1) Consider the finite-length signal

\[ x[n] = \begin{cases} 1, & 0 \leq n \leq 5 \\ 0, & \text{otherwise} \end{cases} \]

Analytically determine \( y[n] = x[n] * x[n] \)

ii) Compute the nonzero samples of \( y[n] = x[n] * x[n] \) using \textit{conv}, and store these samples in the vector \( y \). Your first step should be to define the vector \( x \) to contain the samples of \( x[n] \) on the interval \( 0 \leq n \leq 5 \). Also construct an index vector \( ny \), where \( ny(i) = y[ny(i)] \). For example, \( ny(1) \) should contain \( nx + nx \), where \( nx \) is the first nonzero index of \( x[n] \). Plot your results using \textit{stem}(ny,y) and make sure that your plot agrees with the signal determined in the theoretical part.

\[
\text{Answer:}
\]

\[
\begin{align*}
\text{n} &= [0:5]; \\
x &= \text{ones}(1,\text{length(n)}); \\
y &= \text{conv}(x,x); \\
ny &= [0:10]; \\
\text{figure(1)} \\
\text{stem(ny,y,'filled')} \\
\text{xlabel('Time')} \\
\text{ylabel('Amplitude')} \\
\text{title('y[n]')} \\
\end{align*}
\]

2) Consider the finite-length signal

\[ h[n] = \begin{cases} n, & 0 \leq n \leq 5 \\ 0, & \text{otherwise} \end{cases} \]

Analytically compute \( y[n] = x[n] * h[n] \). Next, compute \( y \) using \textit{conv}, where your first step should be to define the vector \( h \) to contain \( h[n] \) on the interval \( 0 \leq n \leq 5 \). Again construct a vector \( ny \) which contains the interval of \( n \) for which \( y \) contains \( y[n] \). Plot your results using \textit{stem}(ny,y).
**Answer:**

\[ n = [0:5] ; \]
\[ x = \text{ones}(1, \text{length}(n)) ; \]
\[ h = [0:5] ; \]
\[ y = \text{conv}(x, h) ; \]
\[ ny = [0:10] ; \]
\[ \text{figure(1)} \]
\[ \text{stem(ny, y, 'filled')} \]
\[ \text{xlabel('Time')} \]
\[ \text{ylabel('Amplitude')} \]
\[ \text{title('y[n]')} \]

ii) Compare between \( y_2[n] = x[n] * h[n+5] \) and \( y[n] \) which is derived in the previous part?

iii) Use \text{conv} \ to compute the nonzero samples of \( y_2[n] \), and store these samples in the vector \( y_2 \). This vector should be identical to the vector \( y \) computed in part ii. The only difference is that the indices, and store them in the vector \( ny_2 \). Plot \( y_2[n] \) using \text{stem(ny}_2,y_2) \)

**Answer:**

\[ ny = [-5:5] ; \]
\[ x = [1 1 1 1 1] ; \]
\[ h = [0 1 2 3 4 5] ; \]
\[ y_2 = \text{conv}(x, h) ; \]
\[ \text{figure(1)} \]
\[ \text{stem(ny, y_2, 'filled')} \]
\[ \text{xlabel('Time')} \]
\[ \text{ylabel('Amplitude')} \]
\[ \text{title('y[n]')} \]

**3)** \[ x(t) = \begin{cases} 
1, & 1 \leq n \leq 5 \\
0, & \text{otherwise}
\end{cases} \]
\[ h(t) = \begin{cases} 
1, & 2 \leq n \leq 7 \\
0, & \text{otherwise}
\end{cases} \]

Using MATLAB, generate these two signals and find \( y(t) \) which is the result of convolving \( x(t) \) with \( h(t) \).


**Answer:**

\[
Ts = 0.1; \\
t1 = [1:Ts:5]; \\
t2 = [2:Ts:7]; \\
t3 = [3:Ts:12]; \\
x = ones(1, length(t1)); \\
h = ones(1, length(t2)); \\
y = Ts * conv(x, h); \\
figure(1) \\
plot(t3, y) \\
xlabel('Time') \\
ylabel('Amplitude') \\
title('y[t]')
\]