Question21:

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.

Answer:

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:

