

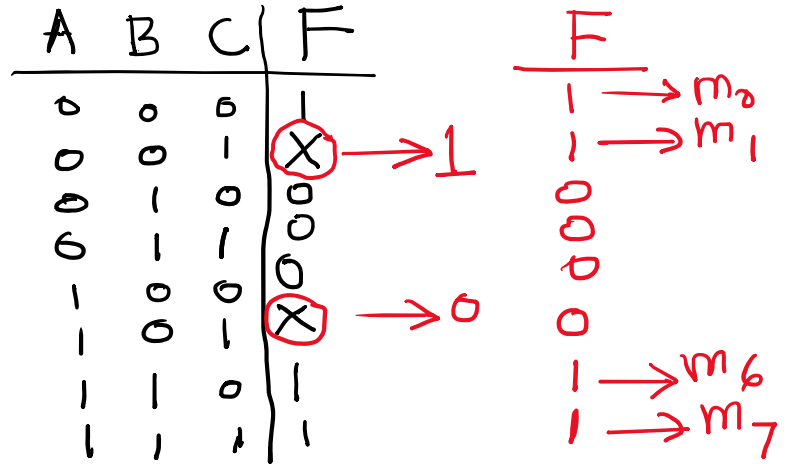
ECE2060 Sp-2022 HW1 Solutions

Prob. 1: 4.6) a.) The don't cares that help in simplification should be set to '1'. The don't cares that do not help simplification should be set to '0'.

Setting the don't care X in row 1 to '1' and setting the don't care in row 5 to '0' allows us to simplify F as:

a) $F = \sum m(0,1,2,6,7) = A'B'C' + A'B'C + ABC' + ABC = A'B'(C'+C) + AB(C'+C)$

$F = A'B' + AB$ since $C' + C = 1$



Prob. 2: 4.7)

A	B	C	F	Σm	ΠM
0	0	0	0		M_0
0	0	1	1	m_1	
0	1	0	1	m_2	
0	1	1	0		M_3
1	0	0	1	m_4	
1	0	1	0		M_5
1	1	0	0		M_6
1	1	1	0		M_7

The complemented literals are highlighted in red for readability.

b) $F = \sum m(1,2,4)$
 $= A'B'C + A'BC' + AB'C'$

c) $F = \Pi M(0,3,5,6,7)$
 $= (A+B+C)(A+B'+C')(A'+B+C')(A'+B'+C)(A'+B'+C')$

Prob. 3: 4.13)

A	B	C	D	Z	Σm
0	0	0	0	1	m_0
0	0	0	1	1	m_1
0	0	1	0	0	
0	0	1	1	0	
0	1	0	0	0	
0	1	0	1	0	
0	1	1	0	0	
0	1	1	1	1	m_7
1	0	0	0	1	m_8
1	0	0	1	0	
1	0	1	0	0	
1	0	1	1	0	
1	1	0	0	0	
1	1	0	1	0	
1	1	1	0	1	m_{14}
1	1	1	1	1	m_{15}

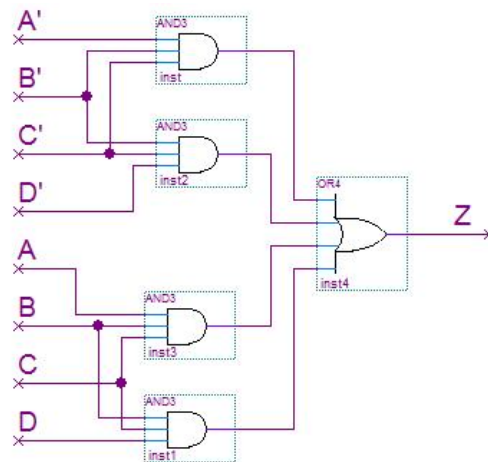
$$F = \Sigma m(0,1,7,8,14,15)$$

$$= A'B'C'D' + A'B'C'D + A'BCD + AB'C'D' + ABCD' + ABCD$$

$$= (A'B'C'D' + A'B'C'D) + (AB'C'D' + A'B'C'D') + (ABCD' + ABCD) + (A'BCD + ABCD)$$

$$= A'B'C' + B'C'D' + ABC + BCD$$

Bold terms are duplicates that allow the use of same term in two separate simplifications. ($X = X+X$)



