#Asignment 1

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1 Problem 1

1.1 Matlab Code

```
clear ;
clear functions ;
clf ;

Nbits      =  2^5 ;  % (-), number of bits per user.
mu         =  2^(-15) ;  % (-), LMS adaptation constant
Npoints_w  =  1 ;  % (-), number of points in w
D          =  0 ;  % (T-spaced samples), Decoding delay
sigman1    =  10^(-5) ;     % <======== sigma changed
a          =  10 ;  % Transmitter attenuation
b          =  10 ;  % Receiver attenuation
% transmitter data
d1    =   ( 2 * ( rand(1,Nbits) < 0.5 ) - 1 ) ;
s1 = a * b * d1 ;
n1  =  sqrt(sigman1) * randn(1,length(s1)) ;
r1  =  s1 + n1 ;
w   =  zeros(1,Npoints_w) ;
rn  =  zeros(1,Npoints_w) ;
errors1   =   0 * d1 ;
wsave = [] ;
for i  =  1 : length(r1)  ,
    if   ( 1 <= (i-D) )  &  ( (i-D) <= length(d1) )   ,

        rn  =  [ r1(i)  rn( 1 : (Npoints_w-1) ) ] ;
        u1  =  w * (rn .') ;

        e1  =  d1( i - D ) - u1 ;
        errors1(i-D) = e1 ;

        w   =   w  +  mu * e1 * rn ;
        wsave  =  [ wsave w ] ;
    end
end
iw = [ 0 : (length(w)-1) ] ;
```

```
subplot(311) ;
stem(iw,abs(w).^2,'o') ;
ylabel('|w|^2') ;
xlabel('Index, i, (-)') ;

subplot(312) ;
se_db = 10 * log10(abs(errors1)+eps) ;
plot(se_db,'o') ;
% axis ( [ 0 (Nbits-1) -40 0] ) ;

subplot(313) ;
stem(wsave)
```

Listing 1: Code for Problem 1

1.2 Plots and Analysis

From the code, the variable **sigman1** represents the variance for the channel noise. This means that the greater this number, the harder to compensate its effects and this can be observed in the learning curve for both values. In the case of **sigman1** being 10^{-5} the plots in Figure(1) show that the error converges at a lower value than when **sigman1** is 10^{-2}. Another aspect is the variation or the *jitter* present in both plots.

