

$$k_0 \in [1 \dots K - 1] : \left( \begin{cases} y[k] = x[K + k - k_0], & k \in [0 \dots k_0 - 1] \\ y[k] = x[k - k_0], & k \in [k_0 \dots K - 1] \end{cases} \right) \Leftrightarrow \left( Y[n] = e^{-j n \frac{2\pi}{K} k_0} X[n] \right)$$