tenta_svar

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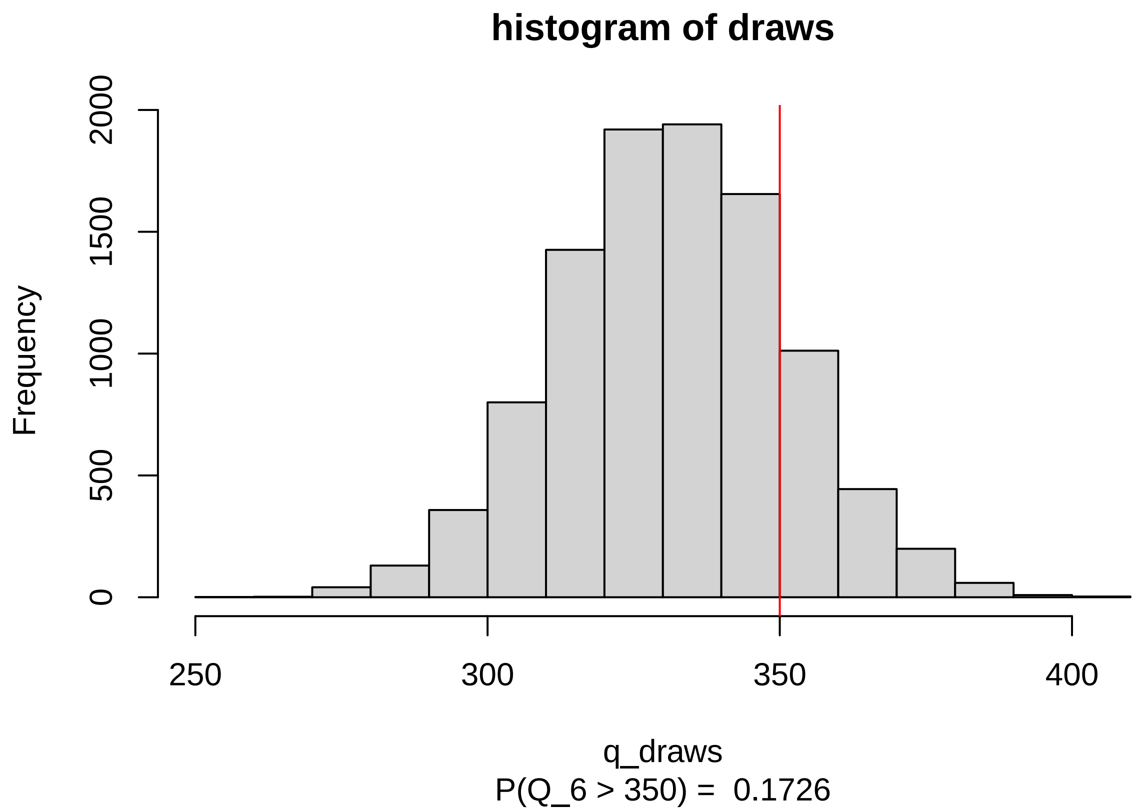
Question 1, Demand of a product

