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ICS Problem Sheet #08

Problem 8.1:

a-) Prime implicants:

minterm pattern	used	minterms pattern	used	〃 〃 〃
$m_1 = 000001$	✓	$m_{1,5} = 000\text{-}01$	✓	$m_{1,5,9,13} = 00\text{--}01$
$m_8 = 001000$	✓	$m_{1,9} = 00\text{-}001$	✓	$m_{1,9,5,13} = 00\text{--}01$
$m_{16} = 010000$	✓	$m_{8,9} = 00100\text{-}$	✓	$m_{8,10,9,11} = 0010\text{--}$
$m_5 = 000101$	✓	$m_{8,10} = 0010\text{-}0$	✓	$m_{8,9,10,11} = 0010\text{--}$
$m_9 = 001001$	✓	$m_{8,24} = 0\text{-}1000$		
$m_{18} = 010010$	✓	$m_{16,18} = 0100\text{-}0$		
$m_{24} = 011000$	✓	$m_{16,24} = 01\text{-}000$		
$m_{10} = 001010$	✓	$m_{5,7} = 0001\text{-}1$		
$m_7 = 000111$	✓	$m_{5,13} = 00\text{-}101$	✓	
$m_{11} = 001011$	✓	$m_{9,11} = 0010\text{-}1$	✓	
$m_{13} = 001101$	✓	$m_{10,11} = 00101\text{-}$	✓	
$m_{29} = 011101$	✓	$m_{9,13} = 001\text{-}01$	✓	
		$m_{13,29} = 0\text{-}1101$		

After removing the redundant patterns we are left with the following

Set of Prime implicants:

$m_{1,5,9,13}$; $m_{8,9,10,11}$; $m_{8,24}$; $m_{5,7}$; $m_{16,18}$; $m_{16,24}$; $m_{13,29}$

We can deduct them from the previous table

b-) Prime implicants Chart:

	m_1	m_5	m_7	m_8	m_9
$m_{1,5,9,13}$					
$m_{8,9,10,11}$					
$m_{8,24}$					
$m_{5,7}$					
$m_{16,18}$					
$m_{16,24}$					
$m_{13,29}$					

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Prime implicants Chart:

	m_1	m_5	m_7	m_8	m_9	m_{10}	m_{11}	m_{13}	m_{16}	m_{18}	m_{24}	m_{29}	
$m_{1,5,9,13}$	✓	✓			✓			✓					essential for m_1
$m_{8,9,10,11}$				✓	✓	✓	✓						essential for m_{11}
$m_{5,7}$		✓	✓										essential for m_7
$m_{16,18}$									✓	✓			essential for m_{18}
$m_{16,24}$									✓		✓		essential for m_{24}
$m_{13,29}$								✓				✓	essential for m_{29}
Covered	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	

Columns that only have a single marked cell indicate essential prime implicants. Hence, in this case all previous prime implicants are essential prime implicants: $m_{1,5,9,13} - m_{8,9,10,11} - m_{5,7} - m_{16,18} - m_{16,24} - m_{13,29}$

And they are sufficient to cover Σ minterms of the function F.