

	BCD				Excess 3				
	A	B	C	D	w	x	y	z	
0	0	0	0	0	0	0	1	1	3
1	0	0	0	1	0	1	0	0	4
2	0	0	1	0	0	1	0	1	5
3	0	0	1	1	0	1	1	0	6
4	0	1	0	0	0	1	1	1	7
5	0	1	0	1	1	0	0	0	8
6	0	1	1	0	1	0	0	1	9
7	0	1	1	1	1	0	1	0	10
8	1	0	0	0	1	0	1	1	11
9	1	0	0	1	1	1	0	0	12
	1	0	1	0	X	X	X	X	
					X	X	X	X	
					X	X	X	X	
					X	X	X	X	
					X	X	X	X	
	1	1	1	1	X	X	X	X	

These inputs have no meaning in BCD. It is assumed they will never occur.

Don't Care

$$w = \text{Sum}(m5, m6, m7, m8, m9)$$

$$x = \text{Sum}(m1, m2, m3, m4, m9)$$

$$y = \text{Sum}(m0, m3, m4, m7, m8)$$

$$z = \text{Sum}(m0, m2, m4, m46, m8)$$

$$w = A + BC + BD$$

		CD=00 CD=01 CD=11 CD=10			
		00	01	11	10
AB=00	00				
AB=01	01		1	1	1
AB=11	11	x	x	x	x
AB=10	10	1	1	x	x

		CD=00 CD=01 CD=11 CD=10			
		00	01	11	10
AB=00	00				
AB=01	01		1	1	1
AB=11	11	1	1	1	1
AB=10	10	1	1	1	1

		CD=00 CD=01 CD=11 CD=10				A
		00	01	11	10	
AB=00	00					
AB=01	01		1	1	1	
AB=11	11	x	x	x	x	
AB=10	10	1	1	x	x	

		CD=00 CD=01 CD=11 CD=10				BD
		00	01	11	10	
AB=00	00					
AB=01	01		1	1	1	
AB=11	11	x	x	x	x	
AB=10	10	1	1	x	x	

w

		CD=00	CD=01	CD=11	CD=10	BC
		00	01	11	10	
AB=00	00					
AB=01	01		1	1	1	
AB=11	11	x	x	x	x	
AB=10	10	1	1	x	x	

$$X = B'C + B'D + BC'D'$$

x

		CD=00	CD=01	CD=11	CD=10
		00	01	11	10
AB=00	00		1	1	1
AB=01	01	1			
AB=11	11	x	x	x	x
AB=10	10		1	x	x

x

		CD=00	CD=01	CD=11	CD=10
		00	01	11	10
AB=00	00		1	1	1
AB=01	01	1			
AB=11	11	1	0	0	0
AB=10	10		1	1	1

x

		CD=00	CD=01	CD=11	CD=10	B'D
		00	01	11	10	
AB=00	00		1	1	1	
AB=01	01	1				
AB=11	11	x	x	x	x	
AB=10	10		1	x	x	

x

		CD=00	CD=01	CD=11	CD=10	B'C
		00	01	11	10	
AB=00	00		1	1	1	
AB=01	01	1				
AB=11	11	x	x	x	x	
AB=10	10		1	x	x	

x

		CD=00	CD=01	CD=11	CD=10	BC'D'
		00	01	11	10	
AB=00	00		1	1	1	
AB=01	01	1				
AB=11	11	x	x	x	x	
AB=10	10		1	x	x	

$$y = CD + C'D'$$

y

		CD=00	CD=01	CD=11	CD=10
		00	01	11	10
AB=00	00	1		1	
AB=01	01	1		1	
AB=11	11	x	x	x	x

y

		CD=00	CD=01	CD=11	CD=10
		00	01	11	10
AB=00	00	1		1	
AB=01	01	1		1	
AB=11	11	1	0	1	0

AB=10 10

1		x	x
---	--	---	---

AB=10 10

1		1	0
---	--	---	---

y

		CD=00	CD=01	CD=11	CD=10	C'D'
		00	01	11	10	
AB=00	00	1		1		
AB=01	01	1		1		
AB=11	11	x	x	x	x	
AB=10	10	1		x	x	

