LO.a: Define a random variable, an outcome, an event, mutually exclusive events, and exhaustive events.

1. If events A and B are mutually exclusive, then which of the following is *true*?
   A. P(A|B) = P(A).
   B. P(AB) = P(A) x P(B).
   C. P(A or B) = P(A) + P(B).

LO.b: State the two defining properties of probability and distinguish among empirical, subjective, and a priori probabilities.

2. The probability of any event can be *best* defined as a number between:
   A. negative one and positive one.
   B. zero and positive infinity.
   C. zero and positive one.

3. If an analyst estimates the probability of a stock earning at least the 5-year market average return using relative frequency from historical data, then the resulting probability is *best* known as:
   A. a priori.
   B. empirical.
   C. subjective.

4. An event is equally likely to occur in any month this year. The probability of the event occurring is *best* known as:
   A. a priori.
   B. empirical.
   C. subjective.

5. Which of the following is *most likely* a subjective probability?
   A. The probability that KSE 100 index will outperform LSE 100 index over a 5 year period.
   B. The probability of a particular outcome when only five possible outcomes exist.
   C. The probability of Kay Electronics going bankrupt changes after adjusting it to the reduced confidence in electronics' companies.

6. Which of the following types of probabilities is *most likely* based on logical analysis?
   A. An empirical probability.
   B. A priori probability.
   C. A subjective probability.

LO.c: State the probability of an event in terms of odds for and against the event.

7. The probabilities of earning returns are as follows:

Probability	**Return**

0.20	15%
0.20	20%
0.20	7%
0.20	12%
0.20	13%

What are the odds of earning *at least* 15%?
A. 2 to 3.
B. 3 to 2.
C. 2 to 5.

8. The odds for a company's share price to fall below $45 are 1 to 5. The probability of the event occurring is *closest* to:
A. 0.17.
B. 0.20.
C. 0.83.

LO.d: Distinguish between unconditional and conditional probabilities.

9. An analyst estimates the probability of a stock earning at least a risk-free rate given that the overall portfolio does not give negative returns. This probability is *best* described as:
A. a priori.
B. conditional.
C. marginal.

10. Consider two independent events, A and B, with unequal probabilities (i.e. $P(A) \neq P(B)$), then the probability of event A given that event B has occurred (i.e., $P(A \mid B)$) is *best* described as:
A. P(A).
B. P(B).
C. $P(B \mid A)$.

LO.e: Explain the multiplication, addition, and total probability rules.

11. A and B are independent events. P(AB), the joint probability of events A and B is *best* denoted by:
A. P(A).
B. P(A) + P(B).
C. P(A) * P(B).

12. Irfanullah & Co. has issued two callable bonds with a maturity of 2 and 5 years respectively. The probability that Bond A will be called is 60% and the probability that Bond B will be called is 50%. The probability that at least one of the bonds will be called is *closest* to:

A. 0.8.
B. 0.3.
C. 0.83.

13. The probability of stock A going up is 0.6 and the probability of Stock B going up is 0.2. The probability that both stocks will go up is 0.15. What is the probability that Stock A will go up *or* Stock B will go up *or* both will go up?
A. 0.12.
B. 0.65.
C. 0.95.

14. The probability of an above average economic growth for a country is 0.35. The probability that GE stock will appreciate given the above average economic growth is 0.60. The joint probability of an above average economic growth and appreciation of GE stock is *closest* to:
A. 0.21.
B. 0.60.
C. 0.95.

LO.f: Calculate and interpret 1) the joint probability of two events, 2) the probability that at least one of two events will occur, given the probability of each and the joint probability of the two events, and 3) a joint probability of any number of independent events.

15. A fund manager has noted that during the past five years 70 percent of the stocks in her portfolio have paid a cash dividend and 20 percent of the stocks have paid a stock dividend. If 80 percent of the stocks have paid a dividend of any kind, the joint probability of a stock paying a cash dividend and a stock dividend is *closest* to:
A. 10%.
B. 15%.
C. 20%.

16. The probability of event A is 50%. The probability of event B is 20%. The joint probability of AB is 5%. The probability that A or B occurs or both occur is *closest* to:
A. 65%.
B. 70%.
C. 75%.

17. A and B are two independent events. The probability of event A is 0.5 and the probability of event B is 0.4. The joint probability of A and B is *closest* to:
A. 0.2.
B. 0.7.
C. 0.9.

