In-Class Assignment (Last Lecture)

(i) A FIR filter acts on the input sequence given by

$$x[0:5] \;=\; \begin{bmatrix} 1 & -3 & 5 & -2 & 6 & 2 \end{bmatrix}^T \;; \qquad x[n] = 0 \text{ for } n < 0 \text{ and } n > 5$$

to produce the output sequence given by

$$y[0:10] \;=\; \begin{bmatrix} 2 & -3 & 0 & 10 & 23 & -27 & 61 & -51 & 54 & 14 & -2 \end{bmatrix}^T$$

and $y[n] = 0$ for $n < 0$ and $n > 10$.
Without performing a convolution, determine the response $v[\,\cdot\,]$ of the filter to the input sequence $u[\,\cdot\,]$ whose which equals zero except for

$$u[0:9] \;=\; \begin{bmatrix} 2 & -6 & 10 & -4 & 11 & 7 & -5 & 2 & -6 & -2 \end{bmatrix}^T$$

(ii) Determine the response of the filter designed in class today to the input sequence

$$x[n] \;=\; 10\cos(0.124\pi n + 0.3) + 20\cos(0.846\pi n - 1.6)$$

Are the input and output sequences periodic? If so, what are their periods?