Problem 1: Moment of Truth Table
Please translate the following expressions/sentence/diagram into a truth table (you don’t have to simplify the expressions in your solution)

(a) \( Y = \overline{AB} + \overline{A}\overline{B}C + \overline{C} \)
\( Y = \overline{AB} (\overline{A}\overline{B}C) + \overline{C} \)
\( Y = (\overline{A} + B) (A + B + \overline{C}) + \overline{C} \)
(distribute) \( Y = \overline{A}A + BA + \overline{A}B + BB + \overline{A}\overline{C} + B\overline{C} \)
\( (A\overline{A} = 0) Y = BA + B + B\overline{C} + \overline{C} = \overline{C} \)
(absorb) \( Y = B + \overline{C} \)

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(b) If A, then either both B and C or neither, else not B.
\( Y = A(BC + B\overline{C}) + \overline{A}\overline{B} \)

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(c)
Problem 2: Boolean
Simplify the following expression to minterms (sum of product) expression (Hint: consider starting with De Morgan’s Law to simplify the inversions)

(a) \( Y = \overline{DC + (D\bar{C} + BA)D} + B(A + \bar{C}) \)

(de morgan) \( Y = (\bar{D} + \bar{C})(\bar{D}C + BA)D + BAC \)

(de morgan) \( Y = (\bar{D} + \bar{C})(\bar{D} + \bar{C} + BA)D + \bar{ABC} \)

(distribute) \( Y = (\bar{D}D + \bar{C}\bar{D} + \bar{D}C + \bar{C}\bar{C} + DB\bar{A} + \bar{CB}\bar{A})D + \bar{ABC} \)

\( D\bar{D} = 0 \) \( Y = 0 + 0 + \bar{C}D + 0 + \bar{CB}\bar{A}D + \bar{ABC} \)

(absorb) \( Y = \bar{C}D + \bar{ABC} \)

Problem 3: K for Karnaugh Map
Derive the minterm/maxterm expressions for the following K-maps, whichever is simplified the most
(a)

\[
\begin{array}{cccc}
00 & 01 & 11 & 10 \\
00 & 00 & 00 & 00 \\
01 & 10 & 00 & 00 \\
11 & 11 & 00 & 00 \\
10 & 00 & 00 & 00 \\
\end{array}
\]

Answer: (student not required to draw the kmap in answer)

\[Y = B\bar{C}\bar{D} + AB\bar{C}\]

(b)

\[
\begin{array}{cccc}
00 & 01 & 11 & 10 \\
00 & 11 & 11 & 11 \\
01 & 11 & 11 & 11 \\
11 & 11 & 01 & 11 \\
10 & 11 & 01 & 11 \\
\end{array}
\]

Answer:

\[Y = AD\]

(c)
**Problem 4: Mealy or Moore**

Identify whether the following diagram represents a Mealy Machine or a Moore Machine, and then convert it to the other type (mealy to moore, and moore to mealy)

Answer: It’s a Mealy machine (output depends on both state and input)

Its Moore Machine form is: (key is to split state B into 2 states based on output value)