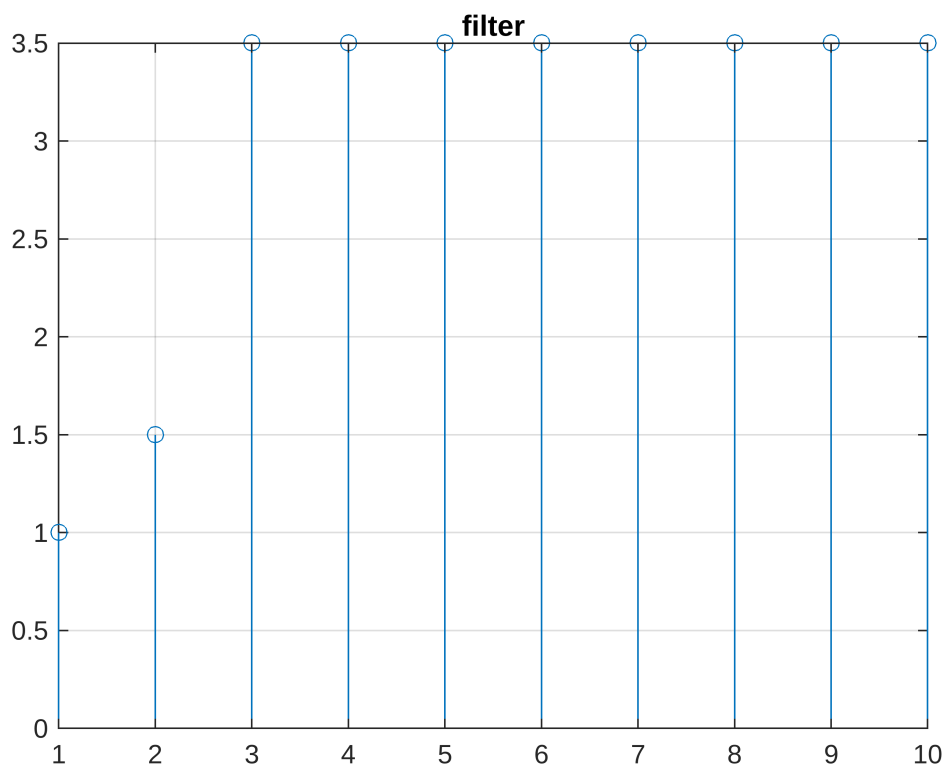


# Digital Signal Processing | Lab 02

## Eperiment 3

### Question A

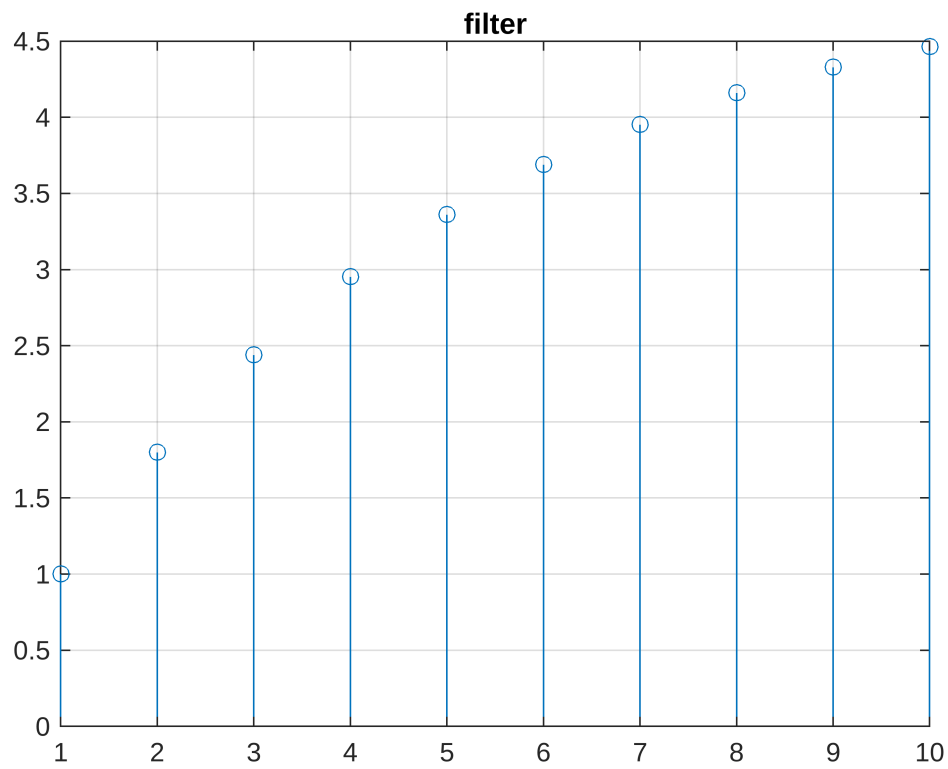
```
a = [1, 0.5, 2];  
b = [1];  
x = ones(1, 10);  
  
y = filter(a, b, x);  
  
figure;  
stem(y);  
title('filter');
```



