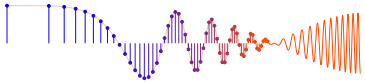


PROBLEM:

Consider a system defined by $y[n] = \sum_{k=5}^{10} b_k x[n-k]$

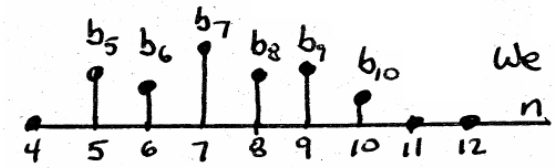
Notice that the filter coefficients b_0, b_1, b_2, ..., b_4 are all zero.

Suppose that the input $x[n]$ is non-zero only for $5 \leq n \leq 20$. Show that $y[n]$ is non-zero at most over a finite interval of the form $N_3 \leq n \leq N_4$. Determine N_3 and N_4.

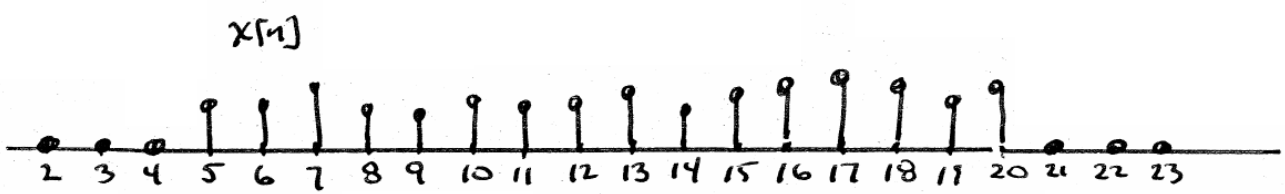
Hint: consult Figs. 5.5 and 5.6 in the book for the sliding window interpretation of the FIR filter.

McClellan, Schafer and Yoder, *Signal Processing First*, ISBN 0-13-065562-7.
Prentice Hall, Upper Saddle River, NJ 07458.

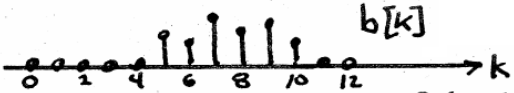
SOLUTION

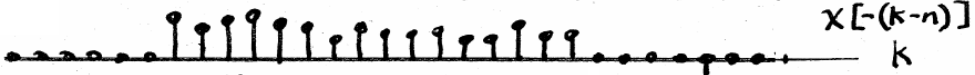


We can view b_k as a sequence $b[n]$



$$y[n] = \sum_{k=5}^{10} b[k]\,x[n-k]$$





Using graphical convolution we observe that alignments where $n \leq 9$, non-zero samples do not overlap. $\therefore y[n] = 0,\ n \leq 9$

Similarly for $n \geq 31$ $y[n] = 0$

$\therefore$ $y[n]$ can be non-zero in the range $N_3 \leq n \leq N_4$

$10 \leq n \leq 30$