Homework #07

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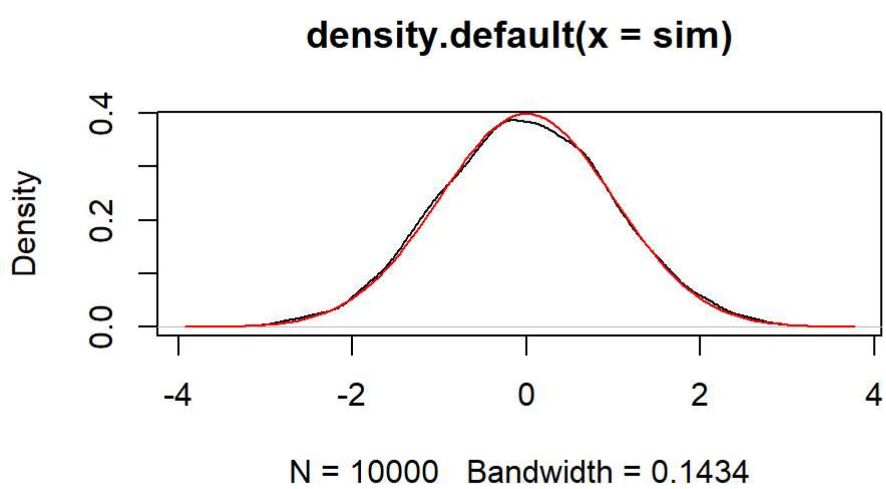
Chapter 05

Problem 25

N = 8

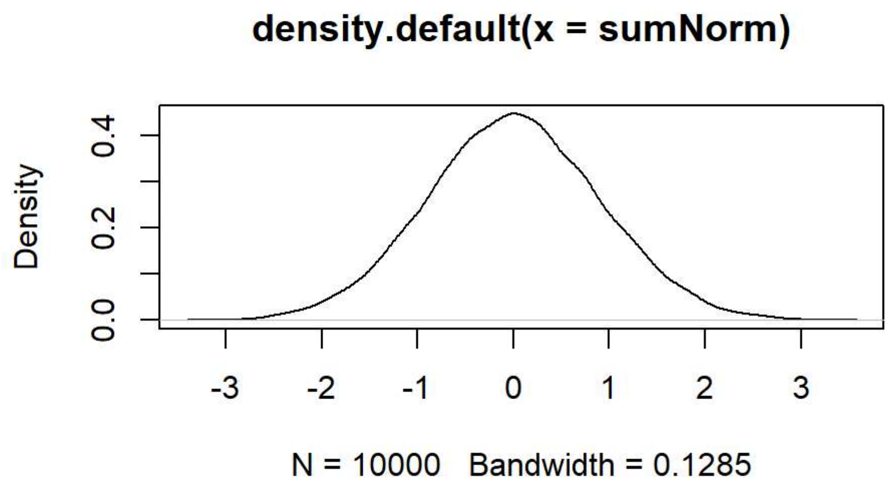
```
n<-8
trials<-10000
mu<-.5*(0+1)
sigma<- sqrt((1/12)*(1-0)^2)
sim<-replicate(trials, {x<-runif(n,0,1);
(mean(x)-mu) / (sigma/sqrt(n))
})
plot(density(sim))
curve(dnorm(x),add=TRUE,col="red")
```