y

		CD=00	CD=01	CD=11	CD=10	CD
		00	01	11	10	
AB=00	00	1		1		
AB=01	01	1		1		
AB=11	11	x	x	x	x	
AB=10	10	1		x	x	

z=D'

z

		CD=00	CD=01	CD=11	CD=10	
		00	01	11	10	
AB=00	00	1			1	
AB=01	01	1			1	
AB=11	11	x	x	x	x	
AB=10	10	1		x	x	

z

		CD=00	CD=01	CD=11	CD=10	
		00	01	11	10	
AB=00	00	1			1	
AB=01	01	1			1	
AB=11	11	1	0	0	1	
AB=10	10	1		0	1	

$w = A + BC + BD$   
 $X = B'C + B'D + BC'D'$   
 $y = CD + C'D'$   
 $z = D'$

$w = A + BC + BD = A + B(C + D)$   
 $X = B'C + B'D + BC'D' = B'(C + D) + B(C'D') = B'(C + D) + b(C + D)'$   
 $y = CD + C'D' = CD + (C + D)'$   
 $z = D'$

	0-0-0-0	0-1-0-0-1	1-0-1-0	1-0-1-1	1-1-0-0
w=A+B(C+D)	0	1	1	1	1
X= B'(C+D)+b(C+D)'	0	1	1	1	1
y= CD+(C+D)'	1	0	0	1	1
z= D'	1	0	1	0	1

	0-0-0-0	0-1-0-0-1	1-1-0-1	1-1-1-0	1-1-1-1
w=A+B(C+D)	0	1	1	1	1
X= B'(C+D)+b(C+D)'	0	1	0	0	0

$y = CD + (C+D)'$     1    0                0                0                1  
 $z = D'$                 1    0                0                1                0

A2	A1	A0	B2	B1	B0	Z2	Z1	Z0	OV
1			1			0			1
0			0			1			1

A2	B2	Z2	OV
1	1	0	1
0	0	1	1

A2	B2	Z2	OV
0	0	0	
0	0	1	1
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	1
1	1	1	

OV =

BCD					Excess 3				
	A	B	C	D	w	x	y	z	
0	0	0	0	0	0	0	1	1	3
1	0	0	0	1	0	1	0	0	4
2	0	0	1	0	0	1	0	1	5
3	0	0	1	1	0	1	1	0	6
4	0	1	0	0	0	1	1	1	7
5	0	1	0	1	1	0	0	0	8
6	0	1	1	0	1	0	0	1	9
7	0	1	1	1	1	0	1	0	10
8	1	0	0	0	1	0	1	1	11
9	1	0	0	1	1	1	0	0	12
	1	0	1	0	1	1	0	1	13
	1	0	1	1	1	1	1	0	14
	1	1	0	0	1	1	1	1	15
	1	1	0	1	1	0	0	0	8
	1	1	1	0	1	0	0	1	9
	1	1	1	1	1	0	1	0	10

don't care condition  
 x that was grouped with 1 → output 1  
 otherwise → output 0

$$\begin{aligned}
F1 &= (A'+B')(A'+C')(B'+C')(A+B+C) + ABC \\
&= (A'+(B'C'))(B'+C')(A+B+C) \\
&= (A'+B'C')(AB'+B'B+B'C+AC'+BC'+CC') + ABC \\
&= (A'+B'C')(AB'+AC'+BC'+B'C) + ABC \\
&= A'AB'+A'AC'+A'BC'+A'B'C+B'C'AB'+B'C'AC'+B'C'BC'+B'C'B'C + ABC \\
&= A'BC'+A'B'C+AB'C'+AB'C'+ ABC \\
&= A'BC'+A'B'C+AB'C'+ ABC
\end{aligned}$$