Question 1.

i.   Given, a boolean function: $Y(A, B, C, D) = \Pi(0, 2, 5, 6, 7, 8, 10, 13, 14, 15)$.
   a) Obtain the most simplified SOP expression.
   b) Draw a logic diagram of the reduced expression using NOR gates only.   [4]

ii.   Verify the following expression using Boolean laws –   [2]
XYZ + XY'Z + XYZ' = X.(Y + Z)

iii.   Convert the following Boolean function into canonical POS form: [2]
F(X, Y) = (X + Y') . (Y' + Z)

iv.   Differentiate between canonical form and cardinal form of Boolean expression.   [2]

Question 2.

The main safe in the nationalized bank can be opened by means of a unique password consisting of three parts. Different parts of the password are held by the Chairman, Regional Manager, Bank Manager and Head Cashier of the bank, respectively. In order to open the safe, any one of the following conditions must be satisfied:

➔ The password of the Chairman, together with the passwords of any two other officials, must be entered.
                    OR
➔ The password of all the three bank officials, excluding the chairman, must be entered.

The **inputs** are:
A ➔ Denotes the Chairman's password.
B ➔ Denotes the Regional Manager's password.
C ➔ Denotes the Bank Manager's password.
D ➔ Denotes the Head Cashier's password.
      [1 indicates YES for entering password and 0 indicates NO in all the above cases]

Output: X ➔ denotes that the safe can be opened **[** 1 indicates YES and 0 indicates NO].

(a) Draw the truth Table for the inputs and outputs given above and write the SOP expression for X(A,B,C,D).   [5]
(b) Reduce X(A,B,C,D) using the K-map. Draw the logic gate diagram for the reduced SOP expression. Assume that variables and their compliments are available as inputs.   [5]

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