18. From the past records of Irfanullah Financial Training, the passing rates for Level I exam and CTP exam have been 70% and 60% respectively. Analysis indicates that among the people

who have passed CTP, 50% have also passed CFA Level I. What is the passing rate of CTP among people who have also passed CFA Level I before?

A. 58.3%.
B. 42.9%.
C. 84%.

19. A company has two bottle producing machines, one old and one new. The older machine produces 10% defective bottles, whereas the new machine produces 4% defective bottles only. Additionally, the new machine uses latest technology to produce 5 times as many bottles as the older machine. Given that the bottle was produced by the new machine, what is the probability that it is *not* defective?

A. 0.864.
B. 0.96.
C. 0.192.

LO.g: Distinguish between dependent and independent events.

20. A and B are independent events. Which of the following conditions is *least likely* true regarding the probability of the independent events?

A. P(A|B) = P(A).
B. P(AB) = P(A) P(B).
C. P(AB) = 0.

21. Which of the following statements about dependent and independent events is *most likely* true?

A. P(A)P(B) is used to determine the joint probability of the two events, A and B, whether they are dependent or independent.
B. P(A)P(B) is used to determine the joint probability of the two events, A and B, that are independent.
C. The two events are independent if the occurrence of one event is related to the occurrence of the other.

22. Two events, A and B, are independent. Given that $P(A) \neq P(B)$, the probability of $P(A \mid B)$ is *most likely*:

A. P(B).
B. $P(B \mid A)$.
C. P(A).

LO.h: Calculate and interpret an unconditional probability using the total probability rule.

23. An analyst is analyzing the prospects of survival of ShopKart, an e-commerce retailer over the next six months. The retailer's survival depends on the growth in customer base. The

analyst assigns probabilities to three possible scenarios and estimates the probability of closing down for each of them.

Scenario	Probability of scenario	Probability of closing down
Decrease in customer base	30%	60%
Maintaining the customer base	50%	30%
Increase in customer base	20%	10%

Based on the analyst's estimates, the probability that ShopKart will not close down in the next six months is *closest* to:

A. 35%.
B. 65%.
C. 72%.

24. Which of the following is used to determine the unconditional probability, given conditional probabilities?
A. Total probability rule.
B. Multiplication rule.
C. Addition rule.

LO.i: Explain the use of conditional expectation in investment applications.

25. Conditional expectation is *least likely* used in investments to determine which of the following?
A. Expected value of EPS if interest rates increase.
B. Sample mean of EPS.
C. Variance of EPS given different scenarios.

LO.j: Explain the use of a tree diagram to represent an investment problem.

26. The probability that a stock's price will change is 0.6 versus a probability of 0.4 that the stock price will not change. If there is a change, the probability of a price increase is 0.4 and the probability of a price decrease is 0.6. The unconditional probability of a price decrease is:
A. 0.24
B. 0.36
C. 0.40

LO.k: Calculate and interpret covariance and correlation.

27. Rehan Khan, a fund manager is allocating different securities in his equity fund with an objective to diversify risk. Assuming no short selling, diversification benefit is *most likely* to occur when the correlations among the securities contained in the portfolio are:
A. equal to positive one.

B. greater than positive one.
C. less than positive one.

28. Two companies, Lemon Co. and Demon Co. have the following probability distributions in different economic situations:

Scenario	P(Scenario)	Expected Returns of Lemon Co.	Expected Returns of Demon Co.
Recession	0.25	2%	4%
Normal	0.5	8%	10%
Boom	0.25	12%	16%

The covariance of the expected returns for Lemon Co. and Demon Co. is *closest* to:
A. 0.0013.
B. 0.0014.
C. 0.0015.

29. Using the same data as in the previous question, the correlation coefficient of Lemon Co. and Demon Co. *is closest* to:
A. 0.34.
B. 0.99.
C. 0.55.

30. Professor Irfanullah comes across the following three statements made by his students.
- Fatima: Covariance lies within the range -1 < Covariance < +1
- Taimour: The covariance of a stock with itself is equal to its own variance.
- Vishal: The covariance of returns is negative when the return of one asset is above its expected value given that the return on the other asset tends to be below its expected value.

The statements made by which of the students are *most likely* correct?
A. Fatima and Taimour.
B. Fatima and Vishal.
C. Taimour and Vishal.

