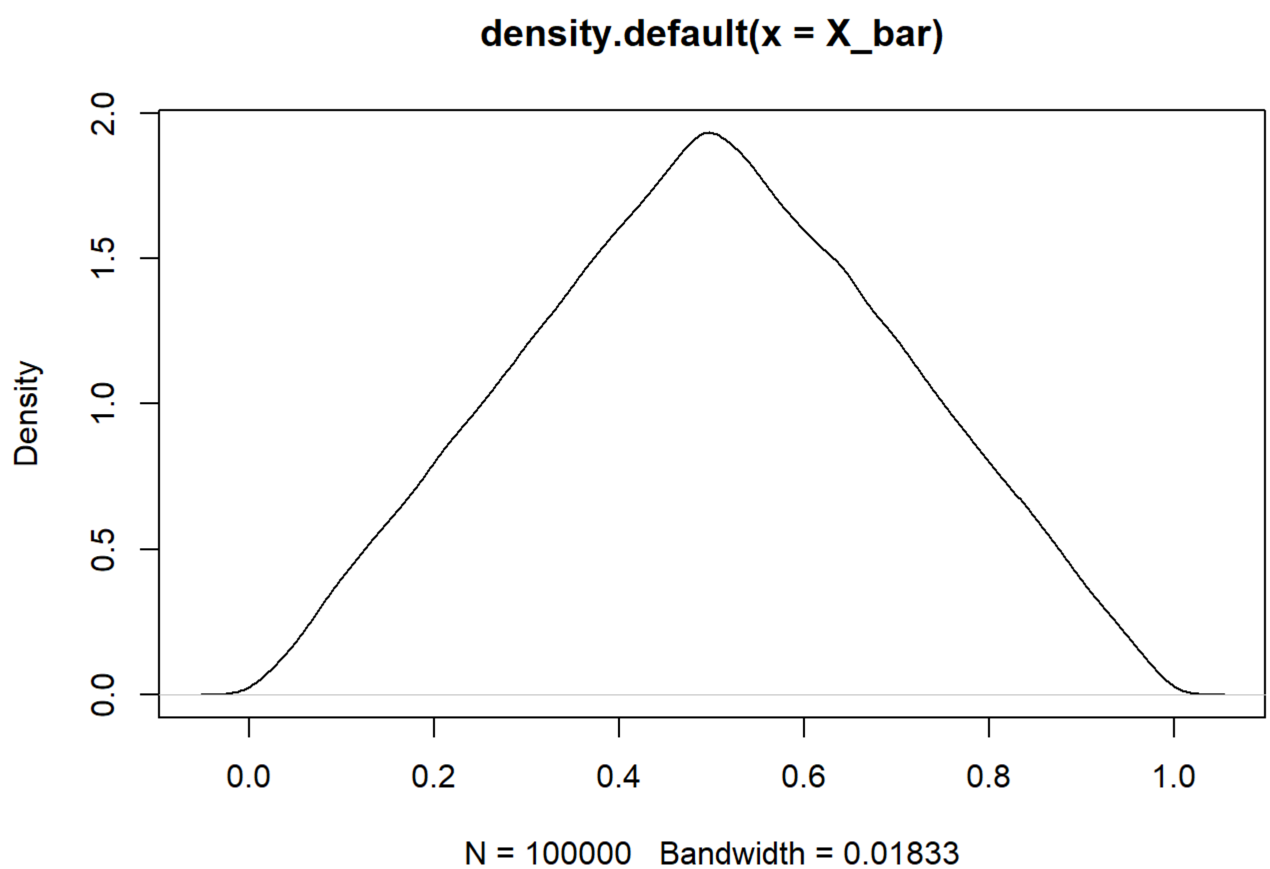
# Q3

Huiyan Li

3/29/2020

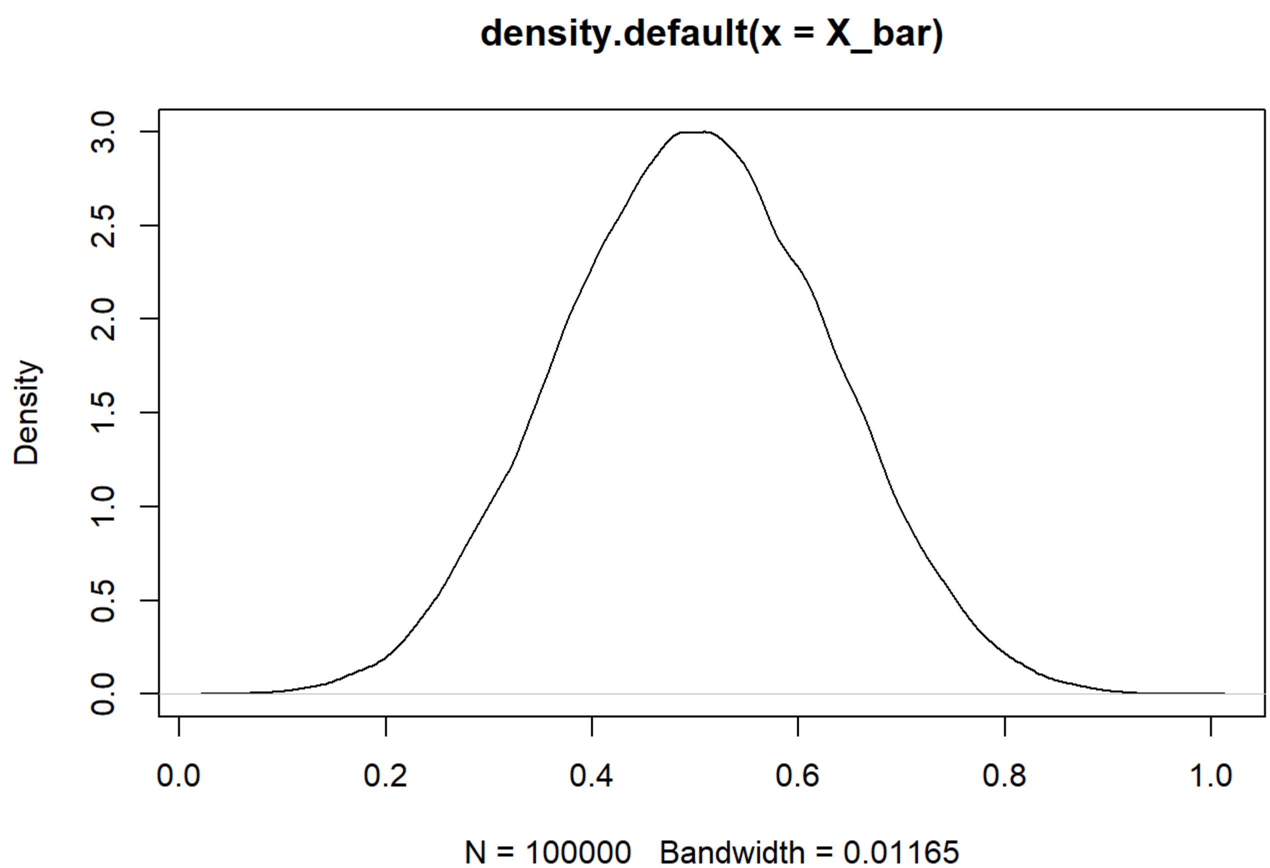
## A. when n = 2, $X \sim Unif[0, 1]$

```
sample_4m_normal = function(x) {
  s = runif(2, min = 0, max = 1)
  return (mean(s))
}
X_bar = replicate(100000, sample_4m_normal())
plot(density(X_bar))
```



