1.h)

* Does this estimator look unbaised?

Yes it does the mean of the 10000 estimators is very close to the equal mean.

* What is the variance?

In our example the variance is 0.04837741

* What distribution does the estimator follow?

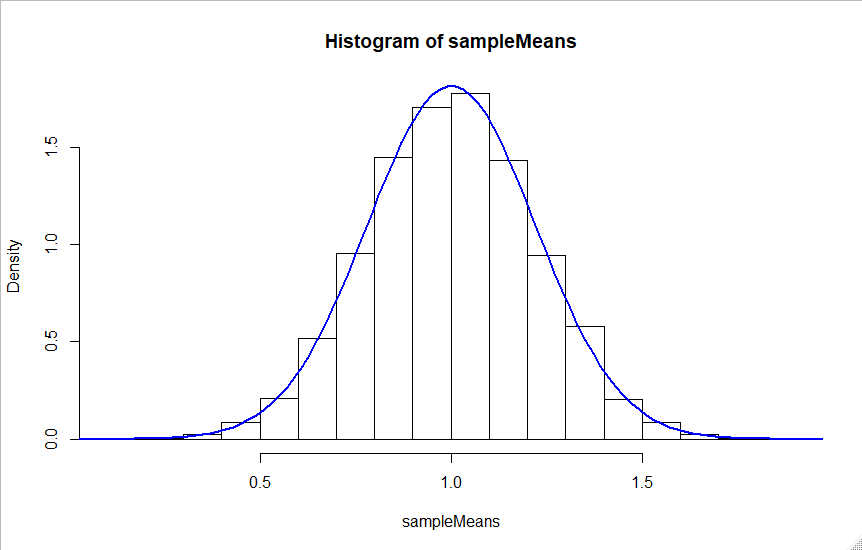


Image 1

The estimator has a normal distribution. In the histogram in image 1 there’s a normal distribution plotted with the variance and mean of the estimator. From the image can be seen that the estimator follows a normal distribution.

* Comparing the results to exercise 1.e

Expected value:

The expected value of the estimator is almost the same as estimated in question 1.e.1. The difference is the result in not an infinite amount of estimations.

Variance:

The variance should be 1/20 = 0.05 and this is also almost met. The found variance is 0.04837741

* Comparing the results to exercise 1.h

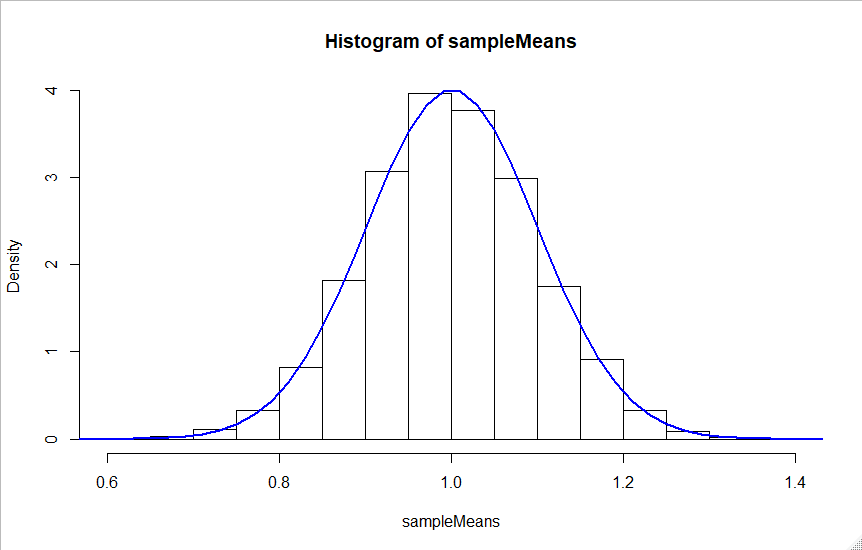
If we look at Image 1 we can see that the estimator has a normal distribution with mean = mu and variance sigmasq/n. This is also what we calculated in 1.h.1. In question 1.h.2 we used the CLT to calculate the asymptotic distribution. That this is true can also be concluded from this simulation.

