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ELEN 431 HW #3

Problem 2

```
R=0.3.*[3 -2 1; -2 3 -2; 1 -2 3];
p=[-2; 1; -0.5];

%optimum weights
wo = inv(R)*p

sigd = p'*inv(R)*p;

%find minimum point on performance function
Jmin = sigd - wo'*p - p'*wo + wo'*R*wo

wo =

    -2.7083
    -0.8333
    -0.2083

Jmin =

    -1.7764e-15
```

Problem 3

```
R=0.25.*[4 3 2 1; 3 4 3 2; 2 3 4 3; 1 2 3 4];
p=[0.5; 0.375; 0.25; 0.175];

wo = inv(R)*p
sigd = p'*inv(R)*p;

Jmin = sigd - wo'*p - p'*wo + wo'*R*wo

wo =
```

```
0.5200
-0.0000
-0.1000
0.1200
```

$J_{min} =$

```
-5.5511e-17
```

Problem 4

```
%Assume abs(alpha)<1, for example here alpha=0.5
n=1000;
m=1;
a=0.5;
u=wgn(m,n,0);

num1=[sqrt(1-a^2) 0];
den1=[1 -a];

x=filter(num1,den1,u);
v=0.1*randn(1,n);

num2=[1 4];
den2=[1];

d=v+filter(num2,den2,x);

[X,R]=corrmtx(x,m);

R
p=[mean(x(1)*conj(d(1))) ; mean(x(2)*conj(d(2))) ]

%Part 2
wo=inv(R)*p;

%Part3
sigd = p'*inv(R)*p;
Jmin = sigd - wo'*p - p'*wo + wo'*R*wo

R =

    1.0688    0.5409
    0.5409    1.0688

p =

    1.2341
    0.3211
```

```
Jmin =  
  
-2.2204e-16
```

Problem 5

```
R=[1 0.5 0.25; 0.5 1 0.5; 0.25 0.5 1];  
p=[3; 1; 0];  
  
wo = inv(R)*p  
  
%Part b  
sigd = 10;  
  
%Jmin equation  
Jmin = sigd + wo'*R*wo  
  
%Part c  
[V,D] = eig(R);  
  
VH = V';  
  
for k =1:3  
    lam(k)=D(k,k);  
    f(k)=(1/lam(k))*V(k,:)*VH(:,k);  
end  
  
sum1 = sum(f);  
  
%Filter according to eigenvalues and vectors  
wo = sum1*p  
  
wo =  
  
    3.3333  
   -0.3333  
   -0.6667  
  
Jmin =  
  
    19.6667  
  
wo =  
  
    13.0000  
     4.3333  
         0
```

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