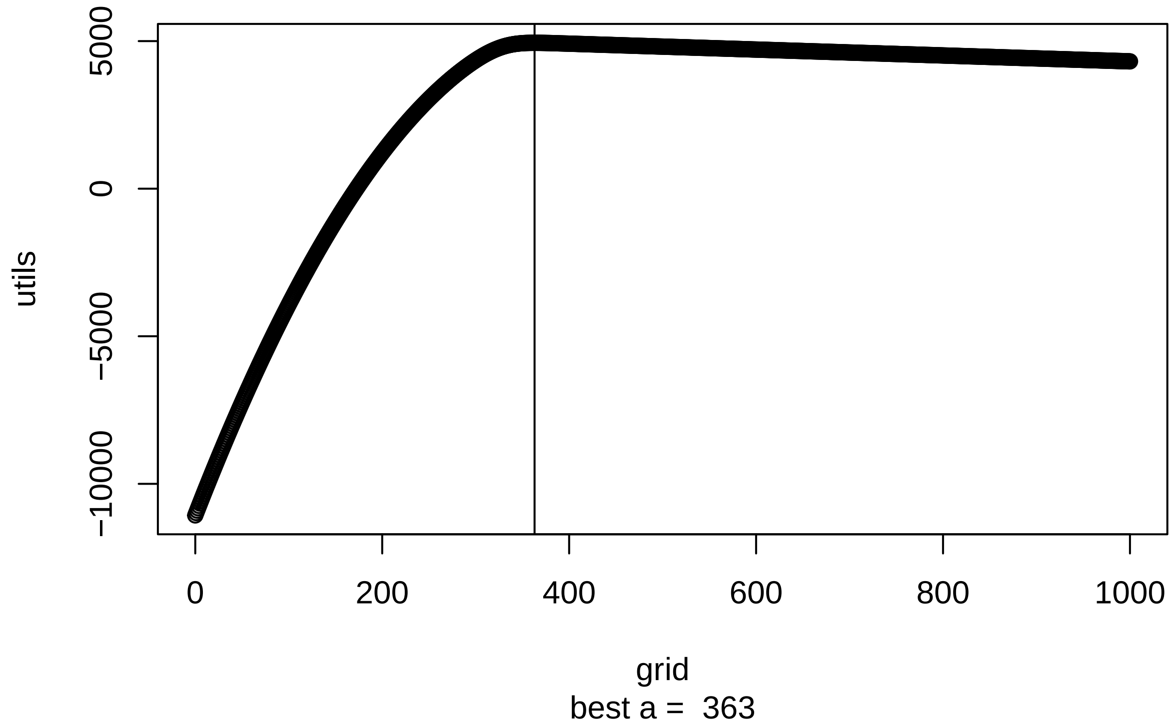
1.b

```
alpha_n = 2326
beta_n = 7

ndraws = 1E4
theta_draws = rgamma(ndraws,shape = alpha_n, rate=beta_n)
q_draws = rpois(ndraws,theta_draws)


prob = mean(q_draws>350)
hist(q_draws, main="histogram of draws", sub= paste("P(Q_6 > 350) = ",prob))
abline(v=350, col="red")
```



1.c

```
grid = seq(0,1000,by=1)
utils = matrix(nrow=length(grid),ncol=1)

for (i in 1:length(grid)){
  utils[i] = mean(utility_func(grid[i],q_draws))
}

best_a = grid[which.max(utils)]
plot(x=grid, y = utils, sub=paste("best a = ",best_a))
abline(v=best_a)
```