1.i)

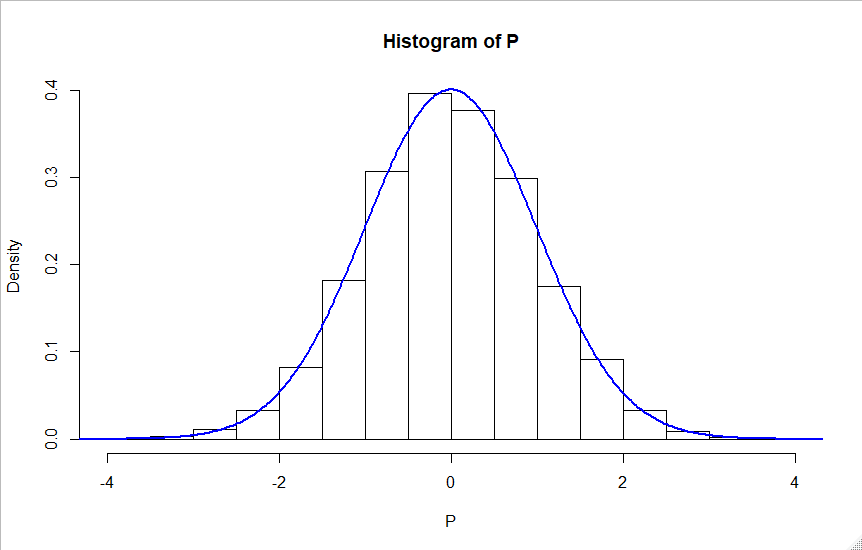
N = 100:

Mean: 1.000792

Variance: 0.009927161



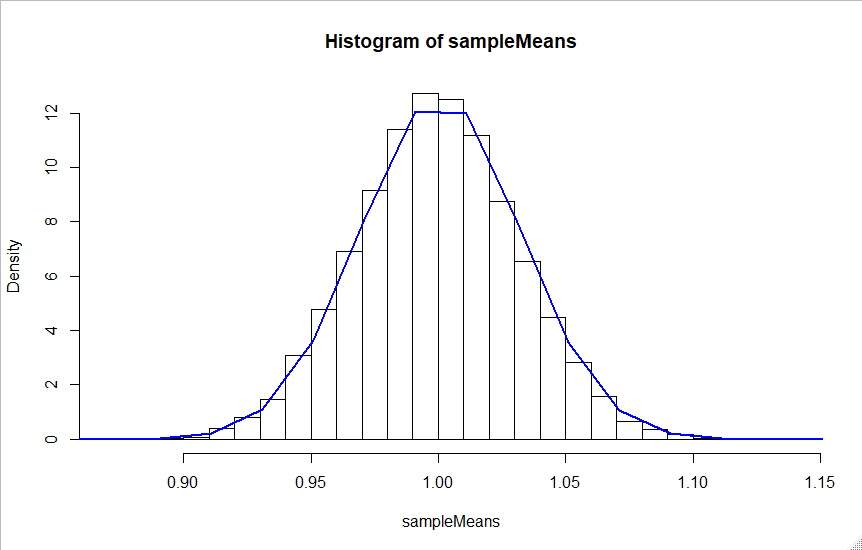
Pivot quantity:



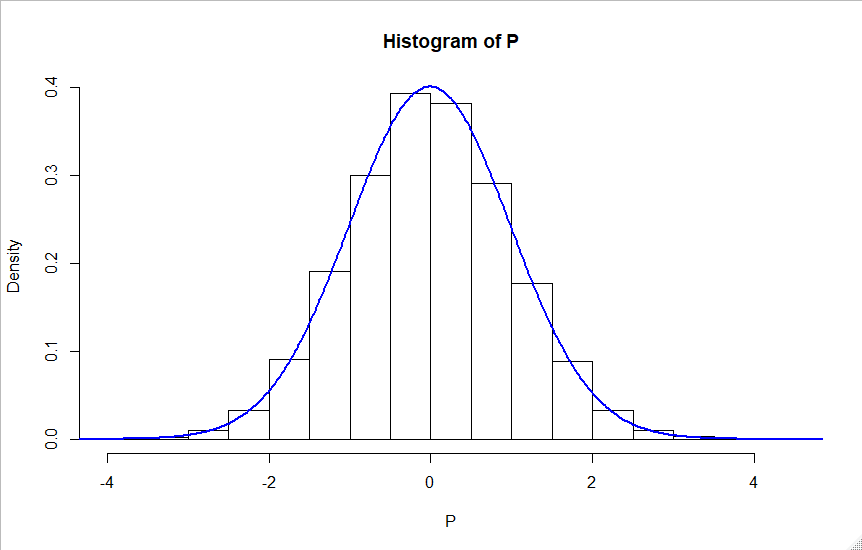
N = 1000:

