

Learning Module 1: Portfolio Risk & Return: Part I

Q.129 Stock ABC's expected return is 7% with a standard deviation of 14%. Stock XYZ's expected return is 11% with a standard deviation of 23%.

Given that the correlation coefficient between ABC and XYZ is 0.4 and that you want to invest 35% of your money in stock ABC and 65% in stock XYZ, the standard deviation of your portfolio will be *closest to*:

A. 16.87%.

B. 17.50%.

C. 8.43%.

The correct answer is **B**.

$$\text{Standard deviation of portfolio} = [w_A^2 \times s_{(RA)}^2 + w_B^2 \times s_{(RB)}^2 + 2 \times (w_A) \times (w_B) \times \text{Cov}(RA, RB)]^{1/2}$$

$$\text{Standard deviation of portfolio} = [(0.35)^2(0.14)^2 + (0.65)^2(0.23)^2 + 2(0.35)(0.65)(0.14)(0.23)(0.4)]^{1/2}$$

$$\text{Standard deviation of portfolio} = [(0.1225)(0.0196) + (0.4225)(0.0529) + 2(0.00293)]^{1/2}$$

$$\text{Standard deviation of portfolio} = [0.002401 + 0.02235 + 0.00586]^{1/2}$$

$$\text{Standard deviation of portfolio} = [0.030611]^{1/2} = 17.50\%$$

A is incorrect. The calculation for 16.87% does not correctly apply the formula for the standard deviation of a portfolio. The precise calculation, as shown above, yields a result of 17.50%.

C is incorrect. The value of 8.43% significantly underestimates the risk (standard deviation) of the portfolio. It ignores the compounded effect of the individual securities' volatilities and their correlation, leading to a substantial underestimation of the portfolio's standard deviation.

CFA Level 1, Portfolio Management, Learning Module 1: Portfolio Risk and Return: Part I, LOS (e) Calculate and interpret portfolio standard deviation.

Q.132 A portfolio is composed of 60% equities and 40% bonds. The variance of equities is 320, the variance of bonds is 110, and the covariance is 90. The portfolio's variance is *closest to*:

A. 154.4.

B. 176.

C. 279.2.

The correct answer is **B**.

$$\text{Portfolio variance} = w_A^2 \times s^2(R_A) + w_B^2 \times s^2(R_B) + 2 \times (w_A) \times (w_B) \times \text{Cov}(R_A, R_B)$$

$$\text{Portfolio variance} = (0.6)^2 \times (320) + (0.4)^2 \times (110) + 2 \times (0.6) \times (0.4) \times (90)$$

$$\text{Portfolio variance} = 115.2 + 17.6 + 43.2 = 176$$

A is incorrect. The calculation that leads to 154.4 does not correctly apply the formula for portfolio variance. It likely results from an incorrect application of weights, variances, or the covariance between the assets.

C is incorrect. The value of 279.2 significantly overestimates the portfolio's variance.

CFA Level 1, Portfolio Management, Learning Module 1: Portfolio Risk and Return: Part I, LOS (d) Calculate and interpret the mean, variance, and covariance (or correlation) of asset returns based on historical data.

Q.133 Investor A has a lower risk aversion than Investor B, and Investor C has a lower risk tolerance than Investor B. Which investor's optimal portfolio will *most likely* have the highest expected return on the capital allocation line?

- A. Investor A's optimal portfolio
- B. Investor B's optimal portfolio
- C. Investor C's optimal portfolio

The correct answer is **A**.

Investor A will most likely take more risk than Investor B, and Investor B will most likely take more risk than Investor C. Therefore, Investor A's optimal portfolio will have the highest expected return.

B is incorrect. While Investor B is more risk-averse than Investor A but less so than Investor C, this middle position in terms of risk tolerance does not necessarily mean their optimal portfolio will have the highest expected return. The relationship between risk aversion and expected return is such that lower risk aversion is associated with a willingness to invest in portfolios with higher expected returns despite the increased risk. Therefore, Investor B, being more risk-averse than Investor A, is less likely to choose a portfolio with the highest expected return compared to Investor A.

C is incorrect. Given that Investor C has the lowest risk tolerance among the three, they are most likely to opt for a portfolio with lower expected returns that align with their lower tolerance for risk. The principle of risk aversion in investment theory suggests that investors with lower risk tolerance prefer to minimize risk, even at the expense of forgoing potentially higher returns. Thus, Investor C's optimal portfolio would be positioned towards the left on the CAL, where portfolios offer lower expected returns in exchange for reduced risk, making it unlikely for their portfolio to have the highest expected return.

CFA Level 1, Portfolio Management, Learning Module 1: Portfolio Risk and Return: Part I, LOS (b) Explain risk aversion and its implications for portfolio selection.

Q.137 Which of the following statements regarding the real risk-free rate of return is *least likely* accurate?

- A. The real risk-free rate of return is the minimum an investor requires.
- B. You don't need the inflation rate to calculate the real risk-free rate of return.
- C. The real risk-free rate of return does not take into account the capital market environment.

The correct answer is **B**.

The inflation rate is needed to calculate the real risk-free rate <

$$R_f = \frac{(1 + \text{nominal free rate})}{(1 + \text{inflation rate})} - 1$$

A is incorrect. The real risk-free rate is indeed a baseline for what investors might expect for taking no risk, assuming no inflation. However, investors typically require a premium above the real risk-free rate to compensate for various risks (inflation, default, liquidity, etc.) associated with different investments. Therefore, while the real risk-free rate is a component of the minimum return investors seek, it is not the complete picture.

C is incorrect. While the real risk-free rate is primarily concerned with inflation adjustment, it is indirectly influenced by the capital market environment. Factors such as monetary policy, economic growth, and investor sentiment, which are part of the capital market environment, can affect inflation rates and, consequently, the real risk-free rate. However, the statement is misleading in suggesting that the real risk-free rate is entirely detached from the broader economic and financial ecosystem.

CFA Level I, Portfolio Management, Learning Module 1: Portfolio Risk & Return: Part I.
LOS 1c: explain the selection of an optimal portfolio, given an investor's utility (or risk aversion) and the capital allocation line

Q.757 The standard deviation of return of an equally weighted investment portfolio in various securities is *most likely*:

- A. Equal to the average of the standard deviation of the individual securities.
- B. Less than the average of the standard deviation of the individual securities.
- C. More than the average of the standard deviation of the individual securities.

The correct answer is **B**.

The standard deviation of an equally weighted investment portfolio offers a lower standard deviation than the average of its individual components due to the correlations or interactions between the individual securities.

A is incorrect. It suggests that the standard deviation of an equally weighted investment portfolio is equal to the average of the standard deviation of the individual securities. This overlooks the critical role of diversification and correlation in reducing portfolio risk. The mere averaging of individual securities' standard deviations does not capture the complex interactions between the returns of those securities that can lead to risk reduction.

C is incorrect. It implies that the standard deviation of an equally weighted investment portfolio is more than the average of the standard deviation of the individual securities. This would only be the case in portfolios composed of perfectly positively correlated securities ($\rho = 1$), which is an unrealistic scenario in practical investment settings. In reality, securities exhibit varying degrees of correlation, and diversification typically leads to a reduction in the portfolio's overall risk, contrary to what option C suggests.

CFA Level I, Portfolio Management, Learning Module 1: Portfolio Management: An Overview. LOS 1e: calculate and interpret portfolio standard deviation.

Q.771 Alan West, a portfolio manager, created the following portfolio:

Security	Security Weight (%)	Expected Standard deviation(%)
A	20	4
B	80	10

If the correlation of returns between the two securities is 0.60, then the expected standard deviation of the portfolio is *closest to*:

A. 9.50%.

B. 8.10%.

C. 8.50%.

The correct answer is **C**.

$$\text{Standard deviation of portfolio} = [(0.2)^2(4\%)^2 + (0.8)^2(10\%)^2 + 2(0.2)(0.8)(0.6)(4\%)(10\%)]^{0.5}$$

$$\text{Standard deviation of portfolio} = 8.50\%$$

A is incorrect. Suggesting that the expected standard deviation of the portfolio is 9.50% overlooks the correct application of the formula for calculating the portfolio's standard deviation, which accounts for the weights of the securities, their individual standard deviations, and the correlation between their returns. The correct calculation yields an expected standard deviation of 8.50%.

B is incorrect. It might result from miscalculating the weights, standard deviations, or the correlation coefficient's impact on the portfolio's overall risk. The accurate calculation, as shown, results in an expected standard deviation of 8.50%.

CFA Level 1, Portfolio Management, Learning Module 1: Portfolio Risk and Return: Part I, LOS (e) Calculate and interpret portfolio standard deviation.

Q.772 Raul Perez, a portfolio manager, created the following portfolio:

Security	Security Weight (%)	Expected Standard deviation(%)
A	40	7
B	60	12

If the covariance of returns between the two securities is -0.004, then the expected standard deviation of the portfolio would be :

A. 6.36%.

B. 6.56%.

C. 6.10%.

The correct answer is **A**.

The formula for the standard deviation of a two-asset portfolio is indeed as follows:

$$\sigma_P^2 = w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2w_1 w_2 \text{Cov}(R_1, R_2)$$

Where:

σ_P^2 = variance of the portfolio.

w_1 and w_2 = weights of the two securities in the portfolio.

σ_1 and σ_2 = respective standard deviations of the two securities.

$\text{Cov}(R_1, R_2)$ = covariance between the returns of the two securities.

Therefore,

$$\sigma_P^2 = (0.4)^2(7\%)^2 + (0.6)^2(12\%)^2 + 2(0.4)(0.6)(-0.004) = 0.004048$$

The standard deviation of the portfolio (σ_P) is the square root of 0.004048, which is approximately 0.0636 or 6.36%.

B is incorrect. An answer of 6.56% would suggest either a miscalculation or incorrect assumptions about the weights, standard deviations, or covariance of the securities in the portfolio. The precise calculation based on the given data results in a standard deviation of approximately 6.36%, not 6.56%.

C is incorrect. An answer of 6.10% would also indicate a misunderstanding or miscalculation of the portfolio's risk.

CFA Level 1, Portfolio Management, Learning Module 1: Portfolio Risk and Return: Part I, LOS (e) Calculate and interpret portfolio standard deviation.

Q.774 Tina Fer, a portfolio manager, created the following portfolio:

Security	Security Weight (%)	Expected Standard deviation(%)
A	10	6
B	90	15

If the standard deviation of the portfolio is 14.1%, then the covariance between the two securities is *closest to*:

A. 0.0008.

B. 0.0009.

C. 0.0090.

The correct answer is **C**.

A portfolio's standard deviation of 14.10% is the weighted average, which is possible only if the correlation between the securities is equal to 1.0. If the correlation coefficient is equal to 1.0, then the covariance is calculated with the following formula:

$$(1) (6\%) (15\%) = 0.0090$$

Note: You could also isolate covariance in the following formula and would come up with the same answer:

$$\sigma_P^2 = w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2w_1 w_2 \text{Cov}(R_1, R_2)$$

A is incorrect. A covariance of 0.0008 would suggest a much weaker relationship between the returns of securities A and B than what is implied by the given portfolio standard deviation of 14.1%. This underestimation does not accurately reflect the dynamics of the portfolio's risk profile.

B is incorrect. This option slightly underestimates the degree to which the returns of the two securities move together within the portfolio.

CFA Level 1, Portfolio Management, Learning Module 1: Portfolio Risk and Return: Part I, LOS (e) Calculate and interpret portfolio standard deviation.

Q.775 Doug Smith, a portfolio manager, created the following portfolio:

Security	Expected Return (%)	Expected Standard Deviation(%)
A	18	12
B	15	10

If the portfolio of the two securities has an expected return of 16%, the proportion invested in Security A is *closest to*:

- A. 33%.
- B. 67%.
- C. 133%.

The correct answer is **A**.

To solve this question, we can use the formula for the expected return of a portfolio. The expected return of a portfolio is the weighted average of the expected returns of the individual securities in the portfolio. Let W_A represent the weight of Security A in the portfolio, and $W_B = 1 - W_A$ represent the weight of Security B (since the total weight must sum up to 1).

The formula for the expected return of the portfolio is given by:

$$16\% = W_A \times 18\% + (1 - W_A) \times 15\%$$

We can solve for W_A as follows:

$$\begin{aligned} 16\% &= W_A \times 18\% + (1 - W_A) \times 15\% \\ 16\% &= 18\% \times W_A + 15\% - 15\% \times W_A \\ 16\% &= 3\% \times W_A + 15\% \\ 1\% &= 3\% \times W_A \\ W_A &= \frac{1\%}{3\%} \\ W_A &= \frac{1}{3} \text{ or approximately } 33\% \end{aligned}$$

B is incorrect. A calculation suggesting 67% investment in Security A would imply a higher expected return than 16%, given that Security A has a higher expected return (18%) than Security B (15%). The weight of Security A in the portfolio is calculated based on the desired portfolio return, which in this case is closer to the return of Security B, indicating a lower weight in Security A.

C is incorrect. A proportion of 133% suggests leveraging or borrowing to invest more than the total portfolio value in Security A, which is not implied by the given information. The question asks for the proportion of the portfolio invested in Security A to achieve a specific expected return, not leveraging strategies. Moreover, a proportion greater than 100% is not feasible in the context of this question, which deals with the allocation between two securities within a portfolio without considering borrowing or leveraging.

CFA Level 1, Portfolio Management, Learning Module 1: Portfolio Risk and Return: Part I, LOS (c) Explain the selection of an optimal portfolio, given an investor's utility (or risk aversion) and the capital allocation line.

Q.776 Carla Mayes, a portfolio manager, created the following portfolio:

Security	Expected Return (%)	Expected Standard Deviation(%)
A	5	8
B	10	14

If the correlation of returns between the two securities is -0.20, the expected standard deviation of a portfolio invested 75% in Security A and 25% in Security B is *closest to*:

A. 5.31%.

B. 6.81%.

C. 6.31%.

The correct answer is **C**.

$$\begin{aligned}\sigma_P^2 &= w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2\rho_{12}\sigma_1\sigma_2 \\ &= [(0.75)^2(8\%)^2 + (0.25)^2(14\%)^2 + 2(0.75)(0.25)(-0.20)(8\%)(14\%)]^{0.5} \\ &= 6.31\%\end{aligned}$$

A is incorrect. It likely omits the covariance term or miscalculates the weights and standard deviations of the individual securities.

B is incorrect. The calculation that leads to 5.31% does not correctly apply the formula for the portfolio's standard deviation. It likely omits the covariance term or miscalculates the weights and standard deviations of the individual securities.

CFA Level I, Portfolio Management, Learning Module 1: Portfolio Risk & Return: Part I.
LOS e: calculate and interpret portfolio standard deviation.

Q.777 Kate Reiners, a portfolio manager, created the following portfolio:

Security	Expected Return (%)	Expected Standard Deviation(%)
A	11	9
B	18	16

If the two securities are uncorrelated, the expected standard deviation of this equal-weighted portfolio is *closest to*:

A. 9.18%.

B. 9.81%.

C. 8.91%.

The correct answer is **A**.

$$\begin{aligned}\text{Portfolio variance} &= w_X^2 \sigma_X^2 + w_Y^2 \sigma_Y^2 + 2w_X w_Y \sigma_X \sigma_Y \rho_{XY} \\ &= \sqrt{(0.5)^2 (0.09)^2 + (0.5)^2 (0.16)^2 + 2(0.5)(0.5)(0.00)(0.09)(0.16)} \\ &= 0.0918 \quad (\text{or } 9.18\%)\end{aligned}$$

B is incorrect. The calculation that leads to 9.81% likely involves a misunderstanding of the formula for combining standard deviations or an incorrect application of the weights or the correlation coefficient.

C is incorrect. The value of 8.91% does not correctly follow from the application of the formula for the standard deviation of a portfolio consisting of uncorrelated securities.

CFA Level 1, Portfolio Management, Learning Module 1: Portfolio Risk and Return: Part I, LOS (c) Explain the selection of an optimal portfolio, given an investor's utility (or risk aversion) and the capital allocation line.

Q.779 Which of the following curve is referred to as the Markowitz efficient frontier?

