ICS 2019 Problem Sheet #8

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CS '22

8.1.a

$m_0 \to 00000$ ✓
$m_2 \to 00010$ ✓
$m_4 \to 00100$ ✓
$m_6 \to 00110$ ✓
$m_9 \to 1001$ ✓
$m_{10} \to 01010$ ✓
$m_{13} \to 01101$ ✓
$m_{14} \to 01110$ ✓
$m_{15} \to 01111$ ✓
$m_{16} \to 10000$ ✓
$m_{17} \to 10001$ ✓
$m_{21} \to 10101$ ✓
$m_{26} \to 11010$ ✓
$m_{28} \to 11100$ ✓
$m_{30} \to 11110$ ✓
$m_{31} \to 11111$ ✓

$m_0 \to 00000$ ✓	$m_0 m_2 \to 000-0$ ✓	$m_0 m_2 m_4 m_6 \to 00-0$	
$m_2 \to 0010$ ✓	$m_0 m_4 \to 00-00$ ✓	$m_0 m_4 m_2 m_6 \to 00--0$	
$m_4 \to 00100$ ✓	$m_0 m_{16} \to -0000$		
$m_{16} \to 10000$ ✓	$m_2 m_6 \to 00-10$ ✓		
$m_6 \to 00110$ ✓	$m_2 m_{10} \to 0-010$ ✓	$m_2 m_6 m_{10} m_{14} \to 0--10$	
$m_9 \to 01001$ ✓	$m_4 m_6 \to 001-0$ ✓	$m_2 m_{10} m_6 m_{14} \to 0--10$	
$m_{10} \to 01010$ ✓	$m_{16} m_{17} \to 1000-$		
$m_{17} \to 10001$ ✓	$m_6 m_{14} \to 0-110$ ✓	$m_0 m_{10} m_{14} m_{26} m_{30} \to -1-10$	
$m_{13} \to 01101$ ✓	$m_9 m_{13} \to 01-01$ ✓		
$m_{14} \to 01110$ ✓	$m_{10} m_{14} \to 01-10$ ✓	$m_{14} m_{15} m_{30} m_{31} \to -111-$	
$m_{21} \to 10101$ ✓	$m_{10} m_{26} \to -1010$ ✓		
$m_{26} \to 11010$ ✓	$m_{17} m_{21} \to 10-01$ ✓		
$m_{28} \to 11100$ ✓	$m_{13} m_{15} \to 011-1$ ✓		
$m_{15} \to 01111$ ✓	$m_{14} m_{15} \to 0111-$ ✓	$m_{14} m_{30} m_{15} m_{31} \to -111-$	
$m_{30} \to 11110$ ✓	$m_{14} m_{30} \to -1110$ ✓		
$m_{31} \to 11111$ ✓	$m_{26} m_{30} \to 11-10$ ✓		
	$m_{28} m_{30} \to 111-0$ ✓		
	$m_{15} m_{31} \to -1111$ ✓		
	$m_{30} m_{31} \to 1111-$ ✓		

Therefore the prime implicants are.

$m_0 m_{16} \rightarrow -0000 = \bar{B}\bar{C}\bar{D}\bar{E}$

$m_{16} m_{17} \rightarrow 1000- = A\bar{B}\bar{C}\bar{D}$

$m_4 m_{13} \rightarrow 01-01 = \bar{A}B\bar{D}E$

$m_{17} m_{21} \rightarrow 10-01 = A\bar{B}\bar{D}E$

$m_{13} m_{15} \rightarrow 011-1 \rightarrow \bar{A}BCE$

$m_{28} m_{30} \rightarrow 111-0 \rightarrow ABC\bar{E}$

$m_0 m_2 m_4 m_6 \rightarrow 00--0 \rightarrow \bar{A}\bar{B}\bar{E}$

$m_2 m_6 m_{10} m_{14} \rightarrow 0\blacksquare--10 \rightarrow \bar{A}D\bar{E}$

$m_{10} m_{14} m_{26} m_{30} \rightarrow -1-10 \rightarrow BD\bar{E}$

$m_{14} m_{15} m_{30} m_{31} \rightarrow -111- \rightarrow BCD$

b)

	m_0	m_2	m_4	m_6	m_{11}	m_{10}	m_{13}	m_{14}	m_{15}	m_{16}	m_{17}	m_{21}	m_{26}	m_{28}	m_{30}	m_{31}
m_0 m_{16}	✓									✓						
m_{16} m_{17}										✓	✓					
m_4 m_{13}					✓		✓									
m_{17} m_{21}											✓	✓				
m_{13} m_{15}							✓		✓							
m_{28} m_{30}														✓	✓	
m_0 m_2 m_4 m_6	✓	✓	✓	✓	✓											
m_2 m_6 m_{10} m_{14}		✓		✓		✓		✓								
m_{10} m_{14} m_{26} m_{30}						✓		✓					✓		✓	
m_{14} m_{15} m_{30} m_{31}								✓	✓						✓	✓

Therefore the essential prime implicants are

m_9 m_{13}
m_{17} m_{21}
m_{28} m_{30}
m_0 m_2 m_4 m_6
m_{10} m_{14} m_{26} m_{30}
m_{14} m_{15} m_{30} m_{31}
m_0 m_{16}

OR

m_4 m_{13}
m_{17} m_{21}
m_{28} m_{30}
m_0 m_2 m_4 m_6
m_{10} m_{14} m_{26} m_{30}
m_{14} m_{15} m_{30} m_{31}
m_{16} m_{17}

c)

$\mathcal{L} = (\neg A \wedge B \wedge \neg D \wedge E) \vee (A \wedge \neg B \wedge \neg D \wedge E) \vee (A \wedge B \wedge C \wedge \neg E) \vee (\neg A \wedge \neg B \wedge \neg E) (B \wedge D \wedge \neg E) \vee (B \wedge C \wedge D) \vee (\neg B \wedge \neg C \wedge \neg D \wedge \neg E)$

OR

$\mathcal{L} = (\neg A \wedge B \wedge \neg B \wedge E) \vee (A \wedge \neg B \wedge \neg D \wedge E) \vee (A \wedge B \wedge C \wedge \neg E) \vee (\neg A \wedge \neg B \wedge \neg E) \vee (B \wedge D \wedge \neg E) \vee (B \wedge C \wedge D) \vee (B \wedge A \wedge \neg B \wedge \neg C \wedge \neg D)$