HW1

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Main Script:

```
%generate data
rng(1);
X=normrnd(5,0.1,[1,100]);
sigma=0.1;
%lkh is the likelihood function to be maximized
%L is the sum of log density of Xi
lkh=@(miu)-L(X,miu,sigma);
%get MLE and the value of lkh when miu equals MLE
[MLE,fval]=fminunc(lkh,5);
%test when we got the correct MLE
miuhat = sum(X)/length(X);
%get sigma_square_hat
syms a;
miu=MLE;
t2=diff(L(X,a,sigma),2);
diff2=subs(t2,'a',MLE);
sigma_square_hat=(-diff2/length(X))^(-1);
%sigmahat approximately follows a normal distribution with
mean sigma_zero
%and variance sigma_square/n
%the confidence interval(95%) for the true parameter
sigma_zero is
lower_bound=MLE-1.96*sqrt(sigma_square_hat/100); %4.9755
upper_bound=MLE+1.96*sqrt(sigma_square_hat/100); %5.0147
%p_value
z=(MLE-5)/sqrt((sigma_square_hat/length(X)));
p_value=2*(1-normcdf(abs(z))); %0.6276
%Since p_value is larger than 5%, we cannot deny Ho: sigma=5
```

L.m:

```
function like=L(X,miu,sigma)
like=0;
for n = 1:100
   like=like+log(f(X(n),miu,sigma));
end
```

f.m:

```
function fun=f(x,miu,sigma)
fun=1/(sigma*sqrt(2*pi))*exp(-(x-miu)^2/(2*sigma^2));
```