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In [17]: import numpy as np
#The given values
mean_values = np.array([100, 100, 50, 50])
std_s = np.array([20, 22, 5, 5])
correlation_matrix = np.array([[1.0, 0.9, 0.0, 0.0],[0.9, 1.0, -0.9, -0.9],
initial_investment = 100
portfolio_weights = [np.array([0.5, 0, 0.25, 0.25]),np.array([0, 0.5, 0.5,
exp_values = [] #intializing lists
stds = [] #intializing lists
for weights in portfolio_weights:
    exp_value = np.dot(weights, mean_values) #Calculating the exp values
    exp_value *= initial_investment #scaling the exp values
    exp_values.append(exp_value) #storing the exp values
for i in range(len(portfolio_weights)): #Calculating the std values
    var = np.dot(portfolio_weights[i], np.dot(correlation_matrix * np.outer
std = np.sqrt(var)
std *= initial_investment #scaling the stds
stds.append(std) #storing the exp values
for h in range(4):
    print(f"Portfolio {h+1} - Expected Value: {exp_values[h]:.2f}, Standard
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Portfolio 1 - Expected Value: 7500.00, Standard Deviation: 1023.17
Portfolio 2 - Expected Value: 7500.00, Standard Deviation: 881.76
Portfolio 3 - Expected Value: 7500.00, Standard Deviation: 872.85
Portfolio 4 - Expected Value: 7500.00, Standard Deviation: 920.26
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A conservative investor may choose a portfolio with a lower standard deviation as will represent lower risk. Portfolio 3 has the lowest standard deviation compared to the others so it might be a preferred choice for a conservative investor.

1. Expected Value of a Portfolio ($E[P]$): $E[P] = w_1 * E[X_1] + w_2 * E[X_2] + w_3 * E[X_3] + w_4 * E[X_4]$
2. Standard Deviation of a Portfolio ($\sigma[P]$): $\text{sqrt}(\text{Portfolio Variance} = \sum \sum (\text{Weight of Asset } i * \text{Weight of Asset } j * \text{Covariance between Asset } i \text{ and Asset } j))$

We used the above formulas to compute the expected values and standard deviations of each portfolio which takes into account the means, stds and correlations between the assets. The mathematical background of these are as follows:

1. Expected Value of a Portfolio ($E[P]$): We calculated the weighted sum of the expected values of the assets to determine the expected value of the portfolio. This is based on the principle that the expected value of a linear combination of random variables is equal to the linear combination of their expected values.
2. Standard Deviation of a Portfolio ($\sigma[P]$): To compute the standard deviation of the portfolio we considered both the individual variances of the assets and the covariances between the assets. The portfolio's standard deviation is not simply the weighted sum of individual standard deviations due to the interdependence of assets. We used the formula for the standard deviation of a portfolio which accounts for the weights, variance and covariances of the assets.

In []: