MA 2611 Lab5

Jacob Nguyen

2022-09-29

1. In an eighth grade English class, the recent scores of an exam followed a normal distribution X~N(78,36). Calculate the following:

a. The proportion of the class expected to score below 50

```
pnorm(q=50,mean=78,sd=6)
```

```
## [1] 1.530627e-06
```

b. The proportion of the class expected to score above 90

```
1 - pnorm(q=90,mean=78,sd=6)
```

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

c. The proportion of the class expected to score between 60 and 80

```
pnorm(q=80,mean=78,sd=6) - pnorm(q=60,mean=78,sd=6)
```

```
## [1] 0.6292088
```

d. The scores for the first and third quantiles of the class

```
qnorm(p=0.25,mean=78,sd=6)
```

```
## [1] 73.95306
```

```
qnorm(p=0.75,mean=78,sd=6)
```

```
## [1] 82.04694
```

e. The scores for the 5th and 95th percentiles of the class

```
qnorm(p=0.05,mean=78,sd=6)
```

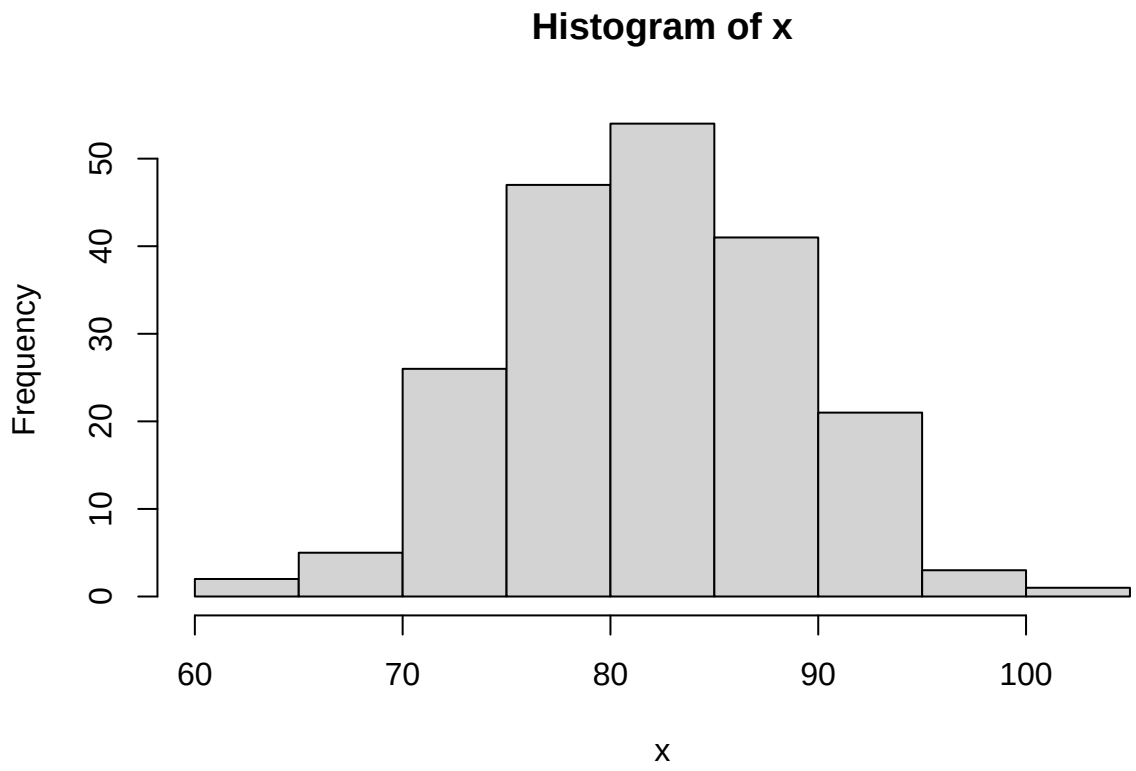
```
## [1] 68.13088
```

```r
qnorm(p=0.95,mean=78,sd=6)
```

```
## [1] 87.86912
```

