

BRSM Take-home Assignment

21.01.25

QUESTION 1 (sampling distributions):

- a. Assume that your population distribution is $N(100,15)$.
- b. Sample 10 random numbers (i.e., your sample size) from $N(100,15)$ and calculate the mean and standard deviation of those numbers.
- c. Repeat this for 1000 trials, and plot the frequency distribution of the obtained means and standard deviations separately.
- d. Repeat steps b and c for 50, 100, 500, and 1500 numbers.
- e. State and explain the observations and inferences you make regarding the above-produced histograms w.r.t to central limit theorem. Hint: The goal of obtaining a sample is to get an estimate that is your best guess about the population mean, which you already know is 100.

QUESTION 2 (sampling distributions): Repeat the above for a population distribution that is a Beta distribution with shape parameters 2 and 5. What do you observe now that is different from Question 2, w.r.t to the central limit theorem. Do you need a larger or smaller sample size now so that your sample estimate of the population mean is accurate?

QUESTION 3 (confidence intervals and sample size):

- a. Sample 30 points from each of the normal distributions of mean 0 and SD 1, mean 2 and SD 0.5, and mean 3 and SD 2.
- b. Plot the means and distributions of the three groups using the appropriate visualization tools. Include an error bar for each group indicating the confidence interval.
- c. Repeat the above two steps by sampling 70 and 100 points.
- d. How does the confidence interval change along with the increase in the number of sampled points?
- e. Write down your interpretation of the obtained confidence intervals.