STAC58A1.R

yulunwu

2022-02-07

```
#3 (a)
x = c(1.56,2.54,1.08,2.45,0.39,0.4,2.56,1.24,1.03,0.33)
MLE_thetahat = sum(x)/30 # claculate the value of thetahat
round(MLE_thetahat,2)
```

```
## [1] 0.45
```

```
# 3(b)
# Likelihood function of theta
L = function(theta) {exp(-sum(x)/theta)*prod(x^2)/(2^10*theta^30)}
relative_L = L(0.5)/L(0.45) # relative likelihood = L(theta0=0.5)/MLE_of_theta
relative_L # print result
```

```
## [1] 0.8667214
```

```
set.seed(2022)
# 5(a)
# function of generate sample with n = 10, mean = 6, sd = 2
sample=function(){
  x = rnorm(10, mean = 6, sd = 2)
  return(x)
}
x_a = sample()
Xa_bar = sum(x_a)/10 # Calculate X_bar
# Function to calculate r_i
R = function(x_i) {(x_i-Xa_bar)/sqrt(sum(x_a^2)-10*Xa_bar^2)}
sum_r = 0
# Loop through each x_i and calculate sum(r_i^3)
for (xa_i in x_a) {
  sum_r = sum_r + R(xa_i)^3
}
sk = sum_r/10 # Calculate sk
sk # print skew
```

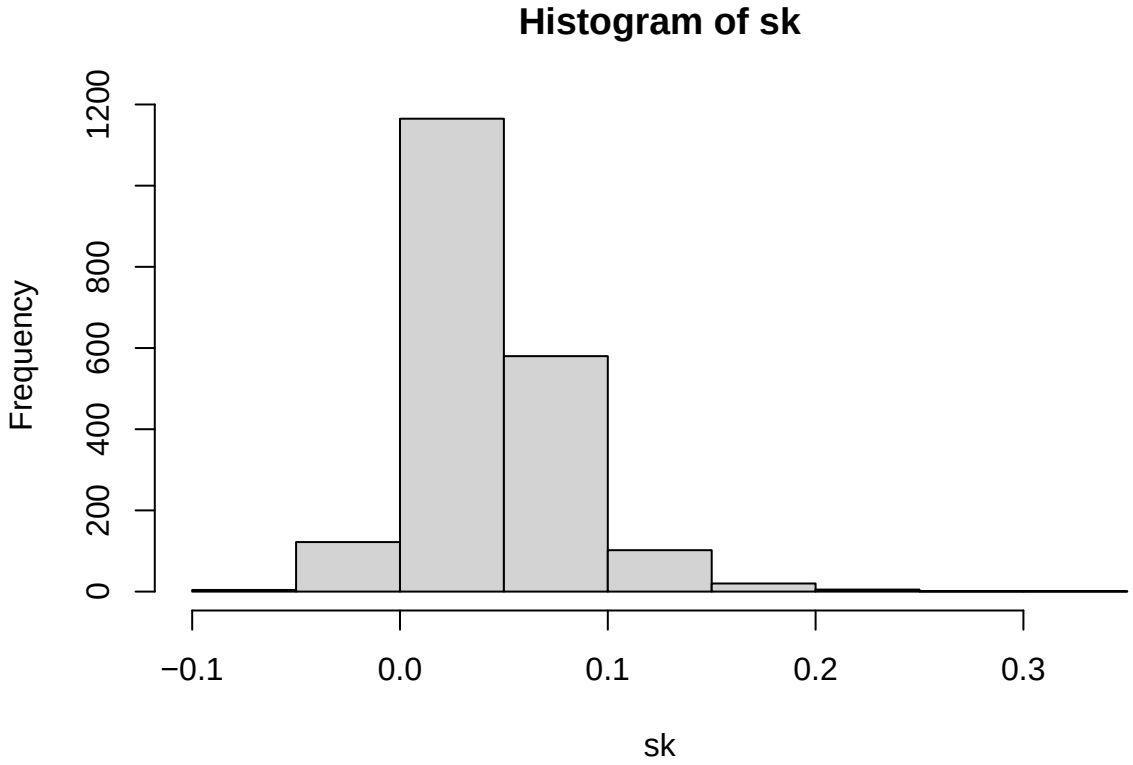
```
## [1] -0.01703587
```

```
# 5(b)
x_b = replicate(20,sample())# Generate 20 samples with n = 10, mean = 6, sd = 2
Xb_bar = sum(x_b)/10 # Calculate X_bar
sum_r = rep(0,20) # Initialize a array with length 20 with 0s
# Loop through each x[i,] and calculate sum(r_i^3)
for (i in c(1,2,3,4,5,6,7,8,9,10)) {
  sum_r = sum_r + R(x_b[i,])^3
}
sk = sum_r/10 # Calculate sk
```

```r
sk # print sk for the samples(total 20 sks)
```

```
##  [1]  0.026071125  0.033790646  0.027333826  0.007414895  0.070909859
##  [6]  0.066912588  0.087210386  0.154884602  0.108175937  0.040450849
## [11]  0.005249296  0.054470654  0.013292367  0.062075552 -0.004579188
## [16]  0.021162518  0.018829799  0.023203855  0.038953700 -0.004315430
```

```r
# 5(c)
# Generate 2000 samples with n = 10, mean = 6, sd = 2
x_c = replicate(2000,sample())
Xc_bar = sum(x_b)/10 # Calculate X_bar
sum_r = rep(0,2000) # Initialize a array with length 2000 with 0s
# Loop through each x[i,] and calculate sum(r_i^3)
for (i in c(1,2,3,4,5,6,7,8,9,10)) {
  sum_r = sum_r + R(x_c[i,])^3
}
sk = sum_r/10 # Calculate sk
hist(sk)
```




```r
# The histogram looks like skew more to the right, and the sk values are
# between -0.1 and 0.4.
# 5(d)
x = c(6.3,8.2,11.37,6.77,9.5,10.65,11.44,14.63,6.38,10.33)
X_bar = sum(x)/10
# Loop through each x_i and calculate sum(r_i^3)
sum_r = 0
for (x_i in x) {
  sum_r = sum_r + R(x_i)^3
}
skew = sum_r/10 # Calculate sk
```

```r
skew # print sk
```

```
## [1] 0.5808942
```

```r
# How many of those 2000 values have absolute value greater than or equal to
# the absolute value calculated for this sample (x)?
n_extreme = sum(abs(sk)>=skew)
n_extreme
```

```
## [1] 0
```

```r
# Calculate the propotion that of those 2000 samples having skewness statistic
# as extreme as or more extreme than the value calculated for this sample (x)
propotion = n_extreme/2000
propotion
```

```
## [1] 0
```

```r
# Conclusion: This sample x is not generated from Normal distribution with
# mean = 6 and sd = 2, because there is not sample in 2000 samples have
# skewness morw extreme than this sample.
```