2. Generate a random sample "x" of 200 observations following X~N(82,51) and create a histogram of the sampling distribution of "x." Calculate the expected value of "x" and compare to where the histogram is centralized.
   Is it centralized around E(X) = 82? Why or why not?

```r
x<-rnorm(n=200,mean=82,sd=sqrt(51))
hist(x)
```




```r
mean(x)
```

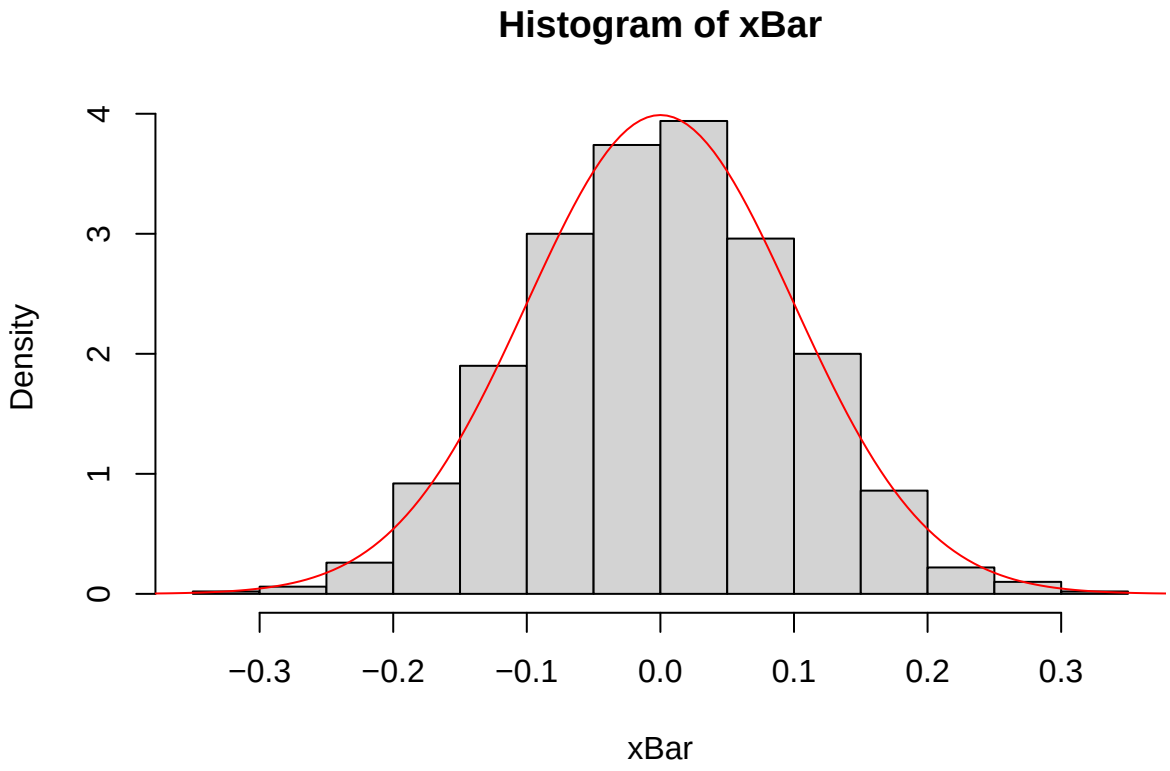
```
## [1] 81.74494
```

It is not centralized around E(X) = 82 because this is a random sample generated and the distribution will not exactly be centered around the given mean, 82.