A. The curve that lies below and to the left of the global minimum-variance portfolio.

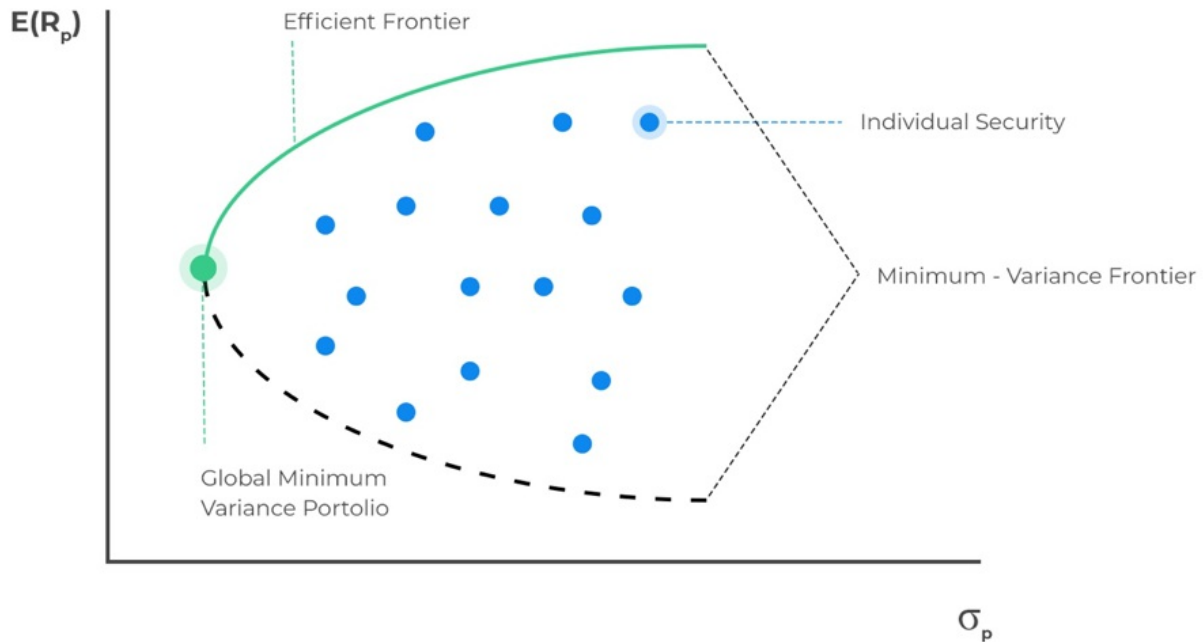
B. The curve that lies above and to the right of the global minimum-variance portfolio.

C. The curve that lies above and to the left of the global minimum-variance portfolio.

The correct answer is **B**.



Global Minimum Variance Portfolio



The curve (shown as the green line) that lies above and to the right of the global minimum-variance portfolio (shown as the green dot) is referred to as the Markowitz efficient frontier. It contains all portfolios of risky assets that rational, risk-averse investors will choose.

A is incorrect. They offer lower returns for a given level of risk or higher risk for a given level of return. Rational investors, seeking to maximize their utility, would not choose portfolios in this region as they can achieve better outcomes by selecting portfolios on the efficient frontier.

C is incorrect. The curve that lies above and to the left of the global minimum-variance portfolio does not exist within the context of the Markowitz portfolio theory. The global minimum-variance portfolio itself is the leftmost point of the efficient frontier, meaning there are no portfolios that offer a higher return for less risk than this point. Any portfolio that would hypothetically lie above and to the left of the global minimum-variance portfolio would imply a risk-return combination that is unattainable under the assumptions of the Markowitz framework, which includes the idea that higher returns come with higher risk.

CFA Level 1, Portfolio Management, Learning Module 1: Portfolio Risk and Return: Part I, LOS (g) Describe and interpret the minimum-variance and efficient frontiers of risky assets and the global minimum-variance portfolio.

Q.780 Which of the following statements is *most* accurate in the context of the minimum-variance frontier?

- A. A risk-averse investor will always choose to invest in a portfolio that lies on the right to the minimum-variance frontier.
- B. A risk-averse investor will always choose to invest in a portfolio that lies on the minimum-variance frontier.
- C. Neither of the above.

The correct answer is **B**.

The minimum-variance frontier represents a set of portfolios that offer the lowest level of risk (variance) for a given level of expected return. For a risk-averse investor, who prioritizes minimizing risk over maximizing returns, choosing a portfolio on the minimum-variance frontier is the most rational decision. This is because any portfolio on this frontier provides the best possible expected return for a given amount of risk. Therefore, it is most accurate to say that a risk-averse investor will always choose to invest in a portfolio that lies on the minimum-variance frontier.

A is incorrect. Suggesting that a risk-averse investor will always choose to invest in a portfolio that lies to the right of the minimum-variance frontier is misleading. Portfolios to the right of the minimum-variance frontier typically involve higher levels of risk for potentially higher returns. A risk-averse investor, by definition, seeks to minimize risk, not necessarily to maximize returns at the cost of taking on more risk. Therefore, such an investor would prefer portfolios on the minimum-variance frontier itself, where the risk is minimized for any level of expected return, rather than opting for higher-risk options to the right of the frontier.

C is incorrect. As explained, the minimum-variance frontier is precisely where a risk-averse investor would look to invest. Portfolios on this frontier offer the lowest possible risk for a given level of expected return, aligning perfectly with the preferences of a risk-averse investor. Therefore, stating that neither of the provided options is accurate overlooks the fundamental principle of risk aversion in investment strategy.

CFA Level 1, Portfolio Management, Learning Module 1: Portfolio Risk and Return: Part I, LOS (g) Describe and interpret the minimum-variance and efficient frontiers of risky assets and the global minimum-variance portfolio.

Q.798 According to the capital market theory, the optimal risky portfolio:

- A. Has the highest expected return
- B. Is the market portfolio
- C. Has the lowest expected variance

The correct answer is **B**.

The capital market theory assumes that investors employ a uniform approach while assessing various assets on the market. It assumes that all investors have homogeneous expectations and use the same probability distributions, inputs, and the same analytical methodologies. As a result, their valuations are identical, and all of them invest in the optimal risk portfolio - the market portfolio.

A is incorrect. While it is true that investors seek portfolios with high expected returns, the highest expected return alone does not define the optimal risky portfolio. According to the capital market theory, the optimal portfolio must also consider the risk associated with achieving these returns. A portfolio with the highest expected return but unacceptable levels of risk would not be considered optimal. The theory emphasizes the importance of balancing expected returns with risk, aiming for the portfolio that offers the best risk-return trade-off, which is embodied by the market portfolio.

C is incorrect. Although minimizing expected variance (or risk) is a critical consideration in portfolio selection, the optimal risky portfolio is not simply the one with the lowest expected variance. If this were the case, the optimal portfolio would consist entirely of risk-free assets, which is not realistic or desirable for most investors seeking higher returns. The capital market theory suggests that the optimal portfolio is one that efficiently balances expected return and risk, which is achieved through diversification. The market portfolio, being fully diversified, effectively spreads out risk while still offering a favorable expected return, making it the optimal choice according to the theory.

C is incorrect. The value of 8.91% does not correctly follow from the application of the formula for the standard deviation of a portfolio consisting of uncorrelated securities.

CFA Level 1, Portfolio Management, Learning Module 1: Portfolio Risk and Return: Part I, LOS (c) Explain the selection of an optimal portfolio, given an investor's utility (or risk aversion) and the capital allocation line.

Q.1299 Calculate the standard deviation of two equally weighted risky assets in a portfolio if the standard deviations of the two assets are 12% and 15% and the correlation between the two assets is 0.5.

A. 11.71%

B. 1.37%

C. 13.37%

The correct answer is **A**.

$$\text{Portfolio variance} = w_X^2 \sigma_X^2 + w_Y^2 \sigma_Y^2 + 2w_X w_Y \sigma_X \sigma_Y \rho_{XY}$$

$$\text{Portfolio variance } \sigma_p = ((0.12^2 \times 0.5^2) + (0.15^2 \times 0.5^2) + (2 \times 0.12 \times 0.15 \times 0.5 \times 0.5 \times 0.5))^{0.5} = 11.$$

B is incorrect. 1.37% significantly underestimates the risk of the portfolio.

C is incorrect. 13.37% overestimates the portfolio's risk.

CFA Level I, Portfolio Management, Learning Module 1: Portfolio Risk & Return: Part I.
LOS e: Calculate and interpret portfolio standard deviation.

Q.1300 What does the utility function represent?

- A. Investors preference in terms of risk and return
- B. Different combinations of risk and return
- C. Minimum variance portfolios

The correct answer is **A**.

The utility function represents the investor's preference in terms of risk and return. The utility function helps in understanding the trade-offs investors are willing to make between the potential for higher returns and the risk of achieving those returns. Essentially, it quantifies the satisfaction or utility an investor expects to derive from different investment choices, considering both the expected return and the associated risk.