Mean: 1.000792

Variance: 0.0009932432



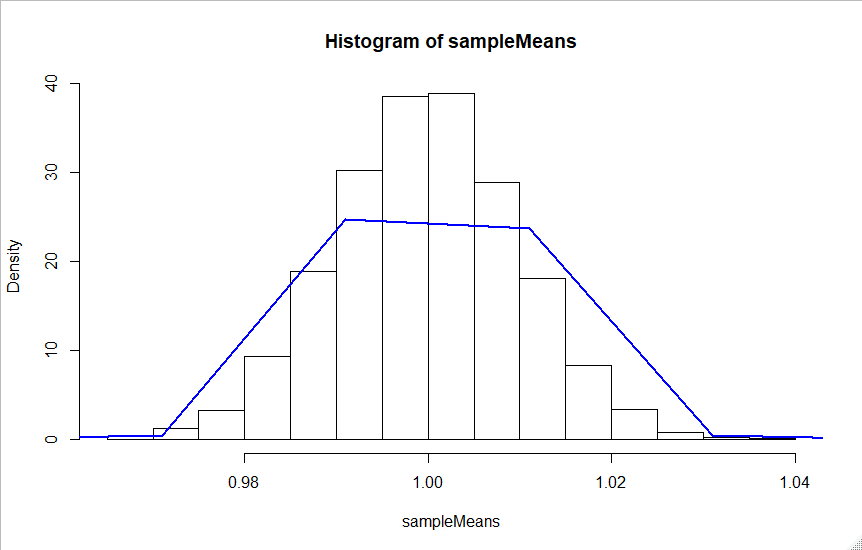
Pivot quantity:



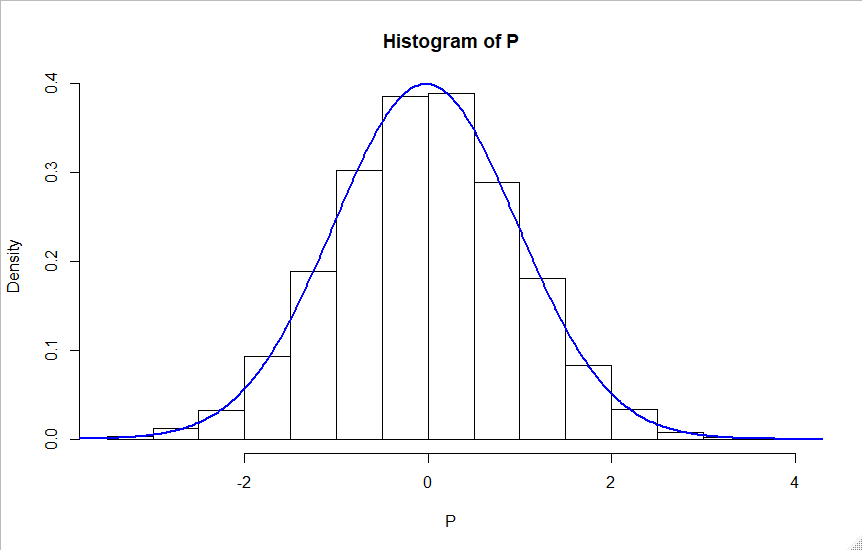
N = 10000:

Mean: 1.000792

Variance: 9.986911e-05



Pivot quantity:



* Is the estimator consistent?

Yes the estimator is consistent. The mean is for all the simulations the same.

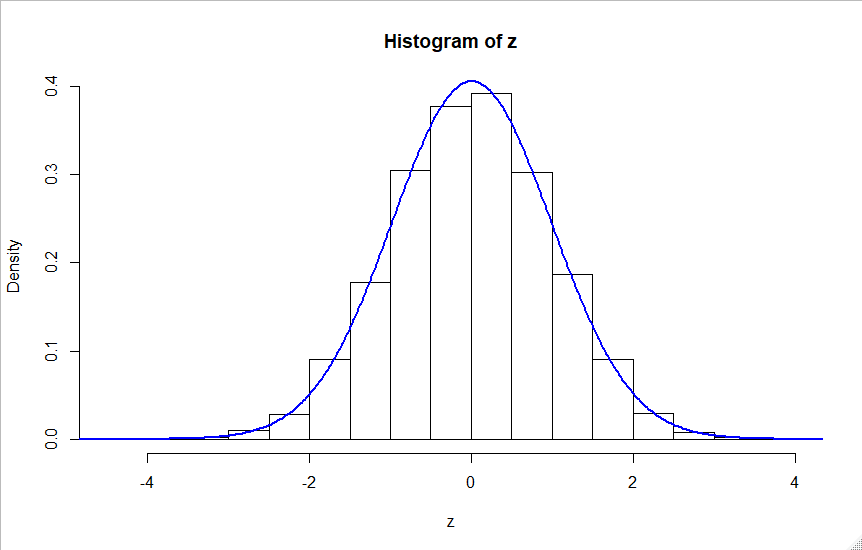
* Difference of the estimators distributions.