The expected steady-state value = 3.5 (last value).

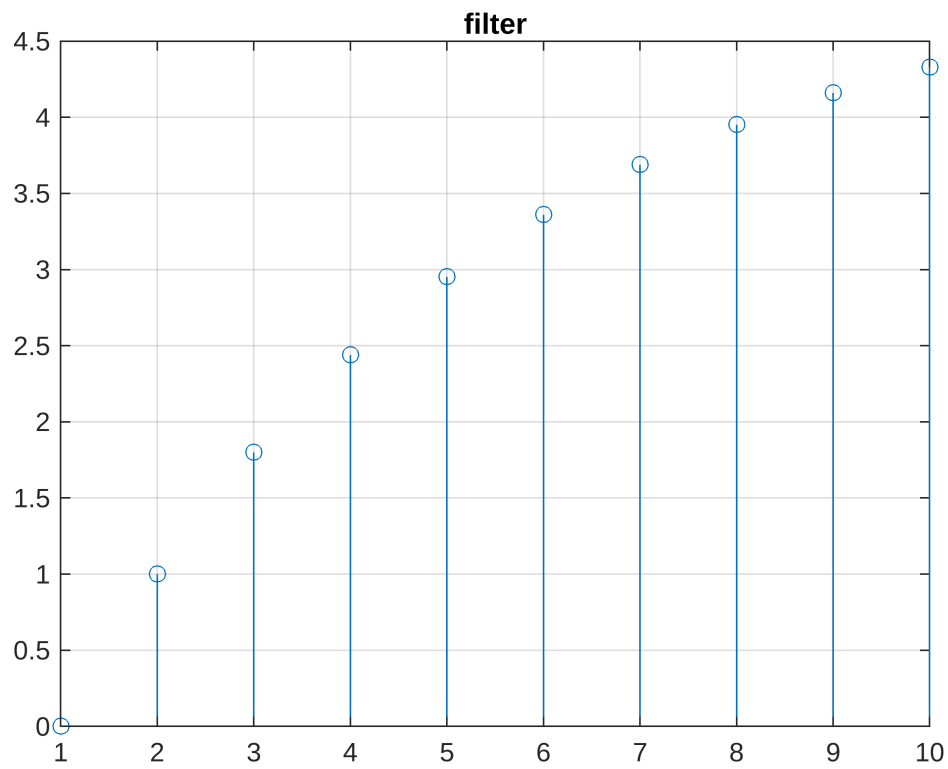
### Question B

```
a = [1 -0.8];  
b = [1];  
x = ones(1,10);  
y = filter(b, a, x);  
figure; stem(y); title('filter');
```



