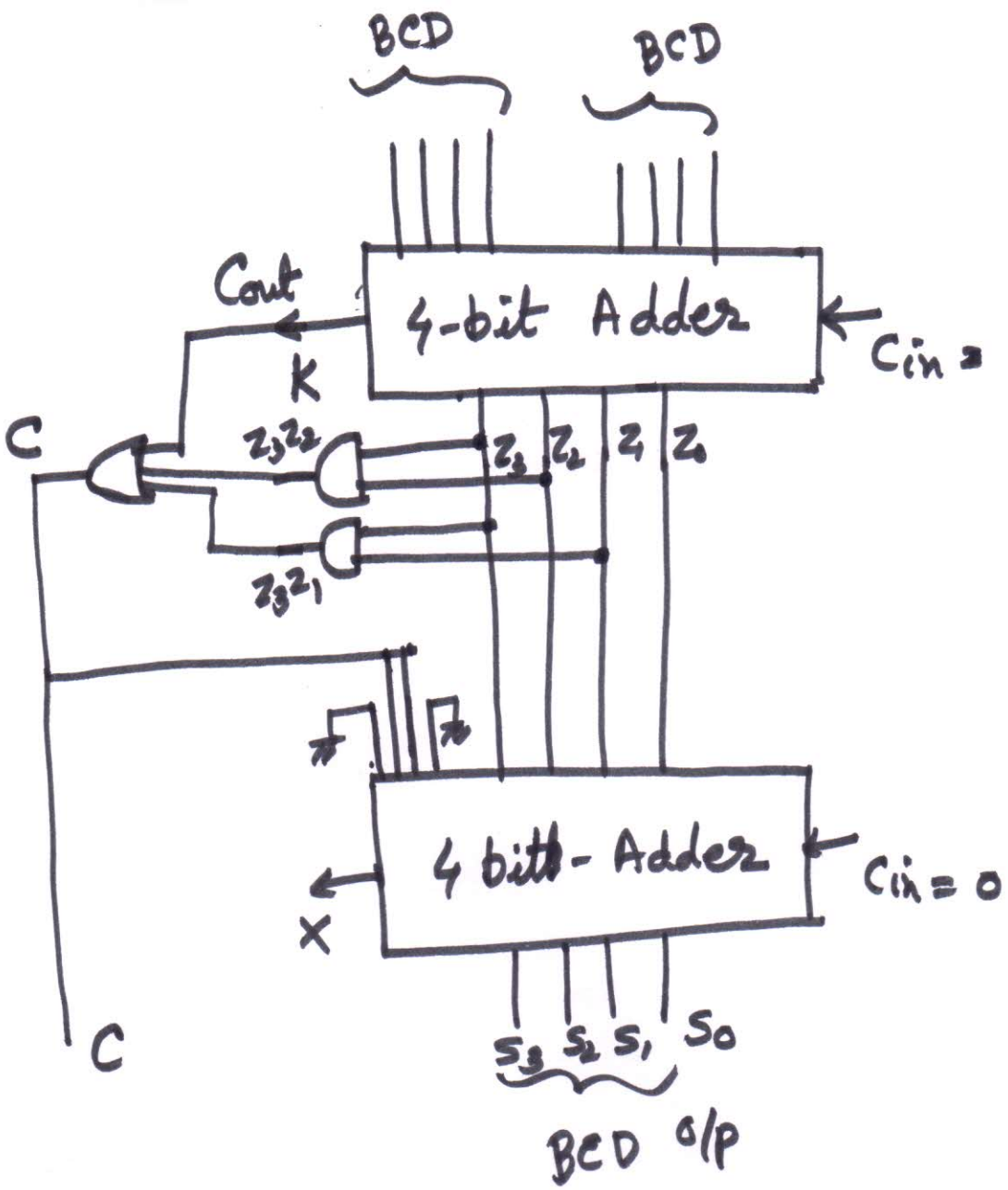
$$f = \sum m(10, 11, 12, 13, 14, 15)$$



$$f = z_3z_2 + z_3z_1$$

So,

$$C = K + z_3z_2 + z_3z_1$$

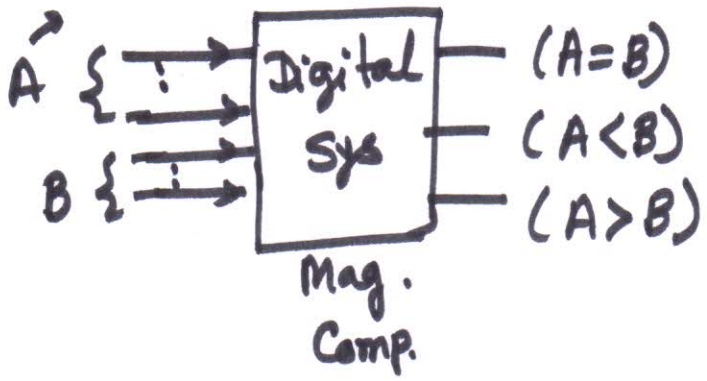

BCD
BCD
Cout
4-bit Adder
Cin = 1
K
C
Z3Z2
Z3
Z2
Z1
Z0
Z3Z1
4 bit - Adder
Cin = 0
X
C
S3 S2 S1 S0
BCD o/p

Magnitude Comparator:

A magnitude comparator is a combinational circuit that compares two given numbers and determines whether one is equal to, less than or greater than the other.

$A : a_3 a_2 a_1 a_0$

$B : b_3 b_2 b_1 b_0$



Z_1 for $(A=B)$

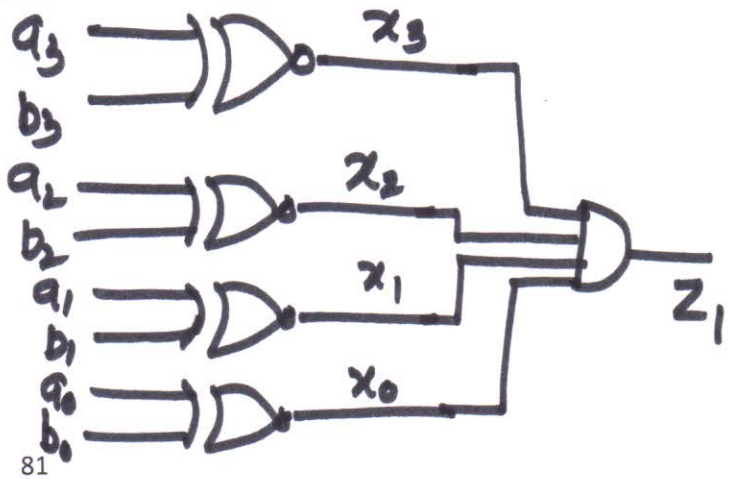
Z_2 for $(A<B)$

Z_3 for $(A>B)$

$Z_1 = 1$ if

$a_3 = b_3$, $a_2 = b_2$, $a_1 = b_1$ & $a_0 = b_0$

Z_1



Magnitude Comparator (Cont.)

$$Z_2 = \bar{a}_3 b_3 + x_3 \bar{a}_2 b_2 + x_3 x_2 \bar{a}_1 b_1 + x_3 x_2 x_1 \bar{a}_0 b_0 \qquad (A<B)$$

$$Z_3 = a_3 \bar{b}_3 + x_3 a_2 \bar{b}_2 + x_3 x_2 a_1 \bar{b}_1 + x_3 x_2 x_1 a_0 \bar{b}_0$$

XNOR $\quad Z = \overline{a \oplus b} = \overline{\bar{a} b + a \bar{b}}$