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SOLUTIONS

- 1 C is correct. Standards of conduct are applied to specific communities or societal groups and identify specific behaviors required of community members. These standards of conduct serve as benchmarks for the minimally acceptable behavior of community members. Codes of ethics serve as a general guide for how community members should act; they communicate the organization's values and overall expectations regarding member behavior, but they do not identify specific behaviors required of community members. Laws and regulations are rules of conduct defined by governments and related entities about obligatory and forbidden conduct broadly applicable for individuals and entities under their jurisdiction.
- 2 B is correct. A profession has several characteristics that distinguish it from an occupation or vocation, such as specialized knowledge and skills, service to others, and a code of ethics shared by its members. A profession is the ultimate evolution of an occupation, resulting from excellence in practice and expected adherence to a code of ethics and standards of practice.
- 3 A is correct. An overconfidence bias can lead individuals to put too much importance on internal traits and intrinsic motivations, such as their own perceptions of personal honesty, that can lead to faulty decision making. Loyalty to an employer and promise of money or prestige are situational influences that can lead to faulty decision making.
- 4 B is correct. Consciously considering long-term consequences will help offset situational influences. We more easily recognize and consider short-term situational influences than longer-term considerations because longer-term considerations have fewer immediate consequences than situational influences do. When decision making is too narrowly focused on short-term factors, we tend to ignore longer-term risks and consequences, and the likelihood of poor ethical decision making increases. A strong compliance policy is a good first step toward developing an ethical culture; a focus on rules adherence may not be sufficient. Emphasis on compliance may not encourage decision makers to consider the larger picture and can oversimplify decision making. Taken to the extreme, a strong compliance culture can become another situational influence that blinds employees to other important considerations. An overconfidence bias can place too much importance on internal traits and intrinsic motivations, such as "I'm honest and would not lie," even though studies have shown that internal traits are generally not the main determinant of whether or not someone will behave ethically in a given situation.
- 5 B is correct. A compliance approach can oversimplify decision making and may not encourage decision makers to consider the larger picture. A strong compliance culture may be a good start in developing an ethical culture but can become another situational influence that may result in employees failing to consider other important factors.
- 6 C is correct. Unethical behavior ultimately harms investment firms. Clients are not attracted if they suspect unethical behavior, leading to less business and lower revenues. Investment firms may also experience higher relative costs because regulators are more likely to have cause to initiate costly investigations.

- 7 B is correct. The investment industry has examples of conduct that may be legal but that CFA Institute considers unethical. Trading while in possession of material nonpublic information is not prohibited by law worldwide and can, therefore, be legal, but CFA Institute considers such trading unethical.
- 8 C is correct. Using an ethical decision-making framework consistently will help you develop sound judgment and decision-making skills and avoid making decisions that have unanticipated ethical consequences. The decision-making process is often iterative, and the decision maker may move between phases of the framework. A decision maker should consider more than confirmable facts and relationships; for example, the decision maker should consider situational influences and personal biases.

SOLUTIONS

- 1 The correct answer is B. This question involves Standard III(B)–Fair Dealing. Smith disseminated a change in the stock recommendation to his clients but then received a request contrary to that recommendation from a client who probably had not yet received the recommendation. Prior to executing the order, Smith should take additional steps to ensure that the customer has received the change of recommendation. Answer A is incorrect because the client placed the order prior to receiving the recommendation and, therefore, does not have the benefit of Smith’s most recent recommendation. Answer C is also incorrect; simply because the client request is contrary to the firm’s recommendation does not mean a member can override a direct request by a client. After Smith contacts the client to ensure that the client has received the changed recommendation, if the client still wants to place a buy order for the shares, Smith is obligated to comply with the client’s directive.
- 2 The correct answer is C. This question involves Standard III(A)–Loyalty, Prudence, and Care and the specific topic of soft dollars or soft commissions. Answer C is the correct choice because client brokerage commissions may not be directed to pay for the investment manager’s operating expenses. Answer B describes how members and candidates should determine how to use brokerage commissions—that is, if the use is in the best interests of clients and is commensurate with the value of the services provided. Answer A describes a practice that is commonly referred to as “directed brokerage.” Because brokerage is an asset of the client and is used to benefit the client, not the manager, such practice does not violate a duty of loyalty to the client. Members and candidates are obligated in all situations to disclose to clients their practices in the use of client brokerage commissions.
- 3 The correct answer is C. This question involves Standard VI(A)–Disclosure of Conflicts. The question establishes a conflict of interest in which an analyst, Jamison, is asked to write a research report on a company that is a client of the analyst’s employer. In addition, two directors of the company are senior officers of Jamison’s employer. Both facts establish that there are conflicts of interest that must be disclosed by Jamison in her research report. Answer B is incorrect because an analyst is not prevented from writing a report simply because of the special relationship the analyst’s employer has with the company as long as that relationship is disclosed. Answer A is incorrect because whether or not Jamison expresses any opinions in the report is irrelevant to her duty to disclose a conflict of interest. Not expressing opinions does not relieve the analyst of the responsibility to disclose the special relationships between the two companies.
- 4 The correct answer is C. This question asks about compliance procedures relating to personal investments of members and candidates. The statement in answer C clearly conflicts with the recommended procedures in the *Standards of Practice Handbook*. Employers should compare personal transactions of employees with those of clients on a regular basis regardless of the existence of a requirement by any regulatory organization. Such comparisons ensure that employees’ personal trades do not conflict with their duty to their clients, and the comparisons can be conducted in a confidential manner. The statement in answer A does not conflict with the procedures in the *Handbook*. Disclosure of such policies will give full information to clients regarding potential conflicts of interest on the part of those entrusted to manage their money. Answer B is incorrect because firms are encouraged to establish policies whereby employees clear their personal holdings and transactions with their employers.

- 5 The correct answer is B. This question relates to Standard III(A)–Loyalty, Prudence, and Care and Standard III(E)–Preservation of Confidentiality. In this case, the member manages funds of a private endowment. Clients, who are, in this case, the trustees of the fund, must place some trust in members and candidates. Bronson cannot disclose confidential financial information to anyone without the permission of the fund, regardless of whether the disclosure may benefit the fund. Therefore, answer A is incorrect. Answer C is incorrect because Bronson must notify the fund and obtain the fund's permission before publicizing the information.
- 6 The correct answer is C. Under Standard IV(C)–Responsibilities of Supervisors, members and candidates may delegate supervisory duties to subordinates but such delegation does not relieve members or candidates of their supervisory responsibilities. As a result, answer B is incorrect. Moreover, whether or not Miller's subordinates are subject to the Code and Standards is irrelevant to her supervisory responsibilities. Therefore, answer A is incorrect.
- 7 The correct answer is B. This question relates to Standard V(A)–Diligence and Reasonable Basis. The opinion of another financial analyst is not an adequate basis for Willier's action in changing the recommendation. Answer C is thus incorrect. So is answer A because, although it is true that members and candidates must distinguish between facts and opinions in recommendations, the question does not illustrate a violation of that nature. If the opinion overheard by Willier had sparked him to conduct additional research and investigation that justified a change of opinion, then a changed recommendation would be appropriate.
- 8 The correct answer is B. This question relates to Standard I(B)–Independence and Objectivity. When asked to change a recommendation on a company stock to gain business for the firm, the head of the brokerage unit must refuse in order to maintain his independence and objectivity in making recommendations. He must not yield to pressure by the firm's investment banking department. To avoid the appearance of a conflict of interest, the firm should discontinue issuing recommendations about the company. Answer A is incorrect; changing the recommendation in any manner that is contrary to the analyst's opinion violates the duty to maintain independence and objectivity. Answer C is incorrect because merely assigning a new analyst to decide whether the stock deserves a higher rating will not address the conflict of interest.
- 9 The correct answer is A. Standard VII(B)–Reference to CFA Institute, the CFA Designation, and the CFA Program is the subject of this question. The reference on Albert's business card implies that there is a "CFA Level II" designation; Tye merely indicates in promotional material that he is participating in the CFA Program and has completed Levels I and II. Candidates may not imply that there is some sort of partial designation earned after passing a level of the CFA exam. Therefore, Albert has violated Standard VII(B). Candidates may communicate that they are participating in the CFA Program, however, and may state the levels that they have completed. Therefore, Tye has not violated Standard VII(B).
- 10 The correct answer is B. This question relates to Standard V(B)–Communication with Clients and Prospective Clients. Scott has issued a research report stating that he expects the price of Walkton Industries stock to rise by US\$8 a share "because the dividend will increase" by US\$1.50 per share. He has made this statement knowing that the dividend will increase only if Congress enacts certain legislation, an uncertain prospect. By stating that the dividend will increase, Scott failed to separate fact from opinion.

The information regarding passage of legislation is not material nonpublic information because it is conjecture, and the question does not state whether the US representative gave Scott her opinion on the passage of the legislation in confidence. She could have been offering this opinion to anyone who asked. Therefore, statement A is incorrect. It may be acceptable to base a recommendation, in part, on an expectation of future events, even though they may be uncertain. Therefore, answer C is incorrect.

- 11 The correct answer is C. This question, which relates to Standard III(B)–Fair Dealing, tests the knowledge of the procedures that will assist members and candidates in treating clients fairly when making investment recommendations. The step listed in C will help ensure the fair treatment of clients. Answer A may have negative effects on the fair treatment of clients. The more people who know about a pending change, the greater the chance that someone will inform some clients before the information's release. The firm should establish policies that limit the number of people who are aware in advance that a recommendation is to be disseminated. Answer B, distributing recommendations to institutional clients before distributing them to individual accounts, discriminates among clients on the basis of size and class of assets and is a violation of Standard III(B).
- 12 The correct answer is B. This question deals with Standard II(A)–Material Nonpublic Information. The mosaic theory states that an analyst may use material public information and nonmaterial nonpublic information in creating a larger picture than shown by any individual piece of information and the conclusions the analyst reaches become material only after the pieces are assembled. Answers A and C are accurate statements relating to the Code and Standards but do not describe the mosaic theory.
- 13 The correct answer is C. This question involves Standard IV(B)–Additional Compensation Arrangements. The arrangement described in the question—whereby Jurgen would be compensated beyond the compensation provided by her firm, on the basis of an account's performance—is not a violation of the Standards as long as Jurgen discloses the arrangement in writing to her employer and obtains permission from her employer prior to entering into the arrangement. Answers A and B are incorrect; although the private compensation arrangement could conflict with the interests of other clients and lead to short-term performance pressures, members and candidates may enter into such agreements as long as they have disclosed the arrangements to their employer and obtained permission for the arrangement from their employer.
- 14 The correct answer is B. This question relates to Standard III(A)–Loyalty, Prudence, and Care—specifically, a member's or candidate's responsibility for voting proxies and the use of client brokerage. According to the facts stated in the question, Farnsworth did not violate Standard III(A). Although the company president asked Farnsworth to vote the shares of the Jones Corporation profit-sharing plan a certain way, Farnsworth investigated the issue and concluded, independently, the best way to vote. Therefore, even though his decision coincided with the wishes of the company president, Farnsworth is not in violation of his responsibility to be loyal and to provide care to his clients. In this case, the participants and the beneficiaries of the profit-sharing plan are the clients, not the company's management. Had Farnsworth not investigated the issue or had he yielded to the president's wishes and voted for a slate of directors that he had determined was not in the best interest of the company, Farnsworth would have violated his responsibilities to the beneficiaries of the plan. In addition, because the brokerage firm provides the lowest commissions and best execution for securities transactions, Farnsworth has met his obligations to the client.

in using this brokerage firm. It does not matter that the brokerage firm also provides research information that is not useful for the account generating the commission because Farnsworth is not paying extra money of the client's for that information.

- 15 The correct answer is A. In this question, Brown is providing investment recommendations before making inquiries about the client's financial situation, investment experience, or investment objectives. Brown is thus violating Standard III(C)–Suitability. Answers B and C provide examples of information members and candidates should discuss with their clients at the outset of the relationship, but these answers do not constitute a complete list of those factors. Answer A is the best answer.
- 16 The correct answer is C. This question involves Standard I(C)–Misrepresentation. Statement I is a factual statement that discloses to clients and prospects accurate information about the terms of the investment instrument. Statement II, which guarantees a specific rate of return for a mutual fund, is an opinion stated as a fact and, therefore, violates Standard I(C). If statement II were rephrased to include a qualifying statement, such as "in my opinion, investors may earn . . .," it would not be in violation of the Standards.
- 17 The correct answer is A. This question involves three of the Standards. Anderb, the portfolio manager, has been obtaining more favorable prices for her personal securities transactions than she gets for her clients, which is a breach of Standard III(A)–Loyalty, Prudence, and Care. In addition, she violated Standard I(D)–Misconduct by failing to adhere to company policy and by hiding her personal transactions from her firm. Anderb's supervisor, Bates, violated Standard IV(C)–Responsibilities of Supervisors; although the company had requirements for reporting personal trading, Bates failed to adequately enforce those requirements. Answer B does not represent a violation because Standard VI(B)–Priority of Transactions requires that personal trading in a security be conducted after the trading in that security of clients and the employer. The Code and Standards do not prohibit owning such investments, although firms may establish policies that limit the investment opportunities of members and candidates. Answer C does not represent a violation because the Code and Standards do not contain a prohibition against employees using the same broker for their personal accounts that they use for their client accounts. This arrangement should be disclosed to the employer so that the employer may determine whether a conflict of interest exists.
- 18 The correct answer is A because this question relates to Standard I(A)–Knowledge of the Law—specifically, global application of the Code and Standards. Members and candidates who practice in multiple jurisdictions may be subject to various securities laws and regulations. If applicable law is more strict than the requirements of the Code and Standards, members and candidates must adhere to applicable law; otherwise, members and candidates must adhere to the Code and Standards. Therefore, answer A is correct. Answer B is incorrect because members and candidates must adhere to the higher standard set by the Code and Standards if local applicable law is less strict. Answer C is incorrect because when no applicable law exists, members and candidates are required to adhere to the Code and Standards, and the Code and Standards prohibit the use of material nonpublic information.
- 19 The correct answer is B. The best course of action under Standard I(B)–Independence and Objectivity is to avoid a conflict of interest whenever possible. Therefore, for Ward to pay for all his expenses is the correct answer. Answer C details a course of action in which the conflict would be disclosed, but the solution is not as appropriate as avoiding the conflict of interest.

Answer A would not be the best course because it would not remove the appearance of a conflict of interest; even though the report would not be affected by the reimbursement of expenses, it could appear to be.

- 20 The correct answer is B. Under Standard IV(A)–Loyalty, members and candidates may undertake independent practice that may result in compensation or other benefit in competition with their employer as long as they obtain consent from their employer. Answer C is not consistent with the Standards because the Standards allow members and candidates to make arrangements or preparations to go into competitive business as long as those arrangements do not interfere with their duty to their current employer. Answer A is not consistent with the Standards because the Standards do not include a complete prohibition against undertaking independent practice.
- 21 The correct answer is B. This question involves Standard VI(A)–Disclosure of Conflicts—specifically, the holdings of an analyst's employer in company stock. Answers A and C do not describe conflicts of interest that Smith would have to disclose. Answer A describes the use of a firm's products, which would not be a required disclosure. In answer C, the relationship between the analyst and the company through a relative is so tangential that it does not create a conflict of interest necessitating disclosure.
- 22 The correct answer is C. This question relates to Standard I(C)–Misrepresentation. Although Michelieu's statement about the total return of his clients' accounts on average may be technically true, it is misleading because the majority of the gain resulted from one client's large position taken against Michelieu's advice. Therefore, this statement misrepresents the investment performance the member is responsible for. He has not taken steps to present a fair, accurate, and complete presentation of performance. Answer B is thus incorrect. Answer A is incorrect because although Michelieu is not guaranteeing future results, his words are still a misrepresentation of his performance history.
- 23 The correct answer is B. The best policy to prevent violation of Standard II(A)–Material Nonpublic Information is the establishment of firewalls in a firm to prevent exchange of insider information. The physical and informational barrier of a firewall between the investment banking department and the brokerage operation prevents the investment banking department from providing information to analysts on the brokerage side who may be writing recommendations on a company stock. Prohibiting recommendations of the stock of companies that are clients of the investment banking department is an alternative, but answer A states that this prohibition would be permanent, which is not the best answer. Once an offering is complete and the material nonpublic information obtained by the investment banking department becomes public, resuming publishing recommendations on the stock is not a violation of the Code and Standards because the information of the investment banking department no longer gives the brokerage operation an advantage in writing the report. Answer C is incorrect because no exchange of information should be occurring between the investment banking department and the brokerage operation, so monitoring of such exchanges is not an effective compliance procedure for preventing the use of material nonpublic information.
- 24 The correct answer is B. Under Standard III(A)–Loyalty, Prudence, and Care, members and candidates who manage a company's pension fund owe these duties to the participants and beneficiaries of the pension plan, not the management of the company or the company's shareholders.

- 25 The correct answer is B. Answer B gives one of the two primary reasons listed in the *Handbook* for disclosing referral fees to clients under Standard VI(C)–Referral Fees. (The other is to allow clients and employers to evaluate the full cost of the services.) Answer A is incorrect because Standard VI(C) does not require members or candidates to discount their fees when they receive referral fees. Answer C is inconsistent with Standard VI(C) because disclosure of referral fees, to be effective, should be made to prospective clients before entering into a formal client relationship with them.
- 26 The correct answer is B. Standard VI(B)–Priority of Transactions does not limit transactions of company employees that differ from current recommendations as long as the sale does not disadvantage current clients. Thus, answer A is incorrect. Answer C is incorrect because the Standard does not require the matching of personal and client trades.
- 27 Answer C is correct. Standard IV(A)–Loyalty discusses activities permissible to members and candidates when they are leaving their current employer; soliciting clients is strictly prohibited. Thus, answer A is inconsistent with the Code and Standards even with the required disclosure. Answer B is incorrect because the offer does not directly violate the Code and Standards. There may be out-of-work members and candidates who can arrange the necessary commitments without violating the Code and Standards.
- 28 Answer A is correct. The question relates to Standard III(A)–Loyalty, Prudence, and Care. Carter believes the broker offers effective execution at a fee that is comparable with those of other brokers, so he is free to use the broker for all accounts. Answer B is incorrect because the accounts that prohibit soft dollar arrangements do not want to fund the purchase of research by Carter. The new trading scheme does not incur additional commissions from clients, so it would not go against the prohibitions. Answer C is incorrect because Carter should not incur unnecessary or excessive “churning” of the portfolios (excessive trading) for the purpose of meeting the brokerage commitments of soft dollar arrangements.
- 29 Answer B is correct according to Standard VII(B)–Reference to CFA Institute, the CFA Designation, and the CFA Program. CFA Program candidates do not receive their actual scores on the exam. Topic and subtopic results are grouped into three broad categories, and the exam is graded only as “pass” or “fail.” Although a candidate may have achieved a topical score of “above 70%,” she or he cannot factually state that she or he received the highest possible score because that information is not reported. Thus, answer C is incorrect. Answer A is incorrect as long as the member or candidate actually completed the exams consecutively. Standard VII(B) does not prohibit the communication of factual information about completing the CFA Program in three consecutive years.
- 30 Answer C is correct. According to Standard III(A)–Loyalty, Prudence, and Care, the CFA Program would be considered a personal or firm expense and should not be paid for with the fund’s brokerage commissions. Soft dollar accounts should be used only to purchase research services that directly assist the investment manager in the investment decision-making process, not to assist the management of the firm or to further education. Thus, answer A is incorrect. Answer B is incorrect because the reasonableness of how the money is used is not an issue; the issue is that educational expense is not research.
- 31 Answer A is correct. Standard I(B)–Independence and Objectivity emphasizes the need for members and candidates to maintain their independence and objectivity. Best practices dictate that firms adopt a strict policy not to accept compensation for travel arrangements. At times, however, accepting paid

travel would not compromise one's independence and objectivity. Answers B and C are incorrect because the added benefits—free conference admission for additional staff members and an exclusive golf retreat for the speaker—could be viewed as inducements related to the firm's working arrangements and not solely related to the speaking engagement. Should Long wish to bring other team members or participate in the golf outing, he or his firm should be responsible for the associated fees.

- 32 Answer C is correct. The guidance to Standard II(A)—Material Nonpublic Information recommends adding securities to the firm's restricted list when the firm has or may have material nonpublic information. By adding these securities to this list, Andrews would uphold this standard. Because waiting until the next day will not ensure that news of the merger is made public, answer A is incorrect. Negotiations may take much longer between the two companies, and the merger may never happen. Andrews must wait until the information is disseminated to the market before he trades on that information. Answer B is incorrect because Andrews should not disclose the information to other managers; no trading is allowed on material nonpublic information.
- 33 Answer B is correct. Through placing a personal purchase order that is significantly greater than the average volume, Pietro is violating Standard IIB—Market Manipulation. He is attempting to manipulate an increase in the share price and thus bring a buyer to the negotiating table. The news of a possible merger and confirmation of the firm's earnings guidance may also have positive effects on the price of Local Bank, but Pietro's actions in instructing the release of the information does not represent a violation through market manipulation. Announcements of this nature are common and practical to keep investors informed. Thus, answers A and C are incorrect.
- 34 Answer C is correct. Cupp violated Standard III(D)—Performance Presentations when he deviated from the firm's stated policies solely to capture the gain from the holding being acquired. Answer A is incorrect because the firm does not claim GIPS compliance and the GIPS standards require external cash flows to be treated in a consistent manner with the firm's documented policies. Answer B is incorrect because the firm does not state that it is updating its composite policies. If such a change were to occur, all cash flows for the month would have to be reviewed to ensure their consistent treatment under the new policy.
- 35 Answer A is correct. According to Standard V(C)—Record Retention, Cannan needed the permission of her employer to maintain the files at home after her employment ended. Without that permission, she should have deleted the files. All files created as part of a member's or candidate's professional activity are the property of the firm, even those created outside normal work hours. Thus, answer B is incorrect. Answer C is incorrect because the Code and Standards do not prohibit using one's personal computer to complete work for one's employer.
- 36 Answer B is correct. According to Standard VII(B)—Reference to CFA Institute, the CFA Designation, and the CFA Program, Quinn cannot claim to have finished the CFA Program or be eligible for the CFA charter until he officially learns that he has passed the Level III exam. Until the results for the most recent exam are released, those who sat for the exam should continue to refer to themselves as "candidates." Thus, answer C is incorrect. Answer A is incorrect because members and candidates may discuss areas of practice in which they believe the CFA Program improved their personal skills.