### Question C

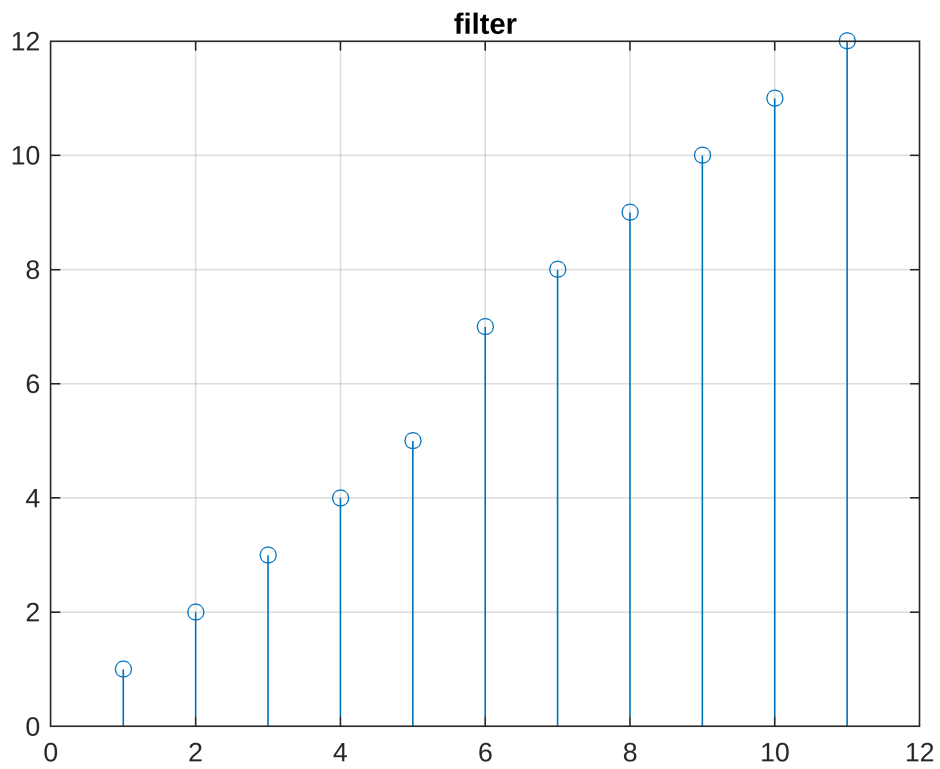
```
a = [1, -0.8];  
b = [1];  
x = ones(1, 10);  
xshift = [0, x(1:end-1)];  
y = filter(b, a, xshift);  
figure;  
stem(y);  
title('filter');
```



The signal in C is delayed by 1 unit from the signal in B.

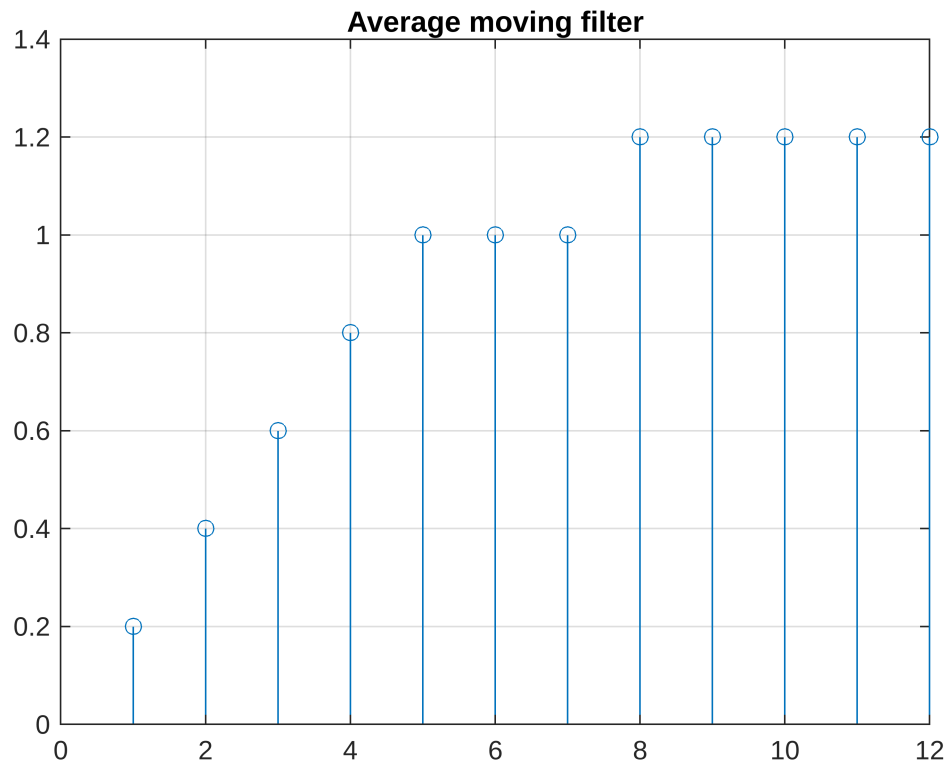
Question D

```
a = [1, -1];  
b = [1];  
x = [1 1 1 1 1 2 1 1 1 1 1];  
y = filter(b, a, x);  
figure;  
stem(y);  
title('filter');
```



### Average moving filter

```
b = ones(1, 5) ;  
b = b / length(b);  
  
x=[1 1 1 1 1 1 1 2 1 1 1 1 ];  
y = filter(b,1,x);  
figure;  
stem(y);  
title('Average moving filter');
```



Averages the values of the last 5 samples.