31. A portfolio will *least likely* benefit from diversification when the correlation between its securities is:
A. 0.0.
B. 0.5.
C. 1.0.

32. The covariance matrix for a portfolio is given below.

Security	A	B
A	480	140
B	140	600

The correlation for the portfolio is *closest* to:

A. 0.26.
B. 0.36.
C. 0.46.

LO.l: Calculate and interpret the expected value, variance, and standard deviation of a random variable and of returns on a portfolio.

33. A portfolio manager had invested a total amount of $300,000 in stocks and fixed income instruments at the start of the year. Equity investments represented 60% of the portfolio and generated year-end return of 35%, whereas the fixed income instruments yielded 15%. The correlation of stock returns with fixed income instruments' returns was found to be 20%. Based on the given data, the portfolio return would be *closest* to:

A. 16.7%.
B. 22.2%.
C. 27.0%.

34. Ali, a CFA candidate, is evaluating a portfolio, which is composed of Fund A and Fund B. He has collected the following information:

	Fund A	Fund B
Portfolio weights (%)	45	55
Expected returns (%)	23	13
Standard deviations (%)	14	6
Correlation between the returns of Fund X and Fund Y	0.7	

The portfolio standard deviation of the returns is *closest* to:

A. 9.50%.
B. 8.90%.
C. 6.00%.

35. The table below shows information on two portfolios:

	Fund A	Fund B
Portfolio weights (%)	45	55
Expected returns (%)	14	18
Standard deviations (%)	25	32
Correlation between the returns of Fund A and Fund B	0.85	

The portfolio standard deviation of returns is *closet* to:

A. 17%.
B. 28%.
C. 35%.

36. The table below shows weighting and returns of different asset classes comprising a portfolio:

Asset class	Asset allocation (weight) (%)	Asset class return (%)	Correlation with equities class (%)
Equities	65	22	100
Bonds	30	8	30
Cash and equivalents	5	1	25

Based on the data given in the table, the portfolio return is *closest* to:
A. 14.50%.
B. 16.75%.
C. 31.00%.

37. Arvind Roy currently has two stocks in his portfolio. 30% is invested in Gala Cement and the remainder is invested in Aqua Fertilizer. The two stocks have been performing quite well over the years with expected returns and standard deviations as follows:

Company	Expected Return	Standard Deviation
Gala Cement	10%	8%
Aqua Fertilizer	17%	20%

The covariance between these two stocks is 0.005. Arvind is considering adding another stock, Teragon Foods. Teragon Foods has a correlation coefficient of 0.4 with the current portfolio. Which of the following statements is *least* accurate?
A. The expected return on the portfolio is 14.9%.
B. By adding Teragon's stock, he will reduce his portfolio's systematic risk.
C. The standard deviation of the portfolio is 14.2%.

38. The probability distribution for a company's dividend yield is as follows:

Probability	Dividend Yield
0.40	6.4%
0.20	7.2%
0.15	8.1%
0.25	6.8%

The expected value of the dividend yield is *closest* to:
A. 6.40%.
B. 6.92%.
C. 7.13%.

39. The probability distribution for the rate of return on a project is as follows:

Probability	Rate of Return
0.30	12.4%

0.25	7.2%
0.20	10.8%
0.25	8.6%

The variance for the above distribution is *closest* to:
A. 2.07.
B. 4.28.
C. 9.83.

40. The total cost of producing mugs is given by the equation: C = 2.5Q + 2000, where C is the total cost in dollars, $2.5 is the variable cost per unit, Q is the number of units, and $2000 is the fixed cost. The quantities and the probabilities of producing the respective quantities are given in the table below:

Probability	**Quantity**
0.30	200
0.50	300
0.20	400

The total expected cost of manufacturing mugs is *closest* to:
A. $2,725.
B. $3,525.
C. $4,250.

41. Which of the following equations relating independent random variables is *most likely* correct?
A. E (XY) = E (X) * E (Y).
B. E (XY) = E (X) + E (Y).
C. E (XY) = E (X) + E (Y) – E (X) E (Y).

LO.m: Calculate and interpret covariance given a joint probability function.

42. The joint probabilities for X and Y are P (X=10, Y=5) = 0.3, and P(X=20, Y=8) = 0.7. The covariance of XY is *closest* to:
A. 6.8.
B. 6.5.
C. 6.3.

