

(b)

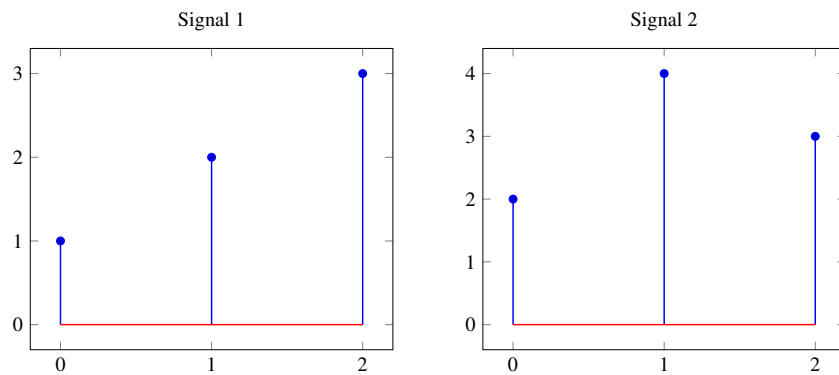
$$\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}, \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$$

(c)

$$\begin{bmatrix} 1 \\ 0 \\ 3 \end{bmatrix}, \begin{bmatrix} -3 \\ 2 \\ 1 \end{bmatrix}$$

3. Correlation

We are given the following two signals, $s_1[n]$ and $s_2[n]$ respectively.



Find the cross correlations, $\text{corr}_{s_1}(s_2)$ and $\text{corr}_{s_2}(s_1)$ for signals $s_1[n]$ and $s_2[n]$. Recall

$$\text{corr}_x(y)[k] = \sum_{i=-\infty}^{\infty} x[i]y[i-k].$$

		$\text{corr}_{\vec{s}_1}(\vec{s}_2)[k]$						
\vec{s}_1		0	0	1	2	3	0	0
$\vec{s}_2[n+2]$								
$\langle \vec{s}_1, \vec{s}_2[n+2] \rangle$		+	+	+	+	+	+	=

		$\text{corr}_{\vec{s}_2}(\vec{s}_1)[k]$						
\vec{s}_1		0	0	1	2	3	0	0
$\vec{s}_2[n+1]$								
$\langle \vec{s}_1, \vec{s}_2[n+1] \rangle$		+	+	+	+	+	+	=

		$\text{corr}_{\vec{s}_1}(\vec{s}_2)[k]$						
\vec{s}_1		0	0	1	2	3	0	0
$\vec{s}_2[n]$								
$\langle \vec{s}_1, \vec{s}_2[n] \rangle$		+	+	+	+	+	+	=

		$\text{corr}_{\vec{s}_2}(\vec{s}_1)[k]$						
\vec{s}_1		0	0	1	2	3	0	0
$\vec{s}_2[n-1]$								
$\langle \vec{s}_1, \vec{s}_2[n-1] \rangle$		+	+	+	+	+	+	=

\vec{s}_1	0	0	1	2	3	0	0
$\vec{s}_2[n-2]$							
$\langle \vec{s}_1, \vec{s}_2[n-2] \rangle$	+	+	+	+	+	+	=

			$\text{corr}_{\vec{s}_2}(\vec{s}_1)[k]$				
\vec{s}_2	0	0	2	4	3	0	0
$\vec{s}_1[n+2]$							
$\langle \vec{s}_2, \vec{s}_1[n+2] \rangle$	+	+	+	+	+	+	=

\vec{s}_2	0	0	2	4	3	0	0
$\vec{s}_1[n+1]$							
$\langle \vec{s}_2, \vec{s}_1[n+1] \rangle$	+	+	+	+	+	+	=

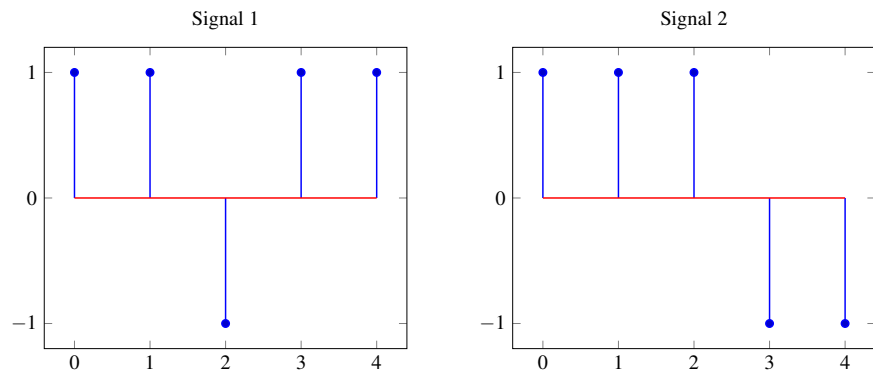
\vec{s}_2	0	0	2	4	3	0	0
$\vec{s}_1[n]$							
$\langle \vec{s}_2, \vec{s}_1[n] \rangle$	+	+	+	+	+	+	=

\vec{s}_2	0	0	2	4	3	0	0
$\vec{s}_1[n-1]$							
$\langle \vec{s}_2, \vec{s}_1[n-1] \rangle$	+	+	+	+	+	+	=

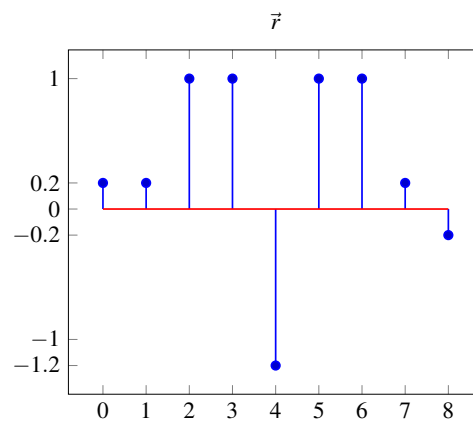
\vec{s}_2	0	0	2	4	3	0	0
$\vec{s}_1[n-2]$							
$\langle \vec{s}_2, \vec{s}_1[n-2] \rangle$	+	+	+	+	+	+	=

4. Identifying satellites and their delays

We are given the following two signals, \vec{s}_1 and \vec{s}_2 respectively, that are signatures for two satellites.



- (a) Your cellphone antenna receives the following signal $r[n]$. You know that there may be some noise present in $r[n]$ in addition to the transmission from the satellite.



Which satellites are transmitting? What is the delay between the satellite and your cellphone? Use cross-correlation to justify your answer.

- (b) Now your cellphone receives a new signal $r[n]$ as below. What the satellites that are transmitting and what is the delay between each satellite and your cellphone?

