Let signal \( x(n) \), \( n = 0, \ldots, N - 1 \) have \( N \)-point DFT \( X(k) \), \( k = 0, \ldots, N - 1 \), with \( N \) even. Find, in terms of \( X(k) \) or \( x(n) \), as appropriate, the DFT (or IDFT) of the following. Then, for the signal and DFT shown below, sketch the result for each of 1) – 5).

\[ x(n) = [0, 0, 1, 1, 2, 1, 1, 0], \quad X(k) = [6, -3.4142, 0, -0.5858, 2, -0.5858, 0, -3.4142] \]

1. \( x_1(n) = \begin{cases} x(n/2), & n \text{ even;} \\ 0, & n \text{ odd.} \end{cases} \) Find \( X_1(k) \), the \( 2N \)-point DFT of \( x_1(n) \).

2. \( x_2(n) = (-1)^n x(n) \). Find \( X_2(k) \), the \( N \)-point DFT of \( x_2(n) \).

3. \( x_3(n) = x(n - N/2) \). Find \( X_3(k) \), the \( N \)-point DFT of \( x_3(n) \).

4. \( X_5(k) = \begin{cases} X(k/2), & k \text{ even;} \\ 0, & k \text{ odd.} \end{cases} \) Find \( x_5(n) \), the \( 2N \)-point IDFT of \( X_5(k) \).

5. \( x_6(n) = \begin{cases} x(n), & 0 \leq n < 8; \\ x(n - 8), & 8 \leq n < 16. \end{cases} \) Find \( X_6(k) \), the \( 2N \)-point DFT of \( x_6(n) \).