LO.n: Calculate and interpret an updated probability using Bayes' formula.

43. A researcher is studying the link between exchange rate movements and the discount rate set by the country's bank. He uses historical data to determine that the probability of exchange rate rising or falling over the next month is 63% and 35% respectively, while the probability that the exchange rate stays the same is 2%. Some days later, he receives information that the central bank will increase the discount rate. The researcher estimates that given the new

information regarding discount rates, the probabilities that the central bank will increase the discount rate given the scenarios that exchange rate rises, falls or stays the same are as follows:

- P(increased discount rate| exchange rate increases) = 67%
- P(increased discount rate| exchange rate stays same) = 9%
- P(increased discount rate| exchange rate decreases) = 24%

What is the probability that the exchange rate will fall given the new information that the central bank will increase the discount rate?

A. 24.0%.
B. 50.8%.
C. 16.5%.

44. An analyst has established the following prior probabilities regarding a company's next quarter's earnings per share (EPS) exceeding, equaling, or being below the consensus estimate.

	Prior Probabilities
EPS exceed consensus	15%
EPS equal consensus	40%
EPS less than consensus	45%

Several days before releasing its earnings statement, the company announces an increase in its dividend. Given this information, the analyst revises his opinion regarding the likelihood that the company's EPS will be below the consensus estimate. He estimates the likelihood of the company increasing the dividend given that EPS exceed/meet/fall below consensus as reported below:

		Probabilities the company increases dividends conditional on EPS exceeding/equaling/falling below consensus
P(increase div	EPS exceed)	75%
P(increase div	EPS equal)	20%
P(increase div	EPS below)	5%

Using Bayes' formula, the updated (posterior) probability that the company's EPS will be below the consensus given that the dividend has increased is *closest* to:

A. 10.47%.
B. 24.36%.
C. 29.45%.

45. Finnish Mortgage Holding Company estimated that about 5 percent of its mortgage holders default. Out of those who default, 80 percent of them make payments a month late as compared to 60 percent of those who do not default. The probability that a mortgage with late payments will default is *closest* to:

A. 0.04.

B. 0.07.
C. 0.20.

46. ABC Juices Limited has outlets in the city as well as the suburbs. 60% of the people live in the city, while the rest live in the suburbs. ABC's juices are consumed by 50% of the people in the city and 25% of those in the suburbs. The probability that a person chosen at random lives in the city given that he consumes ABC Juices is *closest* to:
A. 0.25.
B. 0.50.
C. 0.75.

47. The probability of boom is 60% and the probability of recession is 40% for the economy of Lorekia. If Lorekia's economy is in a boom, the probability of Stock LMN outperforming is 85%, and the probability of the stock underperforming is 15%. On the other hand, during a recession, there is a 20% probability that Stock LMN will outperform and an 80% probability that it will underperform. The probability of the economy being in a recession, given that LMN is outperforming is *closest* to:
A. 0.14.
B. 0.20.
C. 0.27.

LO.o: Identify the most appropriate method to solve a particular counting problem, and solve counting problems using factorial, combination, and permutation concepts.

48. The number of ways we can choose r objects from a total of n objects, when the order in which the r objects are listed does matter is given by the permutation formula:
$_nP_r = n!/(n - r)!$
How many permutations are possible when choosing 3 objects from a total of 9 objects?
A. 84.
B. 210.
C. 504.

49. An investor is considering investing in 8 bonds. According to a new investment policy of a company, an investor can invest in 3 bonds graded AAA, 3 bonds graded AA and 2 graded A. The investor can choose this combination from a pool of 30 bonds available in market. Of the 30 bonds 10 are AAA, 10 are AA and 10 are A. How many different ways are possible for an investor to invest considering the new policy?
A. 560.
B. 648,00.
C. 46,656,000.

50. The number of ways in which three stocks can be sold from a total of 12 stocks, when the order in which the stocks are sold matters, is *most likely*:
A. 144.

B. 1320.
C. 1728.

51. Which of the following methods will you *most likely* use to count the number of ways for a certain event when the order matters?
A. Combination.
B. Labeling.
C. Permutation.

52. The number of ways to select 15 stocks from a universe of 60 stocks, given that the order does not matter, is *most likely*:
A. 4.
B. 5.
C. 7.

