Digital Logic Design: Homework 3

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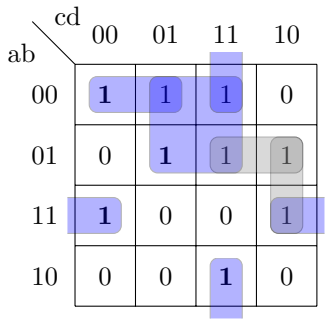
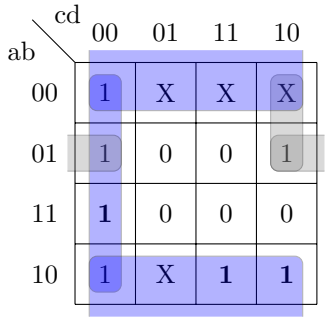
5.6

a)



The bolded minterms in the Karnaugh map make their respective prime implicant essential. Non-blue groups indicate options between multiple possible minterms.
A minimum sum-of-products for f is $f(a,b,c,d) = a'b'c' + a'd + b'cd + abd' + a'bc$. The last term may be substituted with bcd'.

c)



The bolded minterms in the Karnaugh map make their respective prime implicant essential. Non-blue groups indicate options between multiple possible minterms.
A minimum sum-of-products for f is $f(a,b,c,d) = c'd' + b' + a'bd'$. The last term may be substituted with $a'cd'$.

5.7

b)

$f(a, b, c, d) = a'b' + a'c'd' + abc.$

5.9

b)

$f(a, b, c, d)$
$= a'b'c'e' + ab'cd' + abe' + b'd'e + cde + a'b'cd$
$= (a + b' + c')(a' + d' + e' + c)(a' + b + e')(b + d' + e)(c' + d + e)(a + b' + d + e').$

5.14

d)

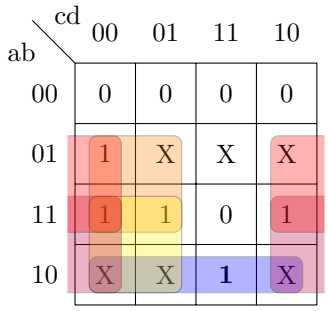
$f(a, b, c) = a'c' + bc.$

f)

$f(x, y, z) = z' + xy' + x'y.$

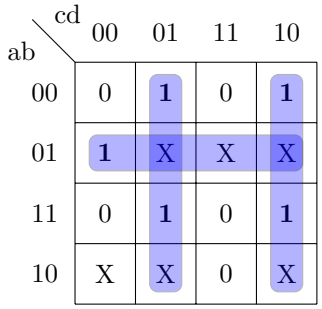
5.22

a)



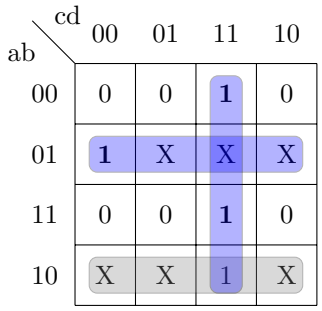
The bolded minterms in the Karnaugh map make their respective prime implicant essential.
The minimum sum-of-products for f are $ab' + bc' + bd'$, $ab' + ac' + bd'$.
The prime implicants are circled in the graph above: ab', bc', bd', ac', ad'

c)



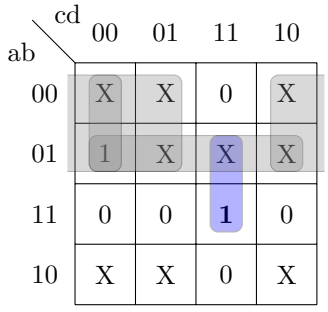
The bolded minterms in the Karnaugh map make their respective prime implicant essential.
The minimum sum-of-products for f are $ab' + bc' + bd'$, $ab' + ac' + bd'$.
The prime implicants are circled in the graph above: ab', bc', bd', ac', ad'

e)



The bolded minterms in the Karnaugh map make their respective prime implicant essential.
The minimum sum-of-products for f is $a'b + cd$.
The prime implicants are circled in the graph above: $a'b, cd, ab'$.

g)



The bolded minterms in the Karnaugh map make their respective prime implicant essential.
The minimum sum-of-products for f are $bcd + a'b, bcd + a'c', bcd + a'd'$.
The prime implicants are circled in the graph above: $bcd, a'b, a'c', a'd'$.

5.25

c)

ab \ cd	00	01	11	10
00	**1**	0	X	1
01	0	0	0	**1**
11	0	0	0	0
10	X	1	0	X

$f(a, b, c, d) = b'd' + ab'c' + a'cd'.$

d)

ab \ cd	00	01	11	10
00	0	X	X	0
01	1	X	0	0
11	0	0	1	1
10	1	0	1	1

$f(a, b, c, d) = a'bc' + ab'd' + ac.$

5.34

a)

ab \ cd	00	01	11	10
00	X	0	X	1
01	1	X	1	X
11	X	0	X	1
10	0	X	**1**	X

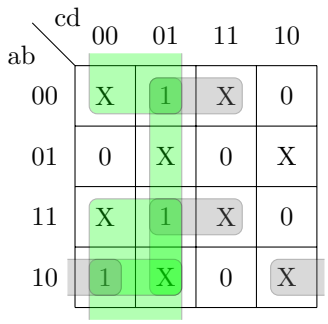
b)

The prime implicants of f are $a'd', bd', a'b, c, ab'd$.

c)

The minimum sum of products for $f(a, b, c, d)$ are $a'b + c, bd' + c, a'd' + c$.

d)



The prime implicants of f' are $b'c', ac', ab'd', c'd, a'b'd, abd$.

f)

The minimum sum of products for $f(a, b, c, d)$ are $b'c' + ac', b'c' + c'd, ac' + c'd$.