If we compare the different histograms we can see that all the estimators follow a normal distribution with the same mean. The difference when N gets bigger is the density around the mean. This is also expected if we look at question 1.f.2 the variance gets a lot smaller.

* Distributions pivot quantity for different N:

As expected the distribution of the pivot quantity doesn’t chance for a bigger N. There is only a very small chance in how “clean” the normal distribution is.

2.g)



As seen from the given image the distribution of z is from the form standard normal. This was also the result from question 2.c

2.h)

Results:

The estimated value of the sample set is: 0.005420443

The variance of the sample set is: 0.9675482

For alpha = 0.01 we reject H0 is mu < -2.282869

For alpha = 0.05 we reject H0 is mu < -1.612524

For alpha = 0.10 we reject H0 is mu < -1.255165

Because we already discussed that z follows a normal distribution the rejection values are calculated using a normal distribution with the calculated mean and variance. The rejection regions is in the same direction as the alternative hypothesis. In this case a one sided bound.

3.c)

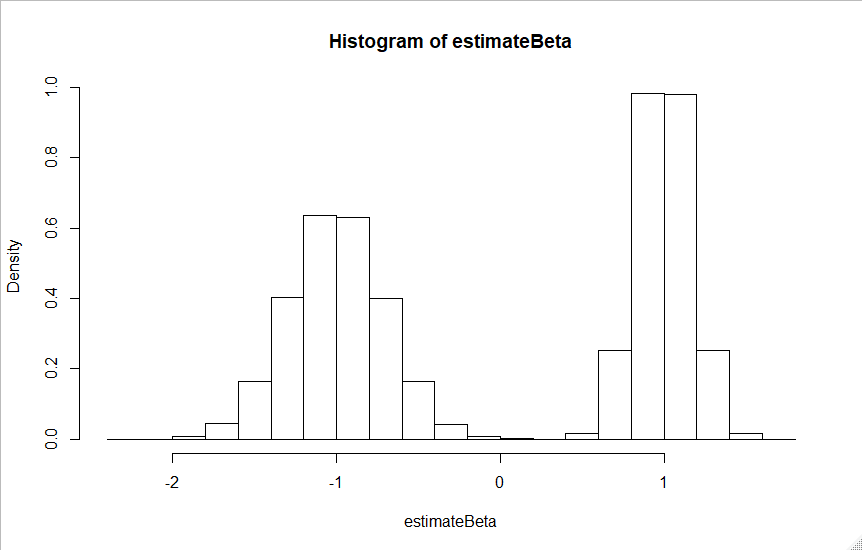
Results:

The estimated value of beta 1 is: 0.9998632

The variance of beta 1 is: 0.02595322

The estimated value of beta 2 is: -1.000981

The variance of beta 2 is: 0.08604292



- Yes the expected value of the estimators is close to the true value.

- Variances can be found in the result section

- Looking at the histograms we can argue that the estimators follow a normal distribution. This is also expected due the CLT.

3.d)

Results:

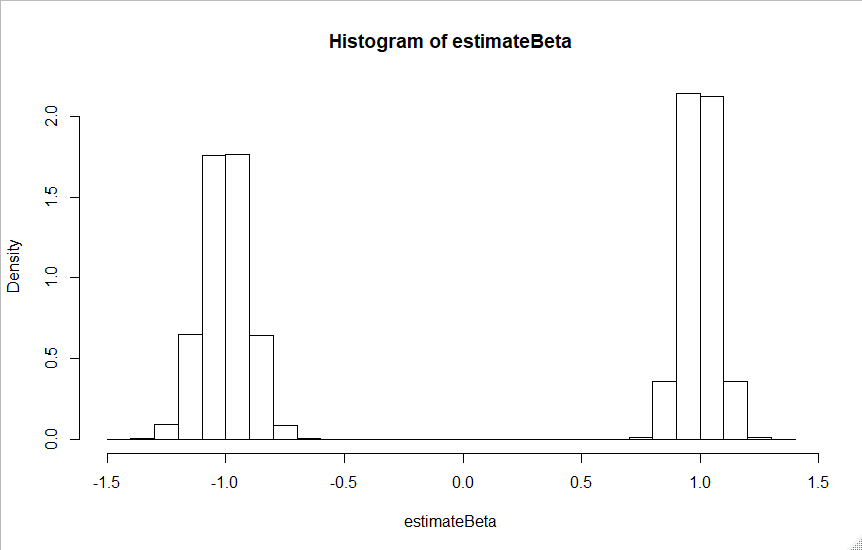
N=100:

