Q1  
A- Simplify the following expression by using K-Map

\[ F = (A \oplus B) + (C \oplus D) + \overline{A B C D} + A B C D \]

B- Simplify the following expression using Boolean algebra laws

\[ \overline{(A + B)} + \overline{A B} \]

Q2  
A- Convert the following:

1- \((6891)_{10}\) to \((\quad )_{16}\)
2- \((8DE1)_{16}\) to \((\quad )_2\)
3- \((646)_{10}\) to \((\quad )\) gray code

B- Perform the following operations

1- \((B92 \times A4B)_{16}\)
2- \((611 - 134)_{10}\)
3- \((1010100)_2 - (1000100)_2\) use 2'S complement addition

Q3  Transmitted code word \((C_1C_2K_1C_3K_2K_3K_4)\) received as \((0001001)\) find error location by using hamming code

Q4  Design counter to count in the following Sequence 1, 3, 5, 2, 4 and repeat

Q5  
A- Find the values of \(A, B, C\) through three pulses when initial values for \(A, B, C\) are 101 respectively

\[ \begin{array}{c}
\text{T} \\
\text{C} \\
\text{Q} \\
\text{K}
\end{array} \quad \begin{array}{c}
\text{T} \\
\text{B} \\
\text{Q} \\
\text{A}
\end{array} \quad \begin{array}{c}
\text{T} \\
\text{A} \\
\text{Q} \\
\text{0}
\end{array} \]

B- Use 2-input and 4-output decoder with enable to construct 3-input and 8-output decoder