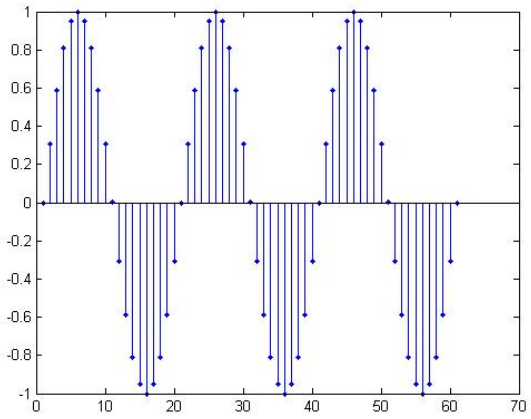
Exercise 1

1.a.

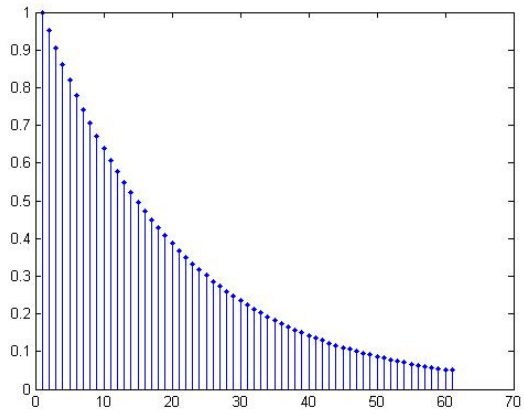
```
fo = 0.05 ; k = [0:1:60];  y = sin(2*pi*fo*k); stem(y,'.');
```



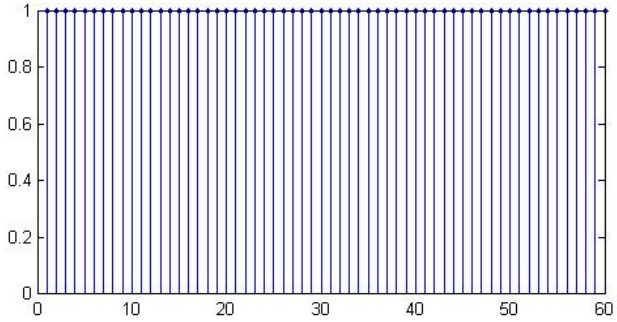
Period is 20.

1.b. Similarly, period is 10.

1.c. `y = exp(-k/20); stem(y,'.');`

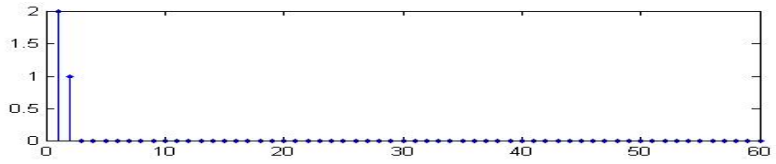


1.d. `u = ones(60, 1); stem(u,'.'); pbaspect([2,1,1]);`

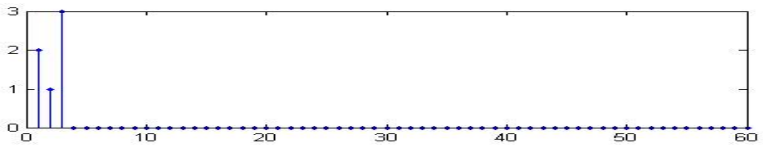


2.

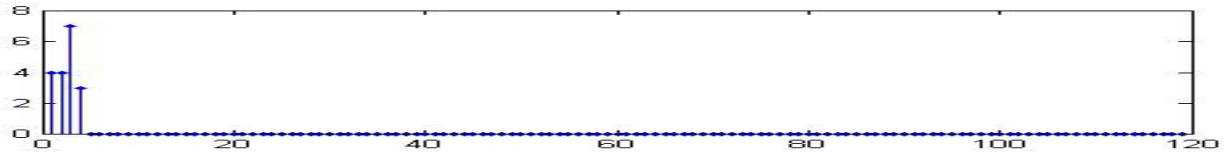
```
d0 = [1; zeros(59,1)]; d0 = d0';
d_1 = [0; 1; zeros(58, 1)]'; x = 2*d0 + d_1; stem(x,'.'); pbaspect([3,1,1]);
```




```
d_2 = [0; 0; 1; zeros(57, 1)]'; y = 2*d0 + d_1 + 3*d_2; stem(y,'.'); pbaspect([3,1,1]);
```

