

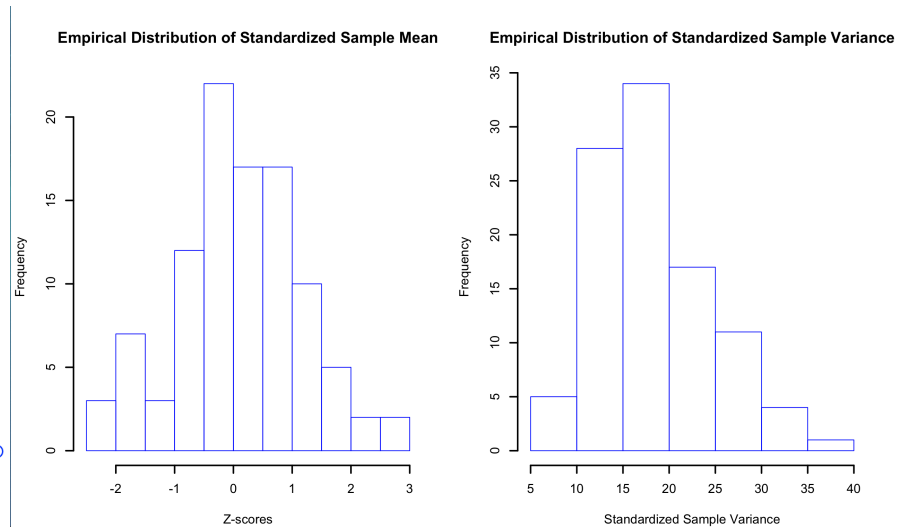
"I pledge my honor that I have abided by the Stevens Honor System."

Problem 1:

Problem 2:

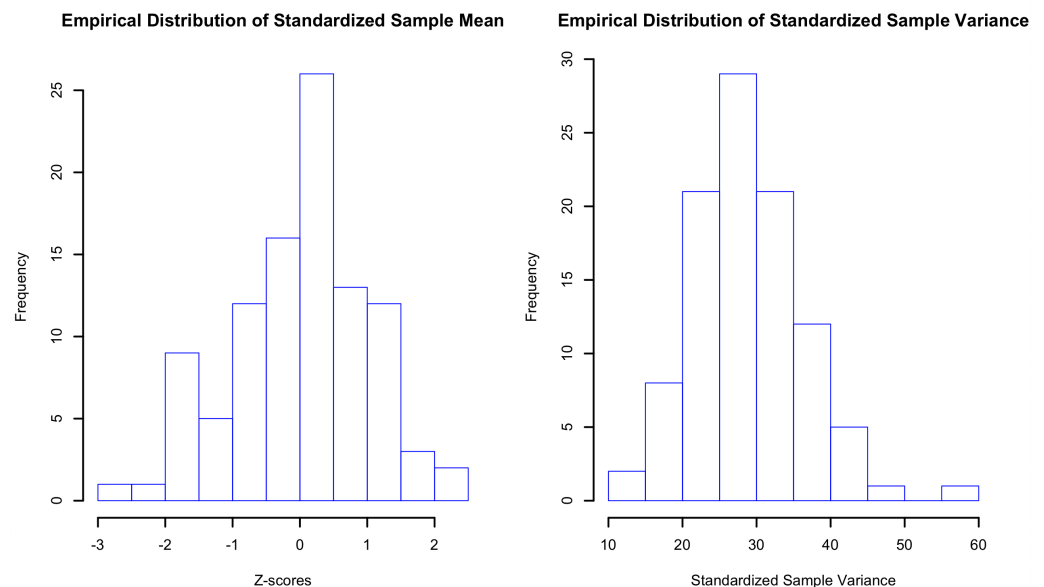
(i).

```
> set.seed(1031)
> n <- 20
> mu <- 2
> sigma <- 3
> N <- 100
> X_mean <- array(dim = c(N))
> X_var <- array(dim = c(N))
>
> for (i in 1:N)
+ {
+   X <- rnorm(n, mean = mu, sd = sigma)
+   X_mean[i] <- mean(X)
+   X_var[i] <- var(X)
+ }
> Z <- (X_mean-mu)/sigma*sqrt(n)
> Xi <- (n-1)*X_var/sigma^2
>
> plot(1:1)
> dev.new()
> par(mfrow=c(1,2))
> hist(Z, xlab = "Z-scores", border = "blue",main = "Empirical Distribution of Standardized Sample Mean", lwd=2,prob= FALSE)
> hist(Xi, xlab = "Standardized Sample Variance", border = "blue",main = "Empirical Distribution of Standardized Sample Variance", lwd=2,prob= FALSE)
>
```