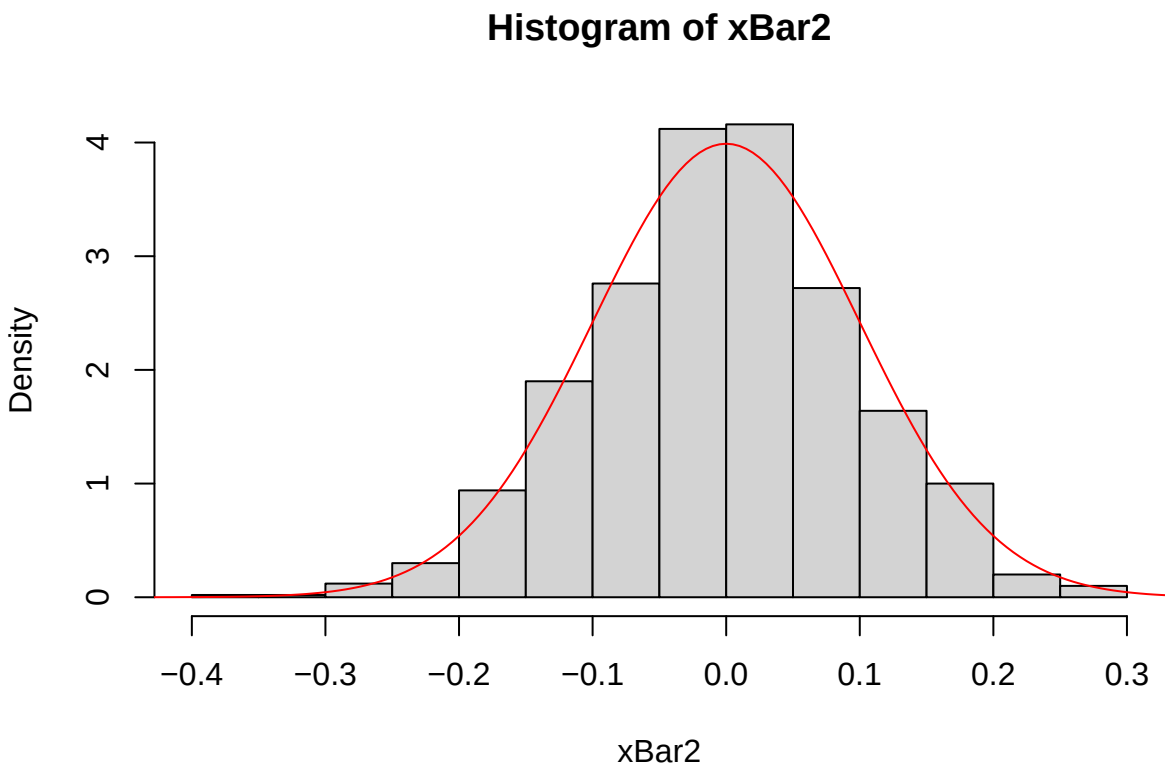
3. Assume a continuous random variable X~N(0,1). The following sample R code generates the histogram and density of the sample mean for n=10:

a. Draw the histograms for "xBar"

```r
n<-100 # sample size
sampleN<-1000 # number of samples
xBar<-array(NA, sampleN) # store values of sample mean for all samples

for (i in 1:sampleN) {
aSample<-rnorm(n) # generates a sample of size "n" from N(0,1)
xBar[i]<-mean(aSample) # stores sample mean of all 1000 samples
}

hist(xBar, freq=FALSE) # histogram for the sample mean
x<-seq(from=-1, to=1, by=0.005) # defines "x" for plotting
lines(x, dnorm(x,mean=0,sd=1/sqrt(n)),col="red")
```