53. Vicky Walters has to conduct a series of tasks in order to complete her research project. The first task can be done in 6 different ways, the second one in 2 different ways, and the final task in 2 different ways. The total number of ways in which Walters can carry out all three tasks is *most likely*:
A. 10.
B. 24.
C. 180.

Solutions

1. C is correct. Mutually exclusive events are those events which cannot happen together, i.e. there is no intersection between the two events. Therefore, both P (A|B) and P (AB) must be equal to zero.

2. C is correct. The two defining properties of a probability are as follows:
   - The probability of any event, E, is a number between 0 and 1.
   - The sum of the probabilities of any set of mutually exclusive and exhaustive events equals one.

3. B is correct. An empirical probability is "a probability estimated from data as a relative frequency of occurrence."

4. A is correct. A probability obtained based on logical analysis is a priori probability.

5. C is correct.
   Empirical: it is based on past data.
   A Priori: it is based on logical reasoning.
   Subjective: it is based on personal judgment.

6. B is correct. A priori probability is based on logical analysis, an empirical probability on historical data, and a subjective probability on personal or subjective judgment.

7. A is correct. The odds of an event can be determined by dividing the probability of the event occurring by the probability of the event not occurring. As a formula this can be expressed as: P(E) / (1 – P(E)). In this case the probability of the event (earning at least 15%) is 0.20 + 0.20 which 0.40. The probability of the event not occurring (earning less than 15%) is 0.20 + 0.20 + 0.20 = 0.60. Hence the odds are 0.40/0.60 = 2/3. This can also be written as 2 to 3.

8. A is correct. The probability of an event occurring given the odds for it is calculated as follows:
   Probability of E given odds of a to b $= \frac{a}{a+b} = \frac{1}{1+5} \approx 0.17$.

9. B is correct. A probability of an event given (conditioned on) another event is a conditional probability.

10. A is correct. Two events, A and B, are independent if and only if P(A | B) = P(A) or, equivalently, P(B | A) = P(B). The wording of the question precludes P(A) = P(B); therefore, responses B and C cannot be correct.

11. C is correct. According to the multiplication rule of probabilities, the joint probability of A and B can be expressed as:
    $P(AB) = P(A|B) * P(B)$

It is given that A and B are independent events and hence P(A|B) = P (A).
$P(AB) = P(A) * P(B)$

12. A is correct. The probability that at least one of the bonds will be called can be calculated using the Addition rule of probability which is:
P(A or B) = P(A) + P(B) – P(A and B) where P(A and B) is P(A) * P(B)
$P(\text{A or B}) = 0.6 + 0.5 - 0.6 * 0.5 = 0.8.$

13. B is correct. Whenever *or* is used, use the addition rule for probabilities to calculate the probability of either of the events occurring or that both will occur:
$P(\text{A or B}) = P(A) + P(B) - P(AB)$
$P(\text{A or B}) = 0.6 + 0.2 - 0.15 = 0.65.$

14. A is correct. The joint probability can be computed using the multiplication rule:
P (AB) = P(A | B) P(B) where P(A | B) is the conditional probability of A given that B has occurred. If, A refers to the probability that that GE stock will appreciate and B refers to the probability that the economic growth will be above average, then the joint probability is: 0.60 * 0.35 = 0.21.

15. A is correct. The probability that at least one of two events will occur is the sum of the probabilities of the separate events less the joint probability of the two events.
$P(\text{A or B}) = P(A) + P(B) - P(AB)$
$80\% = 70\% + 20\% - P(AB)$; therefore, $P(AB) = 10\%$.

16. A is correct. $P(\text{A or B}) = P(A) + P(B) - P(AB) = 50 + 20 - 5 = 65\%$.

17. A is correct. A and B are two independent events, their joint probability is equal to the product of their individual probabilities, so joint probability = 0.5 × 0.4 = 0.2.

18. B is correct. Data given in the question:
$P(CFA) = 70\%,\ P(CTP) = 60\%,\quad P(CFA \mid CTP) = 50\%, P(CTP \mid CFA) = ?$
$P(CTP \mid CFA) = P(CTP\ CFA)/P(CFA)$
We have to find the passing rate of CTP giving members who have passed the CFA exams as well.
$P(\text{CFA and CTP}) = P(CTP\ CFA) = P(CFA \mid CTP) * P(CTP) = 0.5 * 0.6 = 0.3$
$P(CTP \mid CFA) = P(\text{CTP and CFA})/P(CFA) = 0.3/0.7 = 0.428$ or 42.8%.