B is incorrect. While the utility function does indeed take into account risk and return, its primary purpose is not to enumerate possible combinations but to express the investor's preferences among those combinations. The utility function is more about the subjective valuation of risk-return trade-offs rather than an objective mapping of all possible risk-return scenarios.

C is incorrect. This option mistakenly identifies the utility function as representing minimum variance portfolios. Minimum variance portfolios are a concept in portfolio theory that focuses on constructing a portfolio with the lowest possible risk (variance) for a given level of expected return. Although the utility function considers risk (which includes variance), it is not limited to the concept of minimizing variance. Instead, it encompasses a broader perspective on how investors evaluate risk in relation to return, which may or may not align with the goal of achieving a minimum variance portfolio.

CFA Level I, Portfolio Management, Learning Module 1: Portfolio Risk & Return: Part I. LOS c: Explain the selection of an optimal portfolio, given an investor's utility (or risk aversion) and the capital allocation line.

Q.1301 Which of the following indifference curves will a risk-averse investor have?

- A. An upward-sloping curve
- B. A downward-sloping curve
- C. A downward straight line

The correct answer is **A**.

A risk-averse investor will have an upward-sloping curve because he will only take additional risk for additional returns. This is because a risk-averse individual requires higher returns to compensate for any additional risk they take on. For a risk-averse investor, the willingness to accept higher risk is only present if it is accompanied by a proportionately higher expected return.

B is incorrect. A downward-sloping curve would suggest that an investor is willing to accept lower returns for higher levels of risk, which contradicts the fundamental behavior of a risk-averse investor. Risk-averse individuals seek to maximize their returns for a given level of risk or minimize their risk for a given level of return. Therefore, a downward-sloping curve does not accurately represent the preferences of a risk-averse investor.

C is incorrect. A downward straight line would imply a constant trade-off between risk and return, regardless of the level of risk involved. This does not accurately reflect the behavior of risk-averse investors, who require increasingly higher returns to compensate for additional units of risk. The straight line suggests a linear relationship between risk and return, which oversimplifies the complex decision-making process of risk-averse investors. In reality, the trade-off between risk and return is not linear, and the curvature of the indifference curve reflects the varying degrees of risk aversion among investors.

CFA Level I, Portfolio Management, Learning Module 1: Portfolio Risk & Return: Part I.
LOS b: explain risk aversion and its implications for portfolio selection.

Q.1302 Which of the following statements is *most* accurate about correlations?

- A. The higher the correlation between assets, the higher the diversification benefit.
- B. The lower the correlation between assets, the lower the diversification benefit.
- C. The higher the correlation between assets, the lower the diversification benefit.

The correct answer is **C**.

A high correlation between assets creates lower diversification benefits. If the correlation is negative, the portfolio risk can be eliminated. When assets have a high positive correlation, they tend to move in the same direction under similar market conditions. This similarity in movement means that when one asset experiences a downturn, the other is likely to do the same, thereby offering little to no risk reduction through diversification.

A is incorrect. It suggests that higher correlation between assets leads to higher diversification benefits, which is a misunderstanding of the concept of diversification. In reality, the opposite is true. Higher correlation between assets means their returns move more closely together, which reduces the potential for risk reduction through diversification. In extreme cases, if two assets have a correlation of 1, combining them in a portfolio offers no diversification benefit at all, as they would respond identically to market conditions.

B is incorrect. It means the assets' returns do not move in tandem. This lack of synchronicity allows for the smoothing of portfolio returns over time, as the negative performance of some assets can be compensated by the positive performance of others, thereby enhancing the portfolio's risk-adjusted return.

CFA Level I, Portfolio Management, Learning Module 1: Portfolio Risk & Return: Part I.
LOS (f): Describe the effect on a portfolio's risk of investing in assets that are less than perfectly correlated.

Q.1304 Which of the following is *least likely* correct about the coefficient of correlation?

- A. A correlation of zero means there is no linear relationship between two stocks.
- B. A correlation of -1 means the two stock returns are always proportional in opposite directions.
- C. A correlation of 3 means the two stock returns are always proportional in the same direction.

The correct answer is **C**.

The least likely correct statement about the coefficient of correlation is option C.

A correlation coefficient is a number between -1 and 1 that tells you the strength and direction of a relationship between variables. A correlation of zero means there is no linear relationship between two variables. A correlation of -1 means the two variables are perfectly negatively correlated, which implies that when one variable increases, the other variable decreases proportionally. However, a correlation of 3 is not possible since the correlation coefficient ranges from -1 to 1.

A is incorrect. The statement that a correlation of zero means there is no linear relationship between two stocks is accurate. A zero correlation indicates that there is no linear dependency between the movements of the two stocks. However, it's important to note that this does not imply there is no relationship at all between the two variables; they could have a non-linear relationship that the correlation coefficient does not capture.

B is incorrect. A correlation coefficient of -1 signifies a perfect negative linear relationship between two variables. This means that if one variable increases, the other variable decreases in a perfectly proportional manner, and vice versa. This relationship is crucial in finance for diversification purposes, as it allows investors to hedge against risk by combining assets that move in opposite directions.

CFA Level I, Portfolio Management, Learning Module 1: Portfolio Risk & Return: Part I.
LOS (d): Calculate and interpret the mean, variance, and covariance (or correlation) of asset returns based on historical data.

Q.1306 Peter Pamco, a fund manager, constructs a portfolio consisting of four assets that pay returns of 6%, 13%, 15%, and 7%. If the weights of stocks are 20%, 30%, 40%, and 10%, respectively, then the expected return of the portfolio is *closest to*:

A. 13.2%.

B. 11.8%.

C. 21%.

The correct answer is **B**.

$$\text{Total return of portfolio} = 0.2(6\%) + 0.3(13\%) + 0.4(15\%) + 0.1(7\%) = 11.8\%$$

A is incorrect. The option suggesting 13.2% as the expected return does not align with the calculation based on the given weights and returns of the assets in the portfolio.

C is incorrect. The option suggesting 21% as the expected return significantly overestimates the portfolio's performance. This figure does not correspond with the weighted average of the returns provided for the assets in the portfolio. Such a high expected return could only be achieved if the assets with higher returns (13%, 15%) had significantly greater weights or if the returns themselves were higher. This highlights the importance of accurately applying the formula for expected return, taking into account the actual weights and returns of the assets in the portfolio.

CFA Level I, Portfolio Management, Learning Module 1: Portfolio Risk & Return: Part I.
LOS (a): Describe characteristics of the major asset classes that investors consider in forming portfolios.

Q.1309 The line that represents the combination of an optimal risky portfolio and a risk-free asset is known as the:

- A. Indifference curve.
- B. Capital allocation line.
- C. Efficient frontier.

The correct answer is **B**.

The capital allocation line represents the combination of an optimal risky portfolio and a risk-free asset. The slope of the CAL, known as the Sharpe ratio, measures the additional return an investor receives for each additional unit of risk. The CAL starts from the risk-free rate on the y-axis, indicating the return of the risk-free asset, and extends upward to the right, showing the increasing return levels available with increasing levels of risk from the risky portfolio. This line is significant because it helps investors understand how they can adjust their portfolio to achieve a desired level of risk and return by mixing a risk-free asset with a risky portfolio.

A is incorrect. An indifference curve represents combinations of portfolios that give the investor the same level of satisfaction or utility. Indifference curves are used in the context of utility theory to illustrate an investor's preference for risk versus return. Each curve connects points that offer the same utility level to the investor, but they do not specifically represent the combination of a risk-free asset and a risky portfolio. Therefore, the concept of an indifference curve is distinct from the Capital Allocation Line, which directly relates to the mix of a risk-free asset and an optimal risky portfolio to achieve different levels of expected return for varying levels of risk.

C is incorrect. No other portfolios offer higher returns for the same risk or lower risk for the same return. The Efficient Frontier is a key concept in portfolio optimization, but it does not specifically incorporate a risk-free asset. Instead, it focuses on the optimal combination of risky assets alone. While the Efficient Frontier is related to the concept of the Capital Allocation Line, as the tangent point between the CAL and the Efficient Frontier identifies the optimal risky portfolio, the Efficient Frontier itself does not represent the combination of a risk-free asset and a risky portfolio, which is the defining characteristic of the Capital Allocation Line.