Problem 26

By inspection, mu = 10, sigma = 2.5

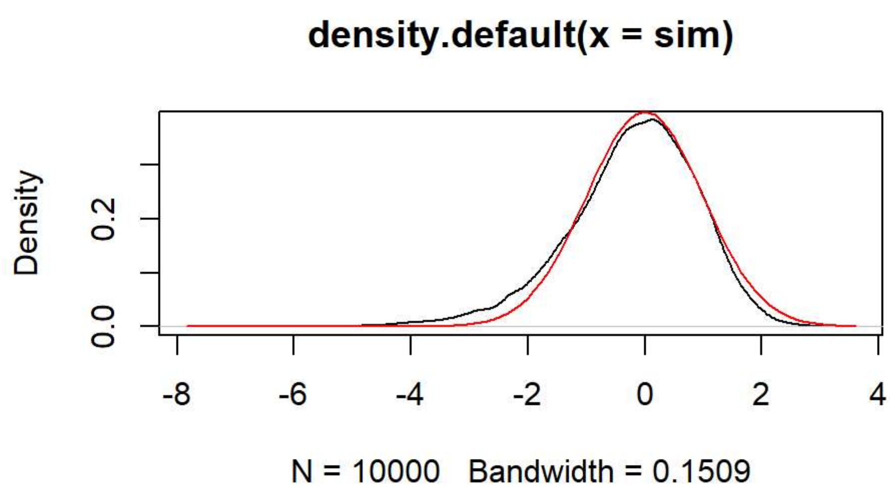
```
mu<-10
sigma<-2.5
n<-100
sumNorm<-replicate(10000,{x <- replicate(n, x<-sum(rexp(20, 2)));
                  (mean(x)-mu)/(sigma/sqrt(n))})
plot(density(sumNorm))
```



Problem 28

N = 36

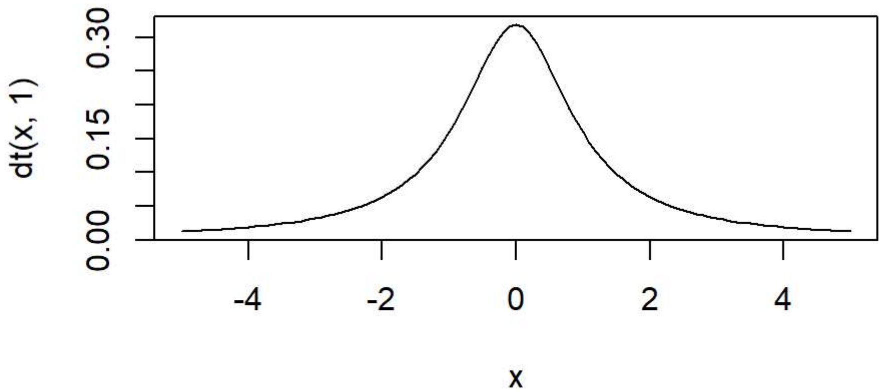
```
n<-36
trials<-10000
k<-2
mu<-k
sigma<- sqrt(2*k)
sim<-replicate(trials, {x<-rchisq(n,df=k);
(mean(x)-mu) / (sd(x)/sqrt(n))
})
plot(density(sim))
curve(dnorm(x),add=TRUE,col="red")
```



Problem 30

a.

```
curve(dt(x, 1), from = -5, to = 5)
```



b.

```
x<-replicate(10,mean(rt(100,1)))
y<-replicate(10,mean(rt(1000,1)))
z<-replicate(10,mean(rt(10000,1)))
x;y;z
```

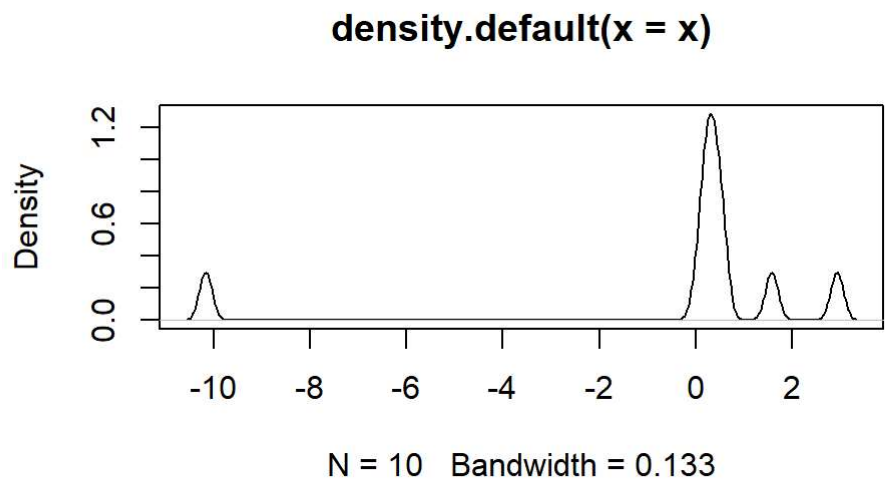
```
##  [1] -10.15873479   0.06135676   0.23603428   0.37500493   0.21981890
##  [6]   1.57487308   0.55444057   2.92937889   0.48798601   0.31203998
```

```
##  [1]  -0.1040474  -2.3421840   1.1200097   0.4597604  -1.3562335   0.2768023
##  [7]   1.0946895 -12.7685502  -1.0600909  10.4177791
```

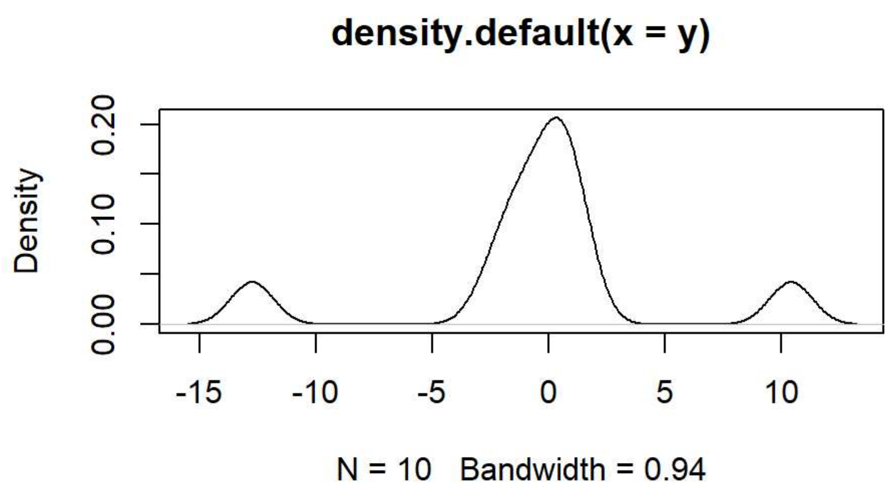
```
##  [1] -2.8119947  1.1671858  0.2167064 36.4373808  0.6693422  1.0989255
##  [7] -0.3780790 -0.1529971  0.6115447  0.9078466
```

c.

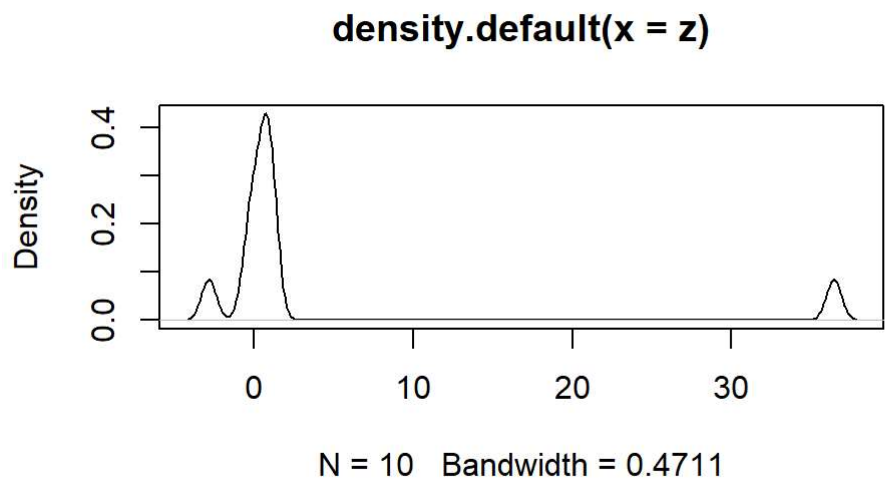
```
plot(density(x))
```




```
plot(density(y))
```