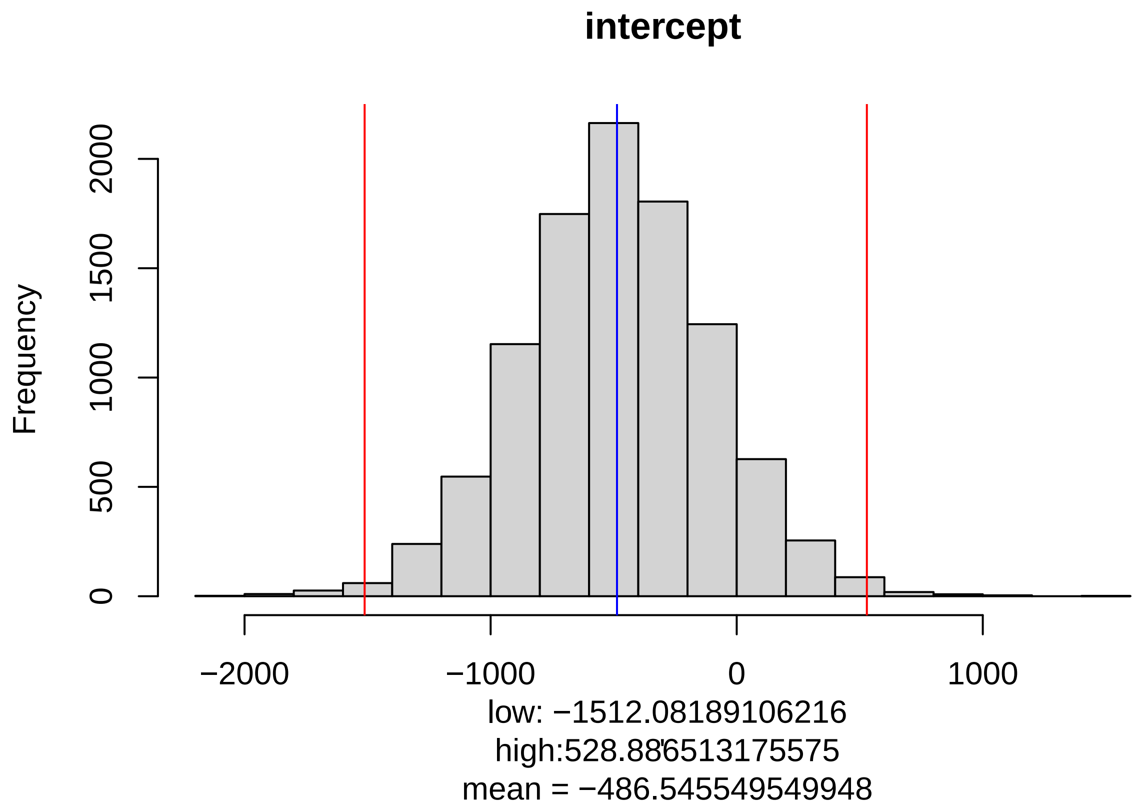


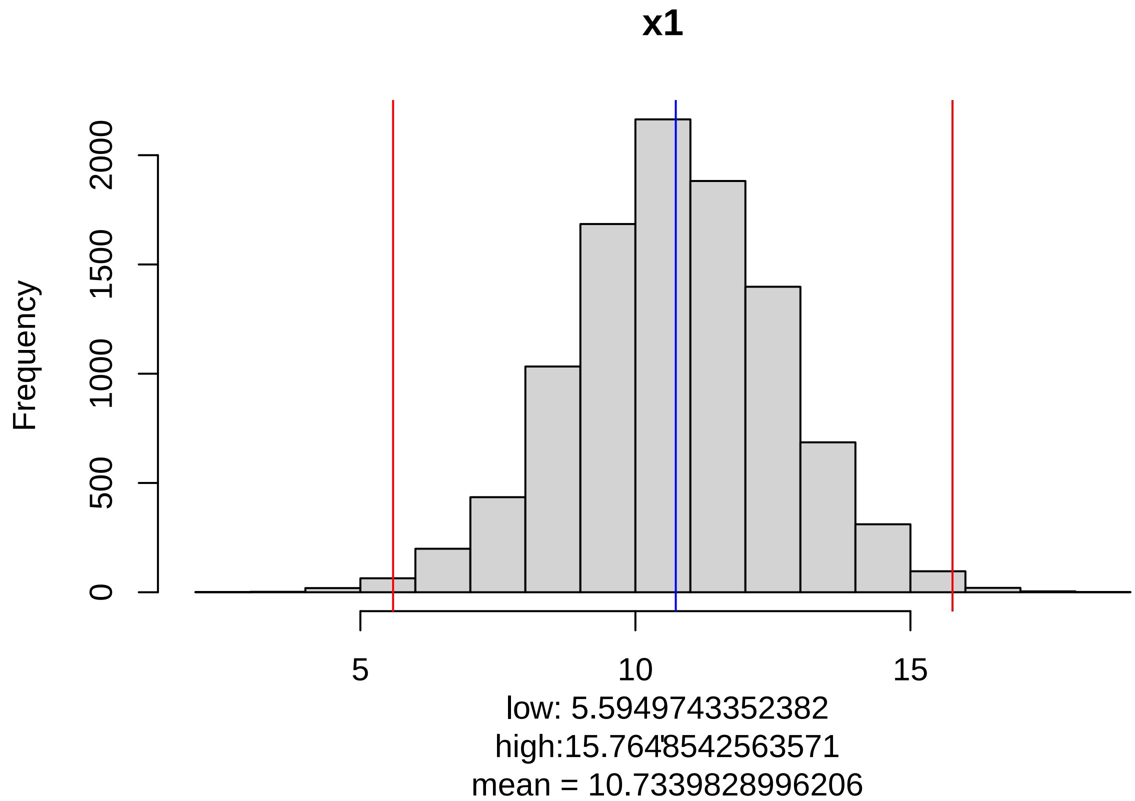
Question 2, Regression

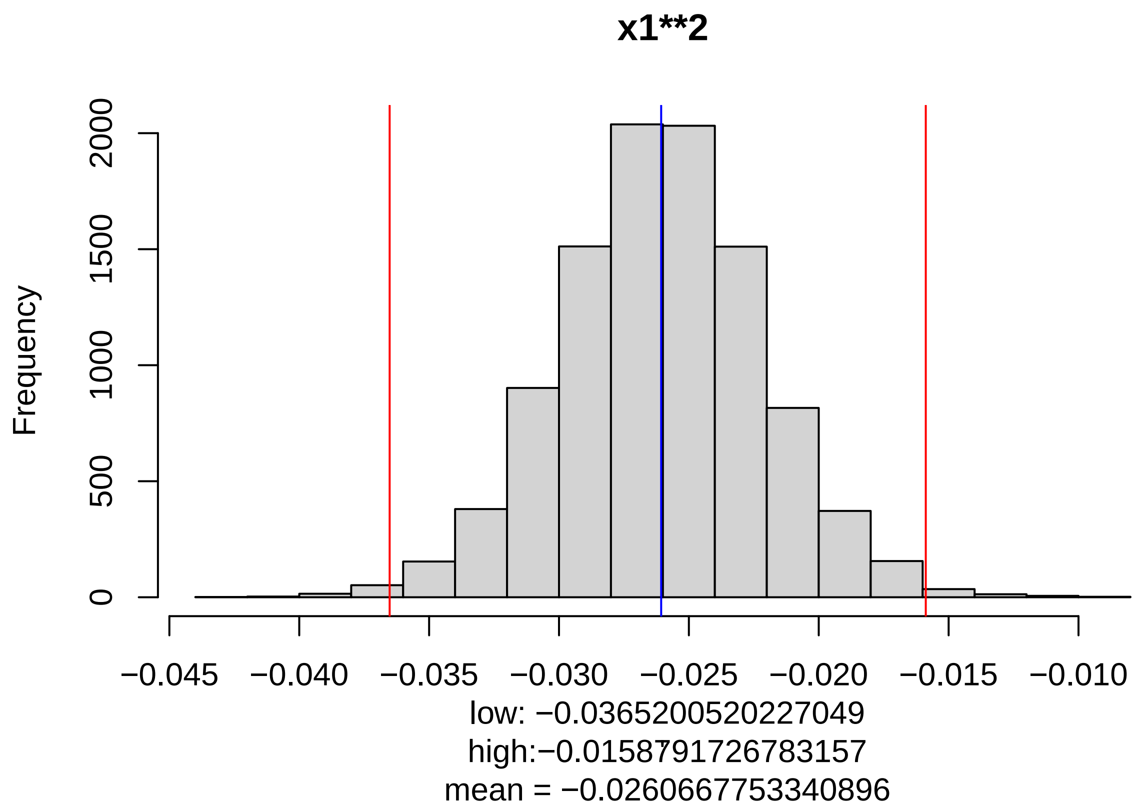
2.a

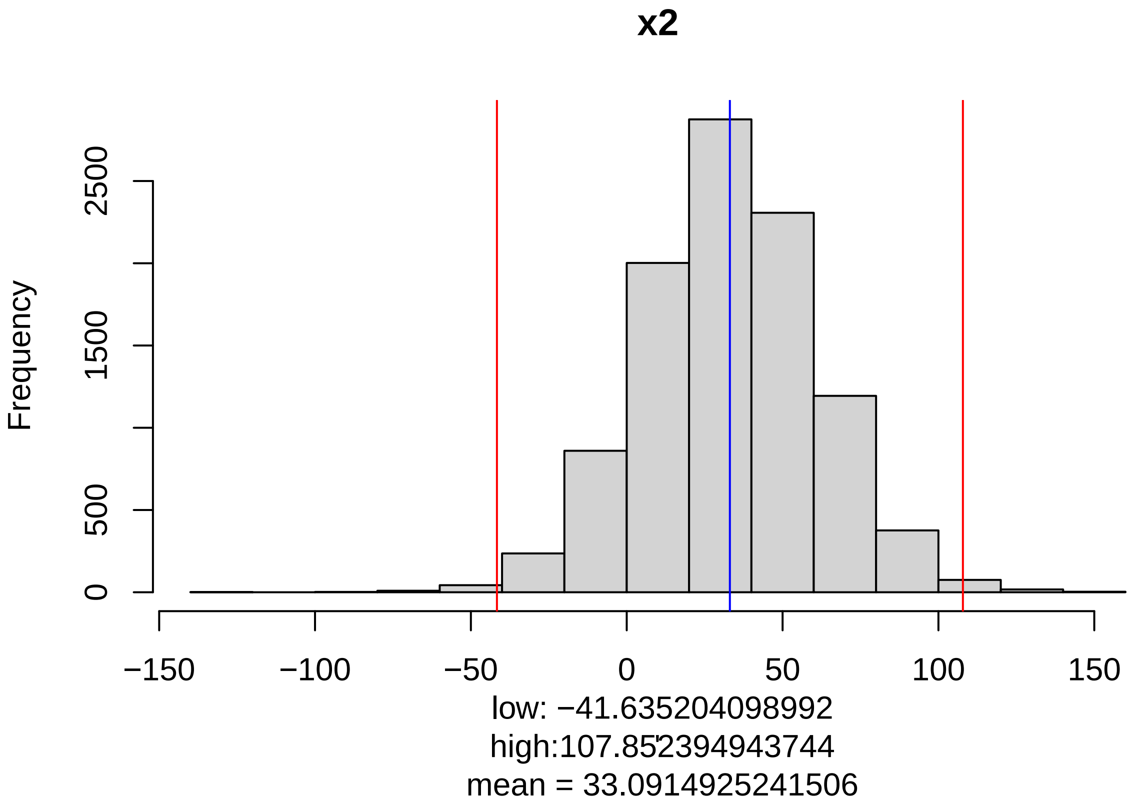
```
num_covs = dim(X)[2]
num_draws = 10000

#priors

mu_0 = rep(0,num_covs)
omega_0 = 1/(100) * diag(6)
v_0 = 1
sigma2_0 = 100^2

res = BayesLinReg(y,X, mu_0, omega_0, v_0, sigma2_0, num_draws)

betas = res$betaSample

for (i in 1:num_covs){
  sample = betas[,i]
  sample_interval = quantile(sample, probs=c(0.005,0.995))
  sample_mean = mean(sample)

  hist(sample, main = colnames(X)[i],
```