The estimated value of beta 1 is: 0.9998997

The variance of beta 1 is: 0.004787179

The estimated value of beta 2 is: -1.000478

The variance of beta 2 is: 0.009147363



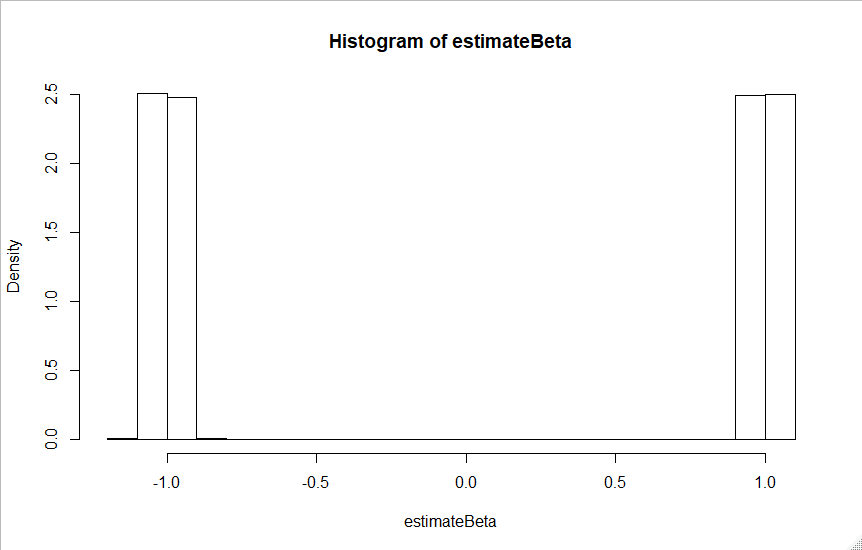
N=1000:

The estimated value of beta 1 is: 1.000038

The variance of beta 1 is: 0.0005089952

The estimated value of beta 2 is: -1.000149

The variance of beta 2 is: 0.001021152



4.g)

Results

For alpha is 0.01 the percentage of estimator p 1 that is in the confidence interval is 0.87782

For alpha is 0.01 the percentage of estimator p 2 that is in the confidence interval is 0.96035

For alpha is 0.01 the percentage of estimator p 3 that is in the confidence interval is 0.97728

For alpha is 0.05 the percentage of estimator p 1 that is in the confidence interval is 0.87594

For alpha is 0.05 the percentage of estimator p 2 that is in the confidence interval is 0.94842

For alpha is 0.05 the percentage of estimator p 3 that is in the confidence interval is 0.9278

For alpha is 0.1 the percentage of estimator p 1 that is in the confidence interval is 0.86722

For alpha is 0.1 the percentage of estimator p 2 that is in the confidence interval is 0.84497

For alpha is 0.1 the percentage of estimator p 3 that is in the confidence interval is 0.89266

4.h)

Results

N=200

For alpha is 0.01 the percentage of estimator p 1 that is in the confidence interval is 0.9807

For alpha is 0.01 the percentage of estimator p 2 that is in the confidence interval is 0.98851

For alpha is 0.01 the percentage of estimator p 3 that is in the confidence interval is 0.9875

For alpha is 0.05 the percentage of estimator p 1 that is in the confidence interval is 0.92546

For alpha is 0.05 the percentage of estimator p 2 that is in the confidence interval is 0.9433

For alpha is 0.05 the percentage of estimator p 3 that is in the confidence interval is 0.94828

For alpha is 0.1 the percentage of estimator p 1 that is in the confidence interval is 0.87723

For alpha is 0.1 the percentage of estimator p 2 that is in the confidence interval is 0.90886

For alpha is 0.1 the percentage of estimator p 3 that is in the confidence interval is 0.90258

N=2000

For alpha is 0.01 the percentage of estimator p 1 that is in the confidence interval is 0.98841

For alpha is 0.01 the percentage of estimator p 2 that is in the confidence interval is 0.98935

For alpha is 0.01 the percentage of estimator p 3 that is in the confidence interval is 0.98983

For alpha is 0.05 the percentage of estimator p 1 that is in the confidence interval is 0.94702

For alpha is 0.05 the percentage of estimator p 2 that is in the confidence interval is 0.9489

For alpha is 0.05 the percentage of estimator p 3 that is in the confidence interval is 0.94958

For alpha is 0.1 the percentage of estimator p 1 that is in the confidence interval is 0.89703

For alpha is 0.1 the percentage of estimator p 2 that is in the confidence interval is 0.90317

For alpha is 0.1 the percentage of estimator p 3 that is in the confidence interval is 0.89975