## Exercises

1.

```
u = @(x) heaviside(x);
r = @(a, b, i) a <= i & i <= b;

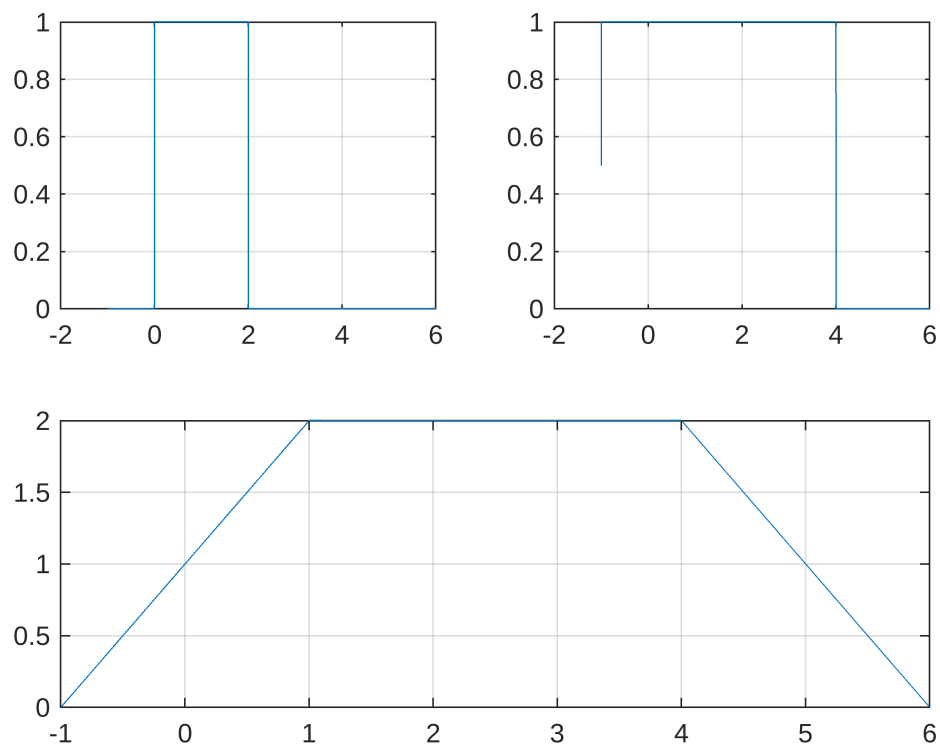
fs = 1000;

n = -1:1/fs:6;

x1 = u(n) - u(n-2);
x2 = u(n + 1) - u(n-4);

x3 = conv(x1(r(0, 2, n)), x2(r(-1, 4, n))) / fs;

figure;
subplot(2,2,1); plot(n, x1);
subplot(2,2,2); plot(n, x2);
subplot(2,1,2); plot(n, x3);
```