CFA Level I, Portfolio Management, Learning Module 1: Portfolio Risk & Return: Part I. LOS (c): Explain the selection of an optimal portfolio, given an investor's utility (or risk aversion) and the capital allocation line.

Q.1311 A portfolio that has the least risk (smallest standard deviation) on the efficient frontier is called the:

- A. Global minimum variance portfolio.
- B. Least risky portfolio.
- C. Most efficient portfolio.

The correct answer is **A**.

A portfolio with the least risk (smallest standard deviation) on the efficient frontier is called the global minimum variance portfolio. The efficient frontier itself is a concept from modern portfolio theory, which represents a set of portfolios that offer the highest expected return for a given level of risk or the lowest risk for a given level of expected return. Among these portfolios, the global minimum variance portfolio is unique because it is the one that minimizes risk across all possible portfolios, not just those on the efficient frontier. This makes it an important concept in portfolio management and asset allocation, as it provides a benchmark for the lowest risk that can be achieved through diversification under the assumptions of modern portfolio theory.

B is incorrect. This option incorrectly suggests that the portfolio with the least risk on the efficient frontier is known as the least risky portfolio. While this description is intuitively appealing, it lacks the specificity and recognition of the established terminology within finance and investment theory. The term "least risky portfolio" could apply to various contexts and does not specifically denote the portfolio on the efficient frontier with the smallest standard deviation.

C is incorrect. Labeling the portfolio with the least risk on the efficient frontier as the most efficient portfolio is misleading. Efficiency, in the context of the efficient frontier, refers to the optimal trade-off between risk and return. While the global minimum variance portfolio does indeed have the least risk, it does not necessarily offer the most efficient trade-off between risk and return for all investors. Different investors may have different risk tolerances and return objectives, leading them to prefer portfolios elsewhere on the efficient frontier that better align with their individual preferences. Therefore, the term "most efficient portfolio" is too broad and does not accurately describe the unique characteristics of the global minimum variance portfolio.

CFA Level I, Portfolio Management, Learning Module 1: Portfolio Risk & Return: Part I.
LOS (g): Describe and interpret the minimum-variance and efficient frontiers of risky assets and the global minimum-variance portfolio.

Q.1313 Which stock will a risk-seeking investor *most likely* pick if Stock A pays a 5% return with a 2% standard deviation and Stock B pays a 7% return with a 6% standard deviation?

- A. Stock A
- B. Stock B
- C. Indifference between A and B

The correct answer is **B**.

In the context of choosing between Stock A and Stock B, the decision-making process of a risk-seeking investor would be influenced primarily by the trade-off between the expected returns and the associated risk levels of each stock.

Stock A offers a 5% return with a 2% standard deviation, indicating a relatively low level of risk and a modest potential return. On the other hand, Stock B provides a 7% return with a 6% standard deviation, signifying a higher level of risk but also a greater potential return. For a risk-seeking investor, the higher expected return of Stock B, despite its greater risk (as quantified by the standard deviation), makes it a more attractive investment option. The investor's preference for higher risk in pursuit of higher returns aligns with the characteristics of Stock B, making it the preferred choice.

A is incorrect. Stock A, with its lower return and lower standard deviation, represents a safer investment compared to Stock B. While it might be suitable for risk-averse investors who prioritize stability and are cautious about potential losses, it does not align with the preferences of a risk-seeking investor. The lower potential return of Stock A, despite its reduced risk, is less appealing to an investor who is willing to embrace higher volatility for the chance of achieving greater financial gains.

C is incorrect. Indifference between Stock A and Stock B would imply that the investor places equal value on the different risk-return profiles of the two stocks, which is not consistent with the behavior of a risk-seeking investor. Risk-seeking investors have a clear preference for investments that offer higher returns, even if those investments come with higher levels of risk. Therefore, suggesting that a risk-seeking investor would be indifferent between a lower-risk, lower-return option and a higher-risk, higher-return option does not accurately reflect the decision-making criteria of such investors.

CFA Level I, Portfolio Management, Learning Module 1: Portfolio Risk & Return: Part I. LOS (b): Explain risk aversion and its implications for portfolio selection.

Q.1315 Which of the following statements is *most* accurate regarding a negative covariance between two assets?

The returns of two assets are:

- A. Moving together in negative directions.
- B. Moving in opposite directions.
- C. Uncorrelated.

The correct answer is **B**.

Negative covariance between two assets indicates that the returns of these assets tend to move in opposite directions. By including assets with negative covariance in a portfolio, an investor can potentially lower the portfolio's overall volatility, as the negative movement in one asset's return is often offset by a positive movement in another's. This relationship is crucial for constructing a diversified portfolio that aims to minimize risk while striving for a certain level of return.

A is incorrect. This option suggests that the returns of two assets are moving together in negative directions, which misinterprets the concept of negative covariance. Negative covariance does not imply that both assets are moving negatively (i.e., both losing value) at the same time. Instead, it means that when one asset's return increases, the other's tends to decrease, and vice versa. The direction (positive or negative) of the returns is not specified by the covariance; it only indicates the relationship between the movements of the two assets.

C is incorrect. Stating that two assets are uncorrelated implies that there is no linear relationship between their returns. However, negative covariance specifically indicates a type of linear relationship where the returns of the two assets move in opposite directions. Uncorrelated assets have a covariance of zero, meaning that the return of one asset provides no information about the return of the other. This is distinctly different from a negative covariance, which does provide information about the relationship between the returns of two assets.

CFA Level I, Portfolio Management, Learning Module 1: Portfolio Risk & Return: Part I. LOS (d): Calculate and interpret the mean, variance, and covariance (or correlation) of asset returns based on historical data.

Q.1316 Which of the following has a greater return and a higher risk?

- A. T-Bills
- B. Large-cap stocks
- C. Small-cap stocks

The correct answer is **C**.

Small-cap stocks are generally considered to have a greater return and a higher risk compared to T-Bills and large-cap stocks. This is primarily due to the nature of small-cap companies, which are smaller in market capitalization. These companies often operate in niche markets or are in the early stages of development, making them more susceptible to market volatility and economic changes. However, this also means they have a higher potential for growth compared to larger, more established companies. Historically, small-cap stocks have shown higher returns over the long term, albeit with higher volatility and risk. This higher risk and return profile is attributed to the fact that small-cap companies can rapidly grow in value, but they can also face significant challenges that can adversely affect their stock prices.

A is incorrect. T-Bills, or Treasury Bills, are short-term government securities that are considered to be one of the safest investments since they are backed by the full faith and credit of the U.S. government. Due to their low risk, T-Bills typically offer lower returns compared to stocks.

B is incorrect. Large-cap stocks represent companies with large market capitalizations and are generally considered to be more stable and less volatile than small-cap stocks. These companies are often leaders in their industries, with established business models and consistent revenue streams. While large-cap stocks can offer solid returns and are an essential part of a diversified investment portfolio, they typically do not offer the same growth potential as small-cap stocks. The lower risk associated with large-cap stocks usually translates to lower volatility and, consequently, lower returns compared to small-cap stocks. Investors looking for growth might prefer small-cap stocks despite the higher risk, while those seeking stability might lean towards large-cap stocks.

***CFA Level I, Portfolio Management, Learning Module 1: Portfolio Risk & Return: Part I.
LOS (b): Explain risk aversion and its implications for portfolio selection.***

Q.1321 An investor purchased a share for \$65 which paid a dividend of \$3 and was sold for \$72 at the end of the period. The holding period return is *closest to*:

- A. 12%.
- B. 13.33%.
- C. 15.38%.

The correct answer is **C**.

$$\text{HPR} = \frac{(\text{Ending price} - \text{Beginning price} + \text{Dividend})}{\text{Beginning price}}$$

$$\text{HPR} = \frac{(\$72 - 65 + \$3)}{\$65} = 15.38\%$$

A is incorrect. It suggests an HPR of 12%. This calculation does not accurately reflect the total returns from the investment, including both the capital gain and the dividend received. It underestimates the actual return the investor made on the investment.

B is incorrect. It indicates an HPR of 13.33%. It appears to only partially account for the dividend received or the capital gain, leading to an inaccurate representation of the investment's performance.

CFA Level I, Portfolio Management, Learning Module 1: Portfolio Risk & Return: Part I.
LOS (d): Calculate and interpret the mean, variance, and covariance (or correlation) of asset returns based on historical data.

Q.1327 Calculate the standard deviation of two equally weighted risky assets in a portfolio if the variance of the two assets is 0.0121 and 0.0484 and the correlation is 1.

