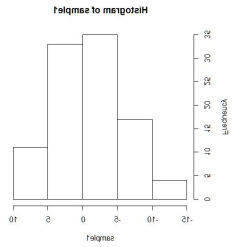
The answers of question 5

a. x = seq(1,100)

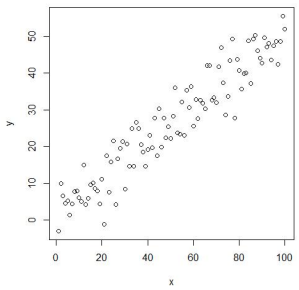
b. w = 2 + 0.5 * x

c. sample1 = rnorm(n=100,mean = 0,sd = 5)
mean_sample1 = mean(sample1)
variance_sample1 = var(sample1)
hist(sample1)
Mean_sample1 is -0.50822
Variance_sample1 is 24.6893



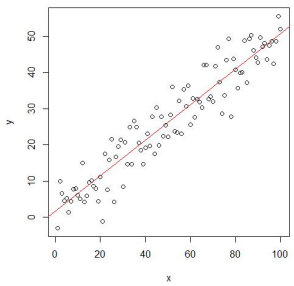
I observed that most of values concentrate near the 0 value.

d. y = w + sample1



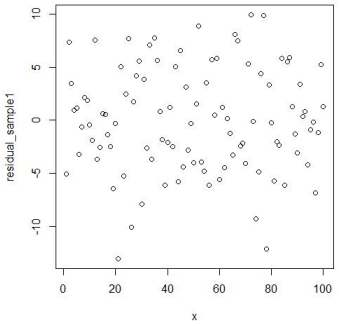
e.

f. beta1 = sum((x - mean(x)) * (y - mean(y))) / sum((x - mean(x))^2)
beta0 = mean(y) - beat1 * mean(x)
plot(x = x , y = y)
abline(lm(y~x), lwd=1, col="red")
Beta1 is 0.4963
Beta0 is 1.6822



I observed that the line is in the middle of those points.

g. residual_sample1 = residuals(lm(y~x))
plot(x,residual_sample1)
MSE = sum(residual_sample1^2) / (100 - 2)
MSE is 24.929



I observed that those points are approximated symmetry. The axis of symmetry is 0.

h. I observed that those results approximate the same.

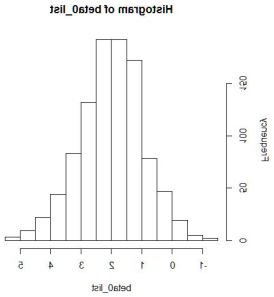
i.

```
hw = function(){
  x = seq(1,100)
  w = 2 + 0.5 * x
  sample1 = rnorm(n=100,mean = 0,sd = 5)
  mean_sample1 = mean(sample1)
  variance_sample1 = var(sample1)
  #hist(sample1)
  y = w + sample1
  #plot(x = x , y = y)
  beta1 = sum((x - mean(x)) * (y - mean(y))) / sum((x - mean(x))^2)
  beta0 = mean(y) - beta1 * mean(x)
  #plot(x = x , y = y)
  #abline(lm(y~x), lwd=1, col="red")
  residual_sample1 = residuals(lm(y~x))
  #plot(x,residual_sample1)
  MSE = sum(residual_sample1^2) / (100 - 2)
  print(c(beta0,beta1,MSE,mean_sample1,variance_sample1))
  return(c(beta0,beta1,MSE,mean_sample1,variance_sample1))
}
beta0_list = c()
beta1_list = c()
mse_list = c()
mean_sample1_list = c()
variance_sample1_list = c()
for (i in c(1:1000)){
  results = hw()
  beta0_list[i] = results[1]
```

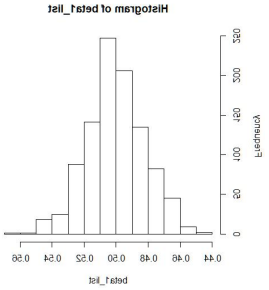
```
    beta1_list[i] = results[2]
    mse_list[i] = results[3]
    mean_sample1_list[i] = results[4]
    variance_sample1_list[i] = results[5]
}
mean_beta0 = mean(beta0_list)
mean_beta1 = mean(beta1_list)
mean_mse = mean(mse_list)
```

Mean_beta0 is 1.98635
Mean_beta1 is 0.500145
Mean_mse is 24.87754

Beta0 histogram



Beat1 histogram



MSE histogram