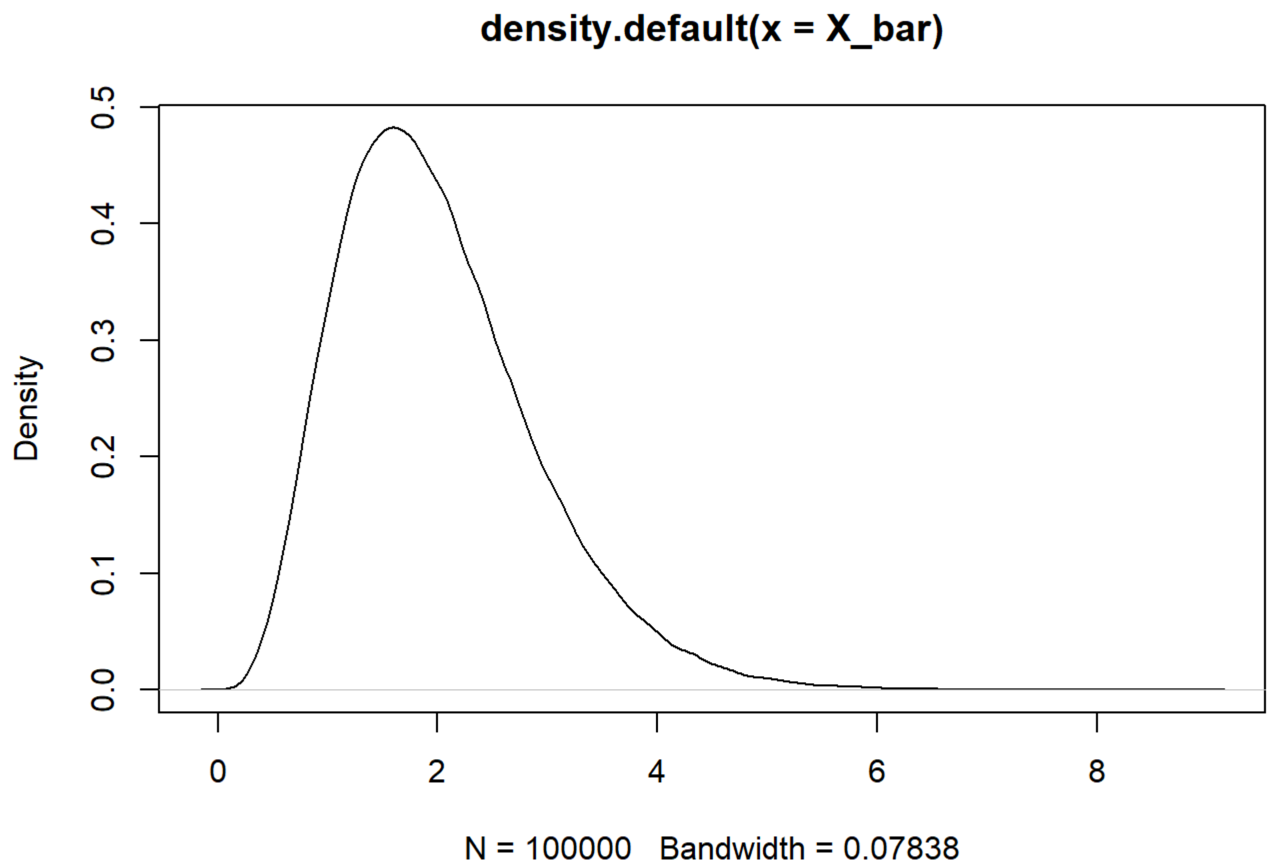

## B. when n = 5, $X \sim Unif[0, 1]$

```
sample_4m_normal = function(x) {
  s = runif(5, min = 0, max = 1)
  return (mean(s))
}
X_bar = replicate(100000, sample_4m_normal())
plot(density(X_bar))
```