- 37** Answer A is correct. Hart’s decision to invest in the retail fund appears directly correlated with Rodriguez’s statement about the successful quarter of Mega Retail and thus violates Standard II(A)—Material Nonpublic Information. Rodriguez’s information would be considered material because it would influence the share price of Mega Retail and probably influence the price of the entire exchange-traded retail fund. Thus, answer B is incorrect. Answer C is also incorrect because Rodriguez shared information that was both material and nonpublic. Company officers regularly have such knowledge about their firms, which is not a violation. The sharing of such information, however, even in a conversation between friends, does violate Standard II(A).
- 38** Answer C is correct. Standard VII(A)—Conduct as Members and Candidates in the CFA Program prohibits providing information to candidates or the public that is considered confidential to the CFA Program. In revealing that questions related to the analysis of inventories and analysis of taxes were on the exam, Park has violated this standard. Answer B is incorrect because the guidance for the standard explicitly acknowledges that members and candidates are allowed to offer their opinions about the CFA Program. Answer A is incorrect because candidates are not prohibited from using outside resources.
- 39** Answer B is correct. Paper has violated Standard III(D)—Performance Presentation by not disclosing that he was part of a team of managers that achieved the results shown. If he had also included the return of the portion he directly managed, he would not have violated the standard. Thus, answer A is incorrect. Answer C is incorrect because Paper received written permission from his prior employer to include the results.
- 40** Answer A is correct. Townsend has not provided any information about her clients to the leaders or managers of the golf program; thus, she has not violated Standard III(E)—Preservation of Confidentiality. Providing contact information about her clients for a direct-mail solicitation would have been a violation. Answer B is incorrect because the notice in the newsletter does not violate Standard III(E). Answer C is incorrect because the golf program’s fund-raising campaign had already begun, so discussing the opportunity to donate was appropriate.

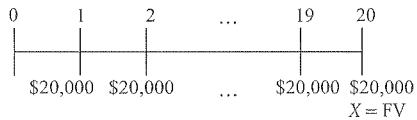
SOLUTIONS

- 1 A is correct. Real Estate is one of the nine sections in the 2010 edition of the GIPS standards. Derivatives and Legal and Ethical Considerations are not sections of the Standards.
- 2 A is correct. Replication of performance is not included in the Fundaments of Compliance section within the GIPS standards.
- 3 C is correct. Firms must meet all the requirements set forth in the GIPS standards and cannot claim partial compliance.

SOLUTIONS

- 1 A** Investment 2 is identical to Investment 1 except that Investment 2 has low liquidity. The difference between the interest rate on Investment 2 and Investment 1 is 0.5 percentage point. This amount represents the liquidity premium, which represents compensation for the risk of loss relative to an investment's fair value if the investment needs to be converted to cash quickly.
- B** To estimate the default risk premium, find the two investments that have the same maturity but different levels of default risk. Both Investments 4 and 5 have a maturity of eight years. Investment 5, however, has low liquidity and thus bears a liquidity premium. The difference between the interest rates of Investments 5 and 4 is 2.5 percentage points. The liquidity premium is 0.5 percentage point (from Part A). This leaves $2.5 - 0.5 = 2.0$ percentage points that must represent a default risk premium reflecting Investment 5's high default risk.
- C** Investment 3 has liquidity risk and default risk comparable to Investment 2, but with its longer time to maturity, Investment 3 should have a higher maturity premium. The interest rate on Investment 3, r_3 , should thus be above 2.5 percent (the interest rate on Investment 2). If the liquidity of Investment 3 were high, Investment 3 would match Investment 4 except for Investment 3's shorter maturity. We would then conclude that Investment 3's interest rate should be less than the interest rate on Investment 4, which is 4 percent. In contrast to Investment 4, however, Investment 3 has low liquidity. It is possible that the interest rate on Investment 3 exceeds that of Investment 4 despite 3's shorter maturity, depending on the relative size of the liquidity and maturity premiums. However, we expect r_3 to be less than 4.5 percent, the expected interest rate on Investment 4 if it had low liquidity. Thus $2.5\% < r_3 < 4.5\%$.

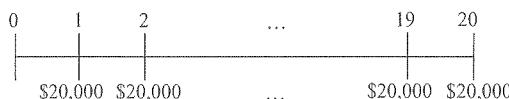
- 2** i. Draw a time line.



- ii. Identify the problem as the future value of an annuity.

- iii. Use the formula for the future value of an annuity.

$$\begin{aligned} FV_N &= A \left[\frac{(1+r)^N - 1}{r} \right] \\ &= \$20,000 \left[\frac{(1+0.07)^{20} - 1}{0.07} \right] \\ &= \$819,909.85 \end{aligned}$$



$$FV = \$819,909.85$$

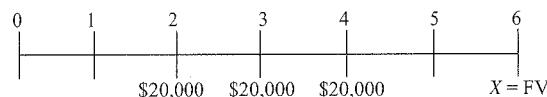
- iv. Alternatively, use a financial calculator.

Notation Used on Most Calculators	Numerical Value for This Problem
<i>N</i>	20
<i>%i</i>	7
<i>PV</i>	n/a (= 0)
<i>FV compute</i>	<i>X</i>
<i>PMT</i>	\$20,000

Enter 20 for *N*, the number of periods. Enter 7 for the interest rate and 20,000 for the payment size. The present value is not needed, so enter 0. Calculate the future value. Verify that you get \$819,909.85 to make sure you have mastered your calculator's keystrokes.

In summary, if the couple sets aside \$20,000 each year (starting next year), they will have \$819,909.85 in 20 years if they earn 7 percent annually.

- 3 i. Draw a time line.



- ii. Recognize the problem as the future value of a delayed annuity. Delaying the payments requires two calculations.
iii. Use the formula for the future value of an annuity (Equation 7).

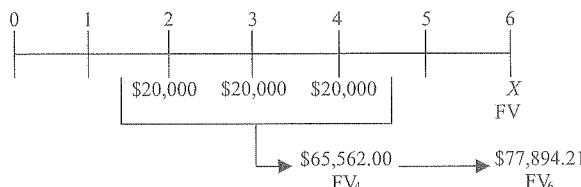
$$FV_N = A \left[\frac{(1 + r)^N - 1}{r} \right]$$

to bring the three \$20,000 payments to an equivalent lump sum of \$65,562.00 four years from today.

Notation Used on Most Calculators	Numerical Value for This Problem
<i>N</i>	3
<i>%i</i>	9
<i>PV</i>	n/a (= 0)
<i>FV compute</i>	<i>X</i>
<i>PMT</i>	\$20,000

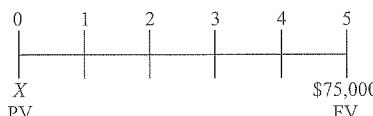
- iv. Use the formula for the future value of a lump sum (Equation 2), $FV_N = PV(1 + r)^N$, to bring the single lump sum of \$65,562.00 to an equivalent lump sum of \$77,894.21 six years from today.

Notation Used on Most Calculators	Numerical Value for This Problem
<i>N</i>	2
<i>%i</i>	9
<i>PV</i>	\$65,562.00
<i>FV compute</i>	<i>X</i>
<i>PMT</i>	n/a (= 0)



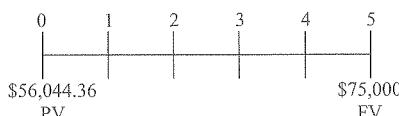
In summary, your client will have \$77,894.21 in six years if she receives three yearly payments of \$20,000 starting in Year 2 and can earn 9 percent annually on her investments.

- 4 i. Draw a time line.



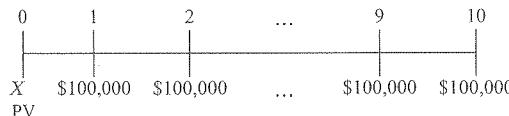
- ii. Identify the problem as the present value of a lump sum.
iii. Use the formula for the present value of a lump sum.

$$\begin{aligned} PV &= FV_N (1 + r)^{-N} \\ &= \$75,000(1 + 0.06)^{-5} \\ &= \$56,044.36 \end{aligned}$$



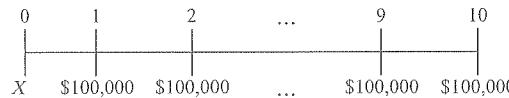
In summary, the father will need to invest \$56,044.36 today in order to have \$75,000 in five years if his investments earn 6 percent annually.

- 5 i. Draw a time line for the 10 annual payments.



- ii. Identify the problem as the present value of an annuity.
iii. Use the formula for the present value of an annuity.

$$\begin{aligned} PV &= A \left[\frac{1 - \frac{1}{(1 + r)^N}}{r} \right] \\ &= \$100,000 \left[\frac{1 - \frac{1}{(1 + 0.05)^{10}}}{0.05} \right] \\ &= \$772,173.49 \end{aligned}$$



$$PV = \$772,173.49$$

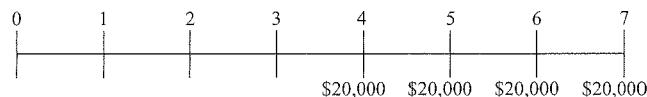
- iv. Alternatively, use a financial calculator.

Notation Used on Most Calculators	Numerical Value for This Problem
<i>N</i>	10
<i>%i</i>	5
PV compute	<i>X</i>
FV	n/a (= 0)
PMT	\$100,000

In summary, the present value of 10 payments of \$100,000 is \$772,173.49 if the first payment is received in one year and the rate is 5 percent compounded annually. Your client should accept no less than this amount for his lump sum payment.

- 6 A** To evaluate the first instrument, take the following steps:

- i. Draw a time line.



- ii.

$$\begin{aligned} PV_3 &= A \left[\frac{1 - \frac{1}{(1+r)^N}}{r} \right] \\ &= \$20,000 \left[\frac{1 - \frac{1}{(1+0.08)^4}}{0.08} \right] \\ &= \$66,242.54 \end{aligned}$$

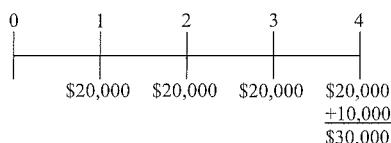
- iii.

$$PV_0 = \frac{PV_3}{(1+r)^N} = \frac{\$66,242.54}{1.08^3} = \$52,585.46$$

You should be willing to pay \$52,585.46 for this instrument.

- B** To evaluate the second instrument, take the following steps:

- i. Draw a time line.



The time line shows that this instrument can be analyzed as an ordinary annuity of \$20,000 with four payments (valued in Step ii below) and a \$10,000 payment to be received at $t = 4$ (valued in Step iii below).

ii.

$$\begin{aligned} PV &= A \left[\frac{1 - \frac{1}{(1+r)^N}}{r} \right] \\ &= \$20,000 \left[\frac{1 - \frac{1}{(1+0.08)^4}}{0.08} \right] \\ &= \$66,242.54 \end{aligned}$$

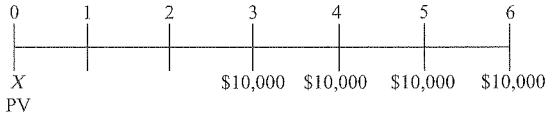
iii.

$$PV = \frac{FV_4}{(1+r)^N} = \frac{\$10,000}{(1+0.08)^4} = \$7,350.30$$

iv. Total = \$66,242.54 + \$7,350.30 = \$73,592.84

You should be willing to pay \$73,592.84 for this instrument.

- 7 i. Draw a time line.



ii. Recognize the problem as a delayed annuity. Delaying the payments requires two calculations.

iii. Use the formula for the present value of an annuity (Equation 11).

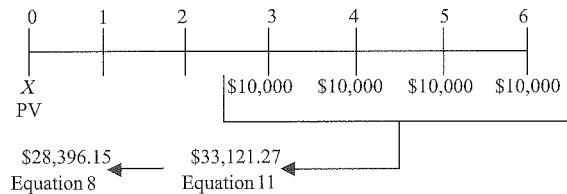
$$PV = A \left[\frac{1 - \frac{1}{(1+r)^N}}{r} \right]$$

to bring the four payments of \$10,000 back to a single equivalent lump sum of \$33,121.27 at $t = 2$. Note that we use $t = 2$ because the first annuity payment is then one period away, giving an ordinary annuity.

Notation Used on Most Calculators	Numerical Value for This Problem
N	4
$\%i$	8
PV compute	X
PMT	\$10,000

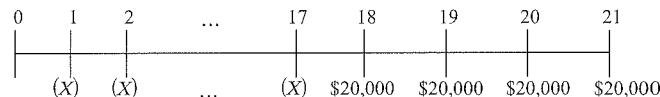
iv. Then use the formula for the present value of a lump sum (Equation 8), $PV = FV_N(1+r)^{-N}$, to bring back the single payment of \$33,121.27 (at $t = 2$) to an equivalent single payment of \$28,396.15 (at $t = 0$).

Notation Used on Most Calculators	Numerical Value for This Problem
N	2
$\%i$	8
PV compute	X
FV	\$33,121.27
PMT	n/a (= 0)



In summary, you should set aside \$28,396.15 today to cover four payments of \$10,000 starting in three years if your investments earn a rate of 8 percent annually.

- 8 i. Draw a time line.



- ii. Recognize that you need to equate the values of two annuities.
 iii. Equate the value of the four \$20,000 payments to a single payment in Period 17 using the formula for the present value of an annuity (Equation 11), with $r = 0.05$. The present value of the college costs as of $t = 17$ is \$70,919.

$$PV = \$20,000 \left[\frac{1 - \frac{1}{(1.05)^4}}{0.05} \right] = \$70,919$$

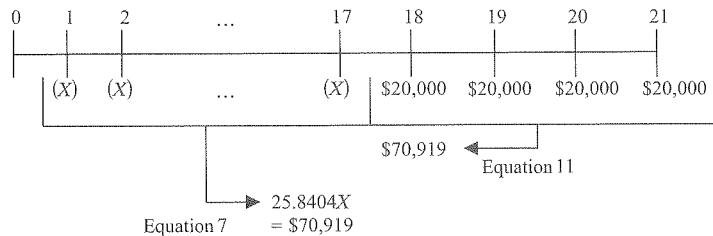
Notation Used on Most Calculators	Numerical Value for This Problem
N	4
$\%i$	5
PV compute	X
FV	n/a (= 0)
PMT	\$20,000

- iv. Equate the value of the 17 investments of X to the amount calculated in Step iii, college costs as of $t = 17$, using the formula for the future value of an annuity (Equation 7). Then solve for X .

$$\$70,919 = \left[\frac{(1.05)^{17} - 1}{0.05} \right] = 25.840366X$$

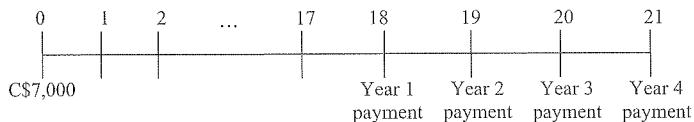
$$X = \$2,744.50$$

Notation Used on Most Calculators	Numerical Value for This Problem
N	17
$\%i$	5
PV	n/a (= 0)
FV	\$70,919
PMT compute	X



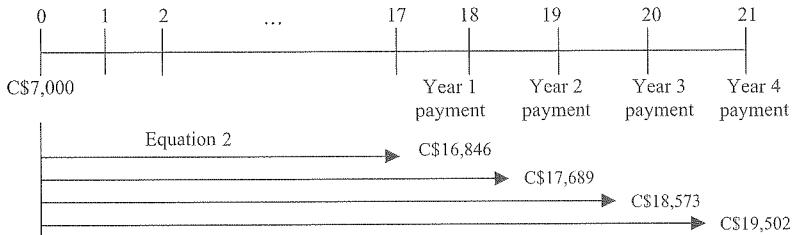
In summary, your client will have to save \$2,744.50 each year if she starts next year and makes 17 payments into a savings account paying 5 percent annually.

- 9 i. Draw a time line.



- ii. Recognize that the payments in Years 18, 19, 20, and 21 are the future values of a lump sum of C\$7,000 in Year 0.

- iii. With $r = 5\%$, use the formula for the future value of a lump sum (Equation 2), $FV_N = PV(1 + r)^N$, four times to find the payments. These future values are shown on the time line below.



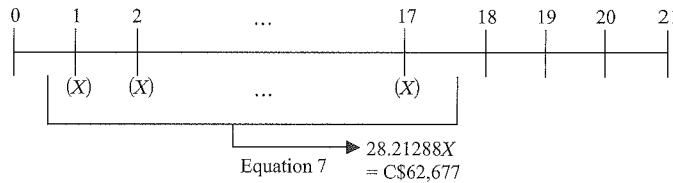
- iv. Using the formula for the present value of a lump sum ($r = 6\%$), equate the four college payments to single payments as of $t = 17$ and add them together.
 $C\$16,846(1.06)^{-1} + C\$17,689(1.06)^{-2} + C\$18,573(1.06)^{-3} + C\$19,502(1.06)^{-4}$
 $= C\$62,677$

- v. Equate the sum of C\$62,677 at $t = 17$ to the 17 payments of X , using the formula for the future value of an annuity (Equation 7). Then solve for X .

$$C\$62,677 = X \left[\frac{(1.06)^{17} - 1}{0.06} \right] = 28.21288X$$

$$X = C\$2,221.58$$

Notation Used on Most Calculators	Numerical Value for This Problem
N	17
$\%i$	6
PV	n/a (= 0)
FV	C\$62,677
PMT compute	X



In summary, the couple will need to put aside C\$2,221.58 each year if they start next year and make 17 equal payments.

- 10 C is correct. The sum of the real risk-free interest rate and the inflation premium is the nominal risk-free rate.
- 11 C is correct. US Treasury bonds are highly liquid, whereas the bonds of small issuers trade infrequently and the interest rate includes a liquidity premium. This liquidity premium reflects the relatively high costs (including the impact on price) of selling a position.
- 12 A is correct. The effective annual rate (EAR) when compounded daily is 4.08%.

$$\text{EAR} = (1 + \text{Periodic interest rate})^m - 1$$

$$\text{EAR} = (1 + 0.04/365)^{365} - 1$$

$$\text{EAR} = (1.0408) - 1 = 0.04081 \approx 4.08\%.$$

- 13 C is correct, as shown in the following (where FV is future value and PV is present value):

$$FV = PV \left(1 + \frac{r_s}{m}\right)^{mN}$$

$$FV_6 = \$75,000 \left(1 + \frac{0.07}{4}\right)^{(4 \times 6)}$$

$$FV_6 = \$113,733.21.$$

- 14 B is correct because £97,531 represents the present value (PV) of £100,000 received one year from today when today's deposit earns a stated annual rate of 2.50% and interest compounds weekly, as shown in the following equation (where FV is future value):

$$PV = FV_N \left(1 + \frac{r_s}{m}\right)^{-mN}$$

$$PV = £100,000 \left(1 + \frac{0.025}{52}\right)^{-52}$$

$$PV = £97,531.58.$$

- 15 A is correct. The effective annual rate (EAR) is calculated as follows:

$$\text{EAR} = (1 + \text{Periodic interest rate})^m - 1$$

$$\text{EAR} = (1 + 0.03/365)^{365} - 1$$

$$\text{EAR} = (1.03045) - 1 = 0.030453 \approx 3.0453\%.$$

Solving for N on a financial calculator results in (where FV is future value and PV is present value):

$$(1 + 0.030453)^N = \text{FV}_N/\text{PV} = ¥1,000,000/¥250,000$$

= 46.21 years, which multiplied by 12 to convert to months results in 554.5, or ≈ 555 months.

- 16** B is correct. The difference between continuous compounding and daily compounding is

$$\text{€}127,496.85 - \text{€}127,491.29 = \text{€}5.56, \text{ or } \approx \text{€}6, \text{ as shown in the following calculations.}$$

With continuous compounding, the investment earns (where PV is present value)

$$\begin{aligned}\text{PV}e^{r_s N} - \text{PV} &= \text{€}1,000,000e^{0.03(4)} - \text{€}1,000,000 \\ &= \text{€}1,127,496.85 - \text{€}1,000,000 \\ &= \text{€}127,496.85\end{aligned}$$

With daily compounding, the investment earns:

$$\text{€}1,000,000(1 + 0.03/365)^{365(4)} - \text{€}1,000,000 = \text{€}1,127,491.29 - \text{€}1,000,000 = \text{€}127,491.29.$$

- 17** B is correct, as shown in the following calculation for an annuity (A) due:

$$\text{PV} = A \left[\frac{1 - \frac{1}{(1+r)^N}}{\frac{r}{r}} \right] (1+r)$$

where $A = \text{€}300$, $r = 0.04$, and $N = 5$.

$$\text{PV} = \text{€}300 \left[\frac{1 - \frac{1}{(1+.04)^5}}{\frac{.04}{.04}} \right] (1.04)$$

$$\text{PV} = \text{€}1,388.97, \text{ or } \approx \text{€}1,389.$$

- 18** B is correct. The value of the perpetuity one year from now is calculated as:

$\text{PV} = A/r$, where PV is present value, A is annuity, and r is expressed as a quarterly required rate of return because the payments are quarterly.

$$\text{PV} = \$2.00/(0.06/4)$$

$$\text{PV} = \$133.33.$$

The value today is (where FV is future value)

$$\text{PV} = \text{FV}_N(1 + r)^{-N}$$

$$\text{PV} = \$133.33(1 + 0.015)^{-4}$$

$$\text{PV} = \$125.62 \approx \$126.$$

- 19** B is correct. To solve for the future value of unequal cash flows, compute the future value of each payment as of Year 4 at the semiannual rate of 2%, and then sum the individual future values, as follows:

Year	End of Year Deposits (\$)	Factor	Future Value (\$)
1	4,000	(1.02) ⁶	4,504.65
2	8,000	(1.02) ⁴	8,659.46
3	7,000	(1.02) ²	7,282.80
4	10,000	(1.02) ⁰	10,000.00
		Sum =	30,446.91

- 20** C is correct, as shown in the following (where FV is future value and PV is present value):

If:

$$FV_N = PV \left(1 + \frac{r_s}{m}\right)^{mN}$$

Then:

$$\left(\frac{FV_N}{PV}\right)^{\frac{1}{mN}} - 1 = \frac{r_s}{m}$$

$$\left(\frac{800,000}{500,000}\right)^{\frac{1}{2 \times 6}} - 1 = \frac{r_s}{2}$$

$$r_s = 0.07988 \text{ (rounded to 8.0%).}$$

- 21** C is correct. As shown below, the present value (PV) of a £2,000 per month perpetuity is worth approximately £400,000 at a 6% annual rate compounded monthly. Thus, the present value of the annuity (A) is worth more than the lump sum offer.

$$A = £2,000$$

$$r = (6\%/12) = 0.005$$

$$PV = (A/r)$$

$$PV = (£2,000/0.005)$$

$$PV = £400,000$$

- 22** B is correct.