19. B is correct. The question is asking for the probability of a bottle produced by the new machine which is not defective. In the question, the probability of defective is given as 4% and therefore, the probability of not defective will be $1 - 0.04 = 0.96$.

20. C is correct. Note that A and B are independent events, and not mutually exclusive events. It is possible that both the independent events occur. Hence, the joint probability, P (AB) is not necessarily 0. Options A and B are correct for independent events.

21. B is correct. The multiplication rule is applied only when the two events A and B are independent.

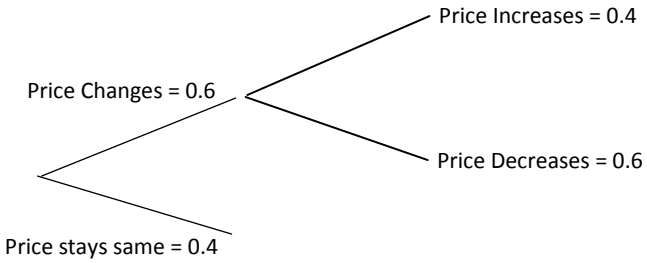
22. C is correct. Since the events are independent, P(A|B) = P(A) and P(B|A) = P(B).

23. B is correct. Using the total probability rule, the unconditional probability of closing down is given by:
$(0.3)(0.6) + (0.5)(0.3) + (0.2)(0.1) = 0.35$
The probability that ShopKart will not close down is,
$1 - 0.35 = 0.65 = 65\%.$

24. A is correct. The total probability rule is used to determine the unconditional probability, given conditional probabilities.

25. B is correct. With Option A we are considering the expected value of EPS if interest rates increase. This requires the use of conditional probability. Option C has the term 'different scenarios' which implies the use of conditional probabilities.

26. B is correct. Consider the tree diagram below:



The probability of a price decrease is equal to the probability of a price change times the probability of a decrease given a change = 0.6 * 0.6 = 0.36.

27. C is correct. Diversification benefit requires correlations less than positive one.

28. C is correct. The formula for solving covariance is:

$$\text{Cov}[X, Y] = \sum_{(x,y)eR_{XY}} (x - E[X])(y - E[Y])P_{XY(x,y)}$$

$E[X] = (2\% * 0.25) + (8\% * 0.5) + (12\% * 0.25) = 7.5\%$
$E[Y] = (4\% * 0.25) + (10\% * 0.5) + (16\% * 0.25) = 10\%$
$\text{Cov}[XY] = 0.25(2\% - 7.5\%)(4\% - 10\%) + 0.5(8\% - 7.5\%)(10\% - 10\%) + 0.25(12\% - 7.5\%)(16\% - 10\%)$
$= 0.000825 + 0 + 0.000675 = 0.0015.$

29. B is correct. The formula for Correlation Coefficient is:
r = (Covariance between X, Y)/(Sample standard deviation of X) ∗ (Sample std. dev. of Y)

$= \sqrt{0.25(2\% - 7.5\%)^2 + 0.5(8\% - 7.5\%)^2 + 0.25(12\% - 7.5\%)^2} = 0.035707$

$= \sqrt{0.25(4\% - 10\%)^2 + 0.5(10\% - 10\%)^2 + 0.25(16\% - 10\%)^2} = 0.042426$

$\text{Cov}[XY] = \frac{0.0015}{0.035707 * 0.042426} = 0.99.$

30. C is correct. Fatima is incorrect because covariance may range from negative infinity to positive infinity. Taimour and Vishal are correct.

31. C is correct. The correlation of 1.0 signifies that the securities are perfectly positively correlated; it implies that they will move in the same direction so the portfolio cannot benefit from diversification.

32. A is correct.
Standard Deviation of A = $\sqrt{480} = 21.91$
Standard Deviation of B = $\sqrt{600} = 24.49$
$\text{Correlation} = \frac{\text{Covariance}}{\text{Standard deviation of A} * \text{Standard deviation of B}} = \frac{140}{21.91 * 24.49} = 0.26.$

33. C is correct.
The total portfolio return is calculated as the weighted average return of the portfolio constituents.
$\text{Portfolio return} = (0.6 * 0.35) + (0.4 * 0.15) = 0.27 = 27.0\%.$

34. B is correct. The portfolio standard deviation of the returns is calculated through following formula:

$\sigma(R_{\text{Portfolio}}) = \sqrt[2]{W_A^2\sigma^2(R_A) + W_B^2\sigma^2(R_B) + 2W_A W_B \text{Cov}(R_A, R_B)}$

And covariance is calculated through following formula:

$\text{Cov}(R_A R_B) = \rho(R_A R_B)\sigma(R_A)\sigma(R_B)$

First calculate the covariance, $\text{Cov} = 0.7 * .14 * .06 = 0.00588$, then enter values in the formula 1 for calculating portfolio standard deviation, you should get portfolio standard deviation = 8.90%.

35. B is correct. Calculate the portfolio standard deviation of returns as follows:
$\sqrt{(.45^2 * 25^2 + .55^2 * .32^2 + 2 * .45 * .55 * .85 * .25 * .32)} = 0.28.$

36. B is correct. The portfolio return is the weighted mean return and is calculated as:

$0.65 * 22 + 0.30 * 8 + 0.05 * 1 = 16.75.$

37. B is correct. Systematic risk cannot be reduced.

38. B is correct. The expected value of the dividend yield is the sum of the probability-weighted average of the dividend yields whose formula is given by:

$$E(X) = \sum_{i=1}^{n} P(X_i)X_i$$

$E(X) = (0.4 * 6.4) + (0.2 * 7.2) + (0.15 * 8.1) + (0.25 * 6.8) = 6.92\%.$

39. B is correct. The formula for variance is as follows:

$$\alpha^2(X) = \sum_{i=1}^{n} P(X_i)[X_i - E(X)]^2$$

$E(X) = (12.4 * 0.3) + (7.2 * 0.25) + (10.8 * 0.2) + (8.6 * 0.25) = 9.83$

$\alpha^2(X) = (0.30)(12.4 - 9.83)^2 + (0.25)(7.2 - 9.83)^2 + (0.20)(10.8 - 9.83)^2 + (0.25)(8.60 - 9.83)^2 = 4.28.$

40. A is correct. First, calculate the expected number of units produced given the probabilities.
$E(Q) = (200 * 0.3) + (300 * 0.5) + (400 * 0.2) = 290$
Use this in the equation to determine the total cost.
Total cost $= 2.5(290) + 2000 = \$2{,}725.$

41. A is correct. The expected value of two independent random variables is the product of their own expected values.

42. C is correct. The joint probabilities in the question are given as follows:

X, Y	**5**	**8**
10	0.3	
20		0.7

$E[X] = 0.3(10) + 0.7(20) = 17$
$E[Y] = 0.3(5) + 0.7(8) = 7.1$
$Cov[XY] = 0.3(10 - 17)(5 - 7.1) + 0.7(20 - 17)(8 - 7.1) = 6.3.$

43. C is correct. According to Bayes' Theorem:
Updated probability of event given the new information

$$= \frac{\text{Probability of new information given event}}{\text{Unconditional probability of new information}} * \text{Prior probability of event}$$

In order to proceed with the given data, we need to calculate the unconditional probability of new information i.e. the probability of an increase in the discount rate.
P (increased discount rate)

= P (increased discount rate| exchange rate increases) ∗ P (exchange rate increases) +
P (increased discount rate| exchange rate stays same) ∗
P (exchange rate stays same) +
P (increased discount rate| exchange rate decreases) ∗ P(exchange rate decreases)
= (0.67 ∗ 0.63) + (0.09 ∗ 0.02) + (0.24 ∗ 0.35)
= 0.5079
= 50.79%

Using the unconditional probability and Bayes' Theorem, we can calculate updated probability of event given the new information about discount rates as:

P (exchange rate decreases| increased discount rate)
= [P (increased discount rate| exchange rate decreases)
÷ P (increased discount rate)] ∗ P (exchange rate decreases)
= (0.24 ÷ 0.5079) ∗ 0.35
= 16.5%.