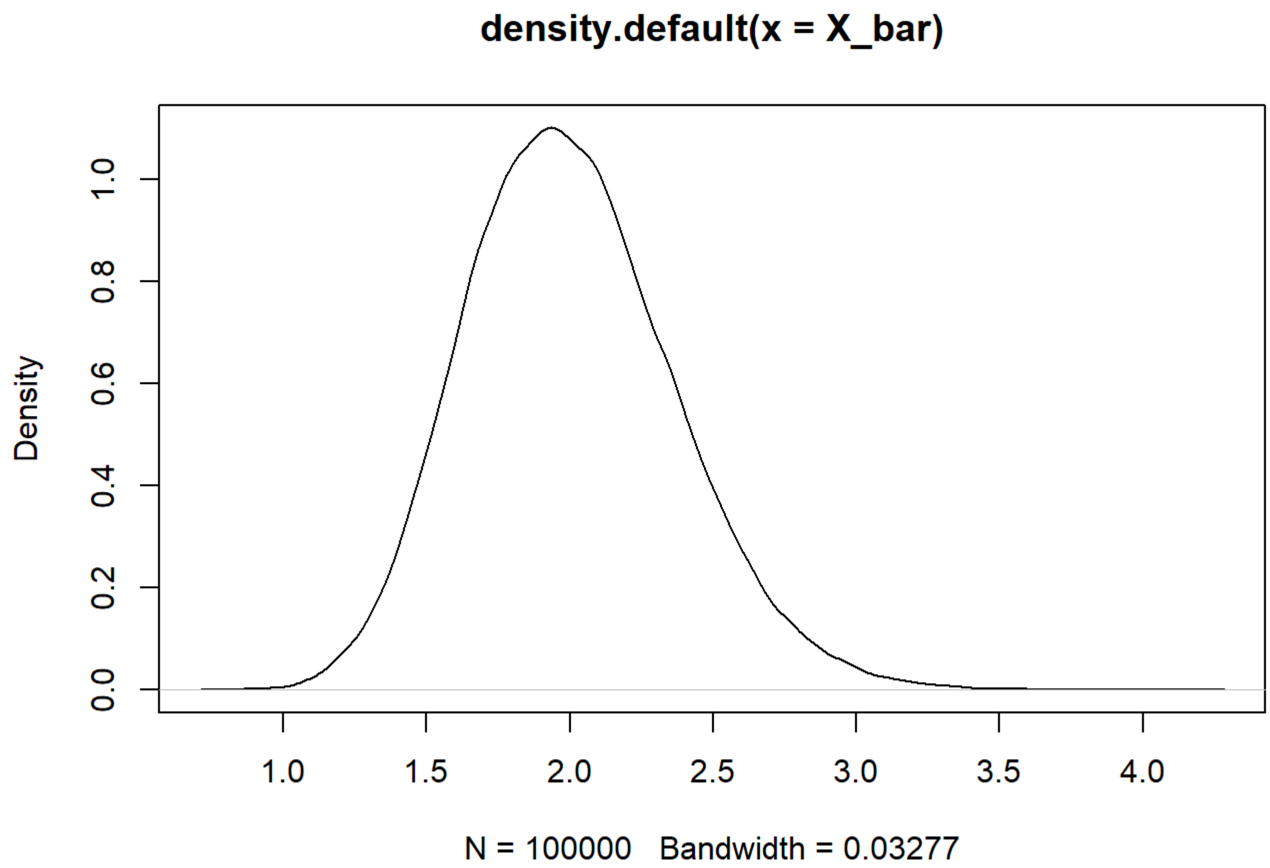

## C. when n = 5, $X \sim x^2_{df=2}$

```
sample_4m_normal = function(x) {
  s = rchisq(5, 2)
  return (mean(s))
}
X_bar = replicate(100000, sample_4m_normal())
plot(density(X_bar))
```



