1 Instructions

You will need to use scipy.stats to generate random variables with a specific distribution. The quantile function discussed below is the "ppf" method in scipy.

For example, if $X \sim \text{Poisson}(2.1)$ then the value that corresponds to the 97.5th percentile can be computed in scipy as

```
import scipy.stats
X = scipy.stats.poisson(2.1)
Quant975 = X.ppf(0.975)
```

The following questions will guide you through a common way to construct confidence intervals. The goal is to develop a method for building a 95% confidence interval for the mean using the central limit theorem.

Q01 - In scipy, generate a Normally distributed random variable with μ equal to 10 and σ equal to 2.

Q02 - Please compute the 97.5th quantile for X

Q03 - Please compute the 2.5th quantile for X

Q04- Quantiles in terms of standard deviations.

Using the above two quantiles we could compute a 95% confidence interval (CI). Let's try to express this 95CI in terms of μ and σ.

Suppose we could write the 97.5th percentile as the mean plus some number of standard deviations, and we could write the 2.5th percentile as the mean minus that same number of standard deviations.

$$\mu + f\sigma = Q(0.975) \quad (1)$$
$$\mu - f\sigma = Q(0.025) \quad (2)$$

Please use the system of equations above to solve for f.

Q05

If the f you found above is correct, then that would mean we could compute a 95% CI for any normally distributed random variable.

a

Please compute a 95% CI for a random variable $Y \sim N(5, 3)$ using the quantile function to compute the 2.5th and 97.5th percentiles

b

Please compute a 95% CI for a random variable $Y \sim N(5, 3)$ using the $\mu \pm f\sigma$ formula you discovered.

Q06

Suppose we collect data on the past number of incident cases of COVID-19 and want to provide a confidence interval around the true mean (a population parameter) number of incident cases.

The data for incident cases looks like this = [552155,455803,388027]

Please compute a 95% and 80% confidence interval for the mean number of incident cases using our newly discovered formula.