The present value of a 10-year annuity (A) due with payments of \$2,000 at a 5% discount rate is calculated as follows:

$$PV = A \left[\frac{1 - \frac{1}{(1+r)^N}}{r} \right] + \$2,000$$

$$PV = \$2,000 \left[\frac{1 - \frac{1}{(1 + 0.05)^9}}{0.05} \right] + \$2,000$$

$$PV = \$16,215.64.$$

Alternatively, the PV of a 10-year annuity due is simply the PV of the ordinary annuity multiplied by 1.05:

$$PV = \$15,443.47 \times 1.05$$

$$PV = \$16,215.64.$$

- 23** B is correct. First, find the present value (PV) of an ordinary annuity in Year 17 that represents the tuition costs:

$$\$50,000 \left[\frac{1 - \frac{1}{(1 + 0.06)^4}}{0.06} \right]$$

$$= \$50,000 \times 3.4651$$

$$= \$173,255.28.$$

Then, find the PV of the annuity in today's dollars (where FV is future value):

$$PV_0 = \frac{FV}{(1 + 0.06)^{17}}$$

$$PV_0 = \frac{\$173,255.28}{(1 + 0.06)^{17}}$$

$$PV_0 = \$64,340.85 \approx \$64,341.$$

- 24** B is correct, as shown in the following table.

Year	Cash Flow (€)	Formula $CF \times (1 + r)^t$	PV at Year 0
1	100,000	$100,000(1.12)^{-1} =$	89,285.71
2	150,000	$150,000(1.12)^{-2} =$	119,579.08
5	-10,000	$-10,000(1.12)^{-5} =$	-5,674.27
			203,190.52

25 B is correct, calculated as follows (where A is annuity and PV is present value):

$$\begin{aligned}
 A &= (\text{PV of annuity}) \left[\frac{1 - \frac{1}{(1 + r_s/m)^{mN}}}{r_s/m} \right] \\
 &= (\text{£}200,000) \left[\frac{1 - \frac{1}{(1 + r_s/m)^{mN}}}{r_s/m} \right] \\
 &= (\text{£}200,000) \left[\frac{1 - \frac{1}{(1 + 0.06/12)^{12(5)}}}{0.06/12} \right] \\
 &= (\text{£}200,000)/51.72556 \\
 &= \text{£}3,866.56
 \end{aligned}$$

26 A is correct. To solve for an annuity (A) payment, when the future value (FV), interest rate, and number of periods is known, use the following equation:

$$\begin{aligned}
 FV &= A \left[\frac{\left(1 + \frac{r_s}{m}\right)^{mN} - 1}{\frac{r}{m}} \right] \\
 \text{£}25,000 &= A \left[\frac{\left(1 + \frac{0.06}{4}\right)^{4 \times 10} - 1}{\frac{0.06}{4}} \right]
 \end{aligned}$$

$$A = \text{£}460.68$$

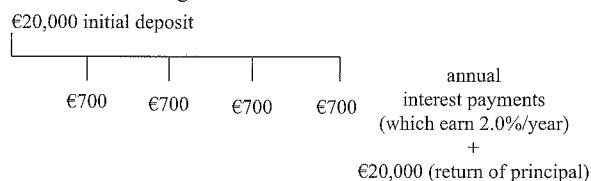
27 B is correct. The PV in Year 5 of a \$50,000 lump sum paid in Year 20 is \$27,763.23 (where FV is future value):

$$PV = FV_N(1 + r)^{-N}$$

$$PV = \$50,000(1 + 0.04)^{-15}$$

$$PV = \$27,763.23$$

28 B is correct, as the following cash flows show:



The four annual interest payments are based on the CD's 3.5% annual rate.

The first payment grows at 2.0% compounded monthly for three years (where FV is future value):

$$FV_N = €700 \left(1 + \frac{0.02}{12}\right)^{3 \times 12}$$

$$FV_N = 743.25$$

The second payment grows at 2.0% compounded monthly for two years:

$$FV_N = €700 \left(1 + \frac{0.02}{12}\right)^{2 \times 12}$$

$$FV_N = 728.54$$

The third payment grows at 2.0% compounded monthly for one year:

$$FV_N = €700 \left(1 + \frac{0.02}{12}\right)^{1 \times 12}$$

$$FV_N = 714.13$$

The fourth payment is paid at the end of Year 4. Its future value is €700.

The sum of all future value payments is as follows:

€20,000.00	CD
€743.25	First payment's <i>FV</i>
€728.54	Second payment's <i>FV</i>
€714.13	Third payment's <i>FV</i>
€700.00	Fourth payment's <i>FV</i>
€22,885.92	Total <i>FV</i>

SOLUTIONS

- 1 C is correct. The NPV sums the project's expected cash flows (CF) discounted at the opportunity cost of capital. The NPV calculation is

$$NPV = \sum_{t=0}^N \frac{CF_t}{(1+r)^t}$$

where

CF_t = the expected net cash flow at time t

N = the investment's projected life

r = the discount rate or opportunity cost of capital

- 2 A is correct.

$$\text{The NPV} = -\$2.2 + \frac{\$1.3}{(1.08)} + \frac{\$1.6}{(1.08)^2} + \frac{\$1.9}{(1.08)^3} + \frac{\$0.8}{(1.08)^4} = \$2.47 \text{ million.}$$

- 3 B is correct. According to the NPV rule, shareholder wealth is maximized by selecting a project with the highest NPV. The IRR rule also signals acceptance; however, the IRR rule should not be used to rank projects. In this case, Project B adds the most value to the firm.
- 4 C is correct. The internal rate of return is computed by identifying all cash flows and solving for the rate that makes the net present value of those cash flows equal to zero.
- 5 B is correct. IRR is determined by setting the net present value equal to zero for the cash flows shown in the table.

Year	Cash Flow (£)
0	-1,000
1	200
2	200
3	900

- 6 C is correct. The IRR investment decision rule states, "Accept projects or investments for which the IRR is greater than the opportunity cost of capital."
- 7 B is correct. The projects are mutually exclusive because the amount to invest is constrained to €1,000,000. Therefore, the net present value (NPV) rule should be used to choose among them when the IRR rule and NPV rule conflict. Based on the opportunity cost of capital of 12%, the NPV of Project B is €138,848, which is higher than the NPV of €71,429 for Project A and the NPV of \$105,013 for Project C.

$$\text{Project A NPV} = -€1,000,000 + €1,200,000/(1.12) = €71,429$$

$$\text{Project B NPV} = -€1,000,000 + €1,600,000/(1.12)^3 = €138,848$$

$$\text{Project C NPV} = -€500,000 + €850,000/(1.12)^3 = €105,013$$

- 8 C is correct. The formula for the holding period return is

$$\frac{P_1 - P_0 + D_1}{P_0}$$

where P_0 is the initial investment, P_1 is the final value at the end of the holding period, and D_1 is the cash dividend paid at the end of the holding period. This investment results in a holding period return (HPR) of

$$\text{HPR} = \frac{\$57.50 - \$52.68 + \$0.88}{\$52.68} = 10.82\%$$

- 9 B is correct. Computation of the money-weighted return, r , requires finding the discount rate that sets the present value (outflows) equal to the present value (inflows).

Solving for r ,

$$\$1,000 + \frac{\$3,165}{(1+r)} = \frac{\$25}{(1+r)} + \frac{\$4,500}{(1+r)^2}$$

results in a value of $r = 6.91\%$

- 10 C is correct. The money-weighted rate of return considers both the timing and amounts of investments into the fund. The investment at the beginning of Year 1 will be worth $\$1,000(1.15)(1.14)(0.96) = \$1,258.56$ at the end of Year 3. The investment made at the beginning of Year 2 will be worth $\$4,000(1.14)(0.96) = \$4,377.60 = \$4,000(1.14)(0.96)$ at the end of Year 3. The investment of $\$45,000$ at the beginning of Year 3 decreases to a value of $\$45,000(0.96) = \$43,200$ at the end of Year 3.

Solving for r ,

$$\$1,000 + \frac{\$4,000}{(1+r)} + \frac{\$45,000}{(1+r)^2} = \frac{\$1,258 + \$4,377.60 + \$43,200}{(1+r)^3}$$

results in $r = -2.08\%$

Note that B is incorrect because the time-weighted rate of return (TWR) of the fund is the same as the geometric mean return of the fund and is thus positive:

$$\text{TWR} = \sqrt[3]{(1.15)(1.14)(0.96)} - 1 = 7.97\%$$

- 11 A is correct. The money-weighted rate of return is found by setting the present value (PV) of investments into the fund equal to the PV of the fund's terminal value. Because most of the investment came during Year 2, the measure will be biased toward the performance of Year 2. Set the PV of investments equal to the PV of the fund's terminal value:

$$\$10 + \frac{100}{(1+r)} = \frac{10 \times 1.14 \times 1.08 + 100 \times 1.08}{(1+r)^2}$$

Solving for r results in $r = 8.53\%$.

The time-weighted return of the fund is $= \sqrt[2]{(1.14)(1.08)} - 1 = 10.96\%$.

- 12 B is correct. The HPY for the bond is

$$\frac{P_1 - P_0 + D_1}{P_0} = \frac{\$990 - \$980 + \$30}{\$980} = 4.08\%$$

- 13 C is correct. The 182-day holding period yield (HPY) is calculated as follows:

$$\text{HPY} = \frac{P_1 - P_0 + D_1}{P_0} = \frac{\$100,000 - \$99,500}{\$99,500} = 0.5025\%$$

- 14** C is correct. The effective annual yield (EAY) is calculated as follows (where HPY is holding period yield):

$$\text{HPY} = \frac{P_1 - P_0 + D_1}{P_0} = \frac{\$100,00 - \$99,620}{\$99,620} = 0.3814\%$$

$$\text{EAY} = (1 + \text{HPY})^{365/123} - 1 = (1 + .003814)^{365/123} - 1 = 1.1362\%$$

- 15** A is correct. The money market yield is equal to the annualized HPY, assuming a 360-day year. $r_{MM} = (\text{HPY})(360/t)$. A T-bill purchased at \$97,000 has a HPY of $[(\$100,000 - \$97,000)/\$97,000] = 3.09\%$. The money market yield for this T-bill is $(3.09\%)(360/300) = 3.71\%$. The effective annual yield for this T-bill is $(1 + 0.0309)^{365/300} - 1 = 3.77\%$.
- 16** A is correct. The holding period yield of a bill can be computed from the bank discount yield by finding the bill's discount D :

$$r_{BD} = \frac{D}{F} \times \frac{360}{t}, \text{ so } 0.0205 = \frac{D}{\$100,000} \times \frac{360}{223}$$

Solving for D results in a discount of \$1269.86. This result implies a purchase price of $\$100,000 - \$1,269.86 = \$98,730.14$.

The holding period yield (HPY) then computes as:

$$\text{HPY} = \frac{\$1,269.86}{\$98,730.14} = 1.286\%$$

B is incorrect because it is the money market yield and C is incorrect because it is the equivalent annual yield.

- 17** C is correct. The EAY is one plus the HPY, compounded forward one year, and then subtract one:

$$\text{EAY} = (1 + \text{HPY})^{365/t} - 1$$

$$(1 + 0.07)^{365/300} - 1 = 8.58\% \approx 8.6\%$$

SOLUTIONS

- 1 B is correct. The FTSE Eurotop 100 represents a sample of all European stocks. It is a subset of the population of all European stocks.
- 2 A is correct. Ordinal scales sort data into categories that are ordered with respect to some characteristic and may involve numbers to identify categories but do not assure that the differences between scale values are equal. The buy rating scale indicates that a stock ranked 5 is expected to perform better than a stock ranked 4, but it tells us nothing about the performance difference between stocks ranked 4 and 5 compared with the performance difference between stocks ranked 1 and 2, and so on.
- 3 A is correct. Any descriptive measure of a population characteristic is referred to as a parameter.
- 4 A is correct. The relative frequency is the absolute frequency of each interval divided by the total number of observations. Here, the relative frequency is calculated as: $(12/60) \times 100 = 20\%$. B is incorrect because the relative frequency of this interval is $(23/60) \times 100 = 38.33\%$. C is incorrect because the cumulative relative frequency of the last interval must equal 100%.
- 5 C is correct. The cumulative relative frequency of an interval identifies the fraction of observations that are less than the upper limit of the given interval. It is determined by summing the relative frequencies from the lowest interval up to and including the given interval. The following table shows the relative frequencies for all the intervals of the data from the previous table:

Lower Limit (%)	Upper Limit (%)	Absolute Frequency	Relative Frequency	Cumulative Relative Frequency
$-9.19 \leq$	< -5.45	1	0.083	0.083
$-5.45 \leq$	< -1.71	2	0.167	0.250
$-1.71 \leq$	< 2.03	4	0.333	0.583
$2.03 \leq$	< 5.77	3	0.250	0.833
$5.77 \leq$	≥ 9.51	2	0.167	1.000

- The interval $-1.71\% \leq x < 2.03\%$ has a cumulative relative frequency of 0.583.
- 6 C is correct. Because there are 50 data points in the histogram, the median return would be the mean of the $50/2 = 25$ th and $(50 + 2)/2 = 26$ th positions. The sum of the return interval frequencies to the left of the 13% to 18% interval is 24. As a result, the 25th and 26th returns will fall in the 13% to 18% interval.
 - 7 C is correct. The mode of a distribution with data grouped in intervals is the interval with the highest frequency. The three intervals of 3% to 8%, 18% to 23%, and 28% to 33% all have a high frequency of 7.
 - 8 A is correct. Twenty observations lie in the interval "0.0 to 2.0," and six observations lie in the 2.0 to 4.0 interval. Together, they represent $26/48$, or 54.17% of all observations, which is more than 50%.
 - 9 C is correct. The median of Portfolio R is 0.8% higher than the mean for Portfolio R.
 - 10 C is correct. The portfolio return must be calculated as the weighted mean return, where the weights are the allocations in each asset class:

$$(0.20 \times 8\%) + (0.40 \times 12\%) + (0.25 \times -3\%) + (0.15 \times 4\%) = 6.25\%, \text{ or } \approx 6.3\%.$$

- 11 A is correct. The geometric mean return for Fund Y is found as follows:

$$\begin{aligned}\text{Fund Y} &= [(1 + 0.195) \times (1 - 0.019) \times (1 + 0.197) \times (1 + 0.350) \times (1 + 0.057)] \\ &\quad (1/5) - 1 \\ &= 14.9\%.\end{aligned}$$

- 12 A is correct. The harmonic mean is appropriate for determining the average price per unit. It is calculated by summing the reciprocals of the prices; then averaging that sum by dividing by the number of prices; and finally, taking the reciprocal of the average:

$$4/[(1/62.00) + (1/76.00) + (1/84.00) + (1/90.00)] = €76.48.$$

- 13 B is correct. Quintiles divide a distribution into fifths, with the fourth quintile occurring at the point at which 80% of the observations lie below it. The fourth quintile is equivalent to the 80th percentile. To find the y th percentile (P_y), we first must determine its location. The formula for the location (L_y) of a y th percentile in an array with n entries sorted in ascending order is $L_y = (n + 1) \times (y/100)$. In this case, $n = 10$ and $y = 80\%$, so

$$L_{80} = (10 + 1) \times (80/100) = 11 \times 0.8 = 8.8.$$

With the data arranged in ascending order (-40.33%, -5.02%, 9.57%, 10.02%, 12.34%, 15.25%, 16.54%, 20.65%, 27.37%, and 30.79%), the 8.8th position would be between the 8th and 9th entries, 20.65% and 27.37%, respectively. Using linear interpolation, $P_{80} = X_8 + (L_y - 8) \times (X_9 - X_8)$,

$$\begin{aligned}P_{80} &= 20.65 + (8.8 - 8) \times (27.37 - 20.65) \\ &= 20.65 + (0.8 \times 6.72) = 20.65 + 5.38 \\ &= 26.03\%.\end{aligned}$$

- 14 A is correct. The formula for mean absolute deviation (MAD) is

$$\text{MAD} = \frac{\sum_{i=1}^n |X_i - \bar{X}|}{n}$$

Column 1: Sum annual returns and divide by n to find the arithmetic mean (\bar{X}) of 16.40%.

Column 2: Calculate the absolute value of the difference between each year's return and the mean from Column 1. Sum the results and divide by n to find the MAD.

These calculations are shown in the following table:

Year	Return	Column 1	Column 2
			$ X_i - \bar{X} $
2009	30.79%		14.39%
2010	12.34%		4.06%
2011	-5.02%		21.42%
2012	16.54%		0.14%
2013	27.37%		10.97%
Sum:	82.02%	Sum:	50.98%

Year	Column 1		Column 2
	Return		$ X_i - \bar{X} $
n :	5	n :	5
\bar{X} :	16.40%	MAD:	10.20%

- 15 C is correct. The mean absolute deviation (MAD) of Fund ABC's returns is greater than the MAD of both of the other funds.

$$\text{MAD} = \frac{\sum_{i=1}^n |X_i - \bar{X}|}{n}, \text{ where } \bar{X} \text{ is the arithmetic mean of the series.}$$

MAD for Fund ABC =

$$\frac{|-20 - (-4)| + |23 - (-4)| + |-14 - (-4)| + |5 - (-4)| + |-14 - (-4)|}{5} = 14.4\%$$

MAD for Fund XYZ =

$$\frac{|-33 - (-10.8)| + |-12 - (-10.8)| + |-12 - (-10.8)| + |-8 - (-10.8)| + |11 - (-10.8)|}{5} = 9.8\%$$

MAD for Fund PQR =

$$\frac{|-14 - (-5)| + |-18 - (-5)| + |6 - (-5)| + |-2 - (-5)| + |3 - (-5)|}{5} = 8.8\%$$

A and B are incorrect because the range and variance of the three funds are as follows:

	Fund ABC	Fund XYZ	Fund PQR
Range	43%	44%	24%
Variance	317	243	110

The numbers shown for variance are understood to be in "percent squared" terms so that when taking the square root, the result is standard deviation in percentage terms. Alternatively, by expressing standard deviation and variance in decimal form, one can avoid the issue of units; in decimal form, the variances for Fund ABC, Fund XYZ, and Fund PQR are 0.0317, 0.0243, and 0.0110, respectively.

- 16 C is correct. According to Chebyshev's inequality, the proportion of the observations within k standard deviations of the arithmetic mean is at least $1 - 1/k^2$ for all $k > 1$.

The upper limit of the range is 2.53%, which is $2.53 - 0.79 = 1.74\%$ above the mean. The lower limit is -0.95, which is $0.79 - (-0.95) = 1.74\%$ below the mean. As a result, $k = 1.74/1.16 = 1.50$ standard deviations.

Because $k = 1.50$, the proportion of observations within the interval is at least $1 - 1/1.5^2 = 1 - 0.444 = 0.556$, or 55.6%. Thus, the number of observations in the given range is at least $240 \times 55.6\%$, which is ≈ 133 .

- 17 B is correct. The coefficient of variation (CV) is the ratio of the standard deviation to the mean, where a higher CV implies greater risk per unit of return.

$$CV_{UTIL} = \frac{s}{\bar{X}} = \frac{1.23\%}{2.10\%} = 0.59$$

$$CV_{MATR} = \frac{s}{\bar{X}} = \frac{1.35\%}{1.25\%} = 1.08$$

$$CV_{INDU} = \frac{s}{\bar{X}} = \frac{1.52\%}{3.01\%} = 0.51$$

- 18 C is correct. The Sharpe ratio (S) is the mean excess portfolio return per unit of risk, where a higher Sharpe ratio indicates better performance:

$$S_1 = \frac{\bar{R}_p - \bar{R}_F}{s_p} = \frac{14.38 - 2.60}{10.53} = 1.12$$

$$S_2 = \frac{\bar{R}_p - \bar{R}_F}{s_p} = \frac{9.25 - 2.60}{6.35} = 1.05$$

$$S_3 = \frac{\bar{R}_p - \bar{R}_F}{s_p} = \frac{13.10 - 2.60}{8.23} = 1.28$$

- 19 B is correct. The Sharpe ratio measures a portfolio's return per unit of risk and is defined as $S_1 = \frac{\bar{R}_p - \bar{R}_F}{s_p}$, where \bar{R}_p is the mean return for the portfolio, \bar{R}_F is the mean return to a risk-free asset, and s_p is the standard deviation of return on the portfolio. The Sharpe ratios for the three portfolios are as follows:

$$\text{Portfolio 1} = (7.8 - 1.5)/15.1 = 6.3/15.1 = 0.417$$

$$\text{Portfolio 2} = (10.2 - 1.5)/20.5 = 8.7/20.5 = 0.424$$

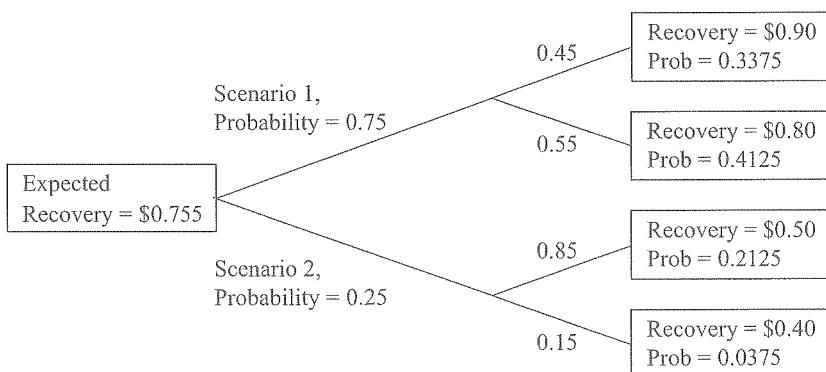
$$\text{Portfolio 3} = (12.9 - 1.5)/29.3 = 11.4/29.3 = 0.389$$

So Portfolio 2 has the highest return per unit of risk.

- 20 B is correct. Portfolio 1 has a skewness of 0.0, which indicates that the portfolio's return distribution is symmetrical and thus its mean and median are equal.
- 21 B is correct. Portfolio 3 has positive excess kurtosis (i.e., kurtosis greater than 3), which indicates that its return distribution is leptokurtic and has fatter tails than the normal. The fatter tails mean Portfolio 3 has a greater number of extreme returns.
- 22 A is correct. Portfolio 1 is positively skewed, so the mean is greater than the median, which is greater than the mode.
- 23 B is correct. The geometric mean compounds the periodic returns of every period, giving the investor a more accurate measure of the terminal value of an investment.

