**Assignment 4: Statistical Inference with Confidence Intervals**

**Topic:** Statistical Inference (Lecture 13)  
**Time:** 30-40 minutes  
**Objective:** Calculate and interpret confidence intervals for a sample dataset.

**Problem Statement:**  
You are given a sample of vitamin D levels (nmol/L) from 100 middle-aged men. Compute the sample mean, standard error, and a 95% confidence interval. Visualize the sample distribution and the confidence interval.

**Dataset:**  
A list of 100 synthetic vitamin D levels generated in the notebook:

import numpy as np

np.random.seed(42)

vitamin\_d = np.random.lognormal(mean=4, sigma=0.5, size=100)

**Requirements:**

* Calculate the sample mean and standard deviation using numpy.
* Compute the standard error (SE = σ/√n).
* Calculate the 95% confidence interval (mean ± 2 \* SE).
* Plot a histogram of the data with the CI overlaid using matplotlib.

**Solution Outline:**

1. Compute mean and standard deviation with numpy.mean and numpy.std.
2. Calculate SE as std / sqrt(n).
3. Compute 95% CI as mean ± 2 \* SE.
4. Plot histogram and add vertical lines for CI bounds.

**Sample Code Starter:**

python

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import numpy as np

import matplotlib.pyplot as plt

np.random.seed(42)

vitamin\_d = np.random.lognormal(mean=4, sigma=0.5, size=100)

*# Students calculate mean, SE, and CI*

mean = np.mean(vitamin\_d)

*# Continue from here*