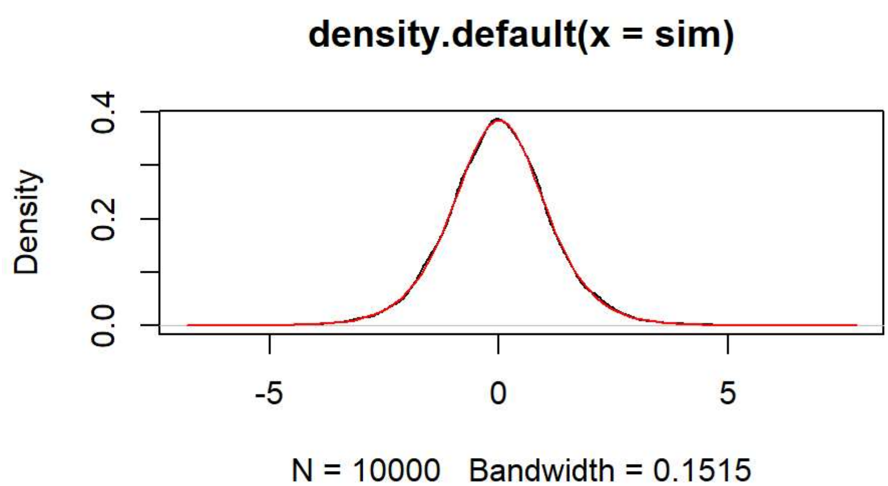



```
plot(density(z))
```



Problem 34

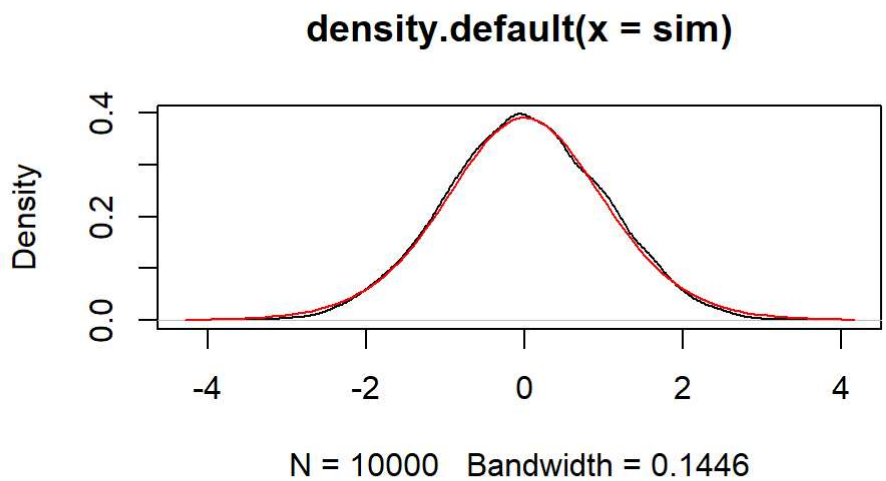
```
n<-8
mu<-2
sim<-replicate(10000, {x<-rnorm(n,2,3);
(mean(x)-mu) / (sd(x)/sqrt(n))
})
plot(density(sim))
curve(dt(x,df=7),add=TRUE,col="red")
```



Chapter 08

Problem 01

```
n<-12
mu<-1
sigma<-3
sim<-replicate(10000, {x<-rnorm(n,1,sigma);
(mean(x)-mu) / (sigma/sqrt(n))
})
plot(density(sim))
curve(dt(x,df=11),add=TRUE,col="red")
```



