Problem # 1

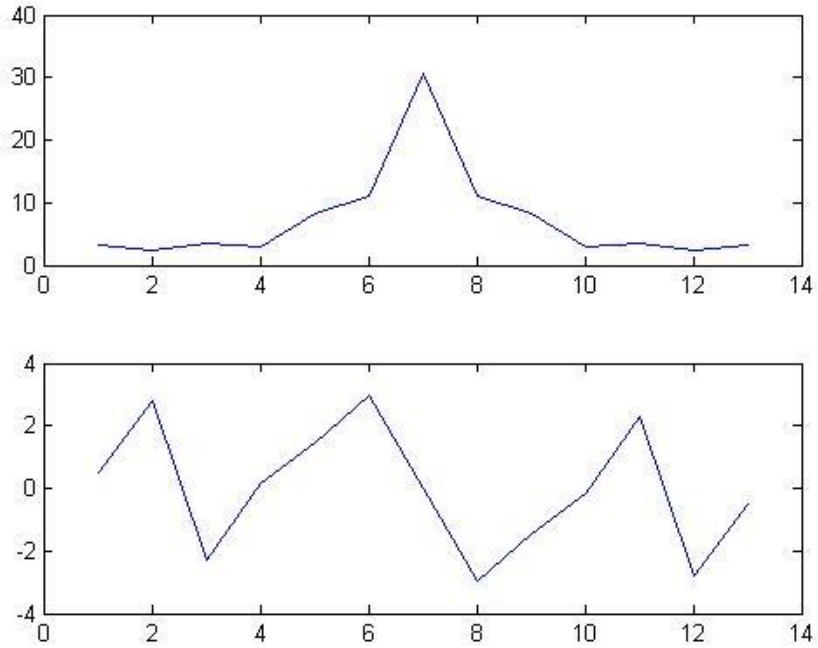
```
clear;clc;
a=1/2;
R=3;
x=1:10;
Y = eco_filter(a,R,x);
subplot(2,1,1);
h=abs(fftshift(fft(Y)));
plot(h)
% figure;
subplot(2,1,2);
plot(angle(fftshift(fft(Y))));
```

Function

```
function [ Y ] = eco_filter( a,R,x )
Y=zeros(1,(length(x)+R));
Y1=zeros(1,(length(x)+R));
Y2=zeros(1,(length(x)+R));

for n=1:length(x)
    if n<4
        Y1(n)=x(n);
    else
        Y2(n)=x(n);
    end
end
Y=Y1+a*Y2;
end
```

Output



Problem # 2 – Multiple Echoes

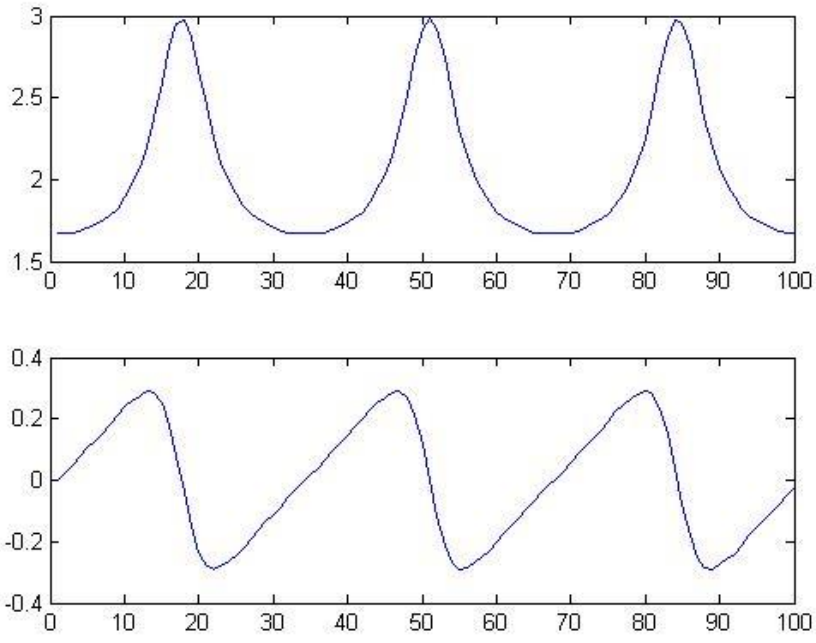
```
clear;clc;
a=1/2;
R=3;
n=6;
x=zeros(100,1);
x(1)=1;
Y = multiple_echo(x,R,a,n);
subplot(2,1,1);
h=abs(fftshift(fft(Y)));
plot(h)
subplot(2,1,2);
plot(angle(fftshift(fft(Y))));
```