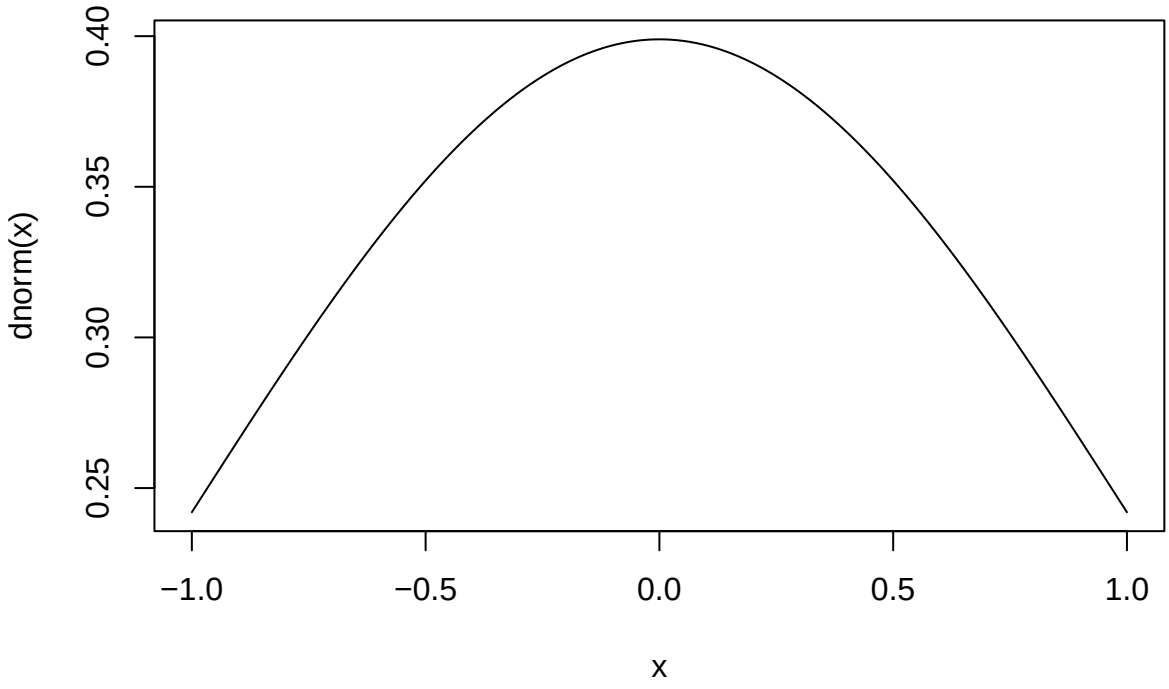



```r
n2<-1000 # sample size
sampleN<-1000 # number of samples
xBar2<-array(NA, sampleN) # store values of sample mean for all samples

for (i in 1:sampleN) {
aSample<-rnorm(n) # generates a sample of size "n" from N(0,1)
xBar2[i]<-mean(aSample) # stores sample mean of all 1000 samples
}

hist(xBar2, freq=FALSE) # histogram for the sample mean
x2<-seq(from=-1, to=1, by=0.005) # defines "x" for plotting
lines(x, dnorm(x,mean=0,sd=1/sqrt(n)),col="red")
```