Problem 03

C = 1.439756

```
qt(0.1, df=6)
```

```
## [1] -1.439756
```

Problem 04

The smaller the degrees of freedom, the more area in the tail, the greater the variance.

```
1-pnorm(2)
```

```
## [1] 0.02275013
```

```
1-pt(2,df=40)
```

```
## [1] 0.02616117
```

```
1-pt(2,df=20)
```

```
## [1] 0.02963277
```

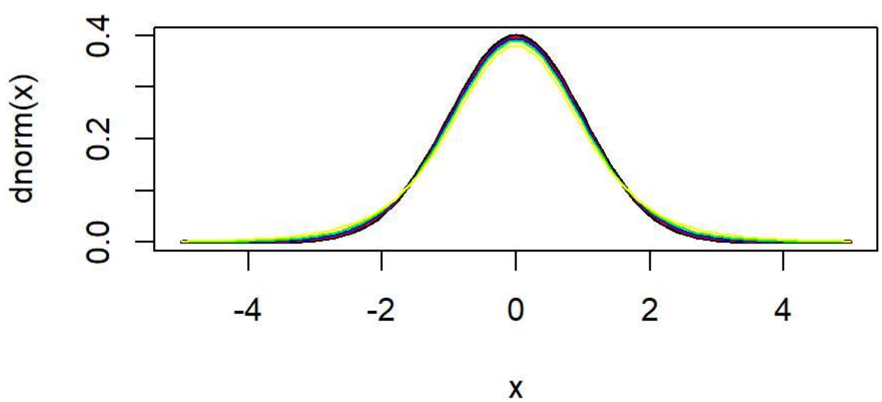
```
1-pt(2,df=10)
```

```
## [1] 0.03669402
```

```
1-pt(2,df=5)
```

```
## [1] 0.05096974
```

```
curve(dnorm(x), from = -5, to = 5, lwd=2)
curve(dt(x,df=40),add=TRUE,col="red")
curve(dt(x,df=20),add=TRUE,col="blue")
curve(dt(x,df=10),add=TRUE,col="green")
curve(dt(x,df=5),add=TRUE,col="yellow")
```



Problem 06

99% confidence interval [16.49394,20.0219]

```
plastics <- fosdata::plastics %>% filter(!is.na(diameter))
diam <- plastics$diameter
xbar<-mean(diam)
s<-sd(diam)
stderror<- s/sqrt(length(diam))
tcritical = -qt(0.005, df=(length(diam)-1))
xbar - tcritical * stderror
```

```
## [1] 16.49394
```

```
xbar + tcritical * stderror
```

```
## [1] 20.0219
```

Problem 07

95% Confidence Interval: [299836.7, 299868.1]
This interval does not include 299729m/s

```
light <- morley$Speed + 299000
xbar<-mean(light)
s<-sd(light)
stderror<- s/sqrt(length(light))
tcritical = -qt(0.025, df=(length(light)-1))
xbar - tcritical * stderror
```

```
## [1] 299836.7
```

```
xbar + tcritical * stderror
```

```
## [1] 299868.1
```

Problem 11

a -> II.
b -> I.
c -> III.

Problem 13

a.

Population mean is 2

```
lambda<-0.5
mu <- (1/lambda)
mu
```

```
## [1] 2
```

b.

```
z<-replicate(10000, {y<-t.test(rexp(10,lambda),mu=2)$conf.int;
      (mu >= y[1]) & (mu <=y[2])})
sum(z)/length(z)
```

```
## [1] 0.8996
```

c.

The value is different than 95% because it is pulling a very small sample, which can lead to very skewed means. Upping the sample size (not the replicate trials) increases the accuracy, while the larger number of trials increases precision.
By reducing the replicate trials by a factor of ten and increasing the sample size by the same, we start seeing more accurate but less precise results.

```
z<-replicate(1000, {y<-t.test(rexp(100,lambda),mu=2)$conf.int;
      (mu >= y[1]) & (mu <=y[2])})
sum(z)/length(z)
```

```
## [1] 0.95
```