SOLUTIONS

- 1 Use Equation 1 to find this conditional probability: $P(\text{stock is dividend paying} \mid \text{telecom stock that meets criteria}) = P(\text{stock is dividend paying and telecom stock that meets criteria})/P(\text{telecom stock that meets criteria}) = 0.01/0.05 = 0.20$.
- 2 According to the multiplication rule for independent events, the probability of a company meeting all three criteria is the product of the three probabilities. Labeling the event that a company passes the first, second, and third criteria, A , B , and C , respectively $P(ABC) = P(A)P(B)P(C) = (0.20)(0.45)(0.78) = 0.0702$. As a consequence, $(0.0702)(500) = 35.10$, so 35 companies pass the screen.
- 3 Use Equation 2, the multiplication rule for probabilities $P(AB) = P(A \mid B)P(B)$, defining A as the event that *a stock meets the financial strength criteria* and defining B as the event that *a stock meets the valuation criteria*. Then $P(AB) = P(A \mid B)P(B) = 0.40 \times 0.25 = 0.10$. The probability that a stock meets both the financial and valuation criteria is 0.10.
- 4 A *Outcomes associated with Scenario 1:* With a 0.45 probability of a \$0.90 recovery per \$1 principal value, given Scenario 1, and with the probability of Scenario 1 equal to 0.75, the probability of recovering \$0.90 is $0.45(0.75) = 0.3375$. By a similar calculation, the probability of recovering \$0.80 is $0.55(0.75) = 0.4125$.
Outcomes associated with Scenario 2: With a 0.85 probability of a \$0.50 recovery per \$1 principal value, given Scenario 2, and with the probability of Scenario 2 equal to 0.25, the probability of recovering \$0.50 is $0.85(0.25) = 0.2125$. By a similar calculation, the probability of recovering \$0.40 is $0.15(0.25) = 0.0375$.
B $E(\text{recovery} \mid \text{Scenario 1}) = 0.45(\$0.90) + 0.55(\$0.80) = \0.845
C $E(\text{recovery} \mid \text{Scenario 2}) = 0.85(\$0.50) + 0.15(\$0.40) = \0.485
D $E(\text{recovery}) = 0.75(\$0.845) + 0.25(\$0.485) = \0.755
E



- 5 A We can set up the equation using the total probability rule:

$$\begin{aligned} P(\text{pass test}) &= P(\text{pass test} \mid \text{survivor})P(\text{survivor}) \\ &\quad + P(\text{pass test} \mid \text{nonsurvivor})P(\text{nonsurvivor}) \end{aligned}$$

We know that $P(\text{survivor}) = 1 - P(\text{nonsurvivor}) = 1 - 0.40 = 0.60$. Therefore, $P(\text{pass test}) = 0.55 = 0.85(0.60) + P(\text{pass test} \mid \text{nonsurvivor})(0.40)$. Thus $P(\text{pass test} \mid \text{nonsurvivor}) = [0.55 - 0.85(0.60)]/0.40 = 0.10$.

$$\begin{aligned}\mathbf{B} \quad P(\text{survivor} \mid \text{pass test}) &= [P(\text{pass test} \mid \text{survivor})/P(\text{pass test})]P(\text{survivor}) \\ &= (0.85/0.55)0.60 = 0.927273\end{aligned}$$

The information that a company passes the test causes you to update your probability that it is a survivor from 0.60 to approximately 0.927.

- C** According to Bayes' formula, $P(\text{nonsurvivor} \mid \text{fail test}) = [P(\text{fail test} \mid \text{nonsurvivor})/P(\text{fail test})]P(\text{nonsurvivor}) = [P(\text{fail test} \mid \text{nonsurvivor})/0.45]0.40$.

We can set up the following equation to obtain $P(\text{fail test} \mid \text{nonsurvivor})$:

$$\begin{aligned}P(\text{fail test}) &= P(\text{fail test} \mid \text{nonsurvivor})P(\text{nonsurvivor}) \\ &\quad + P(\text{fail test} \mid \text{survivor})P(\text{survivor}) \\ 0.45 &= P(\text{fail test} \mid \text{nonsurvivor})0.40 + 0.15(0.60)\end{aligned}$$

where $P(\text{fail test} \mid \text{survivor}) = 1 - P(\text{pass test} \mid \text{survivor}) = 1 - 0.85 = 0.15$. So $P(\text{fail test} \mid \text{nonsurvivor}) = [0.45 - 0.15(0.60)]/0.40 = 0.90$. Using this result with the formula above, we find $P(\text{nonsurvivor} \mid \text{fail test}) = (0.90/0.45)0.40 = 0.80$. Seeing that a company fails the test causes us to update the probability that it is a nonsurvivor from 0.40 to 0.80.

- D** A company passing the test greatly increases our confidence that it is a survivor. A company failing the test doubles the probability that it is a nonsurvivor. Therefore, the test appears to be useful.
- 6 C is correct. The term "exhaustive" means that the events cover all possible outcomes.
- 7 C is correct. A subjective probability draws on personal or subjective judgment that may be without reference to any particular data.
- 8 A is correct. Given odds for E of a to b , the implied probability of $E = a/(a + b)$. Stated in terms of odds a to b with $a = 1$, $b = 5$, the probability of $E = 1/(1 + 5) = 1/6 = 0.167$. This result confirms that a probability of 0.167 for beating sales is odds of 1 to 5.
- 9 C is correct. A conditional probability is the probability of an event given that another event has occurred.
- 10 B is correct. Because the events are independent, the multiplication rule is most appropriate for forecasting their joint probability. The multiplication rule for independent events states that the joint probability of both A and B occurring is $P(AB) = P(A)P(B)$.
- 11 B is correct. The probability of the occurrence of one is related to the occurrence of the other. If we are trying to forecast one event, information about a dependent event may be useful.
- 12 C is correct. The total probability rule for expected value is used to estimate an expected value based on mutually exclusive and exhaustive scenarios.
- 13 B is correct. If Scenario 1 occurs, the expected recovery is 60% (\$50,000) + 40% (\$30,000) = \$42,000, and if Scenario 2 occurs, the expected recovery is 90% (\$80,000) + 10%(\$60,000) = \$78,000. Weighting by the probability of each scenario, the expected recovery is 40%(\$42,000) + 60%(\$78,000) = \$63,600. Alternatively, first calculating the probability of each amount occurring, the expected recovery is (40%)(60%)(\$50,000) + (40%)(40%)(\$30,000) + (60%)(90%)(\$80,000) + (60%)(10%)(\$60,000) = \$63,600.
- 14 A is correct. The covariance is the product of the standard deviations and correlation using the formula $\text{Cov}(\text{US bond returns}, \text{Spanish bond returns}) = \sigma(\text{US bonds}) \times \sigma(\text{Spanish bonds}) \times \rho(\text{US bond returns}, \text{Spanish bond returns}) = 0.64 \times 0.56 \times 0.24 = 0.086$.

- 15 C is correct. The covariance of returns is positive when the returns on both assets tend to be on the same side (above or below) their expected values at the same time, indicating an average positive relationship between returns.
- 16 B is correct. Correlations near +1 exhibit strong positive linearity, whereas correlations near -1 exhibit strong negative linearity. A correlation of 0 indicates an absence of any linear relationship between the variables. The closer the correlation is to 0, the weaker the linear relationship.
- 17 C is correct. The correlation between two random variables R_i and R_j is defined as $\rho(R_i, R_j) = \text{Cov}(R_i, R_j)/\sigma(R_i)\sigma(R_j)$. Using the subscript i to represent hedge funds and the subscript j to represent the market index, the standard deviations are $\sigma(R_i) = 256^{1/2} = 16$ and $\sigma(R_j) = 81^{1/2} = 9$. Thus, $\rho(R_i, R_j) = \text{Cov}(R_i, R_j)/\sigma(R_i)\sigma(R_j) = 110/(16 \times 9) = 0.764$.
- 18 A is correct. As the correlation between two assets approaches +1, diversification benefits decrease. In other words, an increasingly positive correlation indicates an increasingly strong positive linear relationship and fewer diversification benefits.
- 19 A is correct. A covariance matrix for five stocks has $5 \times 5 = 25$ entries. Subtracting the 5 diagonal variance terms results in 20 off-diagonal entries. Because a covariance matrix is symmetrical, only 10 entries are unique ($20/2 = 10$).
- 20 A is correct. The analyst must first calculate expected sales as $0.05 \times \$70 + 0.70 \times \$40 + 0.25 \times \$25 = \$3.50 \text{ million} + \$28.00 \text{ million} + \$6.25 \text{ million} = \$37.75 \text{ million}$.

After calculating expected sales, we can calculate the variance of sales:

$$\begin{aligned}
 &= \sigma^2(\text{Sales}) \\
 &= P(\$70)[\$70 - E(\text{Sales})]^2 + P(\$40)[\$40 - E(\text{Sales})]^2 + P(\$25) \\
 &\quad [\$25 - E(\text{Sales})]^2 \\
 &= 0.05(\$70 - 37.75)^2 + 0.70(\$40 - 37.75)^2 + 0.25(\$25 - 37.75)^2 \\
 &= \$52.00 \text{ million} + \$3.54 \text{ million} + \$40.64 \text{ million} = \$96.18 \text{ million}.
 \end{aligned}$$

The standard deviation of sales is thus $\sigma = (\$96.18)^{1/2} = \9.81 million .

- 21 C is correct. The covariance of returns is positive when the returns on both assets tend to be on the same side (above or below) their expected values at the same time.
- 22 B is correct. The covariance is 26.56, calculated as follows. First, expected returns are

$$\begin{aligned}
 E(R_{FI}) &= (0.25 \times 25) + (0.50 \times 15) + (0.25 \times 10) \\
 &= 6.25 + 7.50 + 2.50 = 16.25 \text{ and} \\
 E(R_{DI}) &= (0.25 \times 30) + (0.50 \times 25) + (0.25 \times 15) \\
 &= 7.50 + 12.50 + 3.75 = 23.75.
 \end{aligned}$$

Covariance is

$$\begin{aligned}
 \text{Cov}(R_{FI}, R_{DI}) &= \sum_i \sum_j P(R_{FI,i}, R_{DI,j})(R_{FI,i} - ER_{FI})(R_{DI,j} - ER_{DI}) \\
 &= 0.25[(25 - 16.25)(30 - 23.75)] + 0.50[(15 - 16.25) \\
 &\quad (25 - 23.75)] + 0.25[(10 - 16.25)(15 - 23.75)] \\
 &= 13.67 + (-0.78) + 13.67 = 26.56.
 \end{aligned}$$

23 C is correct. The combination formula provides the number of ways that r objects can be chosen from a total of n objects, when the order in which the r objects are listed does not matter. The order of the bonds within the portfolio does not matter.

24 A is correct. The answer is found using the combination formula

$${}_nC_r = \binom{n}{r} = \frac{n!}{(n - r)!r!}$$

Here, $n = 4$ and $r = 2$, so the answer is $4!/[(4 - 2)!2!] = 24/[(2) \times (2)] = 6$. This result can be verified by assuming there are four vice presidents, VP1–VP4. The six possible additions to the investment committee are VP1 and VP2, VP1 and VP3, VP1 and VP4, VP2 and VP3, VP2 and VP4, and VP3 and VP4.

25 A is correct. The permutation formula is used to choose r objects from a total of n objects when order matters. Because the portfolio manager is trying to rank the four funds from most recommended to least recommended, the order of the funds matters; therefore, the permutation formula is most appropriate.

SOLUTIONS

- 1 A The put's minimum value is \$0. The put's value is \$0 when the stock price is at or above \$100 at the maturity date of the option. The put's maximum value is $\$100 - \$100 = \$0$ (the exercise price) – \$0 (the lowest possible stock price). The put's value is \$100 when the stock is worthless at the option's maturity date. The put's minimum price increments are \$0.01. The possible outcomes of terminal put value are thus \$0.00, \$0.01, \$0.02, ..., \$100.
- B The price of the underlying has minimum price fluctuations of \$0.01: These are the minimum price fluctuations for terminal put value. For example, if the stock finishes at \$98.20, the payoff on the put is $\$100 - \$98.20 = \$1.80$. We can specify that the nearest values to \$1.80 are \$1.79 and \$1.81. With a continuous random variable, we cannot specify the nearest values. So, we must characterize terminal put value as a discrete random variable.
- C The probability that terminal put value is less than or equal to \$24 is $P(Y \leq 24)$ or $F(24)$, in standard notation, where F is the cumulative distribution function for terminal put value.
- 2 A binomial random variable is defined as the number of successes in n Bernoulli trials (a trial that produces one of two outcomes). The binomial distribution is used to make probability statements about a record of successes and failures or about anything with binary (twofold) outcomes.
- 3 B is correct. The value of the cumulative distribution function lies between 0 and 1 for any x : $0 \leq F(x) \leq 1$.
- 4 C is correct. The binomial distribution is symmetric when the probability of success on a trial is 0.50, but it is asymmetric or skewed otherwise. Here it is given that $p = 0.50$
- 5 B is correct. The probability of any outcome is 0.05, $P(1) = 1/20 = 0.05$. The probability that X is greater than or equal to 3 but less than 6, which is expressed as $P(3 \leq X < 6) = P(3) + P(4) + P(5) = 0.05 + 0.05 + 0.05 = 0.15$
- 6 A The probability of an earnings increase (success) in a year is estimated as $7/10 = 0.70$ or 70 percent, based on the record of the past 10 years.
- B The probability that earnings will increase in 5 out of the next 10 years is about 10.3 percent. Define a binomial random variable X , counting the number of earnings increases over the next 10 years. From Part A, the probability of an earnings increase in a given year is $p = 0.70$ and the number of trials (years) is $n = 10$. Equation 1 gives the probability that a binomial random variable has x successes in n trials, with the probability of success on a trial equal to p .

$$P(X = x) = \binom{n}{x} p^x (1-p)^{n-x} = \frac{n!}{(n-x)!x!} p^x (1-p)^{n-x}$$

For this example,

$$\begin{aligned} \binom{10}{5} 0.7^5 0.3^{10-5} &= \frac{10!}{(10-5)!5!} 0.7^5 0.3^{10-5} \\ &= 252 \times 0.16807 \times 0.00243 = 0.102919 \end{aligned}$$

We conclude that the probability that earnings will increase in exactly 5 of the next 10 years is 0.1029, or approximately 10.3 percent.

- C The expected number of yearly increases is $E(X) = np = 10 \times 0.70 = 7$.

- D The variance of the number of yearly increases over the next 10 years is $\sigma^2 = np(1 - p) = 10 \times 0.70 \times 0.30 = 2.1$. The standard deviation is 1.449 (the positive square root of 2.1).
- E You must assume that 1) the probability of an earnings increase (success) is constant from year to year and 2) earnings increases are independent trials. If current and past earnings help forecast next year's earnings, Assumption 2 is violated. If the company's business is subject to economic or industry cycles, neither assumption is likely to hold.
- 7 B is correct. To calculate the probability of 4 years of outperformance, use the formula:

$$p(x) = P(X = x) = \binom{n}{x} p^x (1 - p)^{n-x} = \frac{n!}{(n-x)!x!} p^x (1 - p)^{n-x}$$

Using this formula to calculate the probability in 4 of 5 years, $n = 5$, $x = 4$ and $p = 0.60$.

Therefore,

$$p(4) = \frac{5!}{(5-4)!4!} 0.6^4 (1 - 0.6)^{5-4} = [120/24](0.1296)(0.40) = 0.2592$$

$$p(5) = \frac{5!}{(5-5)!5!} 0.6^5 (1 - 0.6)^{5-5} = [120/120](0.0778)(1) = 0.0778$$

The probability of outperforming 4 or more times is $p(4) + p(5) = 0.2592 + 0.0778 = 0.3370$

- 8 The observed success rate is $4/7 = 0.571$, or 57.1 percent. The probability of four or fewer successes is $F(4) = p(4) + p(3) + p(2) + p(1) + p(0)$, where $p(4)$, $p(3)$, $p(2)$, $p(1)$, and $p(0)$ are respectively the probabilities of 4, 3, 2, 1, and 0 successes, according to the binomial distribution with $n = 7$ and $p = 0.70$. We have

$$p(4) = (7!/4!3!)(0.70^4)(0.30^3) = 35(0.006483) = 0.226895$$

$$p(3) = (7!/3!4!)(0.70^3)(0.30^4) = 35(0.002778) = 0.097241$$

$$p(2) = (7!/2!5!)(0.70^2)(0.30^5) = 21(0.001191) = 0.025005$$

$$p(1) = (7!/1!6!)(0.70^1)(0.30^6) = 7(0.000510) = 0.003572$$

$$p(0) = (7!/0!7!)(0.70^0)(0.30^7) = 1(0.000219) = 0.000219$$

Summing all these probabilities, you conclude that $F(4) = 0.226895 + 0.097241 + 0.025005 + 0.003572 + 0.000219 = 0.352931$, or 35.3 percent.

- 9 A The expected value of fourth-quarter sales is €14,500,000, calculated as $(€14,000,000 + €15,000,000)/2$. With a continuous uniform random variable, the mean or expected value is the midpoint between the smallest and largest values. (See Example 7.)
- B The probability that fourth-quarter sales will be less than €14,125,000 is 0.125 or 12.5 percent, calculated as $(€14,125,000 - €14,000,000)/(€15,000,000 - €14,000,000)$.
- 10 A Approximately 68 percent of all outcomes of a normal random variable fall within plus or minus one standard deviation of the mean.
- B Approximately 95 percent of all outcomes of a normal random variable fall within plus or minus two standard deviations of the mean.
- C Approximately 99 percent of all outcomes of a normal random variable fall within plus or minus three standard deviations of the mean.

- 11 The area under the normal curve for $z = 0.36$ is 0.6406 or 64.06 percent. The following table presents an excerpt from the tables of the standard normal cumulative distribution function in the back of this volume. To locate $z = 0.36$, find 0.30 in the fourth row of numbers, then look at the column for 0.06 (the second decimal place of 0.36). The entry is 0.6406.

$P(Z \leq x) = N(x)$ for $x \geq 0$ or $P(Z \leq z) = N(z)$ for $z \geq 0$										
x or z	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.00	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.10	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.20	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.30	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.40	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.50	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224

The interpretation of 64.06 percent for $z = 0.36$ is that 64.06 percent of observations on a standard normal random variable are smaller than or equal to the value 0.36. (So $100\% - 64.06\% = 35.94\%$ of the values are greater than 0.36.)

- 12 C is correct. The probability that the performance is at or below the expectation is calculated by finding $F(3) = p(3) + p(2) + p(1)$ using the formula:

$$p(x) = P(X = x) = \binom{n}{x} p^x (1-p)^{n-x} = \frac{n!}{(n-x)!x!} p^x (1-p)^{n-x}$$

Using this formula,

$$p(3) = \frac{4!}{(4-3)!3!} 0.75^3 (1-0.75)^{4-3} = [24/6](0.42)(0.25) = 0.42$$

$$p(2) = \frac{4!}{(4-2)!2!} 0.75^2 (1-0.75)^{4-2} = [24/4](0.56)(0.06) = 0.20$$

$$p(1) = \frac{4!}{(4-1)!1!} 0.75^1 (1-0.75)^{4-1} = [24/6](0.75)(0.02) = 0.06$$

Therefore,

$$F(3) = p(3) + p(2) + p(1) = 0.42 + 0.20 + 0.06 = 0.68 \text{ or } 68.0$$

- 13 A The probability of exhausting the liquidity pool is 4.7 percent. First calculate $x = \lambda / (\sigma\sqrt{T}) = \$2,000 / (\$450\sqrt{5}) = 1.987616$. We can round this value to 1.99 to use the standard normal tables in the back of this book. Using those tables, we find that $N(1.99) = 0.9767$. Thus, the probability of exhausting the liquidity pool is $2[1 - N(1.99)] = 2(1 - 0.9767) = 0.0466$ or about 4.7 percent.
- B The probability of exhausting the liquidity pool is now 32.2 percent. The calculation follows the same steps as those in Part A. We calculate $x = \lambda / (\sigma\sqrt{T}) = \$2,000 / (\$450\sqrt{20}) = 0.993808$. We can round this value to 0.99 to use the standard normal tables in the back of this book. Using

those tables, we find that $N(0.99) = 0.8389$. Thus, the probability of exhausting the liquidity pool is $2[1 - N(0.99)] = 2(1 - 0.8389) = 0.3222$ or about 32.2 percent. This is a substantial probability that you will run out of funds to meet mark to market.

In their paper, Kolb et al. call the probability of exhausting the liquidity pool the probability of ruin, a traditional name for this type of calculation.

- 14 B is correct. The normal distribution has a skewness of 0, a kurtosis of 3, and a mean, median and mode that are all equal.
- 15 B is correct. Multivariate distributions specify the probabilities for a group of related random variables. A portfolio of technology stocks represents a group of related assets. Accordingly, statistical interrelationships must be considered, resulting in the need to use a multivariate normal distribution.
- 16 C is correct. A bivariate normal distribution (two stocks) will have two means, two variances and one correlation. A multivariate normal distribution for the returns on n stocks will have n means, n variances and $n(n - 1)/2$ distinct correlations.
- 17 **A** Because $\£50,000/\£1,350,000$ is 3.7 percent, for any return less than 3.7 percent the client will need to invade principal if she takes out $\£50,000$. So $R_L = 3.7$ percent.
B To decide which of the allocations is safety-first optimal, select the alternative with the highest ratio $[E(R_P) - R_L]/\sigma_P$:

$$\text{Allocation A: } 0.5125 = (16 - 3.7)/24$$

$$\text{Allocation B: } 0.488235 = (12 - 3.7)/17$$

$$\text{Allocation C: } 0.525 = (10 - 3.7)/12$$

$$\text{Allocation D: } 0.481818 = (9 - 3.7)/11$$

Allocation C, with the largest ratio (0.525), is the best alternative according to the safety-first criterion.

- C** To answer this question, note that $P(R_C < 3.7) = N(-0.525)$. We can round 0.525 to 0.53 for use with tables of the standard normal cdf. First, we calculate $N(-0.53) = 1 - N(0.53) = 1 - 0.7019 = 0.2981$ or about 30 percent. The safety-first optimal portfolio has a roughly 30 percent chance of not meeting a 3.7 percent return threshold.
- 18 A is correct. $P(8\% \leq \text{Portfolio return} \leq 11\%) = N(Z \text{ corresponding to } 11\%) - N(Z \text{ corresponding to } 8\%)$. For the first term, $Z = (11\% - 8\%)/14\% = 0.21$ approximately, and using the table of cumulative normal distribution given in the problem, $N(0.21) = 0.5832$. To get the second term immediately, note that 8 percent is the mean, and for the normal distribution 50 percent of the probability lies on either side of the mean. Therefore, $N(Z \text{ corresponding to } 8\%)$ must equal 50 percent. So $P(8\% \leq \text{Portfolio return} \leq 11\%) = 0.5832 - 0.50 = 0.0832$ or approximately 8.3 percent.
- 19 B is correct. There are three steps, which involve standardizing the portfolio return: First, subtract the portfolio mean return from each side of the inequality: $P(\text{Portfolio return} - 7\%) \leq 4\% - 7\%$. Second, divide each side of the inequality by the standard deviation of portfolio return: $P[(\text{Portfolio return} - 7\%)/13\% \leq (4\% - 7\%)/13\%] = P(Z \leq -0.2308) = N(-0.2308)$. Third, recognize that on the left-hand side we have a standard normal variable, denoted by Z and $N(-x) = 1 - N(x)$. Rounding -0.2308 to -0.23 for use with the cumulative

distribution function (cdf) table, we have $N(-0.23) = 1 - N(0.23) = 1 - 0.5910 = 0.409$, approximately 41 percent. The probability that the portfolio will underperform the target is about 41 percent.

