ML Problem 4 R

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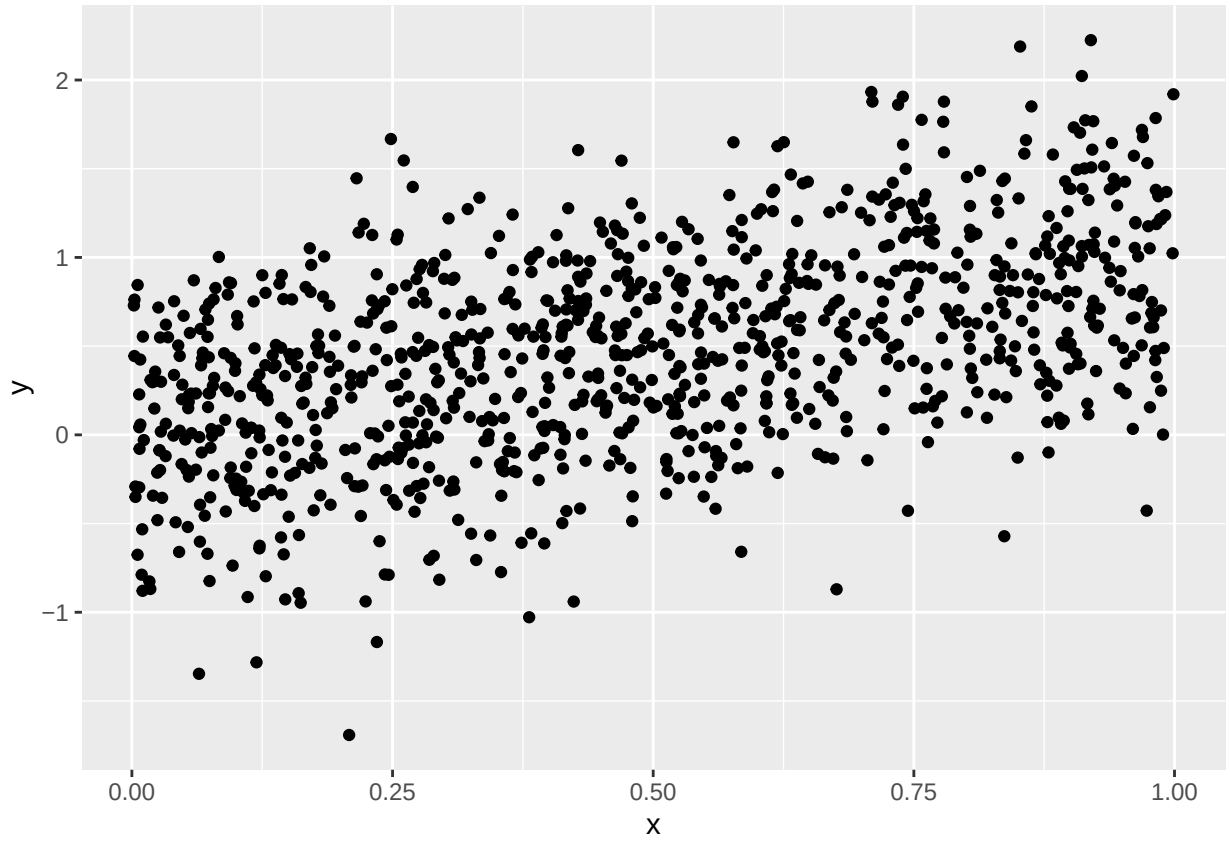
4/17/2021

```
## 1)
n <- 1000
x <- runif(n)
eps <- rnorm(n, sd=0.5)
y <- x + eps
p <- order(x)
x <- x[p]
y <- y[p]
ggplot(mapping=aes(x=x, y=y)) +
  geom_point()
```



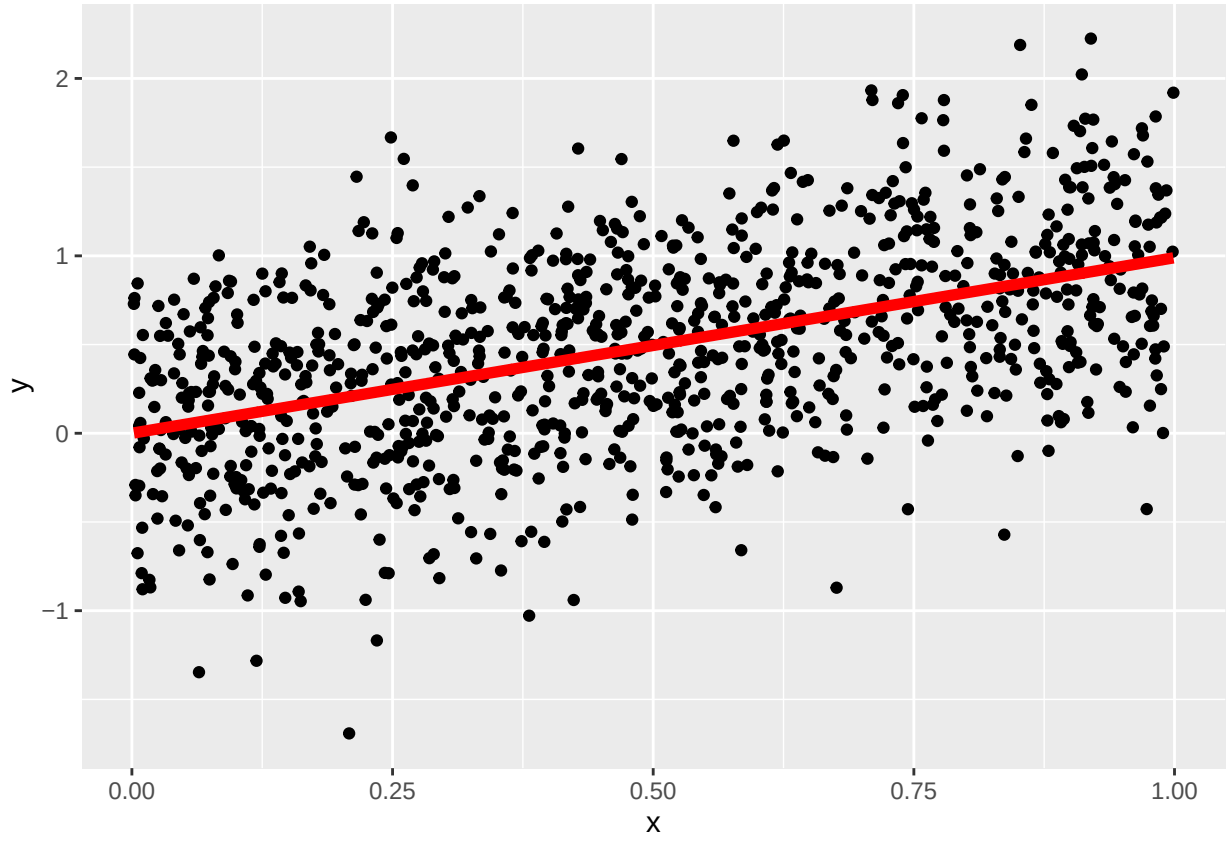

```
## 2)
f <- function(a) {
  return( sum((x*a - y)^2) )
}
```

```r
Df <- function(a) {
  return( sum(2*x * (x*a - y)) )
}
DDf <- sum(2 * x^2)

a <- 0.5
h <- 0.0
f_old <- Inf
f_new <- f(a)

while (f_old - f_new > .Machine$double.eps) {
  h <- -Df(a)/DDf
  a <- a + h
  f_old <- f_new
  f_new <- f(a)
}

ggplot(mapping=aes(x=x, y=y)) +
  geom_point() +
  geom_line(mapping=aes(x=x, y=a * x), size=2, color="red")
```




```r
## 4)
eps <- rnorm(n, sd=0.1)
y <- 30 * (x - 0.25)^2 * (x - 0.75)^2 + eps
X <- cbind(x^0, x^1, x^2, x^3, x^4)
a <- solve(t(X) %*% X, t(X) %*% y)
```

```r
y2 <- a[1] + a[2]*x + a[3]*x^2 + a[4]*x^3 + a[5]*x^4

ggplot(mapping=aes(x=x, y=y)) +
  geom_point() +
  geom_line(mapping=aes(x=x, y=y2), size=2, color="red")
```