Problems 4 & 5: 4.25) a & b

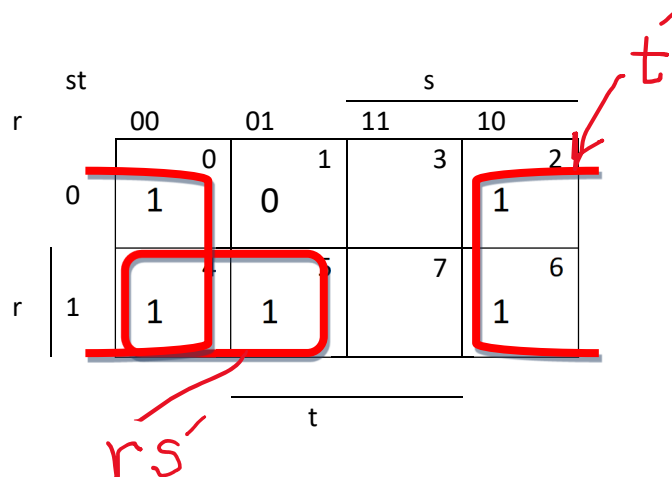
A	B	C	D	F	G		
0	0	0	0	0	1		
0	0	0	1	0	0		
0	0	1	0	0	1		
0	0	1	1	0	0		
0	1	0	0	0	1		
0	1	0	1	1	0		
0	1	1	0	1	1		
0	1	1	1	1	0		
1	0	0	0	0	0		
1	0	0	1	0	0		
1	0	1	0	1	0		
1	0	1	1	1	0		
1	1	0	0	0	0		
1	1	0	1	1	0		
1	1	1	0	1	0		
1	1	1	1	1	0		

$$F = \Sigma m(5,6,7,10,11,13,14,15) = \Pi M(0,1,2,3,4,8,9,12)$$

$$G = \Sigma m(0,2,4,6) = \Pi M(1,3,5,7,8,9,10,11,12,13,14,15)$$

Problems 6 and 7: 5.14) c. Note: Solution is provided for $f_3 = rs' + r't' + st'$ and f .

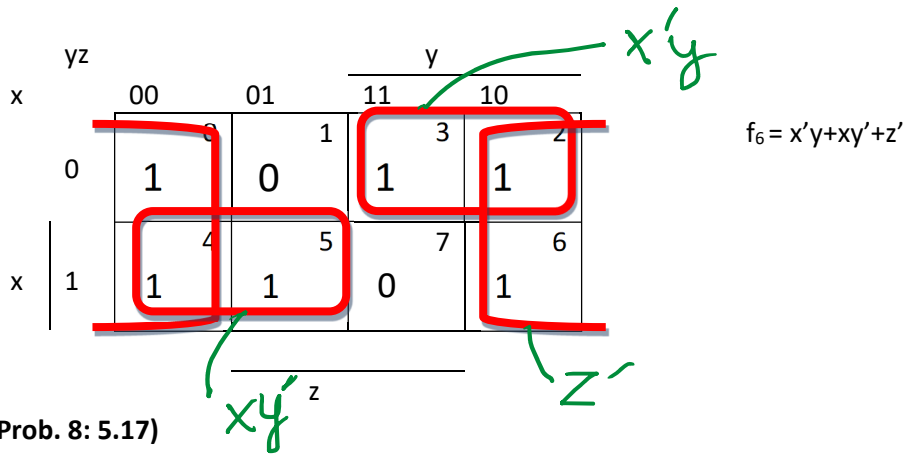
r	s	t	rs'	r't'	st'	f ₃
0	0	0		1		1
0	0	1				0
0	1	0		1	1	1
0	1	1				0
1	0	0	1			1
1	0	1	1			1
1	1	0			1	1
1	1	1				0



$f_3 = rs' + t'$

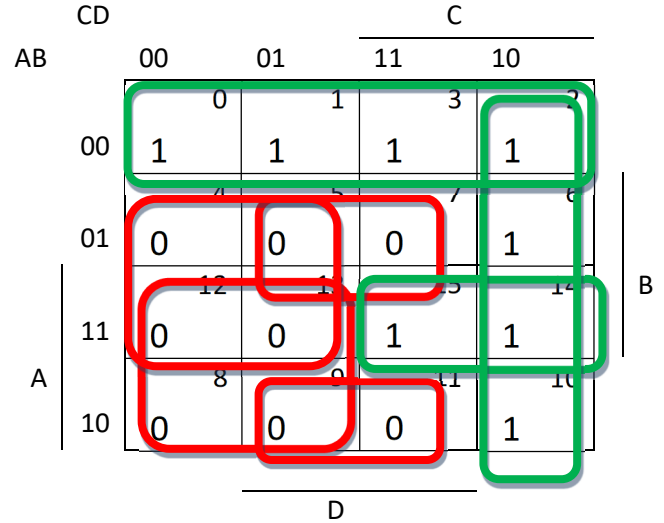
f)

x	y	z	M ₁	M ₇	M ₁ , M ₇	
0	0	0	1	1	1	m ₀
0	0	1	0	1	0	
0	1	0	1	1	1	m ₂
0	1	1	1	1	1	m ₃
1	0	0	1	1	1	m ₄
1	0	1	1	1	1	m ₅
1	1	0	1	1	1	m ₆
1	1	1	1	0	0	



