Minimum sum-of-products

$\S 1$. a) $f(a,b,c,d) = \Sigma m(0,1,3,5,6,7,11,12,14)$

f	cd	00	01	11	10
ab					
00		1 (0)	1 (1)	1 (3)	0 (2)
01		0 (4)	1 (5)	1 (7)	1 (6)
11		1 (12)	0 (13)	0 (15)	1 (14)
10		0 (8)	0 (9)	1 (11)	0 (10)

$\Rightarrow f(a,b,c,d) = a'd + a'b'c' + b'cd + bcd' + abd'$

b) $f(a,b,c,d,e) = \Sigma m(1,5,12,13,14,16,17,21,23,29,30,31) + \Sigma d(0,2,3,9)$

f	de	000	001	011	010	110	111	101	100
ab									
00		d (0)	1 (1)	d (3)	d (2)	0 (6)	0 (7)	1 (5)	d (4)
01		0 (8)	0 (9)	0 (11)	0 (10)	1 (14)	0 (15)	1 (13)	1 (12)
11		1 (24)	0 (25)	0 (27)	0 (26)	1 (30)	1 (31)	0 (29)	0 (28)
10		1 (16)	1 (17)	0 (19)	0 (18)	0 (22)	1 (23)	1 (21)	0 (20)

$\Rightarrow f(a,b,c,d,e) = b'c'd' + a'b'c' + a'cd' + ac'd'e' + bc'd'e' + abcd + ab'ce$

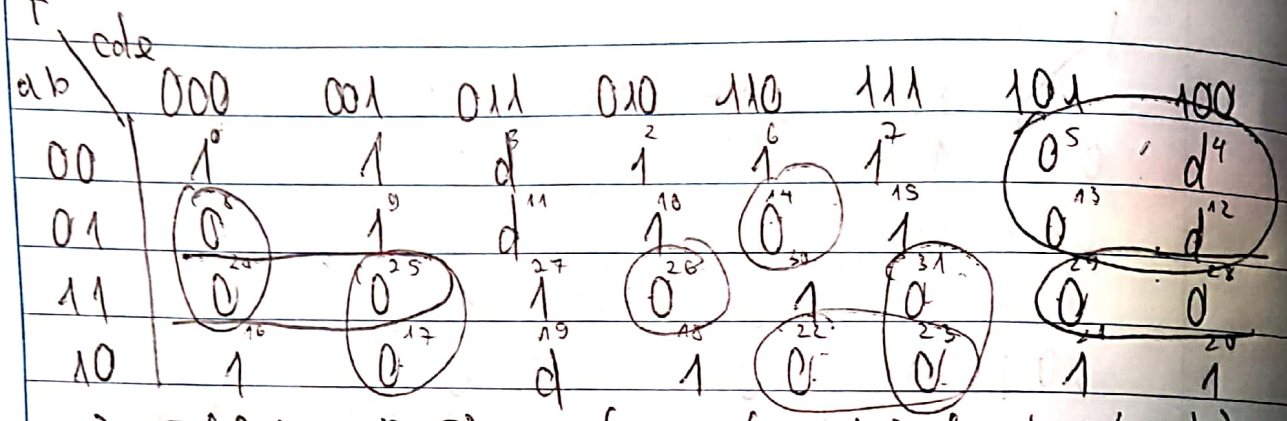
c) $f(a,b,c,d) = \Pi M(5,7,13,14,15) \cdot \Pi D(1,2,3,9)$

f	cd	00	01	11	10
ab					
00		1 (0)	d (1)	d (3)	d (2)
01		1 (4)	0 (5)	0 (7)	1 (6)
11		1 (12)	0 (13)	0 (15)	0 (14)
10		1 (8)	d (9)	1 (11)	1 (10)

$\Rightarrow f(a,b,c,d) = c'd' + b'c + a'bd'$

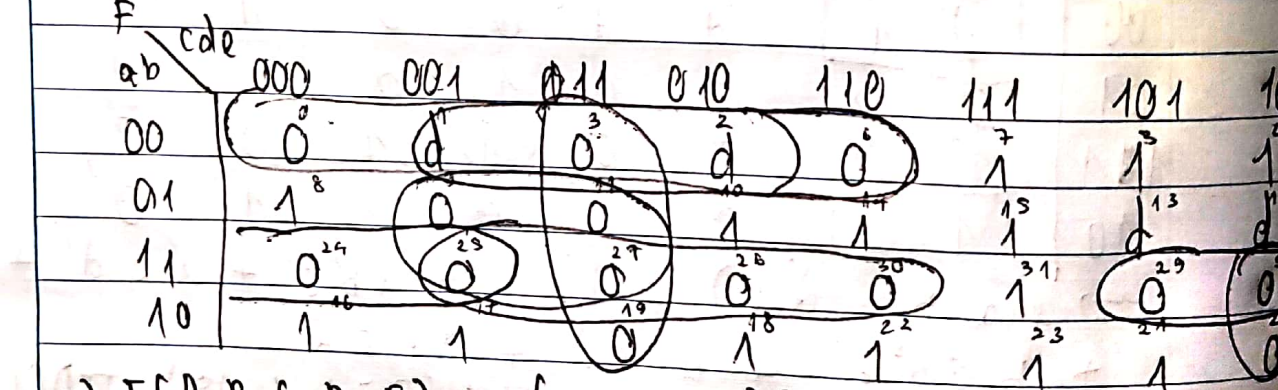
2. minimum product of sums

a) $F(A,B,C,D,E) = \sum m(0,1,2,6,7,9,10,15,16,18,20,21,27,30) + \sum d(3,4,11,12,19)$



$\Rightarrow F(A,B,C,D,E) = (a+c'+d)(a'+b'+d)(b'+c+d+e)(a'+c+d+e')(a'+b+c'+d')(a'+c'+d+e')(a'+b'+c+d'+e)(a+b'+c'+d'+e)$

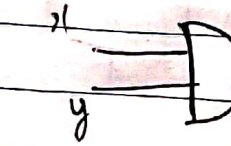
b) $F(A,B,C,D,E) = \Pi M(0,3,6,9,11,19,20,24,25,26,27,28,21,30) \cdot \Pi D(1,2,12,13)$



$\Rightarrow F(A,B,C,D,E) = (a+b+c)(a+b+d)(c+d'+e')(b'+c+e')(a'+b'+d)(a'+b'+e)(a'+c'+d+e)$

3. $F = w'x' + xy + wy'$ chỉ dùng cổng NAND 2 đầu vào

x	y	w	w'x'	xy	wy'	F
0	0	0	1	0	0	1
0	0	1	0	0	1	1
0	1	0	0	0	0	0
0	1	1	0	1	0	1
1	0	0	0	0	0	0
1	0	1	0	0	1	1
1	1	0	0	1	0	1
1	1	1	0	1	0	1



F

x \ yw	00	01	11	10
0	1	1	0	1
1	0	1	1	1

$(x'+y+w)(x+y'+w)$

$(x.x)' = x'$

$F = w'x' + xy + wy'$

$= ((w'x' + xy + wy')')'$

$= [(w'x')' . (xy)' . (wy')']'$

$= [[(w.w)' . (x.x)']' . (xy)' . (w.(y.y)')]'$