Q.1 \[ F_1 = XY + XZ \]

(a) 

(b) 

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Q.2 \[ F_2 = \times (\overline{Y+Z}) \]

(a)

\[
\begin{array}{ccc}
X & Y & Z \\
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0 & 0 & 0 \\
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0 & 1 & 1 \\
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1 & 0 & 1 \\
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1 & 1 & 1 \\
\end{array}
\]

\[ Y+Z \]

\[ F_2 \]
Q.3  \[ F_3 = \overline{x}yz + xy \]

(a) 

(b) 

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(c) \( F_3, F_2 \) and \( F_1 \) are all equivalent functions since their truth tables are identical.
\( a. 4 \)

\( F = XYZ + \overline{XY} \)

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\( b) \quad F = \overline{(XYZ)(\overline{XY})} \)

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\( c) \quad \text{The two circuits are equivalent} \)
\[ F = \bar{B}D + A\bar{B}\bar{C} + A\bar{C}D + \bar{A}BC \]
\[ F = (\bar{B}D + A\bar{B}\bar{C} + A\bar{C}D + \bar{A}BC) \]
\[ = (\bar{B}D + A\bar{B}(\bar{C} + \bar{C}) + A\bar{C}D) \]
\[ = (\bar{B}D + A\bar{B} + A\bar{C}D) \]
\[ = (B + \bar{D})(A + \bar{B})(\bar{A} + \bar{C} + \bar{D}) \]
\[ = (AB + AD + B\bar{B} + B\bar{D})(\bar{A} + \bar{C} + \bar{D}) \]
\[ = A\bar{B}\bar{D} + A\bar{B}\bar{C} + A\bar{C}\bar{D} + \bar{B}\bar{C}\bar{D} \]
\[ + \bar{A}B\bar{D} + \bar{A}D + \bar{B}\bar{D} \]
\[ = \bar{B}\bar{D}\left[1 + \bar{A} + \bar{C}\right] + AD\left[1 + \bar{C} + B\right] \]
\[ + ABC \]
\[ F = \bar{B}\bar{D} + AD + A\bar{B}\bar{C} \]
Q7. (a) \[ ABC + \overline{A}BC + \overline{A}BC + AB\overline{C} + \overline{A}B\overline{C} \]
\[ = BC(A + \overline{A}) + \overline{A}B(C + \overline{C}) + ABC \]
\[ = BC + \overline{A}B + ABC \]
\[ = B(C + A\overline{C}) + \overline{A}B \]
\[ = B(A + C) + \overline{A}B \]

(b) \[ (\overline{CD}) + A \]
\[ = CDA + A + CD + AB \]
\[ = CD(A + 1) + A(1 + B) \]
\[ = CD + A \]

(c) \[ (A + C + D)(A + C + \overline{D})(A + \overline{C} + D)(A + \overline{B}) \]
\[ = ((A + C)(A + C) + (A + C)\overline{D} + (A + C)D + \overline{D}) (A + \overline{C} + D)(A + \overline{B}) \]
\[ = (A + C)[(A + C) + \overline{D} + D] (A + \overline{C} + D)(A + \overline{B}) \]
\[ = (A + C)(A + \overline{C} + D)(A + \overline{B}) \]
\[ = (A + A\overline{C} + AD + CA + \overline{C} + CD)(A + \overline{B}) \]
\[ = A[A + D + \overline{C} + C] + CD \]
\[ = (A + CD)(A + \overline{B}) = A + \overline{B}CD \]
Thus

\[ B(A+C) + \overline{AB} = ABC + \overline{ABC} + \overline{ABC} + ABC + \overline{ABC} \]
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\[
Z = CD + A + A + CD + AB
\]

\[
Z^* = CD + A
\]

By the truth table, \( Z = Z^* \)

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\[
Z = (A+CD)(A+CD)(A+D)(A+B) \quad Z^* = A+BCD
\]

Again, \( Z = Z^* \)