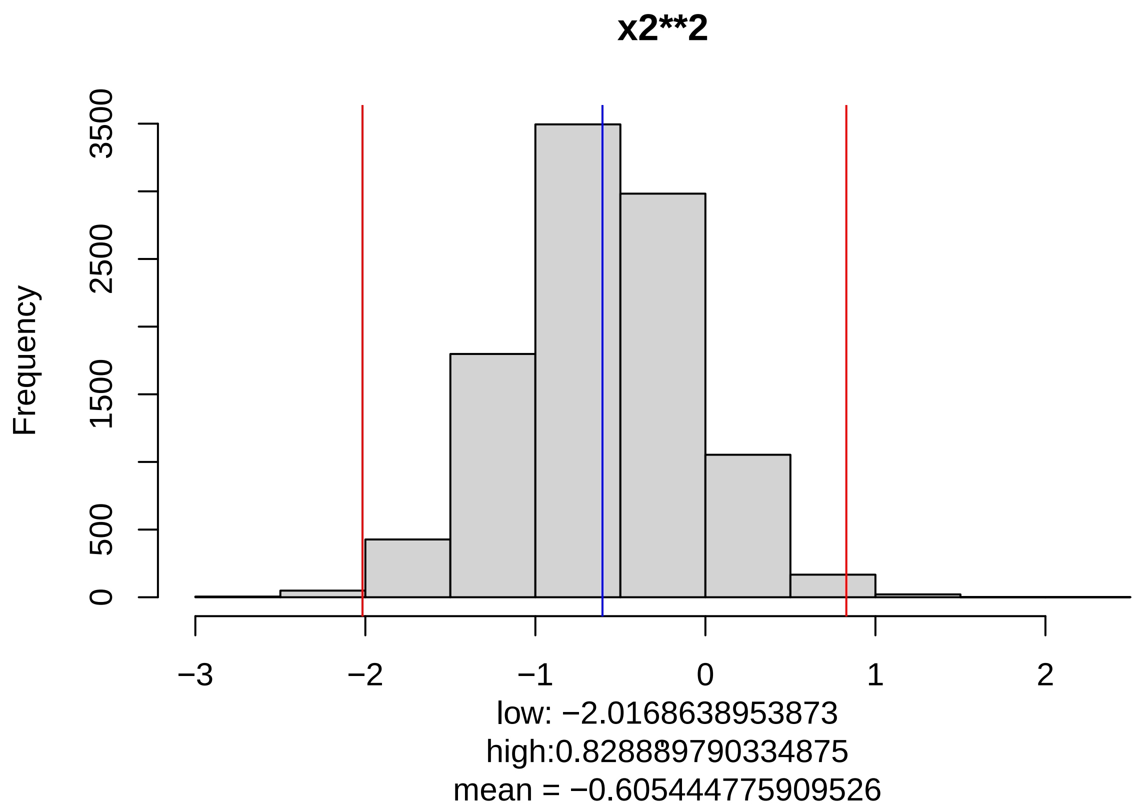
```
        sub = paste(" \n low: ",sample_interval[1],"\n high:",sample_interval[2], "\n mean = ", sample_me

  abline(v=sample_mean, col="blue")
  abline(v=sample_interval, col="red")
}
```

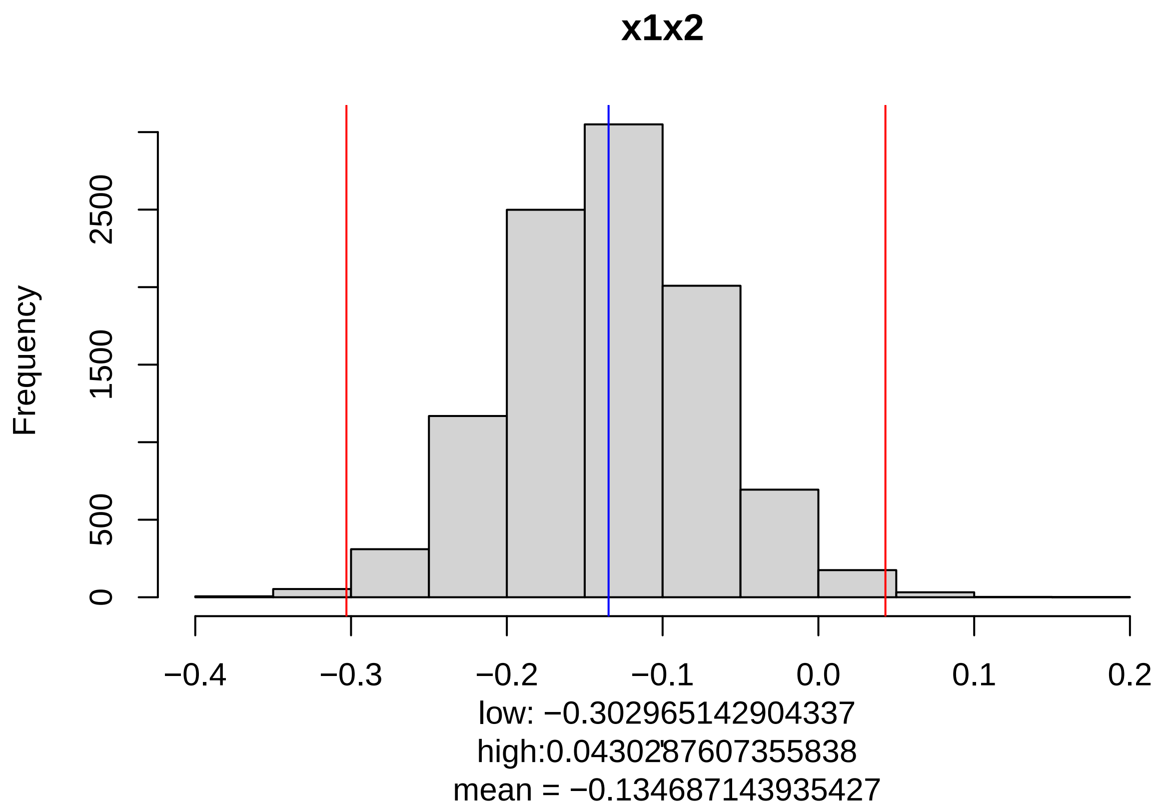



x1
Frequency
0
500
1000
1500
2000
5
10
15
low: 5.5949743352382
high:15.7648542563571
mean = 10.7339828996206


x1**2
Frequency
0
500
1000
1500
2000
−0.045
−0.040
−0.035
−0.030
−0.025
−0.020
−0.015
−0.010
low: −0.0365200520227049
high:−0.0158791726783157
mean = −0.0260667753340896


x2
Frequency
0
500
1500
2500
−150
−100
−50
0
50
100
150
low: −41.635204098992
high:107.852394943744
mean = 33.0914925241506


x2**2
Frequency
0
500
1500
2500
3500
−3
−2
−1
0
1
2
low: −2.0168638953873
high:0.828889790334875
mean = −0.605444775909526



B_1 has a significant positive value according to our analysis. The exact value likely(99%) between [5.9, 15.8]

2.b

```
sigma_sample = res$sigma2Sample

posterior_mean = mean(sigma_sample**.5)
posterior_median = median(sigma_sample**.5)

list(posterior_mean = mean(sigma_sample**.5),
posterior_median = median(sigma_sample**.5))
```

```
## $posterior_mean
## [1] 40.04173
##
## $posterior_median
## [1] 39.57705
```

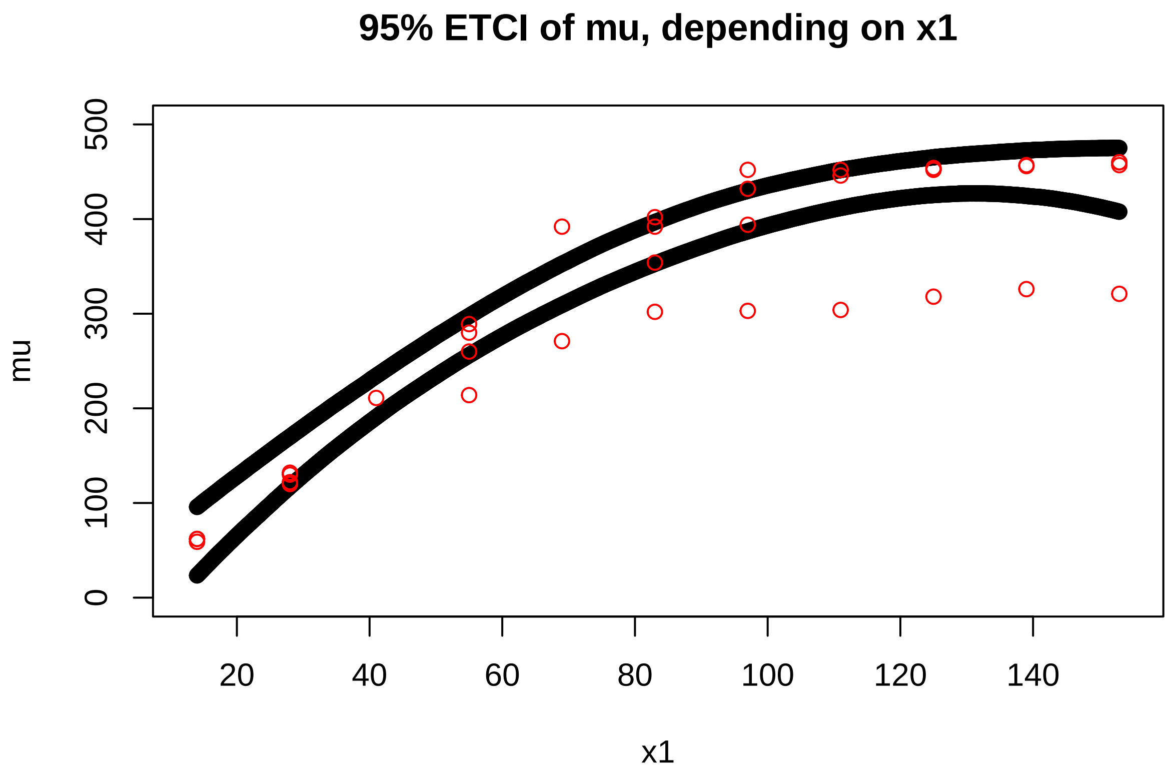
2.c

```
x1_lo = min(X[,2])
x1_hi = max(X[,2])
```

```r
x1_grid = seq(x1_lo,x1_hi,by=.1)

X_test = matrix(nrow=length(x1_grid),ncol = num_covs)

colnames(X_test) = colnames(X)
X_test[,1] = 1
X_test[,2]=x1_grid
X_test[,3] = x1_grid ** 2
X_test[,4] = 27
X_test[,5] = 27** 2
X_test[,6] = 27 * x1_grid
head(X_test)
```

```
##      intercept   x1  x1**2 x2 x2**2  x1x2
## [1,]         1 14.0 196.00 27   729 378.0
## [2,]         1 14.1 198.81 27   729 380.7
## [3,]         1 14.2 201.64 27   729 383.4
## [4,]         1 14.3 204.49 27   729 386.1
## [5,]         1 14.4 207.36 27   729 388.8
## [6,]         1 14.5 210.25 27   729 391.5
```

```r
for (i in 1:length(x1_grid)){
  x_i = X_test[i,]

  mu_i = betas %*% (x_i)

  interval = quantile(mu_i, probs=c(0.025,0.975))
  if (i ==1){
    plot(x=x_i[2], y=interval[1],xlim=c(x1_lo-1,x1_hi+1), ylim=c(0,500), xlab="x1", ylab = "mu", main =
    points(x=x_i[2], y=interval[2])
  }else{
    points(x=x_i[2],y=interval[1])
    points(x=x_i[2], y=interval[2])
  }
}


points(X[,2], y, col="red")
```



2.d

The effect from x1 depends on x2 only in the sixth Feature. x1*X2.

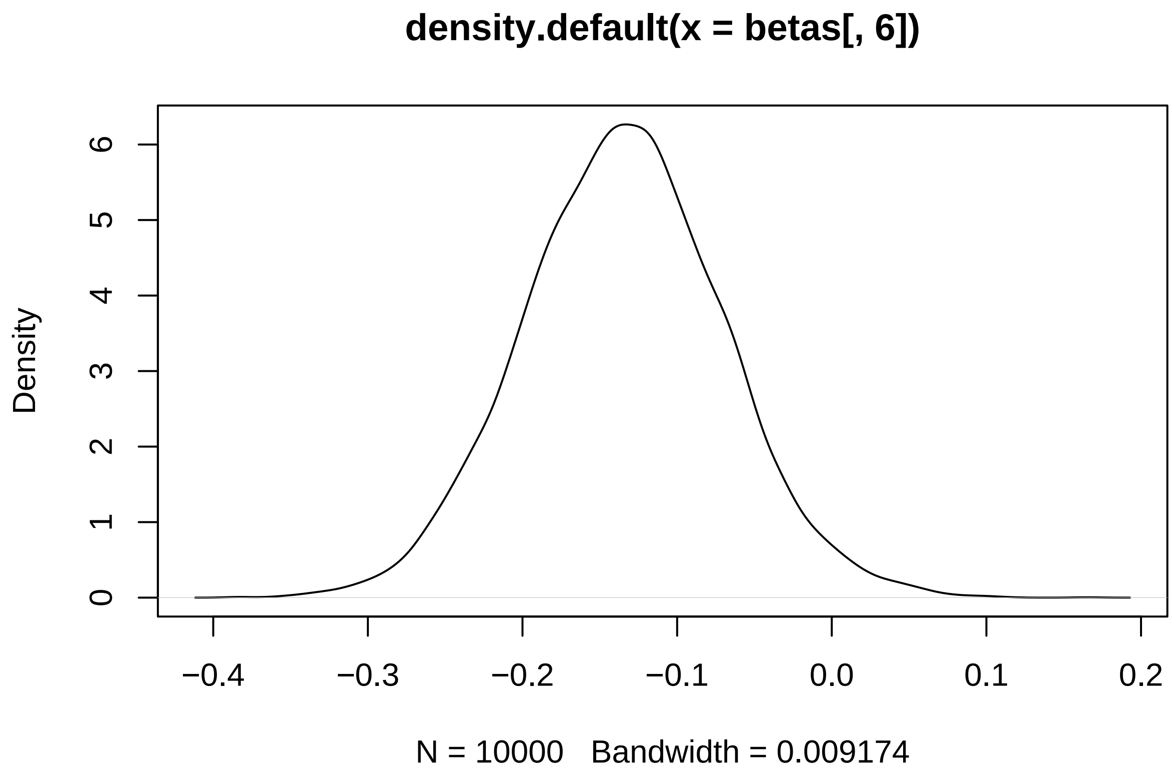
Consider the two extreme cases: 1. x2 = n, n -> 0 2. x2 = M, M -> inf

in case one: the dependence is incredibly small and the sixth feature is inconsequential.

in case two: the dependence is very large and the total effect from x1 depends almost totally on x2.

In general, there will be some dependence and our effect from x1 is dependent on x2. Additionally, we see that the 95% interval for the effect is negative.

```
plot(density(betas[,6]))
```




```r
quantile(betas[,6],probs=c(0.025,0.975))
```

```
##         2.5%        97.5%
## -0.260720767 -0.004737725
```