- 20 A Elements that should appear in a definition of Monte Carlo simulation are that it makes use of a computer; that it is used to represent the operation of a complex system, or in some applications, to find an approximate solution to a problem; and that it involves the generation of a large number of random samples from a specified probability distribution. The exact wording can vary, but one definition follows:

Monte Carlo simulation in finance involves the use of a computer to represent the operation of a complex financial system. In some important applications, Monte Carlo simulation is used to find an approximate solution to a complex financial problem. An integral part of Monte Carlo simulation is the generation of a large number of random samples from a probability distribution.

- B *Strengths.* Monte Carlo simulation can be used to price complex securities for which no analytic expression is available, particularly European-style options.

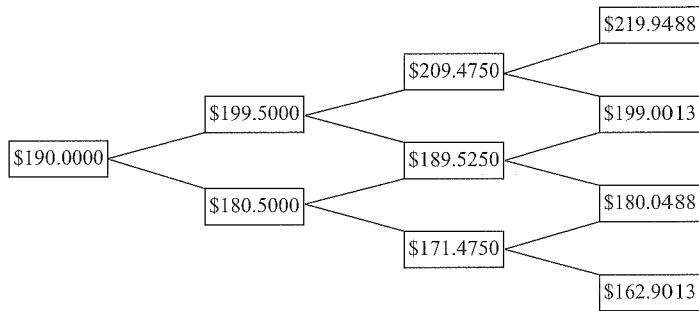
Weaknesses. Monte Carlo simulation provides only statistical estimates, not exact results. Analytic methods, when available, provide more insight into cause-and-effect relationships than does Monte Carlo simulation.

- 21 In the text, we described how we could use Monte Carlo simulation to value an Asian option, a complex European-style option. Just as we can calculate the average value of the stock over a simulation trial to value an Asian option, we can also calculate the minimum value of the stock over a simulation trial. Then, for a given simulation trial, we can calculate the terminal value of the call, given the minimum value of the stock for the simulation trial. We can then discount back this terminal value to the present to get the value of the call today ($t = 0$). The average of these $t = 0$ values over all simulation trials is the Monte Carlo simulated value of the lookback call option.
- 22 C is correct. The rate of return is a random variable because the future outcomes are uncertain, and it is continuous because it can take on an unlimited number of outcomes.
- 23 B is correct. The function $g(x)$ satisfies the conditions of a probability function. All of the values of $g(x)$ are between 0 and 1, and the values of $g(x)$ all sum to 1.
- 24 A is correct. The probability that X will take on a value of 4 or less is: $F(4) = P(X \leq 4) = p(1) + p(2) + p(3) + p(4) = 0.60$. The probability that X will take on a value of 3 or less is: $F(3) = P(X \leq 3) = p(1) + p(2) + p(3) = 0.50$. So, the probability that X will take on a value of 4 is: $F(4) - F(3) = p(4) = 0.10$. The probability of $X = 2$ can be found using the same logic: $F(2) - F(1) = p(2) = 0.25 - 0.15 = 0.10$. The probability of X taking on a value of 2 or 4 is: $p(2) + p(4) = 0.10 + 0.10 = 0.20$.
- 25 A is correct. A trial, such as a coin flip, will produce one of two outcomes. Such a trial is a Bernoulli trial.
- 26 A is correct. The continuously compounded return of an asset over a period is equal to the natural log of period's change. In this case:

$$\ln(120/112) = 6.90\%$$

- 27 C is correct. The probability of an up move (p) can be found by solving the equation: $(p)uS + (1 - p)dS = (p)105 + (1 - p)97 = 102$. Solving for p gives $8p = 5$, so that $p = 0.625$.

- 28 A is correct. Only the top node value of \$219.9488 exceeds \$200.



- 29 A is correct. The probability of generating a random number equal to any fixed point under a continuous uniform distribution is zero.
- 30 C is correct. A characteristic feature of Monte Carlo simulation is the generation of a large number of random samples from a specified probability distribution or distributions to represent the role of risk in the system.
- 31 C is correct. Monte Carlo simulation is a complement to analytical methods. Monte Carlo simulation provides statistical estimates and not exact results. Analytical methods, when available, provide more insight into cause-and-effect relationships
- 32 B is correct. A normal distribution has a skewness of zero (it is symmetrical around the mean). A non-zero skewness implies asymmetry in a distribution.
- 33 A is correct. The chance of a negative return falls in the area to the left of 0% under a standard normal curve. By standardizing the returns and standard deviations of the two assets, the likelihood of either asset experiencing a negative return may be determined: Z-score (standardized value) = $(X - \mu)/\sigma$

Z-score for a bond return of 0% = $(0 - 2)/5 = -0.40$.

Z-score for a stock return of 0% = $(0 - 10)/15 = -0.67$.

For bonds, a 0% return falls 0.40 standard deviations below the mean return of 2%. In contrast, for stocks, a 0% return falls 0.67 standard deviations below the mean return of 10%. A standard deviation of 0.40 is less than a standard deviation of 0.67. Negative returns thus occupy more of the left tail of the bond distribution than the stock distribution. Thus, bonds are more likely than stocks to experience a negative return.

- 34 B is correct. Allocation B has the highest safety-first ratio. The threshold return level R_L for the portfolio is £90,000/£2,000,000 = 4.5%, thus any return less than $R_L = 4.5\%$ will invade the portfolio principal. To compute the allocation that is safety-first optimal, select the alternative with the highest ratio:

$$\frac{E(R_P - R_L)}{\sigma_P}$$

$$\text{Allocation A} = \frac{6.5 - 4.5}{8.35} = 0.240$$

$$\text{Allocation B} = \frac{7.5 - 4.5}{10.21} = 0.294$$

$$\text{Allocation C} = \frac{8.5 - 4.5}{14.34} = 0.279$$

- 35 B is correct. By definition, lognormal random variables cannot have negative values.
- 36 C is correct. A lognormal distributed variable has a lower bound of zero. The lognormal distribution is also right skewed, which is a useful property in describing asset prices.
- 37 A is correct. The continuously compounded return from $t = 0$ to $t = 1$ is $r_{0,1} = \ln(S_1/S_0) = \ln(186.75/208.25) = -0.10897 = -10.90\%$.

SOLUTIONS

- 1 A** The standard deviation or standard error of the sample mean is $\sigma_{\bar{X}} = \sigma/\sqrt{n}$. Substituting in the values for $\sigma_{\bar{X}}$ and σ , we have $1\% = 6\%/\sqrt{n}$, or $\sqrt{n} = 6$. Squaring this value, we get a random sample of $n = 36$.
- B** As in Part A, the standard deviation of sample mean is $\sigma_{\bar{X}} = \sigma/\sqrt{n}$. Substituting in the values for $\sigma_{\bar{X}}$ and σ , we have $0.25\% = 6\%/\sqrt{n}$, or $\sqrt{n} = 24$. Squaring this value, we get a random sample of $n = 576$, which is substantially larger than for Part A of this question.
- 2 A** Assume the sample size will be large and thus the 95 percent confidence interval for the mean of a sample of manager returns is $\bar{X} \pm 1.96s_{\bar{X}}$, where $s_{\bar{X}} = s/\sqrt{n}$. Munzi wants the distance between the upper limit and lower limit in the confidence interval to be 1 percent, which is

$$(\bar{X} + 1.96s_{\bar{X}}) - (\bar{X} - 1.96s_{\bar{X}}) = 1\%$$

Simplifying this equation, we get $2(1.96s_{\bar{X}}) = 1\%$. Finally, we have $3.92s_{\bar{X}} = 1\%$, which gives us the standard deviation of the sample mean, $s_{\bar{X}} = 0.255\%$. The distribution of sample means is $s_{\bar{X}} = s/\sqrt{n}$. Substituting in the values for $s_{\bar{X}}$ and s , we have $0.255\% = 4\%/\sqrt{n}$, or $\sqrt{n} = 15.69$. Squaring this value, we get a random sample of $n = 246$.

- B** With her budget, Munzi can pay for a sample of up to 100 observations, which is far short of the 246 observations needed. Munzi can either proceed with her current budget and settle for a wider confidence interval or she can raise her budget (to around \$2,460) to get the sample size for a 1 percent width in her confidence interval.
- 3 A** This is a small-sample problem in which the sample comes from a normal population with a known standard deviation; thus we use the *z*-distribution in the solution. For a 95 percent confidence interval (and 2.5 percent in each tail), the critical *z*-value is 1.96. For returns that are normally distributed, a 95 percent confidence interval is of the form

$$\mu + 1.96 \frac{\sigma}{\sqrt{n}}$$

The lower limit is $X_l = \mu - 1.96 \frac{\sigma}{\sqrt{n}} = 6\% - 1.96 \frac{18\%}{\sqrt{4}} = 6\% - 1.96(9\%) = -11.64\%$.

The upper limit is $X_u = \mu + 1.96 \frac{\sigma}{\sqrt{n}} = 6\% + 1.96 \frac{18\%}{\sqrt{4}} = 6\% + 1.96(9\%) = 23.64\%$.

There is a 95 percent probability that four-year average returns will be between -11.64 percent and +23.64 percent.

- B** The critical *z*-value associated with the -2.0 percent return is

$$Z = \frac{\bar{X} - \mu}{\sigma/\sqrt{n}} = \frac{-2\% - 6\%}{18\%/\sqrt{4}} = \frac{-8\%}{9\%} = -0.89$$

Using a normal table, the probability of a z -value less than -0.89 is $P(Z < -0.89) = 0.1867$. Unfortunately, although your client is unhappy with the investment result, a four-year average return of -2.0 percent or lower should occur 18.67 percent of the time.

- 4 (Refer to Figure 1 to help visualize the answer to this question.) Basically, only one standard normal distribution exists, but many t -distributions exist—one for every different number of degrees of freedom. The normal distribution and the t -distribution for a large number of degrees of freedom are practically the same. The lower the degrees of freedom, the flatter the t -distribution becomes. The t -distribution has less mass (lower probabilities) in the center of the distribution and more mass (higher probabilities) out in both tails. Therefore, the confidence intervals based on t -values will be wider than those based on the normal distribution. Stated differently, the probability of being within a given number of standard deviations (such as within ± 1 standard deviation or ± 2 standard deviations) is lower for the t -distribution than for the normal distribution.
- 5 A For a 99 percent confidence interval, the reliability factor we use is $t_{0.005}$; for $df = 20$, this factor is 2.845.
B For a 90 percent confidence interval, the reliability factor we use is $t_{0.05}$; for $df = 20$, this factor is 1.725.
C Degrees of freedom equals $n - 1$, or in this case $25 - 1 = 24$. For a 95 percent confidence interval, the reliability factor we use is $t_{0.025}$; for $df = 24$, this factor is 2.064.
D Degrees of freedom equals $16 - 1 = 15$. For a 95 percent confidence interval, the reliability factor we use is $t_{0.025}$; for $df = 15$, this factor is 2.131.
- 6 Because this is a small sample from a normal population and we have only the sample standard deviation, we use the following model to solve for the confidence interval of the population mean:

$$\bar{X} \pm t_{\alpha/2} \frac{s}{\sqrt{n}}$$

where we find $t_{0.025}$ (for a 95 percent confidence interval) for $df = n - 1 = 24 - 1 = 23$; this value is 2.069. Our solution is $1\% \pm 2.069(4\%) / \sqrt{24} = 1\% \pm 2.069(0.8165) = 1\% \pm 1.69$. The 95 percent confidence interval spans the range from -0.69 percent to $+2.69$ percent.

- 7 The following table summarizes the calculations used in the answers.

Forecast (X_i)	Number of Analysts (n_i)	$X_i n_i$	$(X_i - \bar{X})$	$(X_i - \bar{X})^2$	$(X_i - \bar{X})^2 n_i$
1.40	1	1.40	-0.05	0.0025	0.0025
1.43	1	1.43	-0.02	0.0004	0.0004
1.44	3	4.32	-0.01	0.0001	0.0003
1.45	2	2.90	0.00	0.0000	0.0000
1.47	1	1.47	0.02	0.0004	0.0004
1.48	1	1.48	0.03	0.0009	0.0009
1.50	1	1.50	0.05	0.0025	0.0025
Sums	10	14.50			0.0070

- A With $n = 10$, $\bar{X} = \sum_{i=1}^{10} X_i/n = 14.50/10 = 1.45$. The variance is $s^2 = \left[\sum_{i=1}^{10} (X_i - \bar{X})^2 \right] / (n-1) = 0.0070/9 = 0.0007778$. The sample standard deviation is $s = \sqrt{0.0007778} = 0.02789$.
- B The confidence interval for the mean can be estimated by using $\bar{X} \pm t_{\alpha/2}(s/\sqrt{n})$. For 9 degrees of freedom, the reliability factor, $t_{0.025}$, equals 2.262 and the confidence interval is

$$1.45 \pm 2.262 \times 0.02789/\sqrt{10} = 1.45 \pm 2.262(0.00882)$$

$$= 1.45 \pm 0.02$$

The confidence interval for the population mean ranges from 1.43 to 1.47.

- 8 The following table summarizes the calculations used in the answers.

Forecast (X_i)	Number of Analysts (n_i)	$X_i n_i$	$(X_i - \bar{X})$	$(X_i - \bar{X})^2$	$(X_i - \bar{X})^2 n_i$
0.70	2	1.40	-0.04	0.0016	0.0032
0.72	4	2.88	-0.02	0.0004	0.0016
0.74	1	0.74	0.00	0.0000	0.0000
0.75	3	2.25	0.01	0.0001	0.0003
0.76	1	0.76	0.02	0.0004	0.0004
0.77	1	0.77	0.03	0.0009	0.0009
0.82	1	0.82	0.08	0.0064	0.0064
Sums	13	9.62			0.0128

- A With $n = 13$, $\bar{X} = \sum_{i=1}^{13} X_i/n = 9.62/13 = 0.74$. The variance is $s^2 = \left[\sum_{i=1}^{13} (X_i - \bar{X})^2 \right] / (n-1) = 0.0128/12 = 0.001067$. The sample standard deviation is $s = \sqrt{0.001067} = 0.03266$.
- B The sample is small, and the distribution appears to be bimodal. We cannot compute a confidence interval for the population mean because we have probably sampled from a distribution that is not normal.
- 9 If the population variance is known, the confidence interval is

$$\bar{X} \pm z_{\alpha/2} \frac{\sigma}{\sqrt{n}}$$

The confidence interval for the population mean is centered at the sample mean, \bar{X} . The population standard deviation is σ , and the sample size is n . The population standard deviation divided by the square root of n is the standard error of the estimate of the mean. The value of z depends on the desired degree of confidence. For a 95 percent confidence interval, $z_{0.025} = 1.96$ and the confidence interval estimate is

$$\bar{X} \pm 1.96 \frac{\sigma}{\sqrt{n}}$$

If the population variance is not known, we make two changes to the technique used when the population variance is known. First, we must use the sample standard deviation instead of the population standard deviation. Second, we use the *t*-distribution instead of the normal distribution. The critical *t*-value will depend on degrees of freedom $n - 1$. If the sample size is large, we have the alternative of using the *z*-distribution with the sample standard deviation.

- 10 A** The probabilities can be taken from a normal table, in which the critical *z*-values are 2.00 or 3.00 and we are including the probabilities in both tails. The probabilities that the exchange rate will be at least 2 or 3 standard deviations away from the mean are

$$P(|X - \mu| \geq 2\sigma) = 0.0456$$

$$P(|X - \mu| \geq 3\sigma) = 0.0026$$

- B** With Chebyshev's inequality, the maximum probability of the exchange rate being at least k standard deviations from the mean is $P(|X - \mu| \geq k\sigma) \leq (1/k)^2$. The maximum probabilities of the rate being at least 2 or 3 standard deviations away from the mean are

$$P(|X - \mu| \geq 2\sigma) \leq (1/2)^2 = 0.2500$$

$$P(|X - \mu| \geq 3\sigma) \leq (1/3)^2 = 0.1111$$

The probability of the rate being outside 2 or 3 standard deviations of the mean is much smaller with a known normal distribution than when the distribution is unknown and we are relying on Chebyshev's inequality.

- 11** No. First the conclusion on the limit of zero is wrong; second, the support cited for drawing the conclusion (i.e., the central limit theorem) is not relevant in this context.
- 12** In many instances, the distribution that describes the underlying population is not normal or the distribution is not known. The central limit theorem states that if the sample size is large, regardless of the shape of the underlying population, the distribution of the sample mean is approximately normal. Therefore, even in these instances, we can still construct confidence intervals (and conduct tests of inference) as long as the sample size is large (generally $n \geq 30$).
- 13** The statement makes the following mistakes:
- Given the conditions in the statement, the distribution of \bar{X} will be approximately normal only for large sample sizes.
 - The statement omits the important element of the central limit theorem that the distribution of \bar{X} will have mean μ .
- 14** A is correct. The discrepancy arises from sampling error. Sampling error exists whenever one fails to observe every element of the population, because a sample statistic can vary from sample to sample. As stated in the reading, the sample mean is an unbiased estimator, a consistent estimator, and an efficient estimator of the population mean. Although the sample mean is an unbiased estimator of the population mean—the expected value of the sample mean equals the population mean—because of sampling error, we do not expect the sample mean to exactly equal the population mean in any one sample we may take.

- 15 No, we cannot say that Alcorn Mutual Funds as a group is superior to competitors. Alcorn Mutual Funds' advertisement may easily mislead readers because the advertisement does not show the performance of all its funds. In particular, Alcorn Mutual Funds is engaging in sample selection bias by presenting the investment results from its best-performing funds only.
- 16 Spence may be guilty of data mining. He has used so many possible combinations of variables on so many stocks, it is not surprising that he found some instances in which a model worked. In fact, it would have been more surprising if he had not found any. To decide whether to use his model, you should do two things: First, ask that the model be tested on out-of-sample data—that is, data that were not used in building the model. The model may not be successful with out-of-sample data. Second, examine his model to make sure that the relationships in the model make economic sense, have a story, and have a future.
- 17 C is correct. Stratified random sampling involves dividing a population into subpopulations based on one or more classification criteria. Then, simple random samples are drawn from each subpopulation in sizes proportional to the relative size of each subpopulation. These samples are then pooled to form a stratified random sample.
- 18 B is correct. Given a population described by any probability distribution (normal or non-normal) with finite variance, the central limit theorem states that the sampling distribution of the sample mean will be approximately normal, with the mean approximately equal to the population mean, when the sample size is large.
- 19 B is correct. Taking the square root of the known population variance to determine the population standard deviation (σ) results in:

$$\sigma = \sqrt{2.45} = 1.565$$

The formula for the standard error of the sample mean (σ_X), based on a known sample size (n), is:

$$\sigma_X = \frac{\sigma}{\sqrt{n}}$$

Therefore,

$$\sigma_X = \frac{1.565}{\sqrt{40}} = 0.247$$

- 20 B is correct. An unbiased estimator is one for which the expected value equals the parameter it is intended to estimate.
- 21 A is correct. A consistent estimator is one for which the probability of estimates close to the value of the population parameter increases as sample size increases. More specifically, a consistent estimator's sampling distribution becomes concentrated on the value of the parameter it is intended to estimate as the sample size approaches infinity.
- 22 A is correct. As the degree of confidence increases (e.g., from 95% to 99%), a given confidence interval will become wider. A confidence interval is a range for which one can assert with a given probability $1 - \alpha$, called the degree of confidence, that it will contain the parameter it is intended to estimate.

- 23 A is correct. A standard normal distribution has tails that approach zero faster than the *t*-distribution. As degrees of freedom increase, the tails of the *t*-distribution become less fat and the *t*-distribution begins to look more like a standard normal distribution. But as degrees of freedom decrease, the tails of the *t*-distribution become fatter.

- 24 B is correct. The confidence interval is calculated using the following equation:

$$\bar{X} \pm t_{\alpha/2} \frac{s}{\sqrt{n}}$$

Sample standard deviation (*s*) = $\sqrt{245.55} = 15.670$.

For a sample size of 17, degrees of freedom equal 16, so $t_{0.05} = 1.746$.

The confidence interval is calculated as

$$116.23 \pm 1.746 \frac{15.67}{\sqrt{17}} = 116.23 \pm 6.6357$$

Therefore, the interval spans 109.5943 to 122.8656, meaning its width is equal to approximately 13.271. (This interval can be alternatively calculated as 6.6357×2).

- 25 A is correct. To solve, use the structure of Confidence interval = Point estimate \pm Reliability factor \times Standard error, which, for a normally distributed population with known variance, is represented by the following formula:

$$\bar{X} \pm z_{\alpha/2} \frac{\sigma}{\sqrt{n}}$$

For a 99% confidence interval, use $z_{0.005} = 2.58$.

Also, $\sigma = \sqrt{529} = 23$.

Therefore, the lower limit = $31 - 2.58 \frac{23}{\sqrt{65}} = 23.6398$.

- 26 B is correct. All else being equal, as the sample size increases, the standard error of the sample mean decreases and the width of the confidence interval also decreases.

- 27 B is correct. A report that uses a current list of stocks does not account for firms that failed, merged, or otherwise disappeared from the public equity market in previous years. As a consequence, the report is biased. This type of bias is known as survivorship bias.

- 28 B is correct. An out-of-sample test is used to investigate the presence of data-mining bias. Such a test uses a sample that does not overlap the time period of the sample on which a variable, strategy, or model was developed.

- 29 A is correct. A short time series is likely to give period-specific results that may not reflect a longer time period.