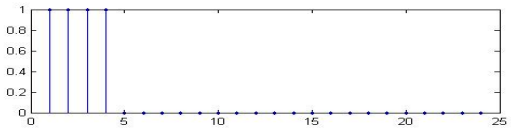



```
z = conv(x, y); stem(z,'.'); pbaspect([3,1,1]);
```

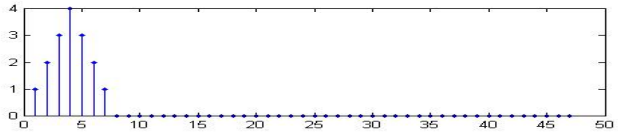


2.b

```
x = [ones(4, 1); zeros(20, 1)]'; y = x; z = conv(x, y);
stem(x,'.'); pbaspect([3,1,1]);
```



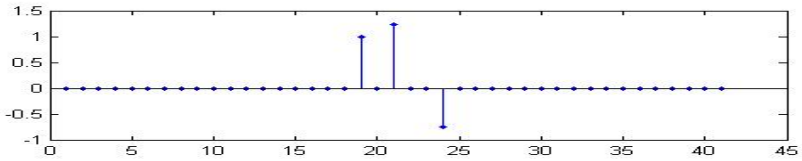

```
stem(z,'.'); pbaspect([3,1,1]);
```



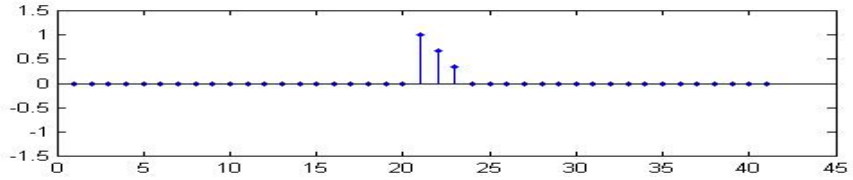
Page 24 of our text shows an example of a convolution involving a non-causal sequence. I wanted to see Matlab do such a convolution, so I supplied some estimated values and ran through the exercise. The resulting graphs agree well with those on page 24 for x[n], h[n], and y[n].

```
>> d0 = [zeros(20,1); 1; zeros(20,1)]; d0 = d0';
>> dp2 = [zeros(18,1); 1; zeros(22,1)]; dp2 = dp2';
>> dp2 = [zeros(18,1); 1; zeros(22,1)]; dp2 = dp2';
>> dn2 = [zeros(22,1); 1; zeros(18,1)]; dn2 = dn2';
>> dn3 = [zeros(23,1); 1; zeros(17,1)]; dn3 = dn3';
>> dn1 = [zeros(21,1); 1; zeros(19,1)]; dn1 = dn1';
>> x = dp2 + (5/4)*d0 - (3/4)*dn3;
>> stem(x,'.'); pbaspect([3,1,1]); axis([-20 20 -1.5 1.5]); axis 'auto x';
```

(*For these sequences, (n = 0) corresponds to 21 on the graph's horizontal axis.*)

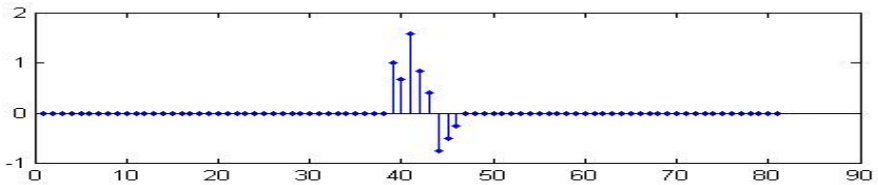



```
>> h = d0 + (2/3)*dn1 + (1/3)*dn2;
>> figure(2); stem(h,'.'); pbaspect([3,1,1]);
```



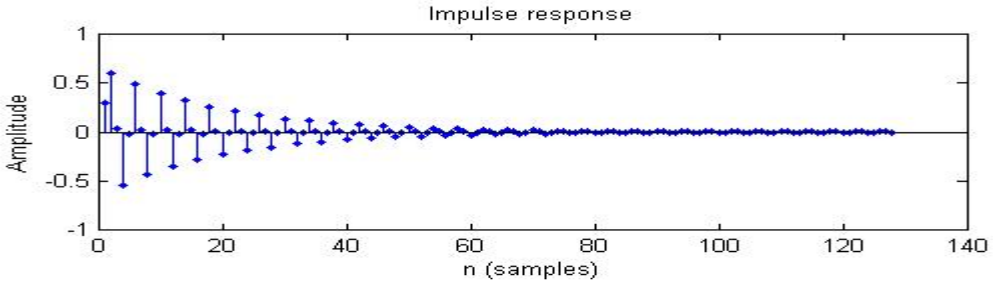

```
>> axis([0 45 -1.5 1.5]);
>> y = conv(x, h);
>> figure(3); stem(h,'.'); pbaspect([3,1,1]);
```