A. 0.237

B. 0.165

C. 0.07

The correct answer is **B**.

When the correlation is 1, the standard deviation is simply the weighted average of the standard deviation of assets in the portfolio.

$$\sigma_p = \sqrt{0.0121} = 0.11$$

$$\sigma_p = \sqrt{0.0484} = 0.22$$

Then, substituting these values into the portfolio standard deviation formula:

$$\sigma_p = \sqrt{(0.5)^2(0.11)^2 + (0.5)^2(0.22)^2 + 2(0.5)(0.5)(0.11)(0.22)(1)}$$

A is incorrect. This option suggests a portfolio standard deviation of 0.237, which does not align with the calculated value.

C is incorrect. The option indicating a standard deviation of 0.07 significantly underestimates the risk of the portfolio.

CFA Level I, Portfolio Management, Learning Module 1: Portfolio Risk & Return: Part I.
LOS (e): Calculate and interpret portfolio standard deviation.

Q.1328 Calculate the standard deviation of two equally weighted risky assets in a portfolio if the standard deviations of the two assets are 9% and 14% and the correlation is 0.

A. 0.083

B. 0.168

C. 0.239

The correct answer is **A**.

$$\sigma_p = \sqrt{(0.5^2 \times 0.09^2) + (0.5^2 \times 0.14^2) + 2 \times 0.5 \times 0.5 \times 0.09 \times 0.14 \times 0}$$

Since the correlation is 0, the last term of the equation drops out, simplifying the calculation to:

$$\sigma_p = \sqrt{(0.5^2 \times 0.09^2) + (0.5^2 \times 0.14^2)}$$

Calculating further:

$$\sigma_p = \sqrt{(0.25 \times 0.0081) + (0.25 \times 0.0196)}$$

$$\sigma_p = \sqrt{0.002025 + 0.0049}$$

$$\sigma_p = \sqrt{0.006925} = 0.083$$

B is incorrect. A standard deviation of 0.168 would imply a higher level of risk and volatility in the portfolio than what is calculated based on the given standard deviations of the individual assets and their correlation. This value does not accurately reflect the combined risk of the two assets when they are equally weighted and uncorrelated.

C is incorrect. A standard deviation of 0.239 would suggest an even higher level of risk and volatility than option B, which is not supported by the calculation based on the provided data. This value significantly overestimates the portfolio's risk, given the assets' standard deviations and zero correlation.

CFA Level I, Portfolio Management, Learning Module 1: Portfolio Risk & Return: Part I. LOS (e): Calculate and interpret portfolio standard deviation.

Q.2841 Which of the following is *least likely* an interpretation of the correlation coefficient?

- A. A correlation coefficient of +1 means that the mean returns of two assets move proportionately in the same direction.
- B. A correlation coefficient of -1 means that the mean returns of two assets move proportionately in a negative direction.
- C. A correlation coefficient of -1 means that the mean returns of two assets move proportionately in opposite directions.

The correct answer is **B**.

The term "in a negative direction" could be interpreted in various ways. It might imply that both assets are declining in value, which is not necessarily the case with a correlation coefficient of -1. A correlation coefficient of -1 indicates a perfect negative correlation, meaning if one asset's return increases, the other's return decreases proportionately, and vice versa.

A is incorrect. This option correctly interprets a correlation coefficient of +1, indicating that the mean returns of two assets move proportionately in the same direction. This means if one asset's return increases, the other asset's return also increases by a proportional amount, and vice versa for decreases. This interpretation aligns with the definition of a perfect positive correlation, where the relationship between two variables is linear and moves in the same direction at all times, reflecting a direct and proportional relationship between the returns of the two assets.

C is incorrect. This option accurately describes a correlation coefficient of -1, stating that the mean returns of two assets move proportionately in opposite directions. This reflects an inverse relationship between the returns of the two assets, where their movements are perfectly mirrored but in opposite directions.

CFA Level I, Portfolio Management, Learning Module 1: Portfolio Risk & Return: Part I.
LOS (d): Calculate and interpret the mean, variance, and covariance (or correlation) of asset returns based on historical data.

Q.2842 Determine the correlation between the shares of Glam Corp. and Duncan Inc. if the covariance of the assets is 0.04, the standard deviation of Glam Corp. is 32% and the standard deviation of Duncan Inc. is 41%.

A. 0.305

B. 0.005

C. 0.11

The correct answer is **A**.

$$\text{Correlation} = \frac{\text{Covariance}}{(\text{Standard deviation A} \times \text{Standard deviation B})}$$

$$\text{Correlation} = \frac{0.04}{(0.32 \times 0.41)} = 0.305$$

B is incorrect. A correlation of 0.005 would suggest an almost non-existent linear relationship between the returns of the two assets, which is not supported by the given data. The calculation of the correlation coefficient using the provided covariance and standard deviations of Glam Corp. and Duncan Inc. yields a result of 0.305, not 0.005.

C is incorrect. A correlation of 0.11 would indicate a very weak positive linear relationship between the returns of Glam Corp. This highlights the necessity of accurately calculating the correlation to understand the strength and direction of the relationship between the returns of two assets.

CFA Level I, Portfolio Management, Learning Module 1: Portfolio Risk & Return: Part I.
LOS (d): Calculate and interpret the mean, variance, and covariance (or correlation) of asset returns based on historical data.

Q.2843 A junior fund manager at Dapper Assets Management is constructing a portfolio consisting of two large-cap stocks that trade on the London stock exchange. Using the data given in the following table, calculate the standard deviation of stock A.

Year	Stock A Return	Stock B Return
1	17%	45%
2	21%	20%
3	-8%	-2%
4	-1%	2%
5	4%	-19%
6	19%	2%
7	-7%	13%

A. 12.46%

B. 1.33%

C. 7.56%

The correct answer is **A**.

$$\text{Mean return} = \frac{(0.17 + 0.21 - 0.08 - 0.01 + 0.04 + 0.19 - 0.07)}{7} = 0.064$$

$$\text{Variance} = \frac{((0.17 - 0.064)^2 + (0.21 - 0.064)^2 + (-0.08 - 0.064)^2 + (-0.01 - 0.064)^2 + (0.04 - 0.064)^2 + (0.19 - 0.064)^2 + (-0.07 - 0.064)^2)}{6}$$

As the variance of Stock A is 0.015529, the standard deviation = $\sqrt{0.015529} = 0.1246$

B is incorrect. A standard deviation of 1.33% would suggest a very low level of volatility in stock A's returns, which does not match the calculated standard deviation based on the given data. This option likely results from a misunderstanding of the calculation process or an error in computation.

C is incorrect. A standard deviation of 7.56% is also incorrect and does not align with the calculated standard deviation from the provided data.

CFA Level I, Portfolio Management, Learning Module 1: Portfolio Risk & Return: Part I. LOS (e): Calculate and interpret portfolio standard deviation.

Q.2844 A junior fund manager at Dapper Assets Management is constructing a portfolio consisting of two large-cap stocks that trade on the London stock exchange. In a meeting with the investment committee, the manager was asked to present the covariance of both stocks. Using the data given in the following table, calculate the covariance if the population mean is unknown.

Year	Stock A Return	Stock B Return
1	17%	45%
2	21%	20%
3	-8%	-2%
4	-1%	2%
5	4%	-19%
6	19%	2%
7	-7%	13%

A. 0.0144

B. 0.0113

C. 0.0091

The correct answer is **B**.

Below are the calculations:

Stock A Return minus Mean Return of A	Stock B Return minus Mean Return of B	Covariance = (Stock A Return Mean Return of A) × (Stock B Return minus Mean Return of B)
0.1057	0.3629	0.0384
0.1457	0.1129	0.0164
-0.1443	-0.1071	0.0155
-0.0743	-0.0671	0.0050
-0.0243	0.2771	0.0067
0.1257	-0.0671	-0.0084
-0.1343	0.0429	-0.0058

$$\text{Cov} = \frac{(0.0384 + 0.0164 + 0.0155 + 0.0050 + 0.0067 - 0.0084 - 0.0058)}{(n - 1)}$$

$$\text{Cov} = \frac{(0.0384 + 0.0164 + 0.0155 + 0.0050 + 0.0067 - 0.0084 - 0.0058)}{6} = 0.0113$$

The reason we use "n-1" and not "n" is essentially that the population mean $E(X)$ is not known and is replaced by the sample mean \bar{x} .

