EXERCISE:11 RAMROM SAMPLING AND SAMPLING DISTRIBUTION

Aim:

To explore random sampling from a population and understand the concept of sampling distribution using Python in Jupyter Notebook.

Procedure:

1. Generate a Population:

○ Create a population of data with a specified distribution (e.g., normal distribution).

2. Random Sampling:

○ Perform random sampling from the population to create multiple samples of different sizes.

○ Compute sample statistics (mean, standard deviation, etc.) for each sample.

3. Sampling Distribution:

○ Plot histograms or density plots of sample statistics (e.g., sample means).

○ Compare the sampling distribution of the sample statistic (mean) with the population distribution.

4. Central Limit Theorem (Optional):

○ Demonstrate the Central Limit Theorem by showing that as sample size increases, the sampling distribution of the sample mean approaches a normal distribution regardless of the population distribution.

In [26]:

```
import numpy as np
import matplotlib.pyplot as plt
population_mean = 50
population_std = 10
population_size = 100000
population = np.random.normal(population_mean, population_std,
population_size)
sample_sizes = [30, 50, 100]
num_samples = 1000
sample_means = {}
for size in sample_sizes:
    sample_means[size] = []

for _ in range(num_samples):
    sample = np.random.choice(population, size=size, replace=False)
    sample_means[size].append(np.mean(sample))
```

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```
plt.figure(figsize=(12, 8))
for i, size in enumerate(sample_sizes):
    plt.subplot(len(sample_sizes), 1, i+1)
    plt.hist(sample_means[size], bins=30, alpha=0.7, label=f'Sample Size
{size}')

plt.axvline(np.mean(population), color='red', linestyle='dashed',
linewidth=1.5)
plt.axvline(np.mean(population), color='red', linestyle='dashed',
linewidth=1.5, label='Population Mean')
plt.title(f'Sampling Distribution (Sample Size {size})')
plt.xlabel('Sample Mean')
plt.ylabel('Frequency')
plt.legend()
plt.tight_layout()
plt.show()
```

In [ ]: