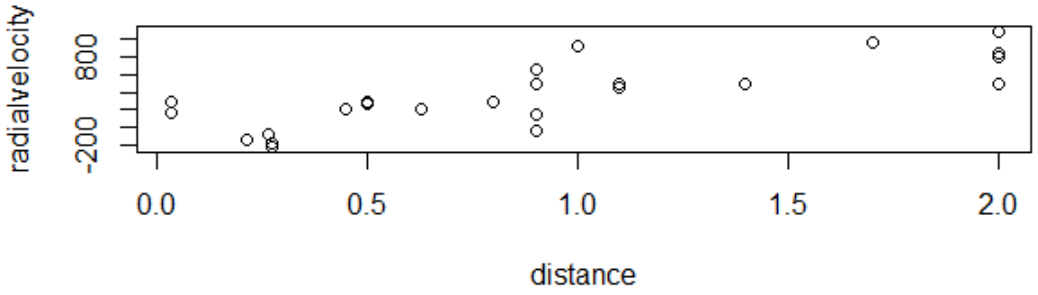
Assignment 4

(a)




```
> hubble = read.table("hubbledata.txt", header=TRUE)
> plot.default(hubble[,2], hubble[,3], xlab="distance", yl
ab="radialvelocity")
```

(b)(i)

```
model {
    for (i in 1:length(y)) {
        y[i] ~ dnorm(beta1+beta2*x[i], sigmasqinv)
    }

    beta1 ~ dnorm(0, .00000001)
    beta2 ~ dnorm(0, .00000001)
    sigmasqinv ~ dgamma(0.0001, 0.0001)

    sigmasq <- 1/sigmasqinv
}
```

(ii)

```
Iterations = 2501:5000
Thinning interval = 1
Number of chains = 4
Sample size per chain = 2500

1. Empirical mean and standard deviation for each variabl
e,
   plus standard error of the mean:

          Mean      SD Naive SE
beta1    -40.98   88.36   0.8836
beta2    454.30   79.94   0.7994
sigmasq 59705.74 19919.73 199.1973
       Time-series SE
beta1           2.029
beta2           1.831
sigmasq       224.518

2. Quantiles for each variable:

          2.5%     25%     50%     75%
beta1    -216.8   -98.56   -41.64    16.5
beta2     294.3   403.36   454.05   505.6
sigmasq 32678.9 45803.21 56011.53 69165.1
          97.5%
beta1     135.8
beta2     612.7
sigmasq 108569.3
```

(iii)

```
> post.samp <- as.matrix(x1)
> mean(post.samp[,"beta2"]>0)
[1] 1
> mean(post.samp[,"beta2"])
[1] 454.3007
> quantile(post.samp[,"beta2"], c(0.025,0.975))
    2.5%    97.5%
294.2685 612.7440
```

Yes, H_0 appears to be positive.

(iv)

```
> mean(post.samp[,"beta1"])
[1] -40.97998
> quantile(post.samp[,"beta1"], c(0.025,0.975))
     2.5%     97.5%
-216.8190  135.8169
```

Yes, my interval contains zero.

(c)(i)

```
model {
    for (i in 1:length(y)) {
        y[i] ~ dnorm(beta2*x[i], sigmasqinv)
    }

    beta2 ~ dnorm(0, .00000001)
    sigmasqinv ~ dgamma(0.0001, 0.0001)

    sigmasq <- 1/sigmasqinv
}
```

(ii)

```
Iterations = 2501:5000
Thinning interval = 1
Number of chains = 4
Sample size per chain = 2500

1. Empirical mean and standard deviation for each variabl
e,
   plus standard error of the mean:
```

```
          Mean      SD Naive SE
beta2     424.1    43.92   0.4392
sigmasq 57880.5 18620.93 186.2093
       Time-series SE
beta2          0.4356
sigmasq      190.3626

2. Quantiles for each variable:

          2.5%     25%   50%     75%
beta2     336.2   395.8   424   452.8
sigmasq 32060.1 44751.6 54532 67321.7
          97.5%
beta2      510.3
sigmasq 103043.4
```

(iii)

```
> mean(post.samp[,"beta2"])
[1] 424.0849
> quantile(post.samp[,"beta2"], c(0.025,0.975))
    2.5%    97.5%
336.1757 510.2753
```

(iv) Standard deviation decreases by around 40 while mean decreases by around 30. The change is very much relative.

The credible interval is narrower than before.

