Due Date: March 24th, 2022 *Problems due: 1,3*

- 1. Consider the following steps:
 - (a) We generate n samples, say X_1, X_2, \ldots, X_n from Normal distribution with mean 100 and variance 16^2 . Compute the sample variance S^2
 - (b) Repeat the previous step 1000 times to generate S_i^2 , $1 \le i \le 1000$. and plot histogram of $\frac{(n-1)S_i^2}{16^2}$
 - (c) plot the density of true distribution of $\frac{(n-1)S_1^2}{16^2}$

Write a R-code to do the above for n = 8, 16, and 50.

- 2. Consider the following steps:
 - (a) we generate n samples, say X_1, X_2, \ldots, X_n from Normal distribution with mean 0 and variance 1 and we generate n samples, say Y_1, Y_2, \ldots, Y_n from $\chi^2(3)$ values.
 - (b) plot histogram of $\frac{X_i}{\sqrt{\frac{Y_i}{3}}}$ for $1 \le i \le n$
 - (c) plot the density of the true distribution¹ of $\frac{X_1}{\sqrt{\frac{Y_1}{3}}}$

Write a R-code to do the above for n = 50 and 100.

- 3. Do Problems 1 and 2 with Normal distribution being replaced by Γ distribution with parameters (3, 10). What do you observe ?
- 4. Do Problems 1 and 2 with Normal distribution being replaced by Poisson distribution with parameter 10. What do you observe ?
- 5. Consider the Poisson(1) distribution.
 - (a) Generate 100 trials of 500 samples respectively.
 - (b) Find the 95%-confidence interval for the mean in each trial.
 - (c) Compute the number of trials in which the true mean lies in the interval.
- 6. The dataset BangaloreRain.csv available here. It contains 100 year monthly rainfall data for Bangalore.
 - (a) Decide if any month's 100 year rainfall is Normally distributed.
 - (b) Calculate the yearly total rain fall for each of the 100 years.
 - (c) Plot the histogram and Decide if the distribution is Normal.
 - (d) Find the 95% confidence interval for the expected annual rainfall in Bangalore.

 $^{^{1}}$ The distribution was first discovered by a man named W.S. Gosset. He discovered the distribution when working for an Irish brewery. He published under the pseudonym Student.