Note: You can also do the problem with the help of the financial calculator by using the STAT function and using the sample standard deviation.

A is incorrect. The value of 0.0144 might result from a misunderstanding of the formula or

incorrect calculations. It's essential to accurately calculate the mean returns and correctly apply the sample covariance formula, ensuring that the deviations are correctly multiplied and summed before dividing by $n-1$.

C is incorrect. It's crucial to follow the sample covariance formula accurately, including the use of $n-1$ in the denominator to account for the estimation of the population parameter from a sample.

CFA Level I, Portfolio Management, Learning Module 1: Portfolio Risk & Return: Part I.
LOS (d): Calculate and interpret the mean, variance, and covariance (or correlation) of asset returns based on historical data.

Q.2845 A fund manager is constructing a portfolio consisting of two stocks. Which of the following equations can the manager use to calculate the correlation coefficient if the covariance is 0.0168, the standard deviation of stock A is 0.125 and the standard deviation of stock B is 0.2?

A. $0.0168/(0.125 \times 0.2)^2$

B. $0.0168/(0.125 \times 0.2)$

C. $0.0168/(0.125^2 \times 0.2^2)$

The correct answer is **B**.

$$\text{Correlation} = \frac{\text{Covariance}}{(\text{Standard deviation A} \times \text{Standard deviation B})}$$

$$\text{Correlation} = \frac{0.0168}{(0.125 \times 0.2)}$$

A is incorrect. It suggests squaring the product of the standard deviations in the denominator, which is not how the correlation coefficient is calculated.

C is incorrect. It suggests squaring each of the standard deviations before multiplying them together in the denominator. Squaring each standard deviation before multiplying would result in a much smaller denominator, which could falsely inflate the perceived strength of the correlation between the two stocks.

CFA Level I, Portfolio Management, Learning Module 1: Portfolio Risk & Return: Part I.
LOS (d): Calculate and interpret the mean, variance, and covariance (or correlation) of asset returns based on historical data.

Q.2846 Hakim Ahmed has recently joined Lampard Investment Inc. He was given the data related to the assets of a portfolio provided in the following table. If the weight of Asset X is 35% and the weight of Asset Z is 65%, then the variance of the portfolio is *closest to*:

Variance Asset X	0.1225
Variance Asset Z	0.3721
Covariance	0.19

- A. 0.3712.
- B. 0.1156.
- C. 0.2587.

The correct answer is **C**.

Portfolio Variance = (Weight of Asset X² × Std. Dev. Asset X²) + (Weight of Asset Z² × Std. Dev. Asset Z²) + (2 × Weight of Asset X × Weight of Asset Z × Covariance)

$$\text{Portfolio Variance} = (0.1225 \times 0.1225) + (0.3721 \times 0.3721) + (2 \times 0.35 \times 0.65 \times 0.19) = 0.2587$$

Note that Variance Asset X = Std. Dev. Asset X²

A is incorrect. The value of 0.3712 might suggest a misunderstanding of how to properly apply the weights of the assets or an incorrect calculation of the portfolio variance.

B is incorrect. The value of 0.1156 significantly underestimates the portfolio variance. Covariance plays a crucial role in determining the portfolio variance, especially in diversified portfolios where the correlation between assets affects the overall risk. Therefore, omitting or miscalculating the impact of covariance can lead to a significant underestimation of portfolio variance.

CFA Level I, Portfolio Management, Learning Module 1: Portfolio Risk & Return: Part I.
LOS (d): Calculate and interpret the mean, variance, and covariance (or correlation) of asset returns based on historical data.

Q.2847 Hakim Ahmed has recently joined Lampard Investment Inc. He has been given data related to the assets of a client's portfolio provided in the following table:

Variance Asset X	0.1225
Variance Asset Z	0.3721
Covariance	0.19

If the weight of Asset X is 35% and the weight of Asset Z is 65%, then the correlation coefficient of the portfolio is *closest to*:

A. 0.8899.

B. 0.0469.

C. 4.168.

The correct answer is **A**.

$$\text{Standard deviation of X} = 0.1225^{1/2} = 0.35$$

$$\text{Standard deviation of Z} = 0.3721^{1/2} = 0.61$$

$$\text{Correlation coefficient} = \frac{\text{Covariance(X,Z)}}{(\text{Standard deviation of X} \times \text{Standard deviation of Z})}$$

$$\text{Correlation coefficient} = \frac{0.19}{(0.35 \times 0.61)} = 0.8899$$

Note: The correlation coefficient does not take into account the weights.

B is incorrect. A correlation coefficient of 0.0469 would indicate a very weak correlation between the two assets, which does not align with the calculated value of 0.8899. The correlation coefficient measures the strength and direction of a linear relationship between two variables, and a value close to 0 suggests no linear correlation. This is not the case here, as the calculation shows a strong positive correlation.

C is incorrect. A correlation coefficient of 4.168 is not possible. The range of a correlation coefficient is between -1 and 1, where 1 indicates a perfect positive linear correlation, -1 indicates a perfect negative linear correlation, and 0 indicates no linear correlation. A value of 4.168 falls outside this range, indicating a misunderstanding of the correlation coefficient's properties.

CFA Level I, Portfolio Management, Learning Module 1: Portfolio Risk & Return: Part I.
LOS (d): Calculate and interpret the mean, variance, and covariance (or correlation) of asset returns based on historical data.

Q.2848 Which of the following is the most appropriate formula for the variance of a portfolio of two assets if the assets are perfectly correlated?

- A. Portfolio Variance = (Weight of Asset 1² + Weight of Asset 2²) * Std. Dev. Asset 1 or 2
- B. Portfolio Variance = (Weight of Asset 1 * Std. Dev. Asset 1 + Weight of Asset 2 * Std. Dev. Asset 2)²
- C. Portfolio Variance = (Weight of Asset 1² * Std. Dev. Asset 1²) + (Weight of Asset 2² * Std. Dev. Asset 2²)

The correct answer is **B**.

The formula for the variance of a portfolio of two assets with a correlation of +1 (or perfect correlation) is:

$$(\text{Weight of Asset 1} \times \text{Std. Dev. Asset 1} + \text{Weight of Asset 2} \times \text{Std. Dev. Asset 2})^2$$

A is incorrect. It suggests a formula that does not account for the correlation between the assets. The formula $(\text{Weight of Asset 1}^2 + \text{Weight of Asset 2}^2) \times \text{Std. Dev. Asset 1 or 2}$ would only be applicable if the assets were perfectly uncorrelated (correlation coefficient of 0), which is not the case here. This formula underestimates the portfolio variance by ignoring the covariance between the assets, which is a critical component in the calculation of portfolio variance, especially under perfect correlation.

C is incorrect. It represents the formula for calculating the portfolio variance without considering the correlation between the assets. The formula $(\text{Weight of Asset 1}^2 \times \text{Std. Dev. Asset 1}^2) + (\text{Weight of Asset 2}^2 \times \text{Std. Dev. Asset 2}^2)$ is used when the assets are uncorrelated. This formula fails to incorporate the covariance between the assets, which is essential for accurately determining the portfolio's variance when the assets are perfectly correlated. In the context of perfect correlation, omitting the covariance leads to a significant underestimation of the portfolio's risk.

CFA Level I, Portfolio Management, Learning Module 1: Portfolio Risk & Return: Part I.
LOS (d): Calculate and interpret the mean, variance, and covariance (or correlation) of asset returns based on historical data.

Q.4836 What does the capital allocation line (CAL) represent when a risk-free asset is combined with a portfolio of risky assets?

- A. The set of portfolios that minimizes the risk for a given level of return.
- B. The set of portfolios that maximizes the return for a given level of risk.
- C. The set of portfolios that offer the same return as the risk-free asset.

The correct answer is **B**.

The capital allocation line (CAL) represents the set of portfolios that maximizes the return for a given level of risk. When a risk-free asset is combined with a portfolio of risky assets, the resulting CAL illustrates the opportunity for investors to choose a superior risk-return trade-off compared to investing in risky assets alone. The slope of the CAL represents the reward-to-variability ratio.

A is incorrect. The efficient frontier, not the CAL, represents the set of portfolios that minimizes risk for a given level of return.

C is incorrect. The CAL actually offers a continuum of return possibilities based on the different combinations of the risk-free asset and the portfolio of risky assets, not just the return of the risk-free asset.

CFA Level I, Topic 3 - Portfolio Management, Learning Module:1, Portfolio Risk and return: Part I, LOS (c) Explain the selection of an optimal portfolio, given an investor's utility (or risk aversion) and the capital allocation line.