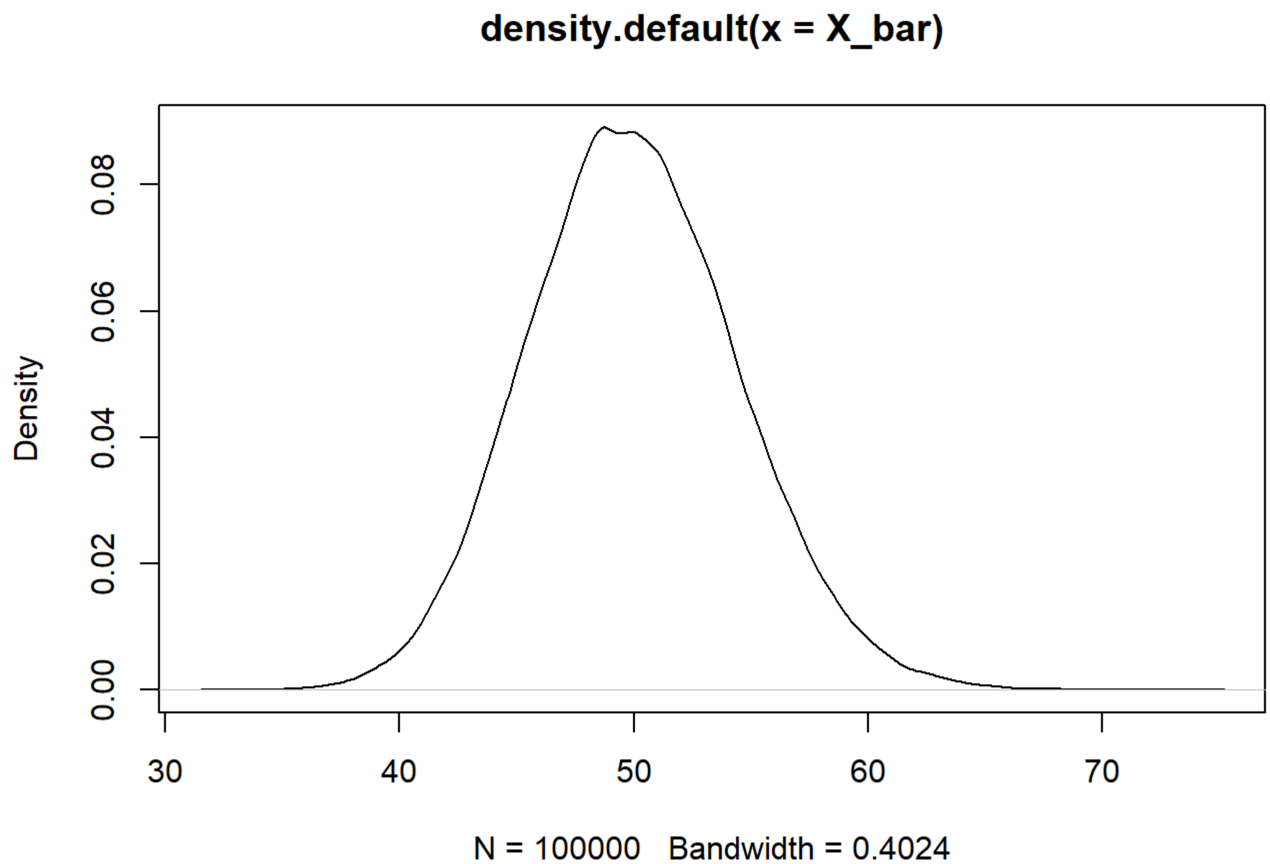

## D. when n = 30, $X \sim x^2_{df=2}$

```
sample_4m_normal = function(x) {
  s = rchisq(30, 2)
  return (mean(s))
}
X_bar = replicate(100000, sample_4m_normal())
plot(density(X_bar))
```




## E. when n = 5, $X \sim x^2_{df=50}$

```
sample_4m_normal = function(x) {
  s = rchisq(5, 50)
  return (mean(s))
}
X_bar = replicate(100000, sample_4m_normal())
plot(density(X_bar))
```




## F. CLT says for large n, $\overline{X}$ converges (in distribution) to a Normal distribution

By comparing your graphs from parts (a) to (e), can you comment on how large n has to be in order for $\overline{X}$ to converge to a Normal distribution.