Function

```
function [y] = multiple_echo(x,R,a,n)
xlen=length(x);
y = zeros(size(x));

for i=1:1:n*R+1
y(i)= x(i);
end
for n=0:1:n
for i=n*R+1:1:xlen
y(i)= y(i)+ a^n*x(i-n*R);
end
end
```

Output



Problem # 1 – Single Echo

```
a=1/2;
R=3;
x=zeros(100,1);
x(1)=1;
Y = echo_filter(a,R,x);
subplot(2,1,1);
h=abs(fftshift(fft(Y)));
plot(h)
subplot(2,1,2);
plot(angle(fftshift(fft(Y))));
```

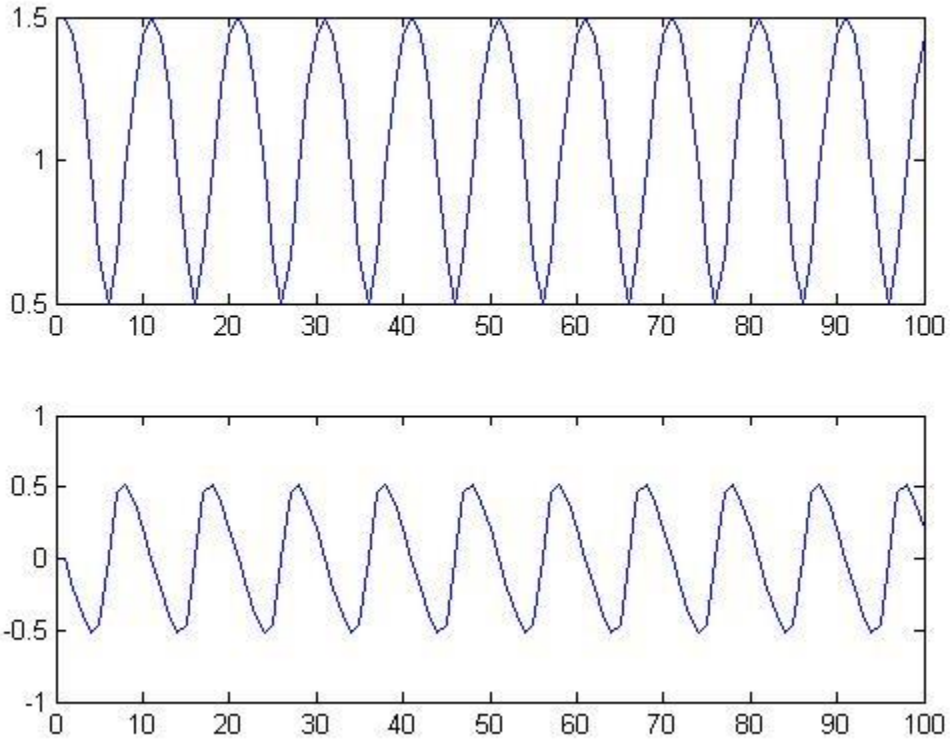
Function

```
function [y] = echo_filter( a,R,x )

Delayline=zeros(10,1);

for n=1:length(x);
    y(n)=x(n)+a*Delayline(10);
    Delayline=[x(n);Delayline(1:10-1)];
end
end
```

Output



Problem # 2 – Multiple Echoes

```
a=1/2;
R=3;
n=6;
x=zeros(100,1);
x(1)=1;
Y=multiple_echo(x,R,a,n);
subplot(2,1,1);
h=abs(fftshift(fft(Y)));
plot(h)
subplot(2,1,2);
plot(angle(fftshift(fft(Y))));
```

Function

```
function y = multiple_echo(x,R,a,n)
xlen=length(x);
y = zeros(size(x));

for i=1:1:n*R+1
y(i)= x(i);
end
for i=n*R+1:1:xlen
val = 0;
for k = 1:1:n+1
val = val+((a^(k-1))*x(i-(k-1)*R));
end
y(i) = val;
end
end
```

Output