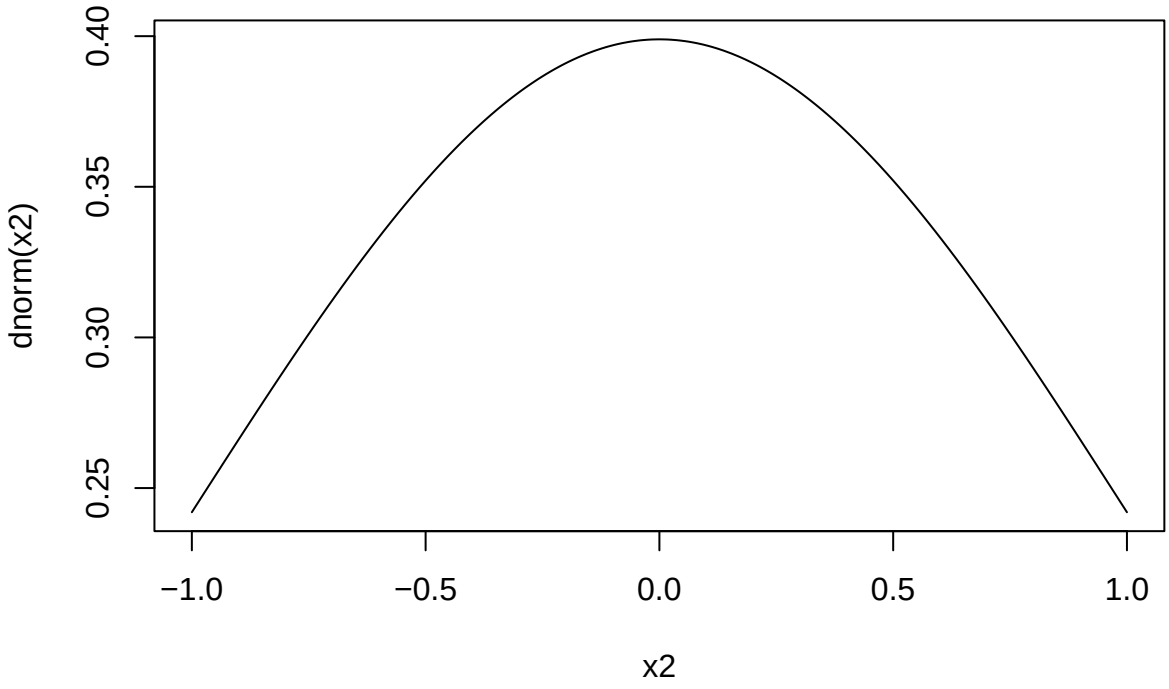


b. Draw the density plots for each “n”

```
plot(x, dnorm(x), type = "l")
```

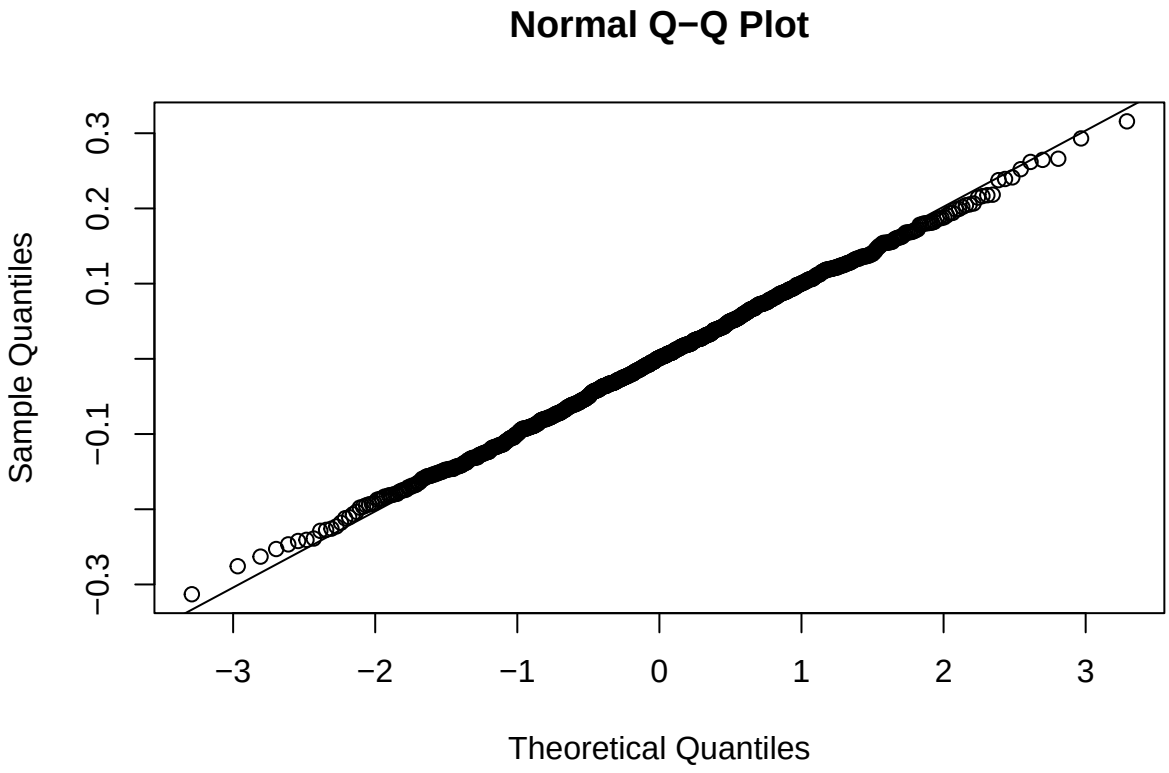



```
plot(x2, dnorm(x2), type = "l")
```