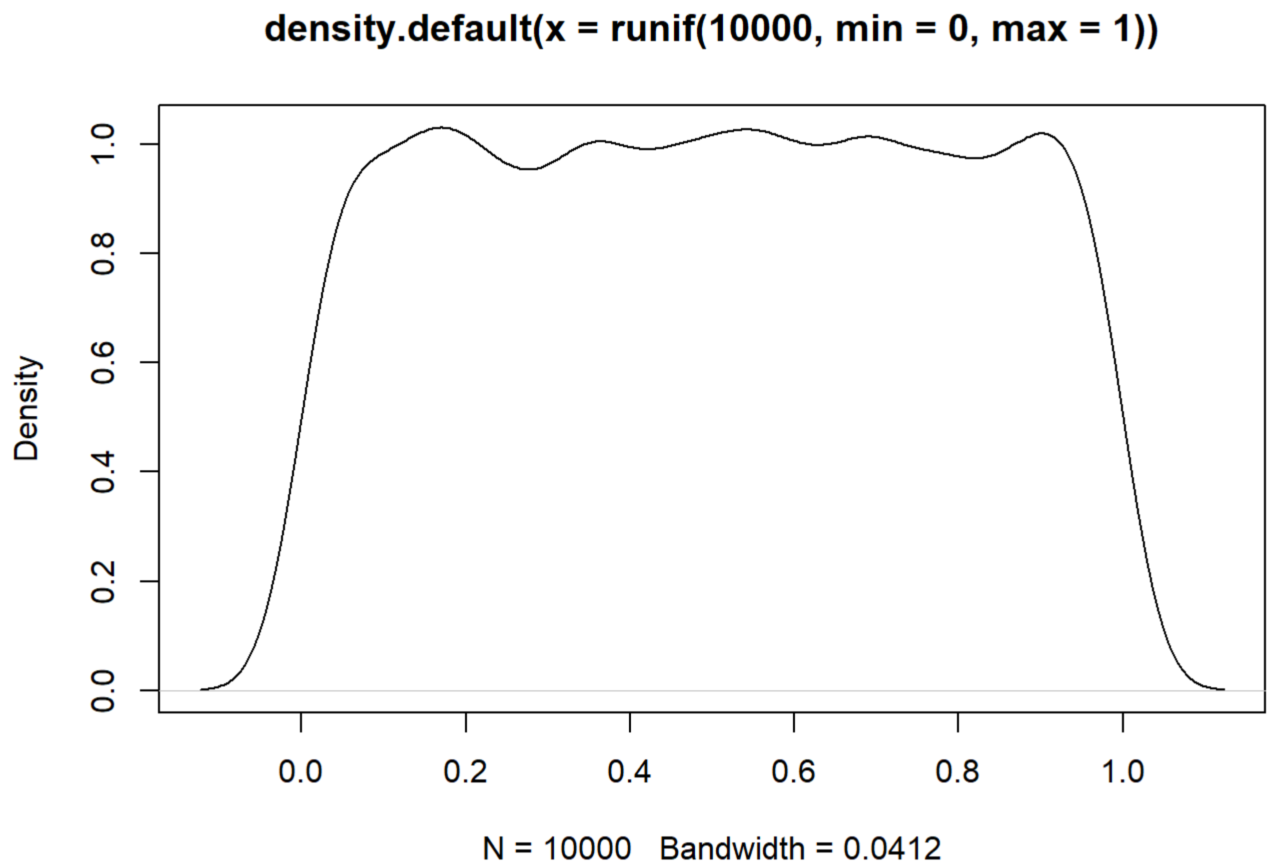
For uniform distribution, the n needs to be greater than 10,000 to show a good shape of the normal distribution For Chi-Squared distribution, the n needs to be greater than 10,000 to show a good shape of the normal distribution

## G. Plot three separate density curves for $Unif[0,1], \chi^2_{df=2}$ and $X^2_{df=50}$

Looking at the skewness of these three curves, what comments can you make on the question asked in part(f)?