SOLUTIONS

- 1 C is correct. Together, the null and alternative hypotheses account for all possible values of the parameter. Any possible values of the parameter not covered by the null must be covered by the alternative hypothesis (e.g., $H_0: \theta \leq 5$ versus $H_a: \theta > 5$).
- 2 A The appropriate test statistic is a t -statistic with $n - 1 = 15 - 1 = 14$ degrees of freedom. A t -statistic is theoretically correct when the sample comes from a normally distributed population with unknown variance. When the sample size is also small, there is no practical alternative.
- B The appropriate test statistic is a t -statistic with $40 - 1 = 39$ degrees of freedom. A t -statistic is theoretically correct when the sample comes from a normally distributed population with unknown variance. When the sample size is large (generally, 30 or more is a “large” sample), it is also possible to use a z -statistic, whether the population is normally distributed or not. A test based on a t -statistic is more conservative than a z -statistic test.
- C The appropriate test statistic is a z -statistic because the sample comes from a normally distributed population with known variance. (The known population standard deviation is used to compute the standard error of the mean using Equation 2 in the text.)
- D The appropriate test statistic is chi-square (χ^2) with $50 - 1 = 49$ degrees of freedom.
- E The appropriate test statistic is the F -statistic (the ratio of the sample variances).
- F The appropriate test statistic is a t -statistic for a paired observations test (a paired comparisons test), because the samples are correlated.
- G The appropriate test statistic is a t -statistic using a pooled estimate of the population variance. The t -statistic has $25 + 30 - 2 = 53$ degrees of freedom. This statistic is appropriate because the populations are normally distributed with unknown variances; because the variances are assumed equal, the observations can be pooled to estimate the common variance. The requirement of independent samples for using this statistic has been met.
- 3 A With degrees of freedom (df) $n - 1 = 26 - 1 = 25$, the rejection point conditions for this two-sided test are $t > 2.060$ and $t < -2.060$. Because the significance level is 0.05, $0.05/2 = 0.025$ of the probability is in each tail. The tables give one-sided (one-tailed) probabilities, so we used the 0.025 column. Read across df = 25 to the $\alpha = 0.025$ column to find 2.060, the rejection point for the right tail. By symmetry, -2.060 is the rejection point for the left tail.
- B With df = 39, the rejection point conditions for this two-sided test are $t > 2.708$ and $t < -2.708$. This is a two-sided test, so we use the $0.01/2 = 0.005$ column. Read across df = 39 to the $\alpha = 0.005$ column to find 2.708, the rejection point for the right tail. By symmetry, -2.708 is the rejection point for the left tail.
- C With df = 39, the rejection point condition for this one-sided test is $t > 2.426$. Read across df = 39 to the $\alpha = 0.01$ column to find 2.426, the rejection point for the right tail. Because we have a “greater than” alternative, we are concerned with only the right tail.

- D** With $df = 20$, the rejection point condition for this one-sided test is $t > 1.725$. Read across $df = 20$ to the $\alpha = 0.05$ column to find 1.725, the rejection point for the right tail. Because we have a “greater than” alternative, we are concerned with only the right tail.
- E** With $df = 18$, the rejection point condition for this one-sided test is $t < -1.330$. Read across $df = 18$ to the $\alpha = 0.10$ column to find 1.330, the rejection point for the right tail. By symmetry, the rejection point for the left tail is -1.330 .
- F** With $df = 49$, the rejection point condition for this one-sided test is $t < -1.677$. Read across $df = 49$ to the $\alpha = 0.05$ column to find 1.677, the rejection point for the right tail. By symmetry, the rejection point for the left tail is -1.677 .
- 4** Recall that with a z -test (in contrast to the t -test), we do not employ degrees of freedom. The standard normal distribution is a single distribution applicable to all z -tests. You should refer to “Rejection Points for a z -Test” in Section 3.1 to answer these questions.
- A** This is a two-sided test at a 0.01 significance level. In Part C of “Rejection Points for a z -Test,” we find that the rejection point conditions are $z > 2.575$ and $z < -2.575$.
- B** This is a two-sided test at a 0.05 significance level. In Part B of “Rejection Points for a z -Test,” we find that the rejection point conditions are $z > 1.96$ and $z < -1.96$.
- C** This is a two-sided test at a 0.10 significance level. In Part A of “Rejection Points for a z -Test,” we find that the rejection point conditions are $z > 1.645$ and $z < -1.645$.
- D** This is a one-sided test at a 0.05 significance level. In Part B of “Rejection Points for a z -Test,” we find that the rejection point condition for a test with a “greater than” alternative hypothesis is $z > 1.645$.
- 5** **A** As stated in the text, we often set up the “hoped for” or “suspected” condition as the alternative hypothesis. Here, that condition is that the population value of Wilco’s mean annual net income exceeds \$24 million. Thus we have $H_0: \mu \leq 24$ versus $H_a: \mu > 24$.
- B** Given that net income is normally distributed with unknown variance, the appropriate test statistic is t with $n - 1 = 6 - 1 = 5$ degrees of freedom.
- C** In the t -distribution table in the back of the book, in the row for $df = 5$ under $\alpha = 0.05$, we read the rejection point (critical value) of 2.015. We will reject the null if $t > 2.015$.
- D** The t -test is given by Equation 4:
- $$t_5 = \frac{\bar{X} - \mu_0}{s/\sqrt{n}} = \frac{30 - 24}{10/\sqrt{6}} = \frac{6}{4.082483} = 1.469694$$
- or 1.47. Because 1.47 does not exceed 2.015, we do not reject the null hypothesis. The difference between the sample mean of \$30 million and the hypothesized value of \$24 million under the null is not statistically significant.
- 6** **A** $H_0: \mu = 0$ versus $H_a: \mu \neq 0$.
- B** The t -test is based on $t = \frac{\bar{X} - \mu_0}{s/\sqrt{n}}$ with $n - 1 = 101 - 1 = 100$ degrees of freedom. At the 0.05 significance level, we reject the null if $t > 1.984$ or if $t < -1.984$. At the 0.01 significance level, we reject the null if $t > 2.626$ or if $t <$

-2.626 . For Analyst A, we have $t = (0.05 - 0) / (0.10 / \sqrt{101}) = 0.05 / 0.00995 = 5.024938$ or 5.025 . We clearly reject the null hypothesis at both the 0.05 and 0.01 levels.

The calculation of the z -statistic with unknown variance, as in this case, is the same as the calculation of the t -statistic. The rejection point conditions for a two-tailed test are as follows: $z > 1.96$ and $z < -1.96$ at the 0.05 level; and $z > 2.575$ and $z < -2.575$ at the 0.01 level. Note that the z -test is a less conservative test than the t -test, so when the z -test is used, the null is easier to reject. Because $z = 5.025$ is greater than 2.575 , we reject the null at the 0.01 level; we also reject the null at the 0.05 level.

In summary, Analyst A's EPS forecasts appear to be biased upward—they tend to be too high.

- C For Analyst B, the t -test is based on t with $121 - 1 = 120$ degrees of freedom. At the 0.05 significance level, we reject the null if $t > 1.980$ or if $t < -1.980$. At the 0.01 significance level, we reject the null if $t > 2.617$ or if $t < -2.617$. We calculate $t = (0.02 - 0) / (0.09 / \sqrt{121}) = 0.02 / 0.008182 = 2.444444$ or 2.44 . Because $2.44 > 1.98$, we reject the null at the 0.05 level. However, 2.44 is not larger than 2.617 , so we do not reject the null at the 0.01 level.

For a z -test, the rejection point conditions are the same as given in Part B, and we come to the same conclusions as with the t -test. Because $2.44 > 1.96$, we reject the null at the 0.05 significance level; however, because 2.44 is not greater than 2.575 , we do not reject the null at the 0.01 level.

The mean forecast error of Analyst B is only $\$0.02$; but because the test is based on a large number of observations, it is sufficient evidence to reject the null of mean zero forecast errors at the 0.05 level.

- 7 A Stating the suspected condition as the alternative hypothesis, we have

$$H_0: \mu_1 - \mu_2 \leq 0 \text{ versus } H_a: \mu_1 - \mu_2 > 0$$

where

μ_1 = the population mean value of Analyst A's forecast errors

μ_2 = the population mean value of Analyst B's forecast errors

- B We have two normally distributed populations with unknown variances. Based on the samples, it is reasonable to assume that the population variances are equal. The samples are assumed to be independent; this assumption is reasonable because the analysts cover quite different industries. The appropriate test statistic is t using a pooled estimate of the common variance. The number of degrees of freedom is

$$n_1 + n_2 - 2 = 101 + 121 - 2 = 222 - 2 = 220.$$

- C For $df = 200$ (the closest value to 220), the rejection point for a one-sided test at the 0.05 significance level is 1.653 .
- D We first calculate the pooled estimate of variance:

$$\begin{aligned} s_p^2 &= \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2} = \frac{(101 - 1)(0.10)^2 + (121 - 1)(0.09)^2}{101 + 121 - 2} \\ &= \frac{1.972}{220} = 0.008964 \end{aligned}$$

Then

$$\begin{aligned} t &= \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\left(\frac{s_p^2}{n_1} + \frac{s_p^2}{n_2} \right)^{1/2}} = \frac{(0.05 - 0.02) - 0}{\left(\frac{0.008964}{101} + \frac{0.008964}{121} \right)^{1/2}} \\ &= \frac{0.03}{0.01276} = 2.351018 \end{aligned}$$

or 2.35. Because $2.35 > 1.653$, we reject the null hypothesis in favor of the alternative hypothesis that the population mean forecast error of Analyst A is greater than that of Analyst B.

- 8 A** We test $H_0: \mu_d = 0$ versus $H_a: \mu_d \neq 0$.
B This is a paired comparisons t -test with $n - 1 = 480 - 1 = 479$ degrees of freedom. At the 0.05 significance level, we reject the null hypothesis if either $t > 1.96$ or $t < -1.96$. We use $df = \infty$ in the t -distribution table under $\alpha = 0.025$ because we have a very large sample and a two-sided test.

$$t = \frac{\bar{d} - \mu_{d0}}{s_d} = \frac{-0.258 - 0}{3.752/\sqrt{480}} = \frac{-0.258}{0.171255} = -1.506529 \text{ or } -1.51$$

At the 0.05 significance level, because neither rejection point condition is met, we do not reject the null hypothesis that the mean difference between the returns on the S&P 500 and small-cap stocks during the entire sample period was 0.

- C** This t -test now has $n - 1 = 240 - 1 = 239$ degrees of freedom. At the 0.05 significance level, we reject the null hypothesis if either $t > 1.972$ or $t < -1.972$, using $df = 200$ in the t -distribution tables.

$$t = \frac{\bar{d} - \mu_{d0}}{s_d} = \frac{-0.640 - 0}{4.096/\sqrt{240}} = \frac{-0.640}{0.264396} = -2.420615 \text{ or } -2.42$$

Because $-2.42 < -1.972$, we reject the null hypothesis at the 0.05 significance level. During this subperiod, small-cap stocks significantly outperformed the S&P 500.

- D** This t -test has $n - 1 = 240 - 1 = 239$ degrees of freedom. At the 0.05 significance level, we reject the null hypothesis if either $t > 1.972$ or $t < -1.972$, using $df = 200$ in the t -distribution tables.

$$t = \frac{\bar{d} - \mu_{d0}}{s_d} = \frac{0.125 - 0}{3.339/\sqrt{240}} = \frac{0.125}{0.215532} = 0.579962 \text{ or } 0.58$$

At the 0.05 significance level, because neither rejection point condition is met, we do not reject the null hypothesis that for the January 1980–December 1999 period, the mean difference between the returns on the S&P 500 and small-cap stocks was zero.

- 9 A** We have a “less than” alternative hypothesis, where σ^2 is the variance of return on the portfolio. The hypotheses are $H_0: \sigma^2 \geq 400$ versus $H_a: \sigma^2 < 400$, where 400 is the hypothesized value of variance, σ_0^2 .
B The test statistic is chi-square with $10 - 1 = 9$ degrees of freedom.
C The rejection point is found across degrees of freedom of 9, under the 0.95 column (95 percent of probability above the value). It is 3.325. We will reject the null hypothesis if we find that $\chi^2 < 3.325$.

- D The test statistic is calculated as

$$\chi^2 = \frac{(n - 1)s^2}{\sigma_0^2} = \frac{9 \times 15^2}{400} = \frac{2,025}{400} = 5.0625 \text{ or } 5.06$$

Because 5.06 is not less than 3.325, we do not reject the null hypothesis.

- 10 A We have a “not equal to” alternative hypothesis:

$$H_0: \sigma_{\text{Before}}^2 = \sigma_{\text{After}}^2 \text{ versus } H_a: \sigma_{\text{Before}}^2 \neq \sigma_{\text{After}}^2$$

- B To test a null hypothesis of the equality of two variances, we use an *F*-test:

$$F = \frac{s_1^2}{s_2^2}$$

- C The “before” sample variance is larger, so following a convention for calculating *F*-statistics, the “before” sample variance goes in the numerator. $F = 22.367/15.795 = 1.416$, with $120 - 1 = 119$ numerator and denominator degrees of freedom. Because this is a two-tailed test, we use *F*-tables for the 0.025 level ($df = 0.05/2$). Using the tables in the back of the volume, the closest value to 119 is 120 degrees of freedom. At the 0.05 level, the rejection point is 1.43. (Using the Insert/Function/Statistical feature on a Microsoft Excel spreadsheet, we would find $\text{FINV}(0.025, 119, 119) = 1.434859$ as the critical *F*-value.) Because 1.416 is not greater than 1.43, we do not reject the null hypothesis that the “before” and “after” variances are equal.

- 11 A is correct. The critical value in a decision rule is the rejection point for the test. It is the point with which the test statistic is compared to determine whether to reject the null hypothesis, which is part of the fourth step in hypothesis testing.
- 12 A is correct. The null hypothesis is the hypothesis to be tested. The null hypothesis is considered to be true unless the evidence indicates that it is false, in which case the alternative hypothesis is accepted.
- 13 A is correct. If the population sampled has unknown variance and the sample is large, a *z*-test may be used. Hypotheses involving “greater than” or “less than” postulations are one-sided (one-tailed). In this situation, the null and alternative hypotheses are stated as $H_0: \mu \leq 6\%$ and $H_a: \mu > 6\%$, respectively. A one-tailed *t*-test is also acceptable in this case.
- 14 C is correct. For a one-tailed hypothesis test, there is a 5% critical value rejection region in one tail of the distribution.
- 15 B is correct. One-tailed tests in which the alternative is “greater than” or “less than” represent the beliefs of the researcher more firmly than a “not equal to” alternative hypothesis.
- 16 A is correct. Calculated using a sample, a test statistic is a quantity whose value is the basis for deciding whether to reject the null hypothesis.
- 17 A is correct. The definition of a Type I error is when a true null hypothesis is rejected.
- 18 B is correct. A Type II error occurs when a false null hypothesis is not rejected.
- 19 B is correct. The level of significance is used to establish the rejection points of the hypothesis test.
- 20 A We have a “not equal to” alternative hypothesis:

$$H_0: \rho = 0 \text{ versus } H_a: \rho \neq 0$$

- B We would use the nonparametric Spearman rank correlation coefficient to conduct the test.
- C Mutual fund expense ratios are bounded from above and below, and in practice there is at least a lower bound on alpha (as any return cannot be less than -100 percent). These variables are markedly non-normally distributed, and the assumptions of a parametric test are not likely to be fulfilled. Thus a nonparametric test appears to be appropriate.
- D The calculation of the Spearman rank correlation coefficient is given in the following table.

Mutual Fund	1	2	3	4	5	6	7	8	9
Alpha (X)	-0.52	-0.13	-0.60	-1.01	-0.26	-0.89	-0.42	-0.23	-0.60
Expense Ratio (Y)	1.34	0.92	1.02	1.45	1.35	0.50	1.00	1.50	1.45
X Rank	5	1	6.5	9	3	8	4	2	6.5
Y Rank	5	8	6	2.5	4	9	7	1	2.5
d_i	0	-7	0.5	6.5	-1	-1	-3	1	4
d_i^2	0	49	0.25	42.25	1	1	9	1	16

$$r_s = 1 - \frac{6 \sum d_i^2}{n(n^2 - 1)} = 1 - \frac{6(119.50)}{9(81 - 1)} = 0.0042$$

We use Table 11 to tabulate the rejection points for a test on the Spearman rank correlation. Given a sample size of 9 in a two-tailed test at a 0.05 significance level, the upper-tail rejection point is 0.6833 (we use the 0.025 column). Thus we reject the null hypothesis if the Spearman rank correlation coefficient is less than -0.6833 or greater than 0.6833. Because r_s is equal to 0.0042, we do not reject the null hypothesis.

- 21 B is correct. Specifying a smaller significance level decreases the probability of a Type I error (rejecting a true null hypothesis), but increases the probability of a Type II error (not rejecting a false null hypothesis). As the level of significance decreases, the null hypothesis is less frequently rejected.
- 22 B is correct. The power of a test is the probability of rejecting the null hypothesis when it is false.
- 23 B is correct. The power of a hypothesis test is the probability of correctly rejecting the null when it is false. Failing to reject the null when it is false is a Type II error. Thus, the power of a hypothesis test is the probability of not committing a Type II error.
- 24 C is correct. When a statistically significant result is also economically meaningful, one should further explore the logic of why the result might work in the future.
- 25 A is correct. The hypothesis is a two-tailed formulation. The t -statistic of 2.802 falls outside the critical rejection points of less than -2.756 and greater than 2.756, therefore the null hypothesis is rejected; the result is statistically significant. However, despite the statistical results, trying to profit on the strategy is not likely to be economically meaningful because the return is near zero after transaction costs.

- 26 C is correct. When directly comparing the p -value with the level of significance, it can be used as an alternative to using rejection points to reach conclusions on hypothesis tests. If the p -value is smaller than the specified level of significance, the null hypothesis is rejected. Otherwise, the null hypothesis is not rejected.
- 27 C is correct. The p -value is the smallest level of significance at which the null hypothesis can be rejected for a given value of the test statistic. The null hypothesis is rejected when the p -value is less than the specified significance level.
- 28 A is correct. The p -value is the smallest level of significance (α) at which the null hypothesis can be rejected.
- 29 C is correct. The p -value is the smallest level of significance (α) at which the null hypothesis can be rejected. If the p -value is less than α , the null can be rejected. The smaller the p -value, the stronger the evidence is against the null hypothesis and in favor of the alternative hypothesis. Thus, the evidence for rejecting the null is strongest for Test 3.
- 30 B is correct. The z -test is theoretically the correct test to use in those limited cases when testing the population mean of a normally distributed population with known variance.
- 31 A is correct. A t -test is used if the sample is small and drawn from a normally or approximately normally distributed population.
- 32 B is correct. A t -statistic is the most appropriate for hypothesis tests of the population mean when the variance is unknown and the sample is small but the population is normally distributed.
- 33 A is correct. The t -statistic value of 0.4893 does not fall into the critical value rejection regions (≤ -1.984 or > 1.984). Instead it falls well within the acceptance region. Thus, H_0 cannot be rejected; the result is not statistically significant at the 0.05 level.
- 34 B is correct. The assumption that the variances are equal allows for the combining of both samples to obtain a pooled estimate of the common variance.
- 35 B is correct. A paired comparisons test is appropriate to test the mean differences of two samples believed to be dependent.
- 36 A is correct. The sample sizes for both the fund manager and the consultant's accounts consists of forty quarterly periods of returns. However, the consultant's client accounts are a subset of the fund manager's entire account base. As such, they are not independent samples. When samples are dependent, a paired comparisons test is appropriate to conduct tests of the differences in dependent items.
- 37 A is correct. A chi-square test is used for tests concerning the variance of a single normally distributed population.
- 38 B is correct. An F -test is used to conduct tests concerning the difference between the variances of two normally distributed populations with random independent samples.
- 39 A is correct. A non-parametric test is used when the data are given in ranks.
- 40 B is correct. There are only 12 (monthly) observations over the one year of the sample and thus the samples are small. Additionally, the funds' returns are non-normally distributed. Therefore, the samples do not meet the distributional assumptions for a parametric test. The Mann–Whitney U test (a nonparametric test) could be used to test the differences between population means.

SOLUTIONS

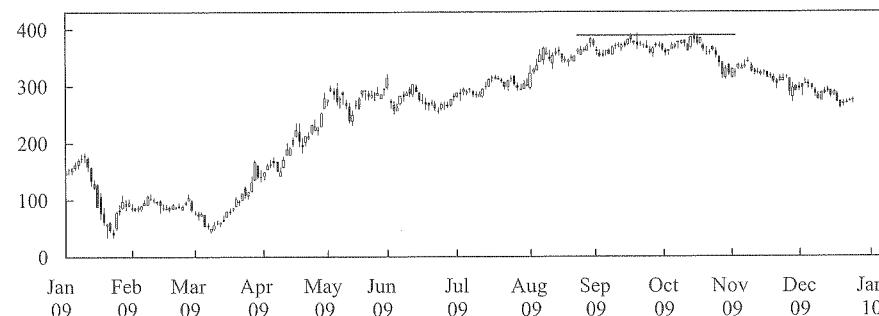
- 1 A is correct. Almost all technical analysis relies on these data inputs.
- 2 A is correct. Technical analysis works because markets are *not* efficient and rational and because human beings tend to behave similarly in similar circumstances. The result is market trends and patterns that repeat themselves and are somewhat predictable.
- 3 A is correct. Trends generally must be in place for some time before they are recognizable. Thus, some time may be needed for a change in trend to be identified.
- 4 A is correct. Commodities and currencies do not have underlying financial statements or an income stream; thus, fundamental analysis is useless in determining theoretical values for them or whether they are over- or undervalued.
- 5 C is correct. The top and bottom of the bars indicate the highs and lows for the day; the line on the left indicates the opening price and the line on the right indicates the closing price.
- 6 C is correct. Dark and light shading is a unique feature of candlestick charts.
- 7 C is correct. Rising volume shows conviction by many market participants, which is likely to lead to a continuation of the trend.
- 8 A is correct. The price of gold in nominal dollars was several orders of magnitude cheaper 100 years ago than it is today (roughly US\$20 then versus US\$1,100 today). Such a wide range of prices lends itself well to being graphically displayed on a logarithmic scale.
- 9 B is correct. A downtrend line is constructed by drawing a line connecting the highs of the price chart.
- 10 B is correct. It is demonstrated in the following chart:

**Exhibit 1 Candlestick Chart: GreatWall Information Industry Co., Ltd. Price Data, November 2008–September 2009
(Price Measured in RMB × 10)**



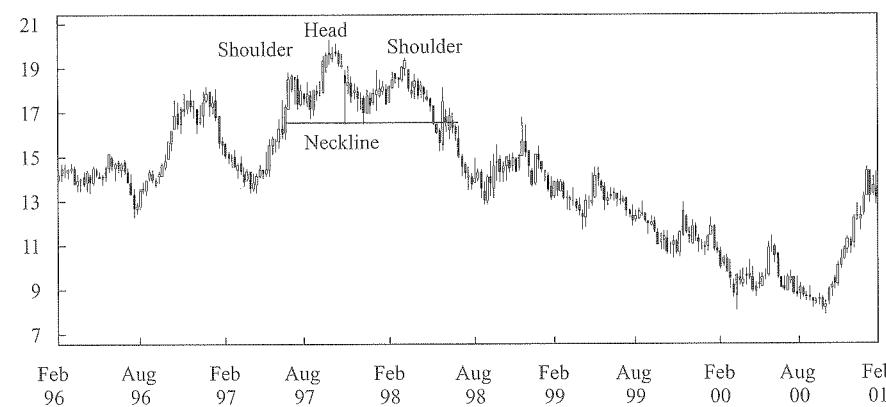
- 11 B is correct.
- 12 C is correct. As shown in the following chart, Barclays shares traded up to 390p on three occasions, each several weeks apart, and declined thereafter each time.

