Applied Statistics HW1 #4 solution.
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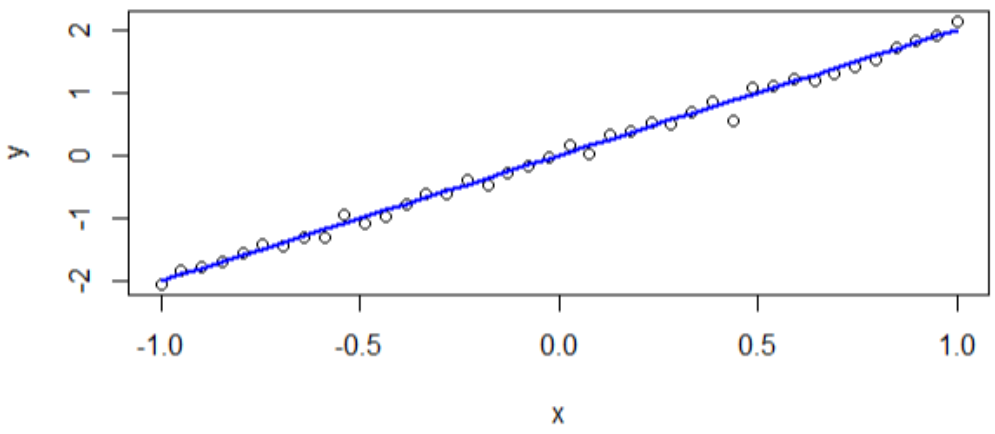
```
# Create a sample of 40 numbers which are normally distributed.
norm <- rnorm(40,0,0.1)
x <- seq(-1,1,length.out = 40)
y <- 2*x+norm
#SLR pass from origin point (0,0) then y = b1*x;
b1<- sum(x*y)/sum(x*x)
# Y origin (Yhat)
y0<- c(b1*x)
c(y0)
[1] -2.01151897 -1.90836415 -1.80520933 -1.70205451 -1.59889969 -1.49574488
[7] -1.39259006 -1.28943524 -1.18628042 -1.08312560 -0.97997078 -0.87681596
[13] -0.77366114 -0.67050632 -0.56735150 -0.46419669 -0.36104187 -0.25788705
[19] -0.15473223 -0.05157741  0.05157741  0.15473223  0.25788705  0.36104187
[25]  0.46419669  0.56735150  0.67050632  0.77366114  0.87681596  0.97997078
[31]  1.08312560  1.18628042  1.28943524  1.39259006  1.49574488  1.59889969
[37]  1.70205451  1.80520933  1.90836415  2.01151897
plot(x,y)
lines(x,y0,col="blue", lwd="2")
```




```
#Error in origin line
e = abs(sum(y-y0))
c(e)  =  0.3039365

# Mean of Yi is Ybar
ybar0 = sum(y)/40
c(ybar0) =  -0.007598413


#r^2 is SSR/SST
SSR = sum((y0-ybar0)*(y0-ybar0))
c(SSR) = 56.7184
SST = sum((y-ybar0)*(y-ybar0))
c(SST) = 57.02526
rsquare <- SSR/SST
c(rsquare) =  0.9946188
```

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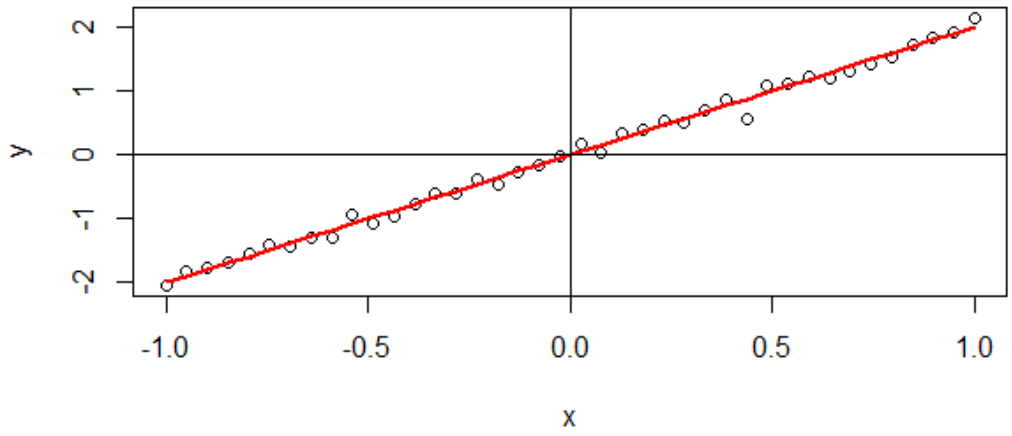
PART-2 ordinary linear regression yˆi = b0 + b1xi

```
#ordinary linear regression yˆi = b0 + b1xi
b1<- sum((x-mean(x))*(y-mean(y)))/sum((x-mean(x))*(x-mean(x)))
 c(b1) =  2.011519

bo <- mean(y)-b1*mean(x)
c(bo)=  -0.007598413

#bo is very small near to zero '0', so it looks like RTO
yhat = bo+b1*x
c(yhat)
 [1] -2.01911738 -1.91596256 -1.81280775 -1.70965293 -1.60649811 -1.50334329
 [7] -1.40018847 -1.29703365 -1.19387883 -1.09072401 -0.98756919 -0.88441437
[13] -0.78125956 -0.67810474 -0.57494992 -0.47179510 -0.36864028 -0.26548546
[19] -0.16233064 -0.05917582  0.04397900  0.14713382  0.25028863  0.35344345
[25]  0.45659827  0.55975309  0.66290791  0.76606273  0.86921755  0.97237237
[31]  1.07552719  1.17868201  1.28183682  1.38499164  1.48814646  1.59130128
[37]  1.69445610  1.79761092  1.90076574  2.00392056

plot(x,y)
lines(x,yhat,col ="red",lwd ="2")
abline(h=0,v=0)
```




```
#calculate error e1
# error almost zero.
e1<-abs(sum(y-yhat))
c(e1) = 1.491862e-15

#calculate r^2 = SSR/SST
# SSR
SSR1 <- sum((yhat -mean(y))*(yhat -mean(y)))
c(SSR1) =  56.71609
# SST
SST1 <- sum ((y-mean(y))*(y -mean(y)))
c(SST1) =  57.02526
#rsquare shows the prefect correlation.
rsquare1 <-SSR1/SST1   c(rsquare1) =  0.9945783
```