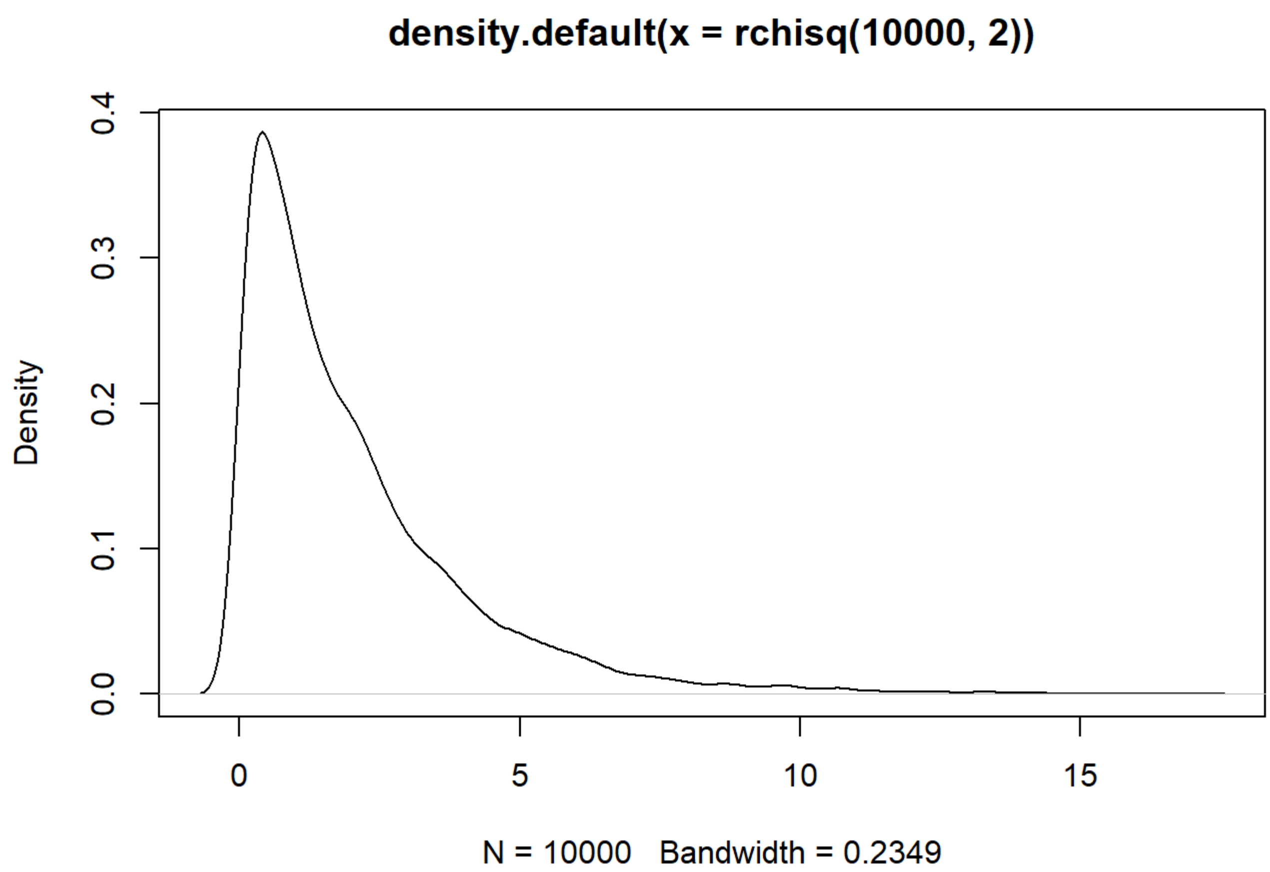
$Unif[0,1]$

```
plot(density(runif(10000, min = 0, max = 1)))
```