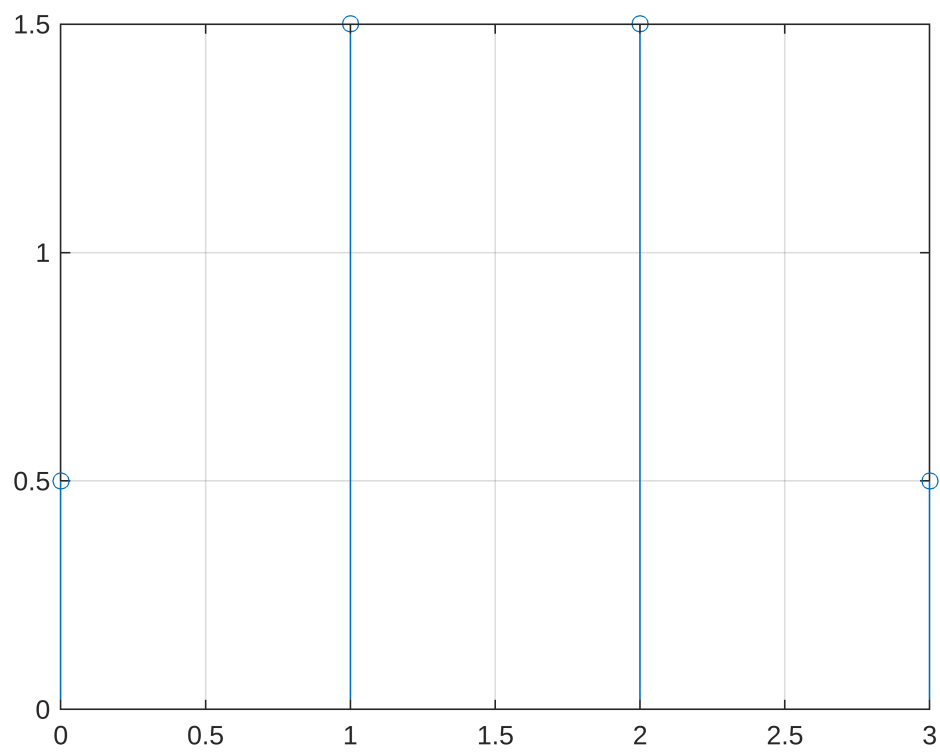


2.

```
n = 0:3;

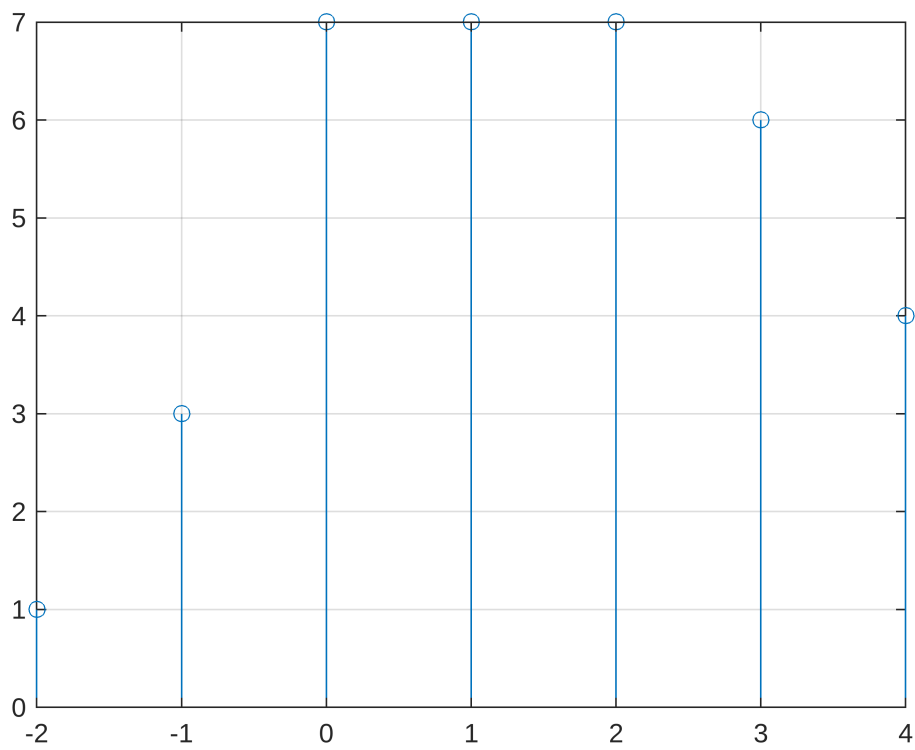
x = u(n) - u(n-2);
h = zeros(1, length(n));
h(n==0 | n==1) = 1;

y = conv(x(r(0, 2, n)), h(r(0, 1, n)));
figure; stem(n, y);
```



