EENG/INFE 226 SIGNALS AND SYSTEMS
LAB 4
THE CONVOLUTION SUM & INTEGRAL

1) a) Consider The Finite-length Signal

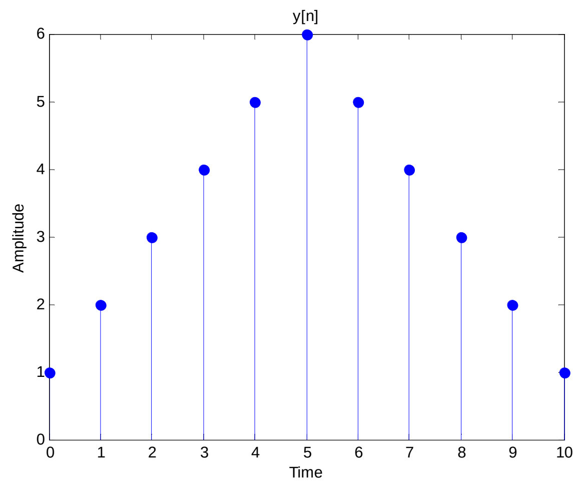
$$x[n] = \begin{cases} 1 & 0 \le n \le 5 \\ 0 & otherwise \end{cases}$$

Analytically determine y[n]=x[n]*x[n]

b) Compute the nonzero samples of *y[n]=x[n]*x[n]* using *conv*, and store these samples in the vector y. Your first step should be define the vector x to contain the samples of x[n] on the interval $0 \le n \le 5$. 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 *stem(ny,y)* and make sure that your plot agrees with the signal determined in part i.

Answer:

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



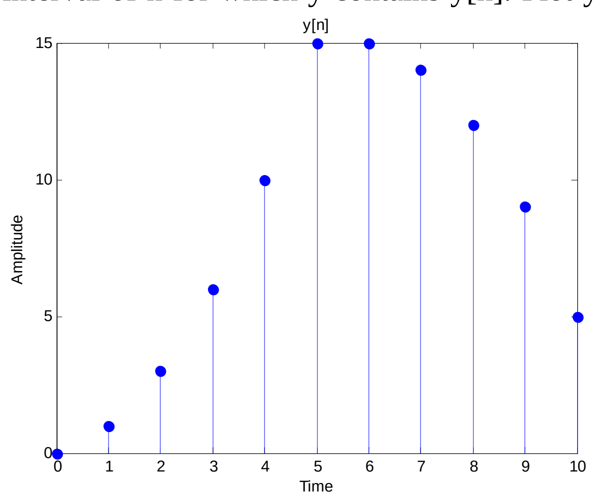
2) i) Consider the finite-length signal

$$x[n] = \begin{cases} n & 0 \le n \le 5 \\ 0 & otherwise \end{cases}$$

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

Answer:

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



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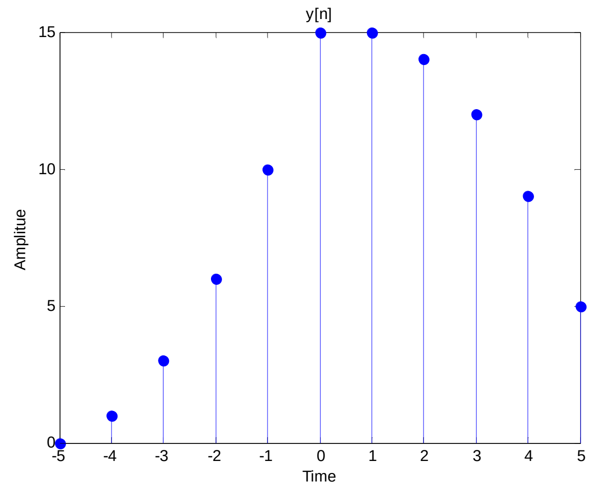
ii) How does y2[n]=x[n]*h[n+5] compare to the signal y[n] derived in part i ?

iii) Use conv to compute the nonzero samples of y2[n], and store these samples in the vector y2. If done corectly, 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 ny2. Plot y2[n] using `stem(ny2,y2)`

Answer:

```
ny=[-5:5];
h=[1 1 1 1 1 1];
x=[0 1 2 3 4 5 ];
y2=conv(x,h);
figure(1)
stem(ny,y2,'filled')
xlabel('Time')
ylabel('Amplitue')
title('y[n]')
```

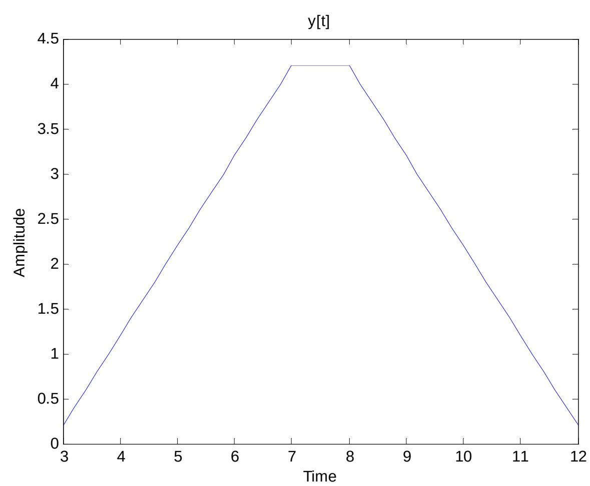


3) $x(t) = \begin{cases} 1 & 1 \le t \le 5 \\ 0 & otherwise \end{cases}$ $\quad h(t) = \begin{cases} 1 & 2 \le t \le 7 \\ 0 & otherwise \end{cases}$

Using the MATLAB,generate these two functions and find the convolution of x(t) and h(t)

Answer:

```
Ts=0.2;
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]')
```



Home work:

Use matlab to generate the following two functions and find the convolution of them:

a)x(t)=cos(πt/2)[u(t)-u(t-10)] , h(t)=sin(πt)[u(t-3)-u(t-12)].

b)x[n]=3n for -1<n<6 , h[n]=1 for 4<n<13.

Print and submit the full program with the graphs on papers next lab session.