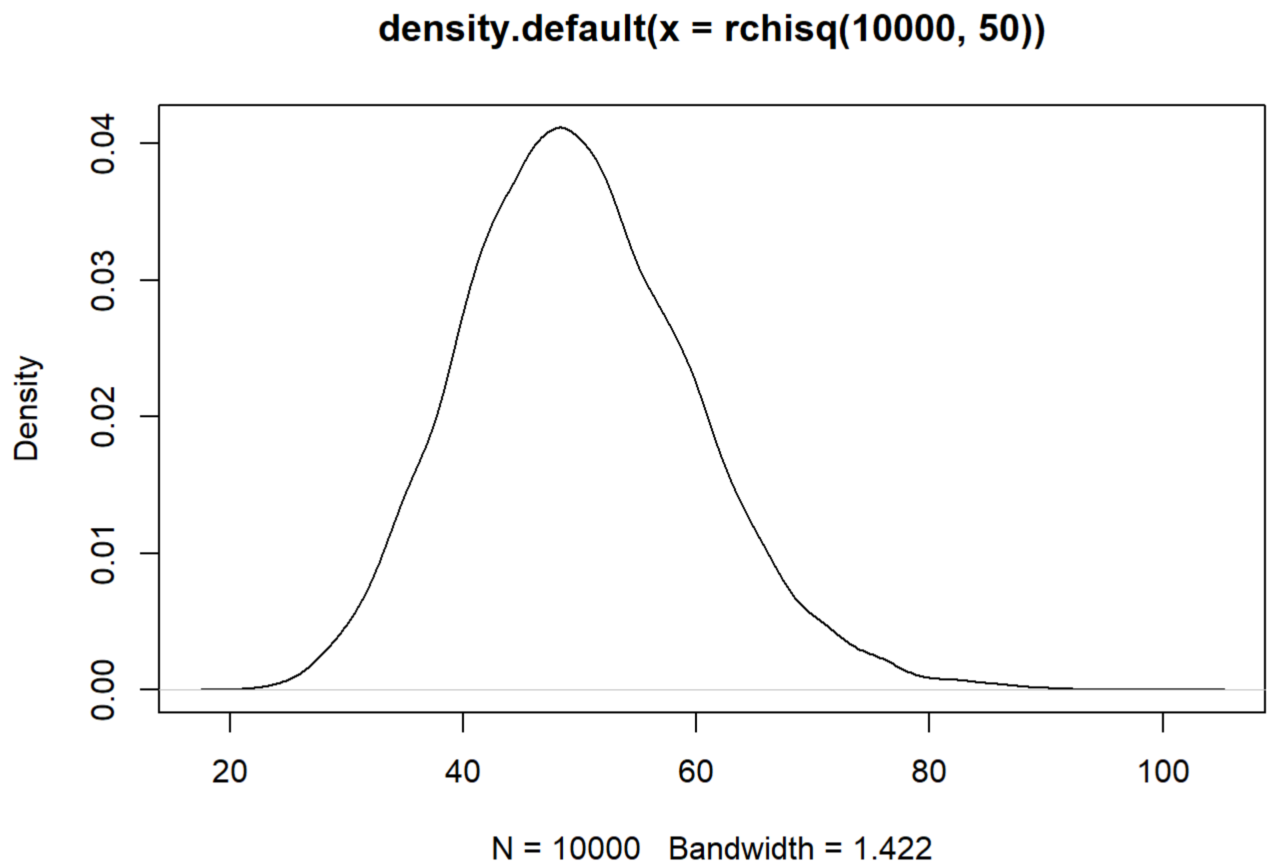

$\chi^2_{df=2}$

```
plot(density(rchisq(10000, 2)))
```




$\chi^2_{df=50}$

```
plot(density(rchisq(10000, 50)))
```




From these graphs, we can see that the density graph indeed shows the density coverge to a normal distribution shape as the sample size gets larger, however, the skewness of these density graphs also indicates how quickly one can converge to a normal distribution, as it shows where the value are distributed.