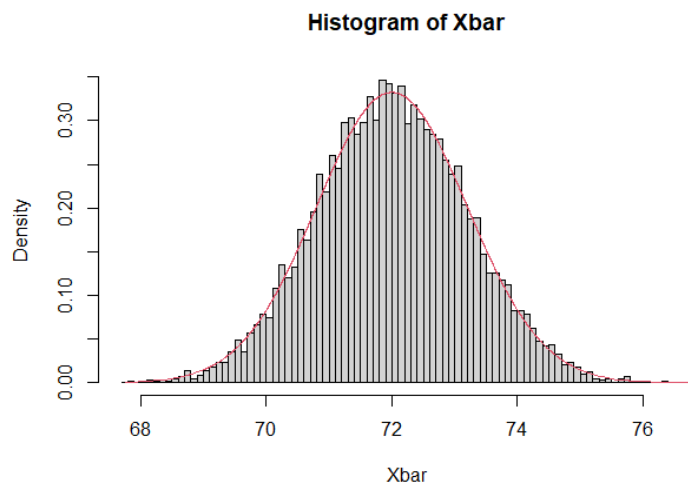# Task 1

```
N<-10000; n<-100; mu<-72; sigma=12
MySamples<-matrix(rep(0, N*n), n, N)
MySamples<-replicate(N, rgamma(n,mu/2,1/2))

Xbar<-apply(MySamples, 2, mean)
SDx<-apply(MySamples, 2, sd)
hist(Xbar,nclass = 100,freq = FALSE)
lines(sort(Xbar),dnorm(sort(Xbar),72,12/sqrt(n)),col=2)
```

Histogram of Xbar

Sample size 10 Code

```
> N<-10000; n<-10; mu<-72; sigma=12
> MySamples<-matrix(rep(0, N*n), n, N)
> MySamples<-replicate(N, rgamma(n,mu/2,1/2))
>
> Xbar<-apply(MySamples, 2, mean)
> SDx<-apply(MySamples, 2, sd)
>
> alpha<-0.05
> q_alpha<-qnorm(1-alpha/2)   #Z-Interval
> ME<-q_alpha*sigma/sqrt(n)
> LCL<-Xbar-ME
> UCL<-Xbar+ME
> Intervals<-data.frame(Xbar, ME, LCL, UCL, Length=UCL-LCL)
> head(Intervals)
    Xbar    ME    LCL    UCL  Length
```

```
1. 70.90855 7.43754 63.47101 78.34609 14.87508
2. 75.29637 7.43754 67.85883 82.73391 14.87508
3. 74.44453 7.43754 67.00699 81.88207 14.87508
4. 70.68596 7.43754 63.24842 78.12350 14.87508
5. 72.03652 7.43754 64.59898 79.47406 14.87508
6. 70.61763 7.43754 63.18009 78.05517 14.87508
>
> Coverage<-(abs(Xbar-mu)<=ME)
> Coverage[1:10]
 [1] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
> Confidence<-sum(Coverage)/N
> Confidence
[1] 0.9477
>
> q_alpha<-qt(1-alpha/2, n-1)   #T-Interval
> ME<-q_alpha*SDx/sqrt(n)
> LCL<-Xbar-ME
> UCL<-Xbar+ME
> Intervals<-data.frame(Xbar, ME, LCL, UCL, Length=UCL-LCL)
> head(Intervals)
     Xbar      ME     LCL     UCL  Length
1. 70.90855  8.470797 62.43775 79.37935 16.94159
2. 75.29637 11.529769 63.76660 86.82614 23.05954
3. 74.44453  6.702186 67.74234 81.14672 13.40437
4. 70.68596  8.353964 62.33199 79.03992 16.70793
5. 72.03652  8.942000 63.09452 80.97852 17.88400
6. 70.61763  6.385093 64.23253 77.00272 12.77019
>
> Coverage<-(abs(Xbar-mu)<=ME)
> Coverage[1:10]
 [1] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
> Confidence<-sum(Coverage)/N
> Confidence
[1] 0.9455
```

Sample size (n)	Coverage of Z-Interval	Coverage of t-Interval
10	.9477	.9455
25	.9491	.9466
50	.9493	.9487
75	.9509	.9487
100	.9496	.9502
200	.9501	.9488
400	.9505	.9497
1000	.9516	.9511

It seems to be the higher the sample size, the closer the Confidence Level is to the desired Confidence Level. This makes sense because with more samples we are more likely to be correct.