(*For this sequence, (n = 0) corresponds to 41 on the graph's horizontal axis.*)

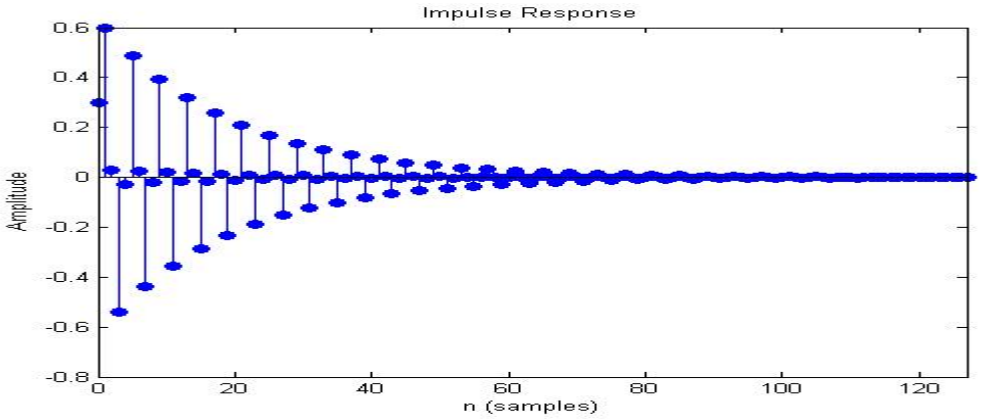


3.a

```
b = [0.3 0.6 0.3]'; a = [1 0 0.9]'; d0 = [1; zeros(127,1)]'; x = d0;
y = filter(b, a, x); stem(y,'.'); pbaspect([3,1,1]);
```



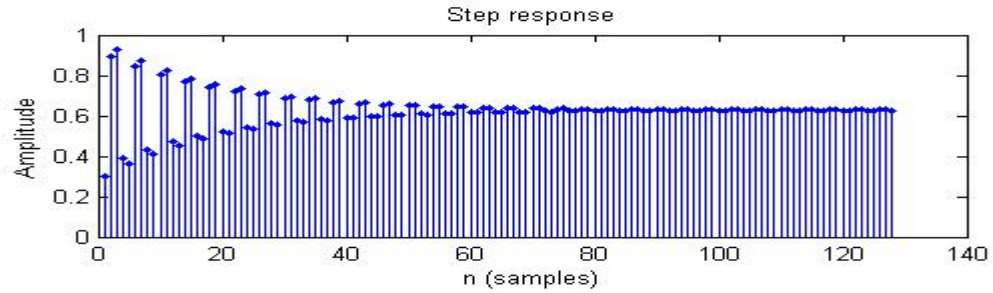
3.b `impz(b,a,128);`



3.c

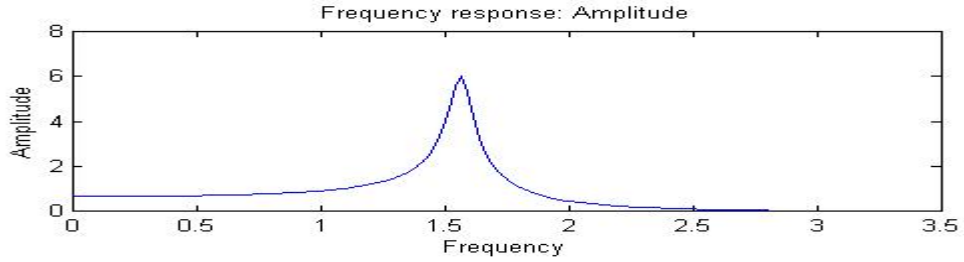
```
u0 = ones(128, 1)'; x = u0; y = filter(b, a, x);
stem(y,'.'); pbaspect([3,1,1]);
```

Step Response



3.d

```
[h,w] = freqz(b,a,128);
plot(w, abs(h)); pbaspect([3,1,1]);                    Frequency response
```




```
plot(w, angle(h)); pbaspect([3,1,1]);                  Phase response
```