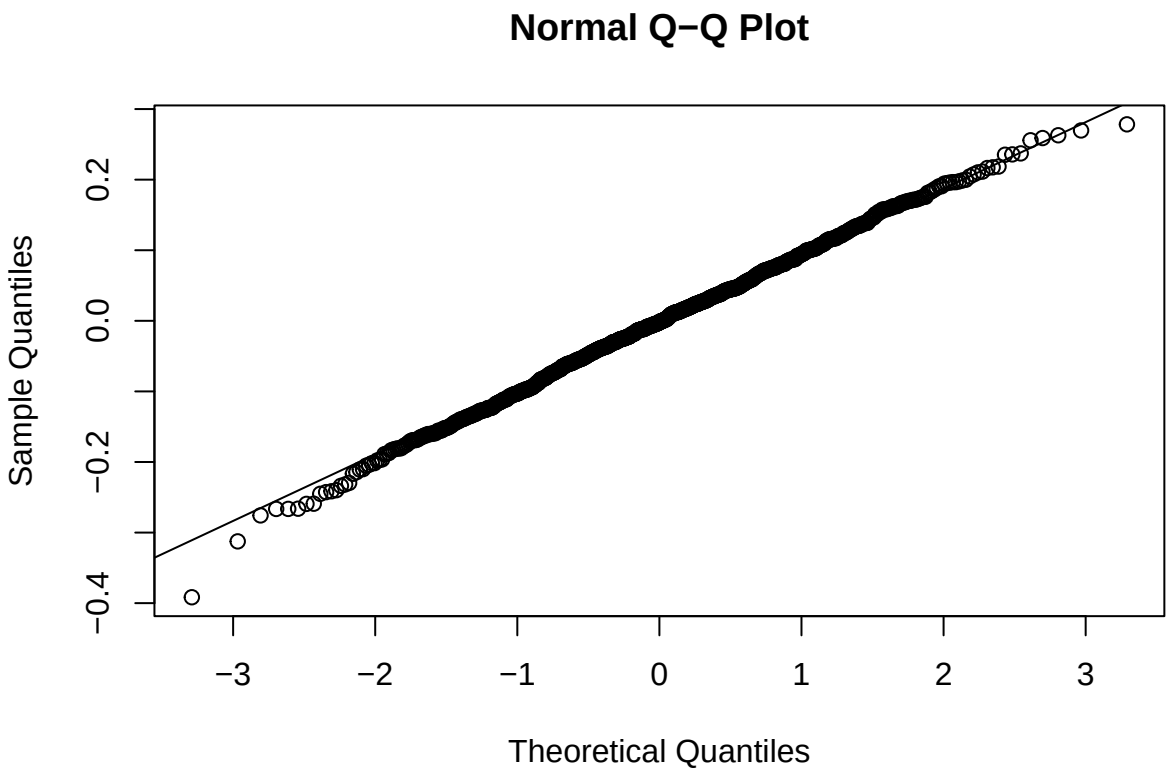


c. Draw the normal probability plots for “xBar”

```
qqnorm(xBar)
qqline(xBar)
```




```
qqnorm(xBar2)
qqline(xBar2)
```


Normal Q−Q Plot
Sample Quantiles
Theoretical Quantiles
−0.4
−0.2
0.0
0.2
−3
−2
−1
0
1
2
3