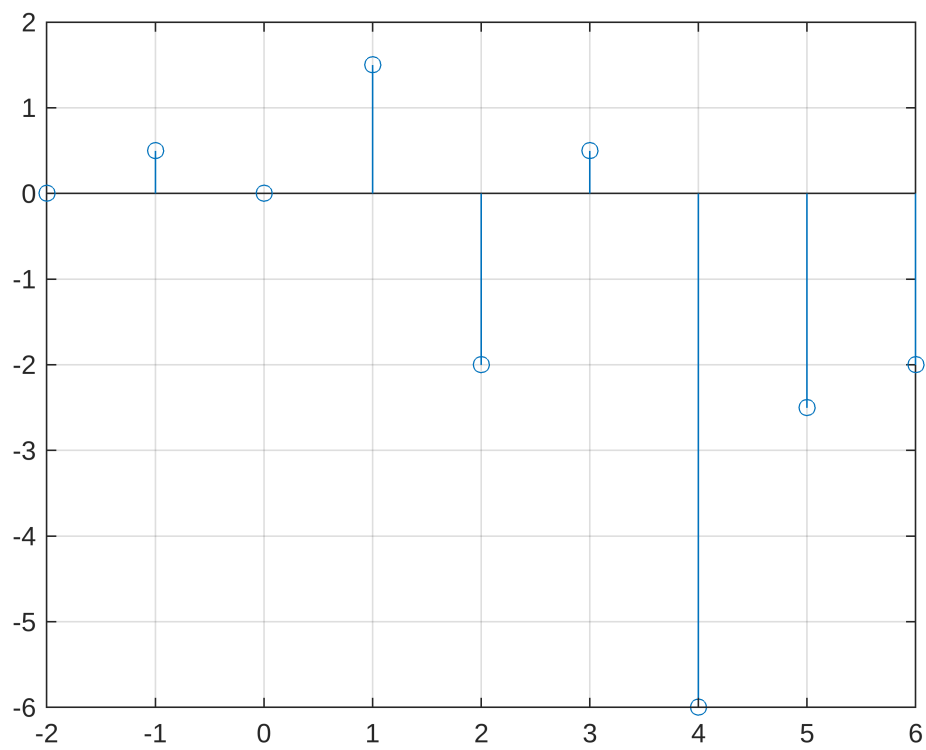
3.

```
x1 = [1 2 4];  
h1 = [1 1 1 1 1];  
y1 = conv(x1, h1);  
figure; stem(-2:4 ,y1);
```

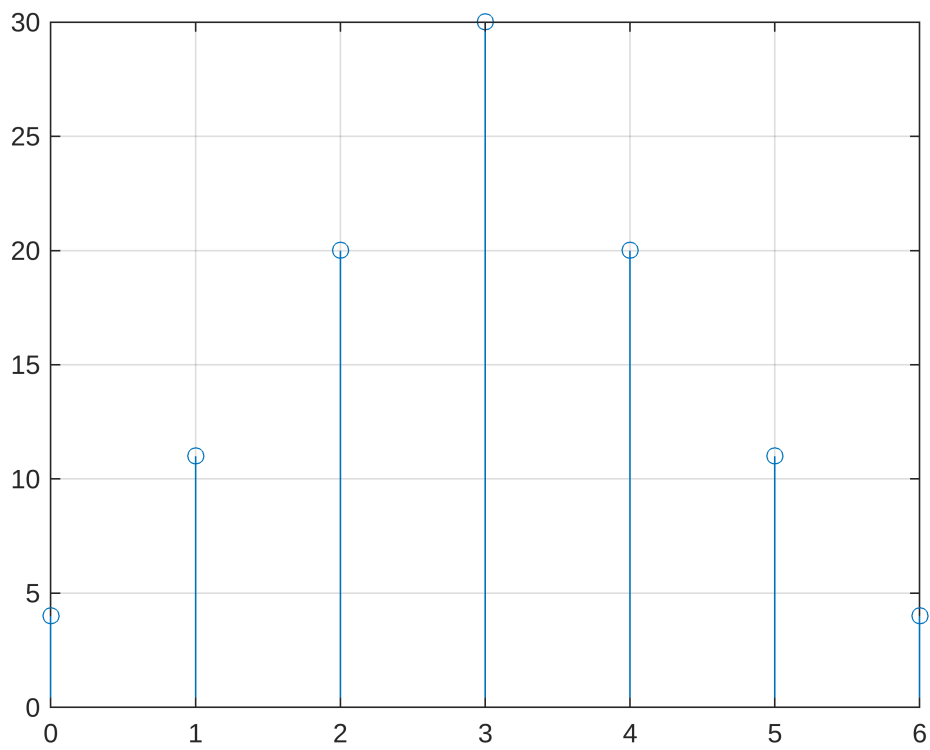


```
x2 = [0 1 -2 3 -4];  
h2 = [0.5 1 2 1 0.5];  
y2 = conv(x2, h2);  
figure; stem(-2:6, y2);
```





```
x3 = [1 2 3 4];  
h3 = [4 3 2 1];  
y3 = conv(x3, h3);  
figure; stem(0:6, y3);
```



```
x4 = [1 2 3 4];  
h4 = [1 2 3 4];  
y4 = conv(x4, h4);  
figure; stem(0:6, y4);
```

