# 6: RANDOM SAMPLING AND SAMPLING DISTRIBUTION

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import numpy as np

import matplotlib.pyplot as plt

np.random.seed(42)

population = np.random.normal(loc=50, scale=10, size=10000) # Mean=50, SD=10, Population size=10,000

plt.figure(figsize=(8, 6))

plt.hist(population, bins=50, color='skyblue', edgecolor='black', alpha=0.7)

plt.title('Population Distribution')

plt.xlabel('Value')

plt.ylabel('Frequency')

plt.show()

sample\_size = 100

random\_sample = np.random.choice(population, size=sample\_size, replace=False)

plt.figure(figsize=(8, 6))

plt.hist(random\_sample, bins=30, color='salmon', edgecolor='black', alpha=0.7)

plt.title(f'Random Sample Distribution (Sample Size = {sample\_size})')

plt.xlabel('Value')

plt.ylabel('Frequency')

plt.show()

num\_samples = 1000 # Number of samples to draw

sample\_means = []

for \_ in range(num\_samples):

sample = np.random.choice(population, size=sample\_size, replace=False)

sample\_means.append(np.mean(sample))

plt.figure(figsize=(8, 6))

plt.hist(sample\_means, bins=50, color='lightgreen', edgecolor='black', alpha=0.7)

plt.title(f'Sampling Distribution of Sample Means (Sample Size = {sample\_size}, Num Samples = {num\_samples})')

plt.xlabel('Sample Mean')

plt.ylabel('Frequency')

plt.show()

print(f"Mean of population: {np.mean(population)}")

print(f"Mean of sampling distribution: {np.mean(sample\_means)}")

print(f"Standard Deviation of population: {np.std(population)}")

print(f"Standard Deviation of sampling distribution: {np.std(sample\_means)}")