Exhibit 2 Candlestick Chart: Barclays plc Price Data, January 2009–January 2010 (Price Measured in British Pence)



- 13 C is correct. The left shoulder formed at around US\$18.50, the head formed at around US\$20.50, and the second shoulder formed at around US\$19.

Exhibit 3 Candlestick Chart: Archer Daniels Midland Company, February 1996–February 2001



- 14 C is correct. Target = Neckline + (Neckline – Head): $\$100 + (\$100 - \$75) = \125
- 15 A is correct. A large increase in the number of IPOs increases the supply of equity and if overall demand remains the same, puts downward pressure on equities. Also, companies tend to issue shares of equity when the managers believe they will receive a premium price, which is also an indicator of a market top.
- 16 B is correct. A value below 1.0 is a bullish sign; it means more volume is in rising shares than in declining ones. The TRIN is calculated as: (Advancing issues/Declining issues)/(Volume of advancing issues/Volume of declining issues).

- 17 C is correct. Bollinger Bands consist of a moving average and a higher line representing the moving average plus a set number of standard deviations from average price (for the same number of periods as used to calculate the moving average) and a lower line that is a moving average minus the same number of standard deviations.
- 18 C is correct. Bollinger Bands are price-based indicators, *not* momentum oscillators, which are constructed so that they oscillate between a high and a low or around 0 or 100.
- 19 A is correct. Triangles are one of several continuation patterns.
- 20 C is correct. It is one of several reversal patterns.
- 21 A is correct. Volume is necessary to confirm the various market rallies and reversals during the formation of the head and shoulders pattern.
- 22 B is correct.
- 23 A is correct. The decennial pattern theory states that years ending with a 5 will have the best performance of any of the 10 years in a decade and that those ending with a zero will have the worst.
- 24 C is correct. A possible reason for the superior performance in the third year is that the US presidential election occurs, together with a number of other elections, in a four-year cycle, so the politicians desiring to be reelected inject money into the economy in the third year to improve their chances of winning the following year.
- 25 A is correct. Long-term cycles require many years to complete; thus, not many cycles are available to observe.
- 26 B is correct.
- 27 A is correct. This is the term for a separate cycle theory.
- 28 C is correct. Relative strength analysis is often used to compare two asset classes or two securities.

SOLUTIONS

- 1 C is correct. When the price elasticity of demand coefficient is -1 , demand is said to be unit elastic, or unitary elastic.
- 2 A is correct. Inserting the price of \$35 into the demand function, quantity demanded is calculated as

$$Q_{hm}^d = 400 - 5(35) = 225$$

At a price of \$35 per health club membership, the elasticity of demand is

$$\text{Price elasticity of demand} = \left(\Delta Q_{hm}^d / \Delta P_{hm} \right) \times \left(P_{hm} / Q_{hm}^d \right)$$

$$\text{Price elasticity of demand} = -5 \times (35/225) = -0.778$$

- 3 B is correct. Price elasticity of demand is likely to be greater for items that are seen as optional or discretionary.
- 4 B is correct. Income elasticity is a measure of how sensitive quantity demanded is to a change in income. If the income elasticity of demand for the product is -0.6 , whenever income increases by 1% , the quantity demanded of the product at each price decreases by 0.6% . Consequently, as income rises, consumers will purchase less of the product.
- 5 B is correct. The cross-price elasticity of demand measures the responsiveness of the demand for onions in response to a change in the price of tomatoes.

From the demand function equation:

$$Q_o^d = 3 - 0.05P_o + 0.009I - 0.16P_t$$

$$Q_o^d = 3 - 0.05(1.25) + 0.009(2,500) - 0.16(3.75) = 24.8375$$

At a price of onions of \$1.25 and a price of tomatoes of \$3.75, the cross-price elasticity of demand is calculated as follows:

$$\text{Cross-price elasticity of demand} = \left(\Delta Q_o^d / \Delta P_t \right) \times \left(P_t / Q_o^d \right)$$

$$\text{Cross-price elasticity of demand} = -0.16 \times (3.75/24.8375) = -0.0242$$

- 6 B is correct. The demand curve shows quantity demanded as a function of own price only.
- 7 A is correct. The situation described is one of excess demand because, in order for markets to clear at the given level of quantity supplied, the company would need to raise prices.
- 8 B is correct. From the demand function:

Solve for Q_{pr}^d :

$$\Delta Q_{pr}^d / \Delta P_{pr} = -3.1 \text{ (the coefficient in front of own price)}$$

$$\begin{aligned} Q_{pr}^d &= 84 - 3.1P_{pr} + 0.8I + 0.9P_{pu} \\ &= 84 - 3.1(38) + 0.8(100) + 0.9(18) \\ &= 62.4 \end{aligned}$$

At $P_{pr} = 38$,

$$\begin{aligned}\text{price elasticity of demand} &= \left(\Delta Q_{pr}^d / \Delta P_{pr} \right) \left(P_{pr} / Q_{pr}^d \right) \\ &= (-3.1)(38/62.4) \\ &= -1.9\end{aligned}$$

- 9 C is correct. From the demand function:

Solve for Q_{pr}^d :

$$\Delta Q_{pr}^d / \Delta I = 0.8 \text{ (coefficient in front of the income variable)}$$

$$\begin{aligned}Q_{pr}^d &= 84 - 3.1P_{pr} + 0.8I + 0.9P_{pu} \\ &= 84 - 3.1(38) + 0.8(100) + 0.9(18) \\ &= 62.4\end{aligned}$$

At $I = 100$,

$$\begin{aligned}\text{the income elasticity of demand} &= \left(\Delta Q_{pr}^d / \Delta I \right) \left(I / Q_{pr}^d \right) \\ &= (0.8)(100/62.4) \\ &= 1.3\end{aligned}$$

- 10 A is correct. From the demand function:

Solve for Q_{pr}^d :

$$\Delta Q_{pr}^d / \Delta P_{pu} = 0.9 \text{ (the coefficient in front of } P_{pu})$$

$$\begin{aligned}Q_{pr}^d &= 84 - 3.1P_{pr} + 0.8I + 0.9P_{pu} \\ &= 84 - 3.1(38) + 0.8(100) + 0.9(18) \\ &= 62.4\end{aligned}$$

At $P = 38$, and $P_{pu} = 18$,

$$\begin{aligned}\text{the cross-price elasticity of demand} &= \left(\Delta Q_{pr}^d / \Delta P_{pu} \right) \left(P_{pu} / Q_{pr}^d \right) \\ &= (0.9)(18/62.4) \\ &= 0.3\end{aligned}$$

- 11 C is correct. With complements, consumption goes up or down together. With a negative cross-price elasticity, as the price of one good goes up, the demand for both falls.
- 12 A is correct. In the case of normal goods, the income and substitution effects are reinforcing, leading to an increase in the amount purchased after a drop in price.
- 13 A is correct. The income effect overwhelms the substitution effect such that an increase in the price of the good results in greater demand for the good, resulting in a positively sloped demand curve.
- 14 A is correct. Normal profit is the level of accounting profit such that implicit opportunity costs are just covered; thus, it is equal to a level of accounting profit such that economic profit is zero.
- 15 A is correct. The law of diminishing returns occurs in the short run when additional output falls as more and more labor is added to a fixed amount of capital. When a factory is operating at full capacity, adding additional employees will

not increase production because the physical plant is already 100% employed. More labor hours will add to costs without adding to output, thus resulting in diminishing marginal returns.

- 16 A is correct. Diminishing marginal returns occur when the marginal product of a resource decreases as additional units of that input are employed. Marginal product, which is the additional output resulting from using one more unit of input, is presented below.

Machine Hours	Total Product	Average Product	Marginal Product
1	3	3.00	3
2	8	4.00	5
3	14	4.67	6
4	19	4.75	5
5	21	4.20	2

The marginal product of the third machine hour is 6 and declines thereafter. Consequently, diminishing marginal returns are first evident beyond three machine hours.

- 17 A is correct. Marginal revenue per unit is defined as the change in total revenue divided by the change in quantity sold. $MR = \Delta TR / \Delta Q$. In this case, change in total revenue equals CHF100,000, and change in total units sold equals 50. $CHF100,000 / 50 = CHF2,000$.
- 18 A is correct. In a perfectly competitive market, an increase in supply by a single firm will not affect price. Therefore, an increase in units sold by the firm will be matched proportionately by an increase in revenue.
- 19 A is correct. Marginal revenue per unit is defined as the change in total revenues divided by the change in quantity sold. $MR = \Delta TR / \Delta Q$. In this case, change in total revenue per day equals €3,000 $[(450 \times €40) - (300 \times €50)]$, and change in units sold equals 150 $(450 - 300)$. $€3,000 / 150 = €20$.
- 20 A is correct. Under perfect competition, a firm is a price taker at any quantity supplied to the market, and $AR = MR = \text{Price}$.
- 21 A is correct. Average fixed cost is equal to total fixed cost divided by quantity produced: $AFC = TFC/Q = 200/4 = 50$.
- 22 C is correct. Marginal cost is equal to the change in total cost divided by the change in quantity produced. $MC = \Delta TC / \Delta Q = 80/1 = 80$.
- 23 C is correct. Average total cost is equal to total cost divided by quantity produced. At 5 units produced the average total cost is 104. $ATC = TC/Q = 520/5 = 104$.
- 24 A is correct. Under perfect competition, price equals marginal revenue. A firm breaks even when marginal revenue equals average total cost.
- 25 C is correct. The firm should shut down production when marginal revenue is less than average variable cost.
- 26 A is correct. A company is said to break even if its total revenue is equal to its total cost. Under conditions of perfect competition, a company will break even when market price is equal to the minimum point of the average total cost curve.
- 27 B is correct. A company will shut down production in the short run when total revenue is below total variable costs.

- 28 C is correct. A company will stay in the market in the long term if total revenue is equal to or greater than total cost. Because total costs are \$7 million (\$4 million variable costs and \$3 million fixed costs), the company will stay in the market in the long term if total revenue equals at least \$7 million.
- 29 B is correct. When total revenue is enough to cover variable costs but not total fixed costs in full, the firm can survive in the short run but would be unable to maintain financial solvency in the long run.
- 30 A is correct. The quantity at which average total cost is minimized does not necessarily correspond to a profit maximum.
- 31 C is correct. Output increases in the same proportion as input increases occur at constant returns to scale.
- 32 B is correct. Economies of scale occur if, as the firm increases output, cost per unit of production falls. Graphically, this definition translates into a long-run average cost curve (LRAC) with a negative slope.
- 33 B is correct. As the firm increases output, diseconomies of scale and higher average total costs can result when there is overlap and duplication of business functions and product lines.
- 34 C is correct. The firm operating at greater than long-run efficient scale is subject to diseconomies of scale. It should plan to decrease its level of production.
- 35 A is correct. Competition should drive prices down to long-run marginal cost, resulting in only normal profits being earned.
- 36 A is correct. Three workers produce the highest average product equal to 170. $AP = 510/3 = 170$.
- 37 B is correct. Marginal product is equal to the change in total product divided by the change in labor. The increase in MP from 2 to 3 workers is 190: $MP = \Delta TP/\Delta L = (510 - 320)/(3 - 2) = 190/1 = 190$.

SOLUTIONS

- 1 C is correct. Monopolistic competition is characterized by many sellers, differentiated products, and some pricing power.
- 2 A is correct. Few sellers of a homogeneous or standardized product characterizes an oligopoly.
- 3 B is correct. The product produced in a perfectly competitive market cannot be differentiated by advertising or any other means.
- 4 C is correct. Profits are maximized when $MR = MC$. For a monopoly, $MR = P[1 - 1/E_p]$. Setting this equal to MC and solving for P :

$$\begin{aligned} \$40 &= P[1 - (1/1.5)] = P \times 0.333 \\ P &= \$120 \end{aligned}$$
- 5 B is correct. The long-run competitive equilibrium occurs where $MC = AC = P$ for each company. Equating MC and AC implies $2 + 8Q = 256/Q + 2 + 4Q$. Solving for Q gives $Q = 8$. Equating MC with price gives $P = 2 + 8Q = 66$. Any price above 66 yields an economic profit because $P = MC > AC$, so new companies will enter the market.
- 6 B is correct. A company in a perfectly competitive market must accept whatever price the market dictates. The marginal cost schedule of a company in a perfectly competitive market determines its supply function.
- 7 A is correct. As prices decrease, smaller companies will leave the market rather than sell below cost. The market share of Aquarius, the price leader, will increase.
- 8 C is correct. In the Nash model, each company considers the other's reaction in selecting its strategy. In equilibrium, neither company has an incentive to change its strategy. ThetaTech is better off with open architecture regardless of what SigmaSoft decides. Given this choice, SigmaSoft is better off with a proprietary platform. Neither company will change its decision unilaterally.
- 9 C is correct. The profit maximizing choice is the level of output where marginal revenue equals marginal cost.
- 10 A is correct. The oligopolist faces two different demand structures, one for price increases and another for price decreases. Competitors will lower prices to match a price reduction, but will not match a price increase. The result is a kinked demand curve.
- 11 B is correct. When companies have similar market shares, competitive forces tend to outweigh the benefits of collusion.
- 12 B is correct. The economic profit will attract new entrants to the market and encourage existing companies to expand capacity.
- 13 B is correct. The dominant company's market share tends to decrease as profits attract entry by other companies.
- 14 B is correct. This allows the investors to receive a normal return for the risk they are taking in the market.
- 15 B is correct. The top four companies in the industry comprise 86 percent of industry sales: $(300 + 250 + 200 + 150)/(300 + 250 + 200 + 150 + 100 + 50) = 900/1050 = 86\%$.
- 16 B is correct. The three-firm Herfindahl–Hirschmann Index is $0.35^2 + 0.25^2 + 0.20^2 = 0.225$.

- 17 B is correct. The Herfindahl–Hirschmann Index does not reflect low barriers to entry that may restrict the market power of companies currently in the market.
- 18 B is correct. The credible threat of entry holds down prices and multiple incumbents are offering undifferentiated products.
- 19 C is correct. There are many competitors in the market, but some product differentiation exists, as the price differential between Deep River's brand and the house brands indicates.

SOLUTIONS

- 1 B is correct. GDP is the total amount spent on all final goods and services produced within the economy over a specific period of time.
- 2 C is correct. By-products of production processes that have no explicit market value are not included in GDP.
- 3 C is correct. Government transfer payments, such as unemployment compensation or welfare benefits, are excluded from GDP.
- 4 A is correct. Canadian GDP is the total market value of all final goods and services produced in a given time period within Canada. The wine was produced in Canada and counts towards Canadian GDP.
- 5 B is correct. This is the value added by the artist: £5,000 – £2,000 = £3,000.
- 6 B is correct. The GDP Deflator = Nominal GDP/Real GDP. To get a ratio less than 1, real GDP exceeds nominal GDP, which indicates that prices have decreased and, accordingly, deflation has occurred.
- 7 A is correct. Nominal GDP is defined as the value of goods and services measured at current prices. Expenditure is used synonymously with the value of goods and services since aggregate expenditures must equal aggregate output of an economy.
- 8 B is correct. Real GDP in the first year was €100 billion/1.11 = €90 and in the last year it was €300 billion/2.00 = €150. Thus, $(€150 - €90)/€90 = 0.67$ or 67%.
- 9 A is correct: $(212.8/190)^{1/2} - 1 = 0.0583$ or 5.8%.
- 10 B is correct.

$$\text{GDP deflator} = \frac{\text{Value of current year output at current year prices}}{\text{Value of current year output at base year prices}} \times 100$$

- 11 B is correct. $\text{GDP} = \text{Consumption} + \text{Gross private domestic investment} + \text{Government Spending} + \text{Exports} - \text{Imports} = 15 + 4 + 3.8 + 1.5 - 1.7 = 22.6$.
 $\text{National income} = \text{GDP} - \text{CCA} = 22.6 - 1.5 = 21.1$
- 12 C is correct. Unincorporated business net income is also known as proprietor's income and is included in personal income.
- 13 A is correct. The fundamental relationship among saving, investment, the fiscal balance, and the trade balance is $S = I + (G - T) + (X - M)$. This form of the relationship shows that private saving must fund investment expenditures, the government fiscal balance, and net exports (= net capital outflows). Rearranging gives $G - T = (S - I) - (X - M)$. The government's fiscal deficit ($G - T$) must be equal to the private sector's saving/investment balance ($S - I$) minus net exports.
- 14 C is correct. The fundamental relationship among saving, investment, the fiscal balance, and the trade balance is $S = I + (G - T) + (X - M)$. Given the levels of output and investment spending, an increase in saving (reduction in consumption) must be offset by either an increase in the fiscal deficit or an increase in net exports. Increasing the fiscal deficit is not one of the choices, so an increase in net exports and corresponding increase in net capital outflows (increased lending to foreigners and/or increased purchases of assets from foreigners) is the correct response.
- 15 A is correct. The IS curve represents combinations of income and the real interest rate at which planned expenditure equals income.

- 16 B is correct. The IS curve represents combinations of income and the real interest rate at which planned expenditure equals income. Equivalently, it represents combinations such that

$$S(Y) = I(r) + (G - T) + (X - M)$$

where $S(Y)$ indicates that planned saving is a (increasing) function of income and $I(r)$ indicates that planned investment is a (decreasing) function of the real interest rate. To maintain this relationship, an increase in government spending (G) requires an increase in saving at any given level of the interest rate (r). This implies an increase in income (Y) at each interest rate level—a rightward shift of the IS curve. Unless the LM curve is vertical, the IS and LM curves will intersect at a higher level of aggregate expenditure/income. Since the LM curve embodies a constant price level, this implies an increase in aggregate expenditure at each price level—a rightward shift of the Aggregate Demand curve.

- 17 C is correct. The LM curve represents combinations of income and the interest rate at which the demand for real money balances equals the supply. For a given price level, an increase in the nominal money supply is also an increase in the real money supply. To increase the demand for real money balances, either the interest must decline or income must increase. Therefore, at each level of the interest rate, income (= expenditure) must increase—a rightward shift of the LM curve. Since the IS curve is downward sloping (higher income requires a lower interest rate), a rightward shift in the LM curve means that the IS and LM curves will intersect at a higher level of aggregate expenditure/income. This implies a higher level of aggregate expenditure at each price level—a rightward shift of the Aggregate Demand curve.
- 18 B is correct. The LM curve represents combinations of income and the interest rate at which the demand for real money balances equals the supply. For a given nominal money supply, an increase in the price level implies a decrease in the real money supply. To decrease the demand for real money balances, either the interest must increase or income must decrease. Therefore, at each level of the interest rate, income (= expenditure) must decrease—a leftward shift of the LM curve.
- 19 A is correct. A decrease in the price level increases the real money supply and shifts the LM curve to the right. Since the IS curve is downward sloping, the IS and LM curves will intersect at a higher level of income and a lower interest rate.
- 20 C is correct. At the full employment, or natural, level of output the economy is operating at an efficient and unconstrained level of production. Companies have enough spare capacity to avoid bottlenecks, and there is a modest, stable pool of unemployed workers (job seekers equal job vacancies) looking for and transitioning into new jobs.
- 21 C is correct. Due to long-term contracts and other rigidities, wages and other input costs do not fully adjust to changes in the price level in the short-run. Given input prices, firms respond to output price changes by expanding or contracting output to maximize profit. Hence, the SRAS is upward sloping.
- 22 B is correct. The slope of the short-run aggregate supply curve reflects the extent to which wages and other input costs adjust to the overall price level. Automatic adjustment of wages would mitigate the impact of price changes on profitability. Hence, firms would not adjust output as much in response to changing output prices—the SRAS curve would be steeper.

- 23 B is correct. A weak domestic currency will result in an increase in aggregate demand at each price level—a rightward shift in the AD curve. A weaker currency will cause a country's exports to be cheaper in global markets. Conversely, imports will be more expensive for domestic buyers. Hence, the net exports component of aggregate demand will increase.
- 24 B is correct. Productivity measures the efficiency of labor and is the amount of output produced by workers in a given period of time. A decline in productivity implies decreased efficiency. A decline in productivity increases labor costs, decreases profitability and results in lower output at each output price level—a leftward shift in both the short-run and long-run aggregate supply curves.
- 25 C is correct. The wealth effect explains the impact of increases or decreases in household wealth on economic activity. Household wealth includes financial and real assets. As asset values increase, consumers save less and spend more out of current income since they will still be able to meet their wealth accumulation goals. Therefore, an increase in household wealth results in a rightward shift in the aggregate demand curve.
- 26 B is correct. Higher aggregate demand (AD) and higher aggregate supply (AS) raise real GDP and lower unemployment, meaning employment levels increase.
- 27 A is correct. Stagflation occurs when output is declining and prices are rising. This is most likely due to a decline in aggregate supply—a leftward shift of the SRAS curve. Depending on the source of the shift, the LRAS may shift too.
- 28 B is correct. An increase in energy prices will shift the short-run aggregate supply curve (SRAS) to the left, reducing output and increasing prices. If there is no change in the aggregate demand curve, in particular if the central bank does not expand the money supply, slack in the economy will put downward pressure on input prices, shifting the SRAS back to its original position. In the long run, the price level will be unchanged.
- 29 A is correct. Technology is the most important factor affecting economic growth for developed countries. Technological advances are very important because they allow an economy to overcome the limits imposed by diminishing marginal returns.
- 30 B is correct. Labor productivity can be directly measured as output/hour.
- 31 B is correct. Output growth is equal to the growth rate of the labor force plus the growth rate of labor productivity, i.e. output per worker. Unlike total factor productivity, output per worker is observable, so this is the most practical way to approach estimation of sustainable growth.
- 32 B is correct. Total factor productivity (TFP) is a scale factor primarily reflecting technology. An increase in TFP means that output increases for any level of factor inputs.
- 33 B is correct. The estimated equation is the standard Solow growth accounting equation. The intercept is the growth rate of total factor productivity.
- 34 C is correct. In the standard Solow growth accounting equation, the coefficient on each factor's growth rate is its share of income.
- 35 B is correct. Diminishing marginal productivity of capital means that as a country accumulates more capital per worker the incremental boost to output declines. Thus, all else the same, economies grow more slowly as they become more capital intensive. Given the relative scarcity and hence high marginal productivity of capital in developing countries, they tend to grow more rapidly than developed countries. This leads to convergence in income levels over time.