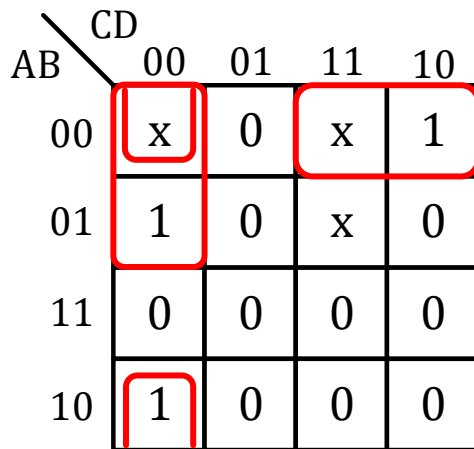
Prob. 8: 5.17)

A	B	C	D	A'B'	CD'	ABC	A'B'CD'	ABCD'	F
0	0	0	0	1					1
0	0	0	1	1					1
0	0	1	0	1	1		1		1
0	0	1	1	1					1
0	1	0	0						0
0	1	0	1						0
0	1	1	0		1				1
0	1	1	1						0
1	0	0	0						0
1	0	0	1						0
1	0	1	0		1				1
1	0	1	1						0
1	1	0	0						0
1	1	0	1						0
1	1	1	0		1	1		1	1
1	1	1	1			1		1	1

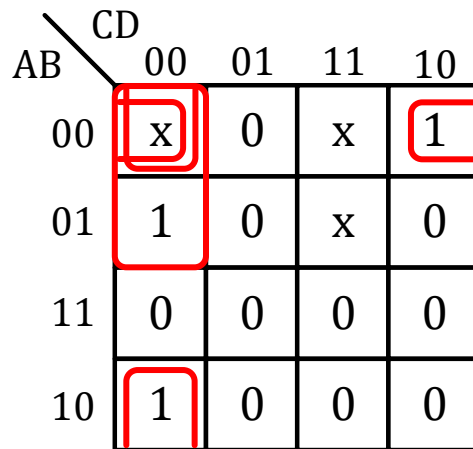


$F = A'B' + CD' + ABC$
 $F' = AC' + BC' + AB'D + A'BD$
 $F = (A'+C)(B'+C)(A'+B+D')(A+B'+D')$

Prob. 9: 5.24) b



$F = A'B'C + A'C'D' + B'C'D'$



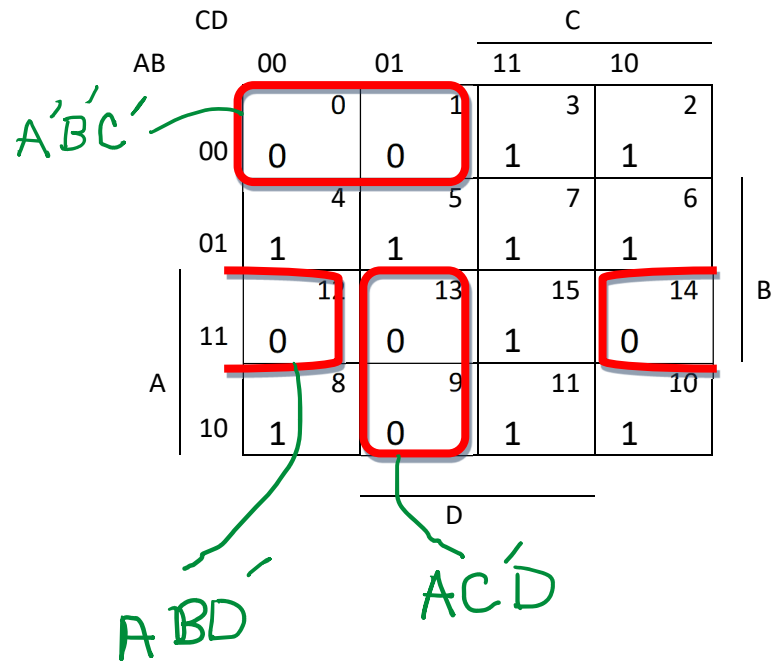
$F = A'B'D' + A'C'D' + B'C'D'$

Both functions are minimum sum of products realizations.

Prob. 10: 5.29)

a) $F = \prod M(0,1,9,12,13,14) = (A+B+C+D)(A+B+C+D')(A'+B+C+D')(A'+B'+C+D)(A'+B'+C+D')(A'+B'+C'+D)$

A	B	C	D	AB'D'	A'B	A'C	CD	F
0	0	0	0					0
0	0	0	1					0
0	0	1	0			1		1
0	0	1	1			1	1	1
0	1	0	0		1			1
0	1	0	1		1			1
0	1	1	0		1	1		1
0	1	1	1		1	1	1	1
1	0	0	0	1				1
1	0	0	1					0
1	0	1	0	1				1
1	0	1	1				1	1
1	1	0	0					0
1	1	0	1					0
1	1	1	0					0
1	1	1	1				1	1



b) $F' = A'B'C' + ABD' + AC'D$

c) $F = F'' = (A+B+C)(A'+B'+D)(A'+C+D')$