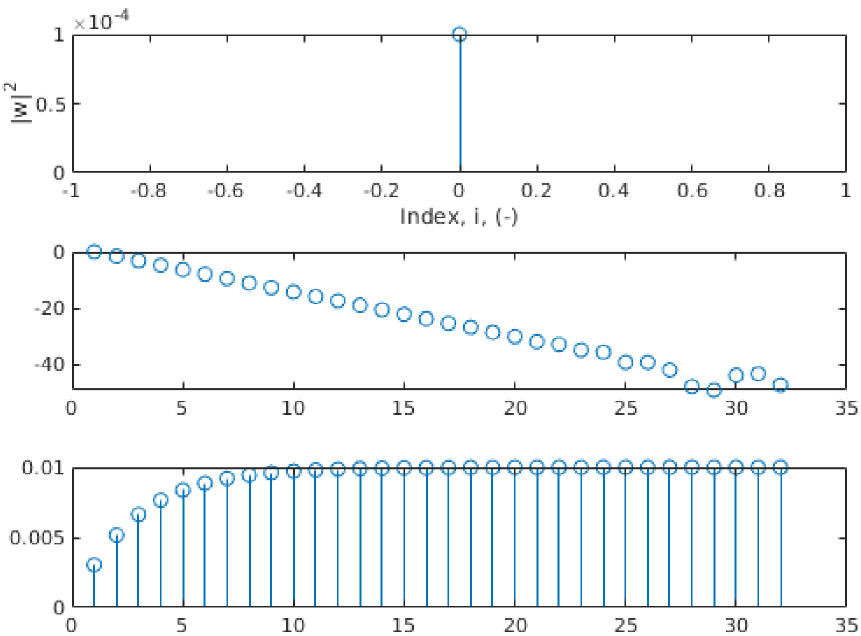

Figure 1: plot for sigma1n=10e-5

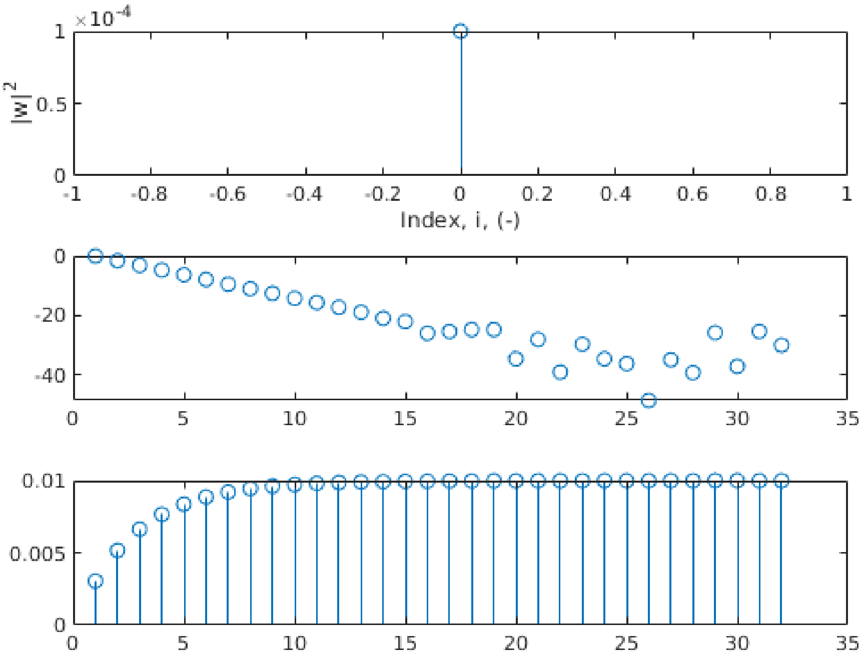

Figure 2: plot for sigma1n=10e-2

2 Problem 2

The learning curve flattens out even thoug there is no noise because the learning process has reached the minimum value expressed by the wienner solution. this value correspond to the minimum of the quadratic curve.

The value at which the learning curve (Fig 3) flattens is -313.1 dB, and its negative is 313.1 dB which corresponds with the SNR of this particular system.

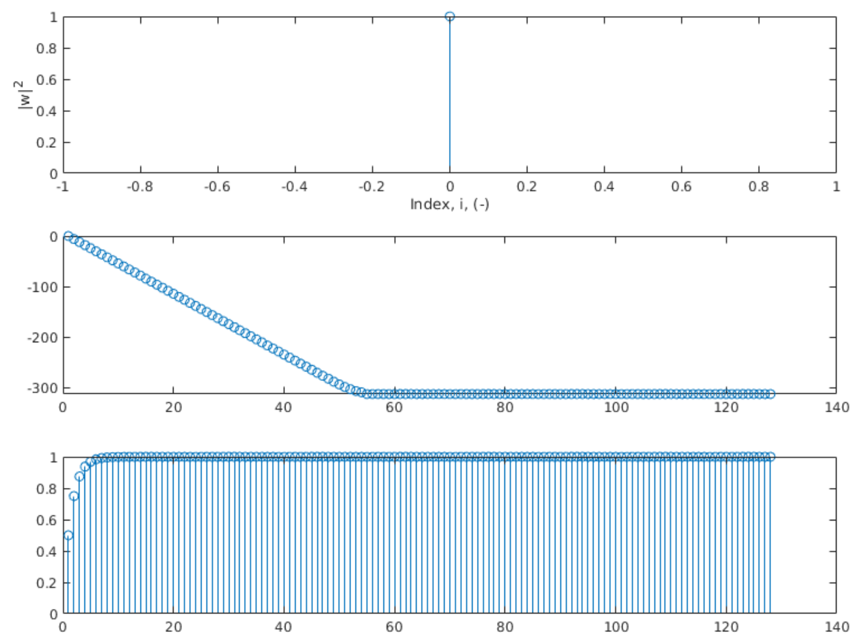

Figure 3: plot without channel noise