HOMEWORK 1

STAT 641– Fall 2025
Due: Sunday, Nov 23rd, by 11:59 pm

Instruction

0 You have to submit your homework to Cavnas on time. Don't email your homework to me.

0 The only acceptable file is pdf.

0 Please make sure to include any relevant R code along with the outputs and comments.

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1. (10 points) Generate your original sample with

```
set.seed(123)
x <- rgamma(200, shape = 2, scale = 5)
```

   Let $X_1, X_2, \ldots, X_{200} \sim \text{Gamma}(2, \theta)$, where θ is an unknown parameter. How can we estimate the standard error of the MLE of θ? Use **boot** package to perform both nonparametric and parametric bootstrapping.

2. (10 points) The **Bangladesh** data set contains measurements of water quality from 271 wells in Bangladesh. The `Chlorine` variable has two missing values. Use the following R code to remove these two observations:

```
library(resampledata)
data("Bangladesh")
head(Bangladesh)
chl <- with(Bangladesh, Chlorine[!is.na(Chlorine)])
```

   (a) Find a 95% confidence interval for the mean chlorine level μ in Bangladeshi wells.

   (b) Using the `boot` package, compute the 95% bootstrap percentile, bootstrap-t, and BCa confidence intervals for μ, and compare the results. Which interval would you report, and why?