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Homework 7

$f(A,B,C,D) = m_0 + m_2 + m_4 + m_6 + m_9 + m_{10} + m_{13} + m_{14} + m_{15} + m_{16} + m_{17} + m_{21} + m_{26} + m_{28} + m_{30} + m_{31}$

minterms	Pattern	Used
m_0	00000	✓
m_2	00010	✓
m_4	00100	✓
m_6	00110	✓
m_9	01001	✓
m_{10}	01010	✓
m_{13}	01101	✓
m_{14}	01110	✓
m_{15}	01111	✓
m_{16}	10000	✓
m_{17}	10001	✓
m_{21}	10101	✓
m_{26}	11010	✓
m_{28}	11100	✓
m_{30}	11110	✓
m_{31}	11111	✓

minterms	Pattern	Used
$m_0\ m_2$	000-0	✓
$m_0\ m_4$	00-00	✓
$m_0\ m_{16}$	-0000	•
$m_2\ m_6$	00-10	✓
$m_2\ m_{10}$	0-010	✓
$m_4\ m_6$	001-0	✓
$m_6\ m_{14}$	0-110	✓
$m_9\ m_{13}$	01-01	•
$m_{10}\ m_{14}$	01-10	✓
$m_{10}\ m_{26}$	-1010	✓
$m_{13}\ m_{15}$	011-1	•
$m_{14}\ m_{15}$	0111-	✓
$m_{14}\ m_{30}$	-1110	✓
$m_{15}\ m_{31}$	-1111	✓
$m_{16}\ m_{17}$	1000-	•
$m_{17}\ m_{21}$	10-01	•
$m_{26}\ m_{30}$	1-110	✓
$m_{28}\ m_{30}$	111-0	•
$m_{30}\ m_{31}$	1111-	✓

minterms	Pattern	Used
$m_0\ m_2\ m_4\ m_6$	00--0	
$m_2\ m_6\ m_{10}\ m_{14}$	0--10	
$m_{10}\ m_{14}\ m_{26}\ m_{30}$	-1-10	
$m_{14}\ m_{15}\ m_{30}\ m_{31}$	-111-	

Pairing

m_0 m_5
m_9
m_{10}
m_2
m_{16}
m_{17}
m_{21}
m_{26}
m_{28}
m_{30}
m_{31}

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Prime implicants

$m_0\ m_{16} \rightarrow -0000$	$\bar{B}\bar{C}\bar{D}\bar{E}$
$m_{16}\ m_{17} \rightarrow 1000-$	$A\bar{B}\bar{C}\bar{D}$
$m_4\ m_{13} \rightarrow 01-01$	$\bar{A}B\bar{D}\bar{E}$
$m_{17}\ m_{21} \rightarrow 10-01$	$A\bar{B}\bar{D}\bar{E}$
$m_{13}\ m_{15} \rightarrow 011-1$	$\bar{A}BC\bar{E}$
$m_{28}\ m_{30} \rightarrow 111-0$	$ABC\bar{E}$
$m_0\ m_2\ m_4\ m_6 \rightarrow 00--0$	$\bar{A}\bar{B}\bar{E}$
$m_2\ m_6\ m_{10}\ m_{14} \rightarrow 0--10$	$\bar{A}D\bar{E}$
$m_{10}\ m_{14}\ m_{26}\ m_{30} \rightarrow$ ~~$--10$~~ $-1-10$	$BD\bar{E}$
~~$m_{14}\ m_{15}\ m_{30}\ m_{31}$~~ $-111-$	BCD

(b)

	m_0	m_2	m_4	m_6	m_8	m_{10}	m_{13}	m_{14}	m_{15}	m_{16}	m_{17}	m_{21}	m_{26}	m_{28}	m_{30}	m_{31}
$m_0 m_{16}$	✓									✓						
$m_{16} m_{17}$										✓	✓					
$m_4 m_{13}$					✓		✓									
$m_{17} m_{21}$											✓	✓				
$m_{13} m_{15}$							✓		✓							
$m_{28} m_{30}$														✓	✓	
$m_0 m_2 m_4 m_6$	✓	✓	✓	✓						✓						
$m_2 m_6 m_{10} m_{14}$		✓		✓		✓		✓								
$m_{10} m_{14} m_{26} m_{30}$						✓		✓	✓				✓		✓	
$m_{14} m_{15} m_{30} m_{31}$								✓	✓						✓	✓

Essential prime implicants are

~~$m_4\ m_{13}$~~, ~~$m_{17}\ m_{21}$~~, ~~$m_{10}\ m_{14}\ m_{26}\ m_{30}$~~, ~~$m_{28}\ m_{30}$~~, ~~$m_{14}\ m_{15}\ m_{30}\ m_{31}$~~

~~$m_{10}\ m_{14}\ m_{26}\ m_{30}$~~, ~~$m_0\ m_2\ m_4\ m_6$~~, $m_0\ m_{16}$

OR

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

(c) $Y = (\neg A \wedge B \wedge \neg D \wedge E) \vee (A \wedge \neg B \wedge \neg D \wedge E) \vee (A \wedge B \wedge C \wedge \neg E) \vee (\neg A \wedge \neg B \wedge \neg E) \vee (B \wedge D \wedge \neg E) \vee (B \wedge C \wedge D) \vee (\neg B \wedge \neg C \wedge \neg D \wedge \neg E)$

OR

$Y = (\neg A \wedge B \wedge \neg D \wedge E) \vee (A \wedge \neg B \wedge \neg D \wedge E) \vee$

$(A \wedge B \wedge C \wedge \neg E) \vee (\neg A \wedge \neg B \wedge \neg E) \vee (B \wedge D \wedge \neg E)$

$\vee (B \wedge C \wedge D) \vee (A \wedge \neg B \wedge \neg C \wedge \neg D)$.