Q.4837 What is the implication of combining investments that are not perfectly correlated in a portfolio?

- A. The portfolio's overall risk increases.
- B. The portfolio's overall risk cannot change.
- C. The portfolio's overall risk can decrease due to diversification.

The correct answer is **C**.

The portfolio's overall risk can decrease due to diversification when combining investments that are not perfectly correlated. This characteristic is due to the fact that the investments may respond differently to various economic events, and their potential negative returns can offset each other, thereby reducing overall volatility.

A is incorrect. The combination of non-perfectly correlated investments can lower, not increase, the portfolio's risk.

B is incorrect. The portfolio's risk can change, and it can decrease due to diversification benefits.

CFA Level I, Topic 3 - Portfolio Management, Learning Module:1, Portfolio Risk and return: Part I, LOS (b) Explain risk aversion and its implications for portfolio selection.

Q.4838 What risk-return characteristics of a portfolio of N risky assets are given by the following equations $E(R_p) = \sum_{i=1}^N w_i E(R_i)$ and $\sigma_p^2 = (\sum_{i=1}^N \sum_{j=1}^N w_i w_j \text{Cov}(ij))$?

- A. Expected return and variance of the portfolio.
- B. Standard deviation and covariance of the portfolio.
- C. Beta coefficient and alpha of the portfolio.

The correct answer is **A**.

The equations $E(R_p) = \sum_{i=1}^N w_i E(R_i)$ for expected return and $\sigma_p^2 = (\sum_{i=1}^N \sum_{j=1}^N w_i w_j \text{Cov}(ij))$ for variance represent the risk-return characteristics of a portfolio composed of N risky assets. Here, w_i is the weight of the i th asset in the portfolio, $E(R_i)$ is the expected return of the i th asset, and $\text{Cov}(ij)$ is the covariance between the returns of assets i and j .

B is incorrect. The standard deviation of the portfolio is the square root of the variance, not directly given by the equation. Covariance is part of the variance calculation.

C is incorrect. Beta coefficient and alpha are measures used in the Capital Asset Pricing Model (CAPM) and are not represented by these equations.

CFA Level I, Topic 3 - Portfolio Management, Learning Module:1, Portfolio Risk and return: Part I, LOS (e) Calculate and interpret portfolio standard deviation.

Q.4839 Assuming there are two risky assets with a zero correlation between them, if the first asset has a standard deviation of 20% and the second asset has a standard deviation of 10%, what is the *likely effect* on the portfolio standard deviation of increasing the weight in the first asset?

- A. The portfolio standard deviation will likely decrease.
- B. The portfolio standard deviation will likely increase.
- C. The portfolio standard deviation will likely remain unchanged.

The correct answer is **B**.

The portfolio standard deviation will likely increase when the weight of the first asset with a higher standard deviation (20%) is increased, assuming a zero correlation between the two assets. This is because a greater weight in the asset with higher volatility will generally increase the overall portfolio risk.

A is incorrect. The portfolio's standard deviation typically increases when the weight of the higher risk asset is increased, not decrease.

C is incorrect. Changing the weights of the assets in the portfolio will change the overall portfolio standard deviation.

CFA Level I, Topic 3 - Portfolio Management, Learning Module:1, Portfolio Risk and return: Part I, LOS (e) Calculate and interpret portfolio standard deviation.

Q.4840 When combining a risk-free asset with a portfolio of risky assets, which type of investors are *most likely* to invest a larger proportion of their wealth in the risk-free asset?

- A. Investors seeking to maximize returns regardless of risk.
- B. Highly risk-averse investors.
- C. Investors who are indifferent to the level of risk.

The correct answer is **B**.

Highly risk-averse investors are most likely to invest a larger proportion of their wealth in the risk-free asset. These investors seek to minimize their exposure to risk and are content with the lower returns provided by risk-free assets relative to riskier investments.

A is incorrect. Investors seeking to maximize returns regardless of risk will be more inclined to invest more in risky assets to gain higher returns.

C is incorrect. Investors who are indifferent to the level of risk are likely to invest in a mix of risk-free and risky assets based on other considerations, rather than favor the risk-free asset exclusively.

CFA Level I, Topic 3 - Portfolio Management, Learning Module:1, Portfolio Risk and Return: Part I, LOS (b) Explain risk aversion and its implications for portfolio selection.

Q.4841 Which of the following measures is *most appropriate* for evaluating the performance of a portfolio considering both risk and return?

- A. Standard deviation of the portfolio.
- B. The Sharpe ratio.
- C. The nominal interest rate

The correct answer is **B**.

The Sharpe ratio is most appropriate for evaluating the performance of a portfolio considering both risk and return. It is a risk-adjusted measure of return that assesses how well the excess return of an investment compensates the investor for the risk taken, relative to a risk-free rate.

A is incorrect. The standard deviation of the portfolio only measures the risk associated with the portfolio and does not consider returns.

C is incorrect. The nominal interest rate does not take into account the risk of investments; it is just a baseline rate of interest without adjustments for inflation or other factors.

CFA Level I, Topic 3 - Portfolio Management, Learning Module:1, Portfolio Risk and return: Part I, LOS (e) Calculate and interpret portfolio standard deviation.

Q.4842 If an investor wishes to create a leveraged portfolio by combining a risk-free asset with risky assets, what is the expected outcome concerning risk and return?

- A. Both risk and return would decrease.
- B. Both risk and return would increase.
- C. Risk would decrease, and return would increase.

The correct answer is **B**.

Both risk and return would increase. A leveraged portfolio involves investing borrowed funds in addition to the investor's own funds, effectively increasing the amount invested in risky assets. This strategy can amplify both the potential returns and the risks associated with the portfolio.

A is incorrect. Leveraging increases both risk and return, not decrease them.

C is incorrect. Leveraging increases risk; it does not decrease it. The potential return increases as well due to higher exposure to risky assets.

CFA Level I, Topic 3 - Portfolio Management, Learning Module:1, Portfolio Risk and return: Part I, LOS (b) Explain risk aversion and its implications for portfolio selection.

Q.4843 What does the capital market line (CML) represent in the context of capital market theory?

- A. The relationship between the expected return of all possible portfolios and their standard deviations.
- B. The relationship between the risk-free rate and the expected market return.
- C. The trade-off between risk and return for portfolios that include all available risky assets.

The correct answer is **C**.

The capital market line (CML) represents the trade-off between risk and return for portfolios that include all available risky assets. It signifies the expected return of efficient portfolios, those that offer the highest expected return for a given level of risk.

A is incorrect. The CML does not represent the expected return of all possible portfolios, only those that are efficient.

B is incorrect. The CML depicts the relationship between portfolio expected return and portfolio total risk (standard deviation) rather than just the risk-free rate and expected market return.

CFA Level I, Topic 3 - Portfolio Management, Learning Module:1, Portfolio Risk and return: Part I, LOS (c) Explain the selection of an optimal portfolio, given an investor's utility (or risk aversion) and the capital allocation line.

Q.4844 An investor is considering a portfolio consisting solely of two risky assets, A and B. Asset A has an expected return of 8%, a standard deviation of return of 15%, and makes up 40% of the portfolio. Asset B has an expected return of 12%, a standard deviation of return of 20%, and constitutes the remaining 60% of the portfolio. If the correlation coefficient between the returns of Asset A and Asset B is 0.3, what is the expected return of the portfolio $E(R_p)$?

- A. 9.6%
- B. 10.4%
- C. 11.2%

The correct answer is **B**.

To calculate the expected return of the portfolio $E(R_p)$, we use the following formula:

$$E(R_p) = w_A \times E(R_A) + w_B \times E(R_B)$$

where,

w_A and w_B are the weights of Asset A and Asset B in the portfolio, respectively. Plug the numbers into the formula:

$$E(R_p) = 0.4 \times 0.08 + 0.6 \times 0.12$$

Now, calculate the expected return:

$$E(R_p) = 0.032 + 0.072 = 0.104, \text{ or, } 10.4\%$$

A is incorrect. 9.6% does not represent the correct weighting of the expected returns of the assets.

C is incorrect. 11.2% is higher than the calculated expected portfolio return.

CFA Level I, Topic 3 - Portfolio Management, Learning Module:1, Portfolio Risk and return: Part I, LOS (a) Describe characteristics of the major asset classes that investors consider in forming portfolios.
