21.Scenario:

you are a scientist conducting research on rare elements found in a specific region. Your goal is to

estimate the average concentration of a rare element in the region using a random sample of

measurements. You will use the NumPy library to perform point estimation and calculate

confidence intervals for the population mean.The rare element concentration data is stored in a CSV

file named "rare\_elements.csv," where each row contains a single measurement of the

concentration.

Question:

write a Python program that allows the user to input the sample size, confidence level, and desired

level of precision.

Code:

import pandas as pd

import numpy as np

from scipy import stats

df = pd.read\_csv(r"C:\Users\jampa\Downloads\rare\_elements.csv")

sample\_size = int(input("Enter the sample size (e.g., 30): "))

confidence\_level = float(input("Enter the confidence level as a percentage (e.g., 95): "))

precision = float(input("Enter the desired margin of error (precision): "))

sample = df["Concentration"].sample(n=sample\_size, random\_state=1)

sample\_mean = np.mean(sample)

std\_err = stats.sem(sample)

alpha = 1 - (confidence\_level / 100)

margin = std\_err \* stats.t.ppf(1 - alpha/2, df=sample\_size - 1)

lower\_bound = sample\_mean - margin

upper\_bound = sample\_mean + margin

print(f"\nSample Mean (Point Estimate): {sample\_mean:.2f}")

print(f"{confidence\_level:.1f}% Confidence Interval: ({lower\_bound:.2f}, {upper\_bound:.2f})")

if margin <= precision:

print(f" The margin of error ({margin:.2f}) is within the desired precision ({precision}).")

else:

print(f" The margin of error ({margin:.2f}) exceeds the desired precision ({precision}). Consider increasing sample size.")

output:

A screenshot of a computer code

AI-generated content may be incorrect.

Dataset:

|  |  |
| --- | --- |
| Concentration | |
| 58.12173 |  |
| 46.94122 |  |
| 47.35914 |  |
| 44.63516 |  |
| 54.32704 |  |
| 38.49231 |  |
| 58.72406 |  |
| 46.19397 |  |
| 51.5952 |  |
| 48.75315 |  |
| 57.31054 |  |
| 39.6993 |  |
| 48.38791 |  |
| 48.07973 |  |
| 55.66885 |  |
| 44.50054 |  |
| 49.13786 |  |
| 45.61071 |  |
| 50.21107 |  |
| 52.91408 |  |
| 44.4969 |  |
| 55.72362 |  |
| 54.50795 |  |
| 52.51247 |  |
| 54.50428 |  |
| 46.58136 |  |
| 49.38555 |  |
| 45.32115 |  |
| 48.66056 |  |
| 52.65178 |  |
| 46.5417 |  |
| 48.01623 |  |
| 46.56414 |  |
| 45.77397 |  |
| 46.64377 |  |
| 49.93668 |  |
| 44.41345 |  |
| 51.17208 |  |
| 58.29901 |  |
| 53.71022 |  |
| 49.04082 |  |
| 45.56186 |  |
| 46.26421 |  |
| 58.46227 |  |
| 50.25404 |  |
| 46.81502 |  |
| 50.95458 |  |
| 60.50128 |  |
| 50.60079 |  |
| 53.08602 |  |
| 51.50085 |  |
| 48.23875 |  |
| 44.28741 |  |
| 48.25329 |  |
| 48.95553 |  |
| 52.93312 |  |
| 54.19492 |  |
| 54.65551 |  |
| 51.42794 |  |
| 54.42571 |  |
| 46.22801 |  |
| 56.26434 |  |
| 52.56465 |  |
| 48.50954 |  |
| 52.44259 |  |
| 49.62214 |  |
| 55.65815 |  |
| 57.59908 |  |
| 60.92788 |  |
| 43.01752 |  |
| 42.77943 |  |
| 47.47767 |  |
| 50.80019 |  |
| 54.38084 |  |
| 51.57817 |  |
| 39.88899 |  |
| 48.46898 |  |
| 54.13987 |  |
| 51.15047 |  |
| 53.81006 |  |
| 48.88836 |  |
| 48.99621 |  |
| 50.93281 |  |
| 52.05026 |  |
| 50.9915 |  |
| 50.59504 |  |
| 46.64669 |  |
| 51.88782 |  |
| 50.60911 |  |
| 55.64742 |  |
| 55.99459 |  |
| 50.92578 |  |
| 48.12358 |  |
| 46.80635 |  |
| 52.11747 |  |
| 50.3867 |  |
| 48.28073 |  |
| 50.21798 |  |
| 46.9 |  |
| 53.49016 |  |
| 47.76436 |  |
| 56.12254 |  |
| 52.01746 |  |
| 52.96789 |  |
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| 53.70278 |  |
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