44. A is correct. First, calculate the unconditional probability for an increase in dividends:

P(Increase div)
= P(Increase div|EPS exceed) ∗ P(EPS exceed) + P(Increase div|EPS equal)
∗ P(EPS equal) + P(Increase div|EPS below) ∗ P(EPS below)
= 0.75 ∗ 0.15 + 0.20 ∗ 0.40 + 0.05 ∗ 0.45 = 0.215

Then update the probability of EPS falling below the consensus as:

$$P(\text{EPS below}|\text{Increase div}) = \left[\frac{P(\text{Increase div}|\text{EPS below})}{P(\text{Increase div})}\right] * P(\text{EPS below})$$

= (0.05 ÷ 0.215) ∗ 0.45 = 0.1047.

45. B is correct. Based on the information presented, Bayes' formula can be applied. The first step is to note down the various probabilities given:

P (Default) = 0.05
P (No default) = 0.95
P (Delayed Payments | Default) = 0.80
P (Timely Payments | Default) = 0.20
P (Delayed Payments | No Default) = 0.60
P (Timely Payments | No Default) = 0.40

$$P(\text{Event} \mid \text{Information}) = \frac{P(\text{Information} \mid \text{Event})}{P(\text{Information})} * P(\text{Event})$$

In this case, 'delayed payments' is the information and 'default' is the event. The formula can be written as.

$$P(\text{Default} \mid \text{Delayed Payments}) = \frac{[P(\text{DelayedPayments}|\text{Default}) * P(\text{Default})]}{\{P(\text{DelayedPayments}|\text{Default}) * P(\text{Default})\} + \{P(\text{DelayedPayments}|\text{NoDefault}) * P(\text{NoDefault})\}}$$

$$P(\text{Default} \mid \text{Delayed Payments}) = \frac{0.80*0.05}{(0.80*0.05)+(0.60*0.95)} = 0.07.$$

46. C is correct. First, note down the various probabilities given in the problem:
P (City) = 0.60
P (Suburbs) = 0.40
P (Consumers | City) = 0.50
P (Consumers | Suburbs) = 0.25

$$\text{P (City | Consumer)} = \frac{[\text{P(Consumer|City)} * \text{P(City)}]}{\{\text{P(Consumer|City)} * \text{P(City)}\} + \{\text{P(Consumer|Suburb)} * \text{P(Suburb)}\}}$$

$$\text{P (City |Consumer)} = \frac{0.50 * 0.60}{(0.50 * 0.60) + (0.25 * 0.40)} = 0.75$$

47. A is correct. First, list the various probabilities given and determine the probability to be calculated:
P (Boom) = 0.60
P (Recession) = 0.40
P (Outperform | Boom) = 0.85
P (Underperform| Boom) = 0.15
P (Outperform | Recession) = 0.20
P (Underperform | Recession) = 0.80
P (Recession| Outperform)

$$= \frac{[\text{P(Outperform|Recession)} * \text{P(Recession)}]}{\{\text{P(Outperform|Recession)} * \text{P(Recession)}\} + \{\text{P(Outperform|Boom)} * \text{P(Boom)}\}}$$

$$\text{P (Recession |Outperform)} = \frac{0.20 * 0.40}{(0.20 * 0.40) + (0.85 * 0.60)} = 0.14$$

48. C is correct. In this problem,
$\frac{9!}{(9-3)!} = \frac{9!}{6!} = 504.$

49. B is correct. The number of ways in which an investor can invest in 3 AAA, 3 AA and 2 A bonds is: ${}_{10}C_3$ x ${}_{10}C_3$ x ${}_{10}C_2$ = 120 x 120 x 45 = 648,000.

50. B is correct. Since the order in which the stocks are sold matters, use the permutation formula:

$$\text{Number of ways} = \frac{n!}{(n-r)!} = \frac{12!}{(12-3)!} = 1320$$

You may also use the nPr function on the calculator. Note that r is the number of stocks to be selected and n is the total number of stocks.

51. C is correct. Permutation is the method used when the order does matter. The order does not matter in combination and labeling.

52. B is correct. Use the combination formula since the order of selection does not matter.

$$\text{Number of ways} = \frac{n!}{r!\,(n-r)!} = \frac{60!}{15!\,(60-15)!} \approx 5$$

You may also use the nCr function on the calculator. Note that r is the number of stocks to be selected and n is the total number of stocks.

53. B is correct. Use the multiplication rule of counting to determine the total number of ways the three tasks can be done. Total number of ways $= 6 * 2 * 2 = 24$.