```r
#Quesiton1. Empirical Bootstrap
#1-a
# observed random sample of y
y <- rep(0:5, c(18,17,8,4,2,1))
y
# number of obsevations
n <- length(y)
n
ybar = mean(y)
truevar = var(y)
truevar

set.seed(123)
nboot = 30
tmpdata = sample(y, n*nboot, replace=TRUE)
bootstrap = matrix(tmpdata, nrow=n, ncol=nboot)
bootstrap

MeanCol <- colMeans(bootstrap)                                    #find the mean for each
 column
MeanCol
subvar <- t(t(bootstrap[,1:nboot]) - MeanCol)^2                   #find the difference
 between each value in a column and the respective column mean, then square the value
subvar
Var <- colSums(subvar)/(n-1)                                      #find the sum of the
 squared difference for each column and divide it by n-1 (formula given as estimator of
 Var(Y))
Var
MSE = (sum((Var-truevar)^2))/nboot                                 #Mean squared error
MSE

#1-b
Qstar = Var - truevar
Q.upper <- quantile(Qstar,prob=0.975)
Q.lower <- quantile(Qstar,prob=0.025)

CI = truevar - c(Q.upper, Q.lower)
print(CI)


#Question2. Parametric bootstrap
#2-a
lambda.mle = mean(y)                                              #mle for poisson is
 lambda = mean = variance
lambda.mle

set.seed(123)
numboot = 30
tdata = rpois(n*numboot, lambda = lambda.mle)
bootstrap = matrix(tdata, nrow=n, ncol=nboot)
bootstrap

MeanCol <- colMeans(bootstrap)                                    #find the mean for each
 column
MeanCol
subvar <- t(t(bootstrap[,1:nboot]) - MeanCol)^2                   #find the difference
 between each value in a column and the respective column mean, then square the value
```

```r
subvar
Var <- colSums(subvar)/(n-1)                                    #find the sum of the
 squared difference for each column and divide it by n-1 (formula given as estimator of
 Var(Y))
Var
MSE = (sum((Var-truevar)^2))/numboot                             #Mean squared error
MSE

#2-b 90% confidence intervel
Qstar = Var - truevar
Q.upper <- quantile(Qstar,prob=0.975)
Q.lower <- quantile(Qstar,prob=0.025)
CI2 = truevar - c(Q.upper, Q.lower)
print(CI2)
```