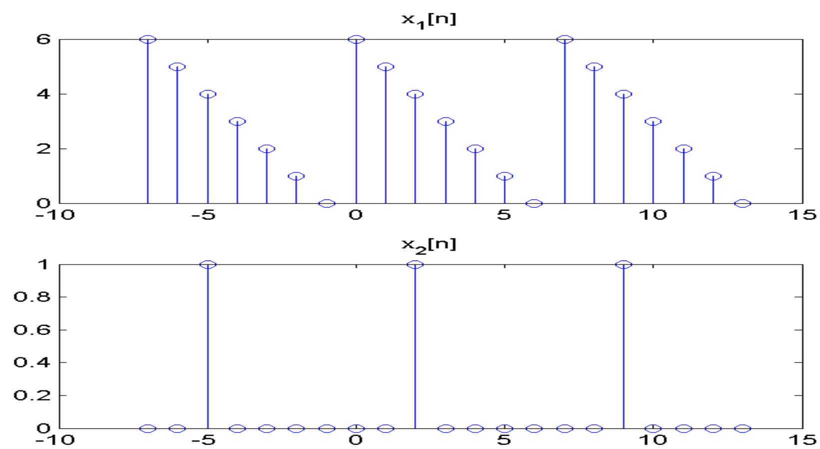
University of California, Berkeley
Department of Electrical Engineering and Computer Sciences
EE123: DIGITAL SIGNAL PROCESSING

Fall 2006

Discussion #8

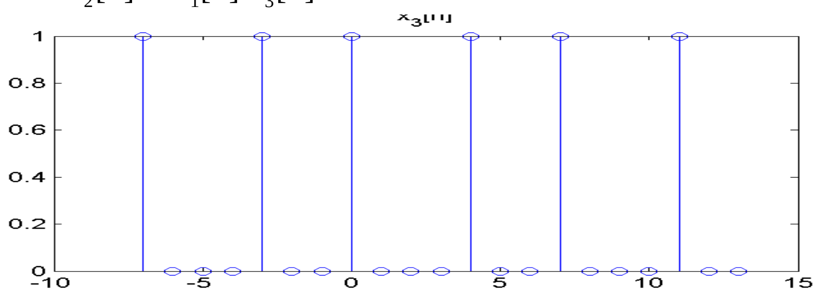
1) Suppose $\tilde{x}[n]$ is a periodic sequence with period *N*. Then $\tilde{x}[n]$ is also periodic with period *3N*. Let $\tilde{X}[k]$ denote the DFS coefficients of $\tilde{x}[n]$ considered as a periodic sequence with period *N*, and let $\tilde{X}_3[k]$ denote the DFS coefficients of $\tilde{x}[n]$ considered as a periodic sequence with period *3N*. Express $\tilde{X}_3[k]$ in terms of $\tilde{X}[k]$.

2) The figure below shows two periodic sequences, $\tilde{x}_1[n]$ and $\tilde{x}_2[n]$, with period *N=7*.

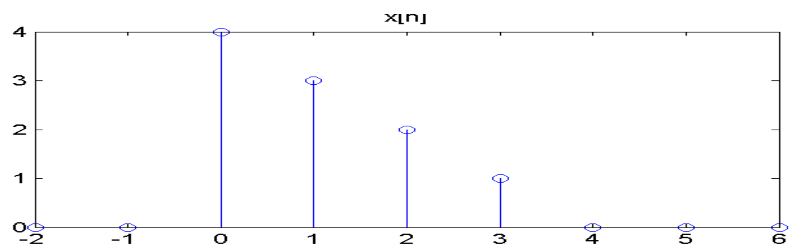


a. Find a sequence $\tilde{y}_1[n]$ whose DFS is equal to the product of the DFS of $\tilde{x}_1[n]$ and the DFS of $\tilde{x}_2[n]$, i.e. $\tilde{Y}_1[k] = \tilde{X}_1[k]\tilde{X}_2[k]$.

b. The figure below shoes a periodic sequence $\tilde{x}_3[n]$ with period *N=7*. Find a sequence $\tilde{y}_2[n]$ whose DFS is equal to the product of the DFS of $\tilde{x}_1[n]$ and the DFS of $\tilde{x}_3[n]$, i.e. $\tilde{Y}_2[k] = \tilde{X}_1[k]\tilde{X}_3[k]$.



3) Consider the real finite-length sequence *x[n]* shown below.



a. Sketch the finite-length sequence *y[n]* whose six-point DFT is $Y[k] = W_6^{4k} X[k]$, where *X[k]* is the six-point DFT of *x[n]*.

b. Sketch the finite-length sequence *w[n]* whose six-point DFT is $W[k] = \mathrm{Re}\{X[k]\}$.

c. Sketch the finite-length sequence *q[n]* whose three-point DFT is *Q[k]=X[2k], k=0,1,2*.