EXPERINMENT-21

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 numpy as np
import math
data = np.genfromtxt("rare_elements.csv", delimiter=",")
data = data[~np.isnan(data)]  # remove missing values if any
print("Total measurements available:", len(data))
sample_size = int(input("Enter sample size: "))
confidence_level = float(input("Enter confidence level (e.g., 0.95): "))
precision = float(input("Enter desired margin of error: "))
if sample_size > len(data):
    print("Sample size too large. Using full dataset.")
    sample_size = len(data)
sample = np.random.choice(data, size=sample_size, replace=False)
mean = np.mean(sample)
std_dev = np.std(sample, ddof=1)
z_values = {0.90: 1.645, 0.95: 1.96, 0.99: 2.575}
z = z_values.get(round(confidence_level, 2), 1.96)
margin_error = z * (std_dev / math.sqrt(sample_size))
lower = mean - margin_error
upper = mean + margin_error
print("\nPoint Estimate (Mean):", round(mean, 4))
print(f"{confidence_level*100}% Confidence Interval: [{round(lower,4)},
{round(upper,4)}]")
print("Observed Margin of Error:", round(margin_error, 4))
if margin_error <= precision:
    print("Desired precision met.")
```

```
else:
    print("Desired precision NOT met.")
```

Output:

```
PS C:\Users\karan\OneDrive\Desktop\New folder (2)> python 21.py
Total measurements available: 120
Enter sample size: 50
Enter confidence level (e.g., 0.95): 0.95
Enter desired margin of error: 0.2

Point Estimate (Mean): 5.1995
95.0% Confidence Interval: [5.0623, 5.3368]
Observed Margin of Error: 0.1373
Desired precision met.
```