4 variable k-maps:

yz \ wx	00	01	11	10
00	1	1	1	0
01	1	1	1	0
11	0	0	1	1
10	0	0	1	1

$\bar{w}\bar{y}$ $x\bar{y}$ wx wy

$f = \bar{w}\bar{y} + wy + wx$

Cost:
3
1
6
3
13

$f = \bar{w}\bar{y} + wy + x\bar{y}$

Cost:
3
1
6
3
13

No unique answer for most simplified equation.

yz \ wx	00	01	11	10
00	1	0	0	1
01	0	0	0	0
11	0	0	0	0
10	1	0	0	1

$f = \bar{x}\bar{z}$

(use the corners to make square)

5 variable map

v	w	x	y	z	f
0	0	0	0	0	

32 rows

$f = \bar{v} f_{\bar{v}} + v f_{v}$

yz \ wx	00	01	11	10	00	01	11	10
00	1	0	0	1	1	0	0	1
01	0	1	1	0	0	1	1	0
11	0	1	1	0	0	1	1	1
10	0	1	0	0	0	1	0	1

$\bar{x}\bar{y}\bar{z}$ $w\bar{x}yv$ xz $\bar{w}xy$

Think of this as a cube. (2-layered 4-var map on top of each other.)

yz \ wx	00	01	11	10
00	1	1	1	0
01	1	1	1	0
11	0	0	1	1
10	0	0	1	1

$(\bar{w}+x+y)$

$(w+\bar{y})$

$f = \bar{w}\bar{y} + wy + wx$ cost: 13 sum to product

$f = (\bar{w}+x+y)(w+\bar{y})$ cost: 10 product to sum

product of sums is cheaper in this case.

Don't Cares

* Sometimes we have an f and some input patterns are not important (don't happen)

wxyz	f
0000	1
0001	0
0010	0
0011	0
0100	1
0101	0
0110	0
0111	0
1000	1
1001	0
1010	X
1011	X
⋮	X
	⋮

← something that outputs "1" when input is a multiple of 4.

"X" means don't care

yz \ wx	00	01	11	10
00	X	1	1	X
01	0	X	1	0
11	0	0	1	0
10	0	0	1	0

$f = wx + x\bar{y}$ ①

$= wx + \bar{y}\bar{z}$ ②

① and ② are functionally equivalent but not algebraically equivalent

f_1

yz \ wx	00	01	11	10
00	0	0	0	0
01	1	1	1	0
11	1	1	1	0
10	0	1	0	0

f_2

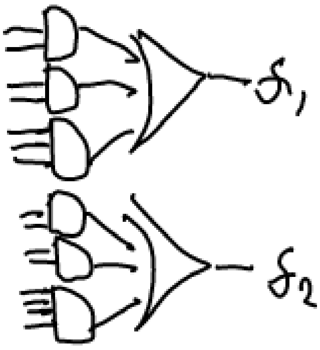
yz \ wx	00	01	11	10
00	0	0	0	0
01	1	0	1	1
11	1	0	1	1
10	0	1	0	0

$f_1 = xz + \bar{w}z + \bar{w}xy$

$f_2 = wz + \bar{x}z + \bar{w}xy\bar{z}$

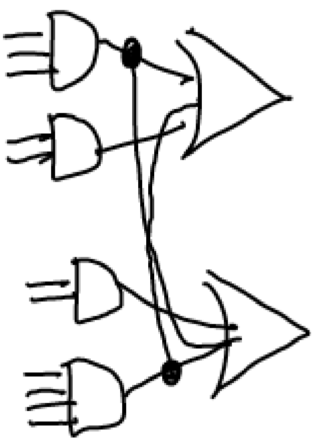
cost: 29

15 AND Input
6 OR Input
6 AND Gates
2 OR Gates



$f_1 = wxz + \bar{w}z + \bar{w}xy\bar{z}$

$f_2 = wzx + \bar{x}z + \bar{w}xy\bar{z}$



cost: 23