

Dont cares

Determine the SOP min Expression for a boolean function w/ 4-bits of input representing a decimal number between 0 and 9. The 1-bit output equals 1 when the input is an even number.

$$A = a_3 a_2 a_1 a_0 \quad \text{Ex: } a_3 a_2 a_1 a_0 = 0101 \quad F = 0$$

$a_3 a_2 \backslash a_1 a_0$	00	01	11	10
00	1			1
01	1			1
11				
10	1			

$a_3' a_0'$ (circled 1s at (00,00), (01,00), (10,00))

$a_2' a_1' a_0'$ (circled 1s at (00,00), (01,00))

$$F(a_3 a_2 a_1 a_0) = a_3' a_0' + a_2' a_1' a_0'$$

- Since the inputs 10-15 will "never" be applied, we don't care what the output is for these inputs.
- Consequently we can make the output equal values which help reduce the complexity of the output.
- Denote this freedom by placing "X" in cells where we don't care what the output equals.

$a_3 a_2 \backslash a_1 a_0$	00	01	11	10
00	1			1
01	1			1
11	X	X	X	X
10	1		X	X

$$F(a_3 a_2 a_1 a_0) = a_0'$$

$$F(a,b,c,d) = \sum m(0,1,5,14,15) + \sum d(4,13)$$

ab \ cd	00	01	11	10
00	1	1		
01	X	1		
11		X	1	1
10				

$$F(abcd) = a'c' + abc$$

$$G(abcd) = \sum m(0,6,7,9,10,12) + \sum d(2,4,8,13)$$

ab \ cd	00	01	11	10
00	1			X
01	X		1	1
11	1	X		
10	X	1		1

$$G(abcd) = b'd' + ac' + a'bc$$

Don't cares on inputs

We can use don't cares on inputs to reduce the size of a truth table. Replace don't cares with all combination of bits.

Ex:

a	b	c	F
x	0	x	0
x	1	0	1
0	1	1	1
1	1	1	X

Find SOP_{min}

a \ bc	00	01	11	10
0	0	0	1	1
1	0	0	X	1

$$f = b$$