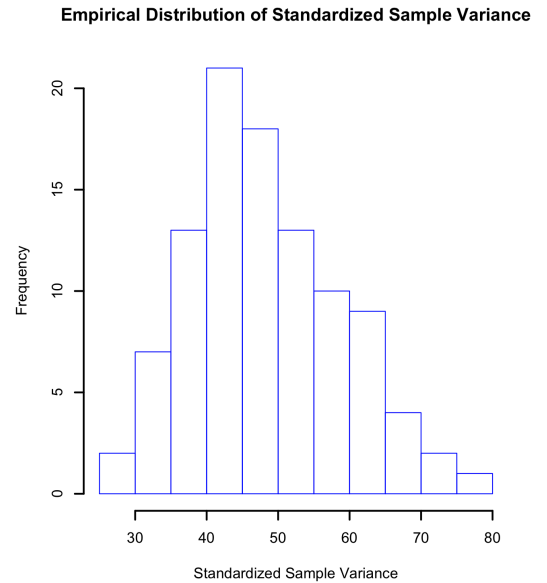
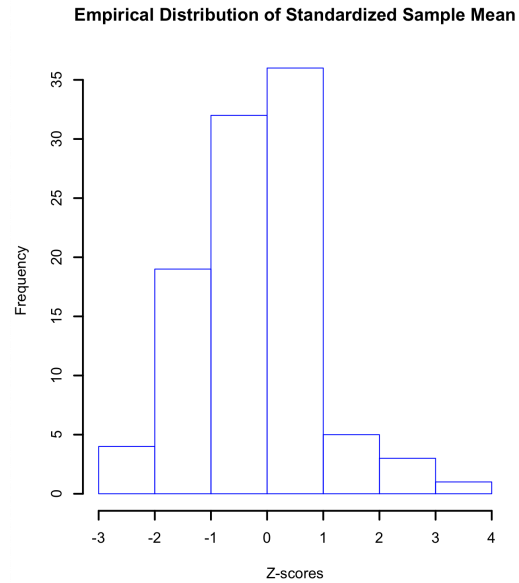
(ii).

```
> set.seed(1031)
> n <- 30
> mu <- 2
> sigma <- 3
> N <- 100
> X_mean <- array(dim = c(N))
> X_var <- array(dim = c(N))
>
> for (i in 1:N)
+ {
+   X <- rnorm(n, mean = mu, sd = sigma)
+   X_mean[i] <- mean(X)
+   X_var[i] <- var(X)
+ }
> Z <- (X_mean-mu)/sigma*sqrt(n)
> Xi <- (n-1)*X_var/sigma^2
>
> plot(1:1)
> dev.new()
> par(mfrow=c(1,2))
> hist(Z, xlab = "Z-scores", border = "blue",main = "Empirical Distribution of Standardized Sample Mean", lwd=2,prob= FALSE)
> hist(Xi, xlab = "Standardized Sample Variance", border = "blue",main = "Empirical Distribution of Standardized Sample Variance", lwd=2,prob= FALSE)
>
```



(iii).

```
> set.seed(1031)
> n <- 50
> mu <- 2
> sigma <- 3
> N <- 100
> X_mean <- array(dim = c(N))
> X_var <- array(dim = c(N))
>
> for ( i in 1:N)
+ {
+ X <- rnorm(n, mean = mu, sd = sigma)
+ X_mean[i] <- mean(X)
+ X_var[i] <- var(X)
+ }
> Z <- (X_mean-mu)/sigma*sqrt(n)
> Xi <- (n-1)*X_var/sigma^2
>
> plot(1:1)
> dev.new()
> par(mfrow=c(1,2))
> hist(Z, xlab = "Z-scores", border = "blue",main = "Empirical Distribution of Standardized Sample Mean", lwd=2,prob= FALSE)
> hist(Xi, xlab = "Standardized Sample Variance", border = "blue",main = "Empirical Distribution of Standardized Sample Variance", lwd=2,prob= FALSE)
>
```



(iv). As n increases $\frac{\bar{X}-2}{\sqrt{3^2/n}}$ goes to standard normal distribution and $\frac{(n-1)S^2}{3^2}$ converges with an n degree freedom