(d)(i)

```
> x1 <- coda.samples(m1, c("beta2","sigmasq"), n.iter = 25
00)
> post.samp <- as.matrix(x1)
> epsilon = mean(hubble$radialvelocity) - mean(hubble$dist
ance)*post.samp[,"beta2"]
```

(ii)

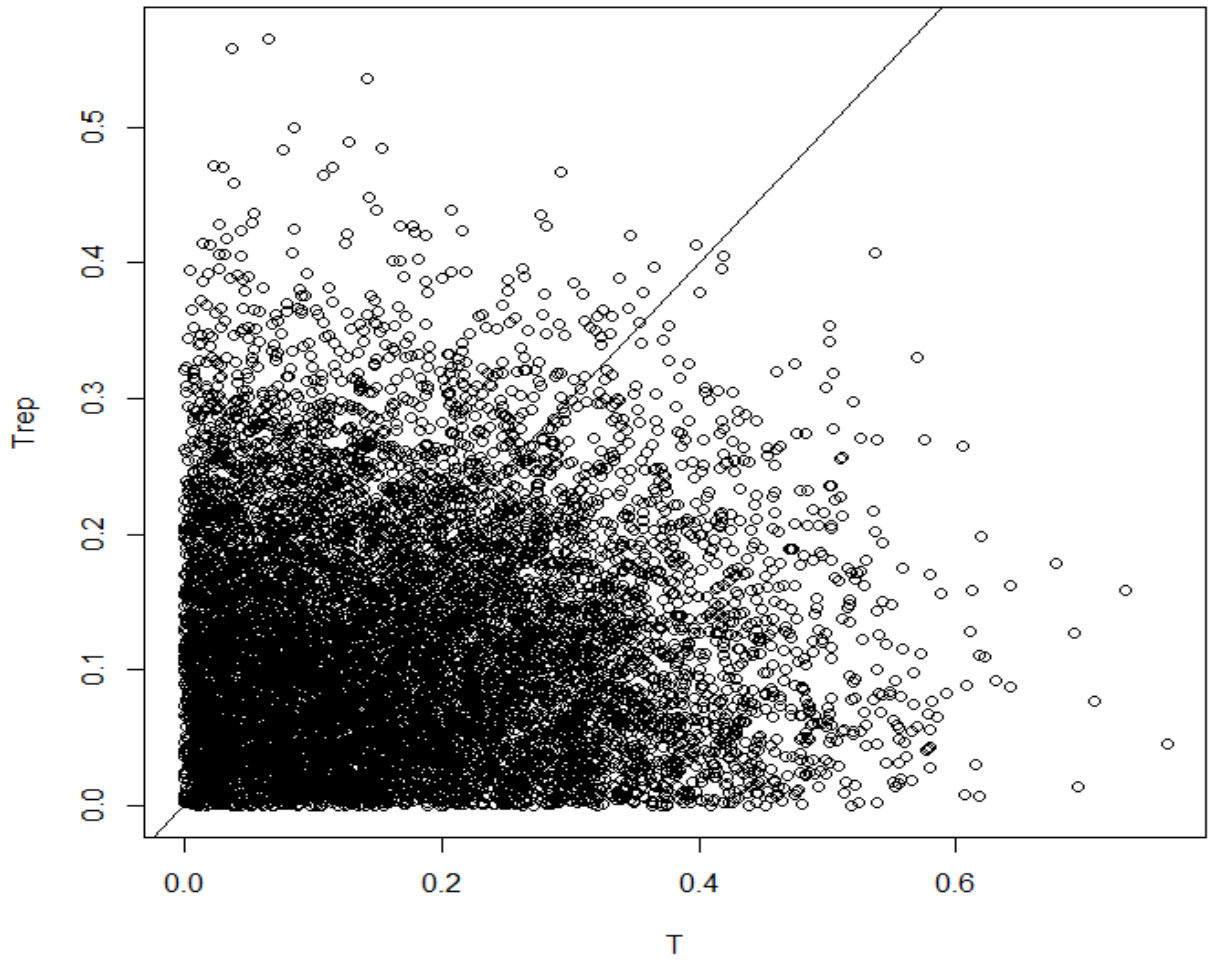
```
> sigma<-post.samp[,"sigmasq"]^0.5
> epsilon_rep <- matrix(rnorm(10000*nrow(hubble),0,sigma),
10000, nrow(hubble))
```

(iii)

```
> abs(cor(epsilon,hubble$distance))
...
> abs(cor(epsilon_rep,hubble$distance))
...
```

(iv)

```
> Tfboy <- abs(cor(t(epsilon),hubble$distance))
> Tfboy_rep <- abs(cor(t(epsilon_rep),hubble$distance))
> plot.default(Tfboy_rep, Tfboy, ylab="Trep", xlab="T")
> abline(coef=c(0,1))
```



(v)

```
> mean(Tfboy_rep >= Tfboy)
[1] 0.6123
```

There is no evidence provided that the no-intercept model does not fit.