SOLUTIONS

- 1 B is correct. The stages of the business cycle occur repeatedly over time.
- 2 B is correct. The net trend during contraction is negative.
- 3 A is correct. Inflation is rising at peaks.
- 4 C is correct. At the end of a recession, firms will run “lean production” to generate maximum output with the fewest number of workers.
- 5 C is correct. When an economy’s expansion is well established, businesses often have difficulty finding qualified workers.
- 6 A is correct. Accelerating inflation and rapidly expanding capital expenditures typically characterize the peak of the business cycle. During such times, many businesses finance their capital expenditures with debt to expand their production capacity.
- 7 B is correct. Physical capital adjustments to downturns come through aging of equipment plus lack of maintenance.
- 8 C is correct. Near the top of a cycle, sales begin to slow before production is cut, leading to an increase in inventories relative to sales.
- 9 A is correct. Austrian economists see monetary policy mistakes as leading to booms and busts.
- 10 C is correct. When a nation’s currency depreciates, domestic goods seem cheaper than foreign goods, placing downward pressure on demand for imports. When the depreciation persists for some time, the country’s total imports are likely to decrease.
- 11 A is correct. Monetarists caution policy effects can occur long after the need for which they were implemented is no longer an issue.
- 12 B is correct. Discouraged workers are defined as persons who have stopped looking for work and are outside the labor force.
- 13 A is correct. Austrian economists advocate limited government intervention in the economy. They advise that the best thing to do in a recession is to allow the necessary market adjustment to take place.
- 14 A is correct. Keynesian economics is based on government intervention in the form of fiscal policy. The national government responds to the recession by using deficit spending to fund infrastructure projects.
- 15 B is correct. Real Business Cycle models conclude that expansions and contractions of the economy are responses to external shocks, such as supply shocks arising from advances in technology or changes in the relative prices of inputs (e.g., energy prices). An increase in energy prices shifts short-run aggregate supply to the left, resulting in higher prices and lower GDP.
- 16 C is correct. This effect makes unemployment rise more slowly as recessions start and fall more slowly as recoveries begin.
- 17 B is correct. With inflation, a fixed amount of money buys fewer goods and services, thus reducing purchasing power.
- 18 A is correct. Discouraged workers have given up seeking employment and are statistically outside the labor force. Therefore, an increase in discouraged workers will decrease the labor force and thus the labor participation ratio, which is the ratio of labor force to total working age population. Additionally, an increase in discouraged workers will decrease the unemployment rate because discouraged workers are not counted in the official unemployment rate.

- 19** C is correct. Disinflation is known as a reduction of inflation from a higher to lower, but still above zero, level.
- 20** B is correct. In an economic recovery, new job seekers return to the labor force, and because they seldom find work immediately, their return may initially raise the unemployment rate.
- 21** C is correct. Frictionally unemployed people are not working at the time of the employment survey but have recently left one job and are about to start another job. The frictionally unemployed have a job waiting for them and are not 100% unemployed, it is just that they have not started the new job yet. Although the treasury manager has left his current employment, he has accepted a new position at another firm starting in six months.
- 22** B is correct. Deflation is connected to a vicious cycle of reduced spending and higher unemployment.
- 23** A is correct. In hyperinflation, consumers accelerate their spending to beat prices increases and money circulates more rapidly.
- 24** A is correct. The Laspeyres index is calculated with these inputs:
- November consumption bundle: $70 \times 0.9 + 60 \times 0.6 = 99$
 - December consumption bundle: $70 \times 1 + 60 \times 0.8 = 118$
 - December price index: $(118/99) \times 100 = 119.19$
 - Inflation rate: $(119.19/100) - 1 = 0.1919 = 19.19\%$
- 25** A is correct. The Paasche index uses the current product mix of consumption combined with the variation of prices. So for December, its value is
- $$(120 \times 1 + 50 \times 0.8)/(120 \times 0.9 + 50 \times 0.6) = (160/138) \times 100 = 115.9$$
- 26** C is correct. This scenario is often referred to as stagflation. Here, the economy is likely to be left to self-correct because no short-term economic policy is thought to be effective.
- 27** C is correct. Disinflation is a decline in the inflation rate—for example, from 7% to 4%.
- 28** C is correct. Central banks typically use consumer price indexes to monitor inflation and evaluate their monetary policies.
- 29** C is correct. The CPI is typically used for this purpose, while the PPI is more closely connected to business contracts.
- 30** B is correct. The inflation rate calculated by using a constant consumption basket (the Laspeyres index) is 10%, derived as follows:

$$\begin{aligned} \text{July 2015 consumption basket} &= (18 \times €1) + (6 \times €2) = €30 \\ \text{August 2015 consumption basket} &= (18 \times €1) + (6 \times €2.5) = €33 \\ \text{Value of the Laspeyres index } (I_L) &= (€33/€30) \times 100 = €110 \\ \text{Inflation rate} &= (110/100) - 1 = 0.10 = 10\% \end{aligned}$$

The inflation rate calculated using a current consumption basket (the Paasche index) is 8%, derived as follows:

$$\begin{aligned} \text{July 2015 consumption basket} &= (17 \times €1) + (4 \times €2) = €25 \\ \text{August 2015 consumption basket} &= (17 \times €1) + (4 \times €2.5) = €27 \\ \text{Value of the Paasche index } (I_P) &= (€27/€25) \times 100 = €108 \\ \text{Inflation rate} &= (108/100) - 1 = 0.08 = 8\% \end{aligned}$$

The inflation rate calculated by “chaining” the monthly prices of consumption baskets as they change over time (the Fisher index) is derived as follows:

$$\text{Value of the Fisher index} = \sqrt{I_P - I_L}$$

$$\text{Value of the Fisher Index} = \sqrt{\€110 \times \€108} = \€108.99$$

$$\text{Inflation rate} = (108.99/100) - 1 = 0.0899 = 8.99\%$$

- 31 A is correct. Core inflation is less volatile since it excludes food and energy prices and therefore will not be as likely to lead to policy overreactions when serving as a target.
- 32 C is correct. For productivity, or output per hour, the faster that it can grow, the further that wages can rise without putting pressure on business costs per unit of output.
- 33 C is correct. While no single indicator is definitive, a mix of them—which can be affected by various economic determinants—can offer the strongest signal of performance.
- 34 B is correct. As the quality of a product improves, it satisfies people's needs and wants better. The measured inflation rate is skewed higher than otherwise unless an adjustment is made for the increase in the quality of the good. Even if the good's price had increased over time, the improvements in quality would still bias the measured inflation rate upward.
- 35 A is correct. A price index of goods and services that excludes food and energy is used to calculate core inflation. Policymakers often use core inflation when reading the trend in the economy and making economic policies. The reason is because policymakers are trying to avoid overreaction to short-term fluctuations in prices as a result of short-term changes in supply and demand.
- 36 B is correct. The narrowing spread of this leading indicator foretells a drop in short-term rates and a fall in economic activity. The prime rate is a lagging indicator and typically moves after the economy turns.
- 37 C is correct. Cost-push inflation occurs when rising costs compel businesses to raise prices generally. A shortage of trained workers leads to wage pressures, and even if such shortages impact only certain sectors of the economy, the economy overall may experience inflationary pressure.
- 38 B is correct. Cost-push inflation refers to the situation in which rising costs, usually wages, compel businesses to raise prices.
- 39 A is correct. Both inventory–sales and unit labor costs are lagging indicators that decline somewhat after a peak. Real personal income is a coincident indicator that by its decline shows a slowdown in business activity.
- 40 B is correct. Rising building permits—a leading indicator—indicates that an upturn is expected to occur or continue. Increasing average duration of unemployment—a lagging indicator—indicates that a downturn has occurred, whereas the lack of any change in services inflation—also a lagging indicator—is neither negative nor positive for the direction of the economy. Taken together, these statistics indicate that a cyclical upturn may be expected to occur.
- 41 A is correct. Aggregate real personal income and industrial output are coincident indicators, whereas the S&P 500 is a leading indicator. An increase in aggregate personal income and industrial output signals that an expansion is occurring, whereas an increase in the S&P 500 signals that an expansion will occur or is expected to continue. Taken together, these statistics indicate that a cyclical upturn is occurring.

- 42 C is correct. Aggregate real personal income is a coincident indicator of the business cycle and the ratio of consumer installment debt to income is a lagging indicator. Increases in the ratio of consumer installment debt follows increases in average aggregate income during the typical business cycle.
- 43 C is correct. Leading economic indicators have turning points that usually precede those of the overall economy. Average weekly hours, manufacturing is a leading economic indicator. The Industrial Production Index is a coincident economic indicator, and the average bank prime lending rate is a lagging economic indicator.

SOLUTIONS

- 1 B is correct. There is an inverse relationship between the money multiplier and the reserve requirement. The money multiplier is equal to 1 divided by the reserve requirement.
- 2 A is correct. Precautionary money demand is directly related to GDP. Precautionary money balances are held to provide a buffer against unforeseen events that might require money. Precautionary balances tend to rise with the volume and value of transactions in the economy, and therefore rise with GDP.
- 3 B is correct. When the interest rate on bonds is I_1 there is an excess supply of money (equal to $M_0 - M_1 > 0$). Economic agents would seek to buy bonds with their excess money balances, which would force the price of bonds up and the interest rate down to I_0 .
- 4 A is correct. According to the theory of money neutrality, an increase in the money supply ultimately leads to an increase in the price level and leaves real variables unaffected in the long run.
- 5 B is correct. If money were neutral in the short run, monetary policy would not be effective in influencing the economy.
- 6 B is correct. By definition, monetarists believe prices may be controlled by manipulating the money supply.
- 7 A is correct. The Fisher effect is based on the idea that the real interest rate is relatively stable. Changes in the nominal interest rate result from changes in expected inflation.
- 8 A is correct. The Fisher effect implies that changes in the nominal interest rate reflect changes in expected inflation, which is consistent with Nominal interest rate = Real interest rate + Expected rate of inflation.
- 9 C is correct. Low levels of inflation has higher economic costs than moderate levels, all else equal; unanticipated inflation has greater costs than anticipated inflation.
- 10 C is correct. Transfer payment programs represent fiscal, not monetary policy.
- 11 B is correct. The supervision of banks is not a role that all central banks assume. When it is a central bank's role, responsibility may be shared with one or more entities.
- 12 A is correct. Central bank activities are typically intended to maintain price stability. Concerning choice B, note that the transmission channels of monetary policy are not independent.
- 13 A is correct. Investment is expected to move inversely with the official policy rate.
- 14 A is correct. Such action would tend to constrict the money supply and increase interest rates, all else equal.
- 15 A is correct. The central bank described is target independent because it set its own targets (e.g., the target inflation rate) and operationally independent because it decides how to achieve its targets (e.g., the time horizon).
- 16 A is correct. Interest rates are expected to rise to protect the exchange rate target.
- 17 C is correct. The purchase of government bonds via open market operations increases banking reserves and the money supply; it is consistent with an expansionary monetary policy.

- 18 A is correct. The neutral rate of interest is that rate of interest that neither stimulates nor slows down the underlying economy. The neutral rate should be consistent with stable long-run inflation.
- 19 B is correct. A central bank would decrease an official interest rate to stimulate the economy. The setting in which an official interest rate is lowered to zero (or even slightly below zero) without stimulating economic growth suggests that there are limits to monetary policy.
- 20 C is correct. Raising reserve requirements should slow money supply growth.
- 21 C is correct. Deflation poses a challenge to conventional monetary policy because once the central bank has cut nominal interest rates to zero (or slightly less than zero) to stimulate the economy, they cannot cut them further.
- 22 A is correct. The inability to determine exactly the neutral rate of interest does not necessarily limit the power of monetary policy.
- 23 A is correct. Public financing of a power plant could be described as a fiscal policy tool to stimulate investment.
- 24 C is correct. Ensuring stable purchasing power is a goal of monetary rather than fiscal policy. Fiscal policy involves the use of government spending and tax revenue to affect the overall level of aggregate demand in an economy and hence the level of economic activity.
- 25 A is correct. Monetary actions may face fewer delays to taking action than fiscal policy, especially when the central bank is independent.
- 26 B is correct. Cyclically adjusted budget deficits are appropriate indicators of fiscal policy. These are defined as the deficit that would exist if the economy was at full employment (or full potential output).
- 27 B is correct. Fiscal policy is subject to recognition, action, and impact lags.
- 28 C is correct. A freeze in discretionary government spending is an example of a contractionary fiscal policy.
- 29 A is correct. A “pay-as-you-go” rule is a neutral policy because any increases in spending or reductions in revenues would be offset. Accordingly, there would be no net impact on the budget deficit/surplus.
- 30 B is correct. Quantitative easing is an example of an expansionary monetary policy stance. It attempts to spur aggregate demand by drastically increasing the money supply.
- 31 B is correct. The belief is that high levels of debt to GDP may lead to higher future tax rates which may lead to disincentives to economic activity.
- 32 A is correct. Government borrowing may compete with private sector borrowing for investment purposes.
- 33 A is correct. If both fiscal and monetary policies are “easy,” then the joint impact will be highly expansionary, leading to a rise in aggregate demand, low interest rates, and growing private and public sectors.

SOLUTIONS

- 1 A is correct. Countries gain from exchange when trade enables each country to receive a higher price for exported goods and/or pay a lower price for imported goods. This leads to more efficient resource allocation and allows consumption of a larger variety of goods.
- 2 B is correct. Resources may need to be reallocated into or out of an industry, depending on whether that industry is an exporting sector or an import-competing sector of that economy. As a result of this adjustment process, less-efficient companies may be forced to exit the industry, which in turn may lead to higher unemployment and the need for retraining in order for displaced workers to find jobs in expanding industries.
- 3 A is correct. The copper industry in Copperland would benefit from trade. Because the cost of producing copper relative to producing tea is lower in Copperland than in Tealand, Copperland will export copper and the industry will expand.
- 4 B is correct. Comparative advantage is present when the opportunity cost of producing a good is less than that of a trading partner.
- 5 C is correct. While Brazil has an absolute advantage in the production of both flashlights and vegetables, Mexico has a comparative advantage in the production of vegetables. The opportunity cost of vegetables in Mexico is $\frac{1}{3}$ per flashlight, while the opportunity cost of vegetables in Brazil is $\frac{1}{2}$ per flashlight.
- 6 C is correct. Mexico has the lowest opportunity cost to produce an extra ruler. The opportunity cost is 2 pencils per ruler in Mexico, 3 pencils per ruler in Brazil, and 4 pencils per ruler in China.
- 7 C is correct. A country gains if trade increases the price of its exports relative to its imports as compared to its autarkic prices, i.e. the final terms of trade are more favorable than its autarkic prices. If the relative price of exports and imports remains the same after trade opens, then the country will consume the same basket of goods before and after trade opens, and it gains nothing from the ability to trade. In that case, its trade partner will capture all of the gains. Of course, the opposite is true if the roles are reversed. More generally, a country captures more of the gains from trade the more the final terms of trade differ from its autarkic prices.
- 8 A is correct. In the Heckscher–Ohlin model a country has a comparative advantage in goods whose production is intensive in the factor with which it is relatively abundantly endowed. In this case, capital is relatively abundant in Germany so Germany has a comparative advantage in producing the capital-intensive product: machine tools. Portugal is relatively labor abundant, hence should produce and export the labor-intensive product: wine.
- 9 B is correct. As a country opens up to trade, it has a favorable impact on the abundant factor, and a negative impact on the scarce factor. This is because trade causes the output mix to change and therefore changes the relative demand for the factors of production. Increased output of the export product increases demand for the factor that is used intensively in its production, while reduced output of the import product decreases demand for the factor used intensively in its production. Because the export (import) product uses the abundant (scarce) factor intensively, the abundant factor gains relative to the scarce factor in each country.

- 10 A is correct. The imposition of a tariff will most likely increase domestic government revenue. A tariff is a tax on imports collected by the importing country's government.
- 11 C is correct. With a voluntary export restraint, the price increase induced by restricting the quantity of imports (= quota rent for equivalent quota = tariff revenue for equivalent tariff) accrues to foreign exporters and/or the foreign government.
- 12 A is correct. By definition, a large country is big enough to affect the world price of its imports and exports. A large country can benefit by imposing a tariff if its terms of trade improve by enough to outweigh the welfare loss arising from inefficient allocation of resources.
- 13 A is correct. A customs union extends a free trade area (FTA) by not only allowing free movement of goods and services among members, but also creating common trade policy against non-members. Unlike a more integrated common market, a customs union does not allow free movement of factors of production among members.
- 14 C is correct. Regional trading agreements are politically less contentious and quicker to establish than multilateral trade negotiations (for example, under the World Trade Organization). Policy coordination and harmonization is easier among a smaller group of countries.
- 15 A is correct. The capital account measures capital transfers and sale and purchase of non-produced, non-financial assets such as mineral rights and intangible assets.
- 16 B is correct. The current account measures the flows of goods and services (including income from foreign investments). Patent fees and legal services are both captured in the services sub-account of the current account.
- 17 C is correct. The current account includes income received on foreign investments. The Korean company effectively "exported" the use of its capital during the quarter to its US subsidiary, and the dividend represents payment for those services.
- 18 B is correct. A current account deficit tends to result from low private saving, high private investment, a government deficit, or a combination of the three. Of the choices, only low private savings contributes toward a current account deficit.
- 19 B is correct. A current account deficit tends to result from low private saving, high private investment, low government savings, or a combination of the three. Of these choices, only high investments can increase productive resources and improve future ability to repay creditors.
- 20 B is correct. The WTO provides the legal and institutional foundation of the multinational trading system and is the only international organization that regulates cross-border trade relations among nations on a global scale. The WTO's mission is to foster free trade by providing a major institutional and regulatory framework of global trade rules. Without such global trading rules, today's global transnational corporations would be hard to conceive.
- 21 A is correct. The World Bank's mission is to help developing countries fight poverty and enhance environmentally sound economic growth. The World Bank helps to create the basic economic infrastructure essential for creation and maintenance of domestic financial markets and a well-functioning financial industry in developing countries.

- 22 C is correct. From an investment perspective, the IMF helps to keep country-specific market risk and global systemic risk under control. The Greek sovereign debt crisis in 2010, which threatened to destabilize the entire European banking system, is a recent example. The IMF's mission is to ensure the stability of the international monetary system, the system of exchange rates and international payments which enables countries to buy goods and services from each other.
- 23 C is correct. The GATT was the only multilateral body governing international trade from 1948 to 1995. It operated for almost half a century as a quasi-institutionalized, provisional system of multilateral treaties and included several rounds of negotiations.

SOLUTIONS

- 1 B is correct. The exchange rate is the number of units of the price currency that 1 unit of the base currency will buy. Equivalently, it is the number of units of the price currency required to buy 1 unit of the base currency.
- 2 B is correct. The real exchange rate (quoted in terms of domestic currency per unit of foreign currency) is given by:

$$\text{Real exchange rate}_{(d/f)} = S_{d/f} \times (P_f/P_d)$$

An increase in the domestic price level (P_d) *decreases* the real exchange rate because it implies an *increase* in the relative purchasing power of the domestic currency.

- 3 B is correct. The receivable is due in 100 days. To reduce the risk of currency exposure, the British company would initiate a forward contract to sell euros/buy pounds at an exchange rate agreed to today. The agreed-upon rate is called the forward exchange rate.
- 4 C is correct. The sell side generally consists of large banks that sell foreign exchange and related instruments to buy-side clients. These banks act as market makers, quoting exchange rates at which they will buy (the bid price) or sell (the offer price) the base currency.
- 5 B is correct. In the case of a direct exchange rate, the domestic currency is the price currency (the numerator) and the foreign currency is the base currency (the denominator). If the domestic currency appreciates, then fewer units of the domestic currency are required to buy 1 unit of the foreign currency and the exchange rate (domestic per foreign) declines. For example, if sterling (GBP) appreciates against the euro (EUR), then euro–sterling (GBP/EUR) might decline from 0.8650 to 0.8590.
- 6 A is correct. An indirect quote takes the foreign country as the price currency and the domestic country as the base currency. To get CHF—which is the executive’s domestic currency—as the base currency, the quote must be stated as EUR/CHF. Using the hotel manager’s information, the indirect exchange rate is $(1/1.2983) = 0.7702$.
- 7 C is correct. The appreciation of sterling against the Swiss franc is simply the inverse of the 12% depreciation of the Swiss franc against Sterling: $[1/(1 - 0.12)] - 1 = (1/0.88) - 1 = 0.1364$, or 13.64%.
- 8 B is correct. The percentage appreciation of the base currency can be calculated by dividing the appreciated exchange rate by the initial exchange rate. In this case, the unknown is the initial exchange rate. The initial exchange is the value of X that satisfies the formula:

$$1.4500/X = 1.08$$

Solving for X leads to $1.45/1.08 = 1.3426$.

- 9 A is correct. To get to the ZAR/HKD cross-rate, it is necessary to take the inverse of the CNY/ZAR spot rate and then multiply by the CNY/HKD exchange rate:

$$\begin{aligned}\text{ZAR/HKD} &= (\text{CNY/ZAR})^{-1} \times (\text{CNY/HKD}) \\ &= (1 / 0.9149) \times 0.8422 = 0.9205\end{aligned}$$

- 10** C is correct. The ZAR/SEK cross-rate from the original dealer is $(1.0218/0.9149) = 1.1168$, which is lower than the quote from the second dealer. To earn an arbitrage profit, a currency trader would buy SEK (sell ZAR) from the original dealer and sell SEK (buy ZAR) to the second dealer. On 1 million SEK the profit would be

$$\text{SEK } 1,000,000 \times (1.1210 - 1.1168) = \text{ZAR } 4200$$

- 11** B is correct. The number of forward points equals the forward rate minus the spot rate, or $0.14193 - 0.1378 = 0.00413$, multiplied by 10,000: $10,000 \times 0.00413 = 41.3$ points. By convention, forward points are scaled so that ± 1 forward point corresponds to a change of ± 1 in the last decimal place of the spot exchange rate.
- 12** A is correct. Given the forward rate and forward points as a percentage, the unknown in the calculation is the spot rate. The calculation is as follows:

$$\text{Spot rate} \times (1 + \text{Forward points as a percentage}) = \text{Forward rate}$$

$$\text{Spot rate} \times (1 + 0.068) = 1.0123$$

$$\text{Spot} = 1.0123 / 1.068 = 0.9478$$

- 13** B is correct. The base currency trading at a forward discount means that 1 unit of the base currency costs less for forward delivery than for spot delivery; i.e., the forward exchange rate is less than the spot exchange rate. The forward points, expressed either as an absolute number of points or as a percentage, are negative.
- 14** C is correct. To eliminate arbitrage opportunities, the spot exchange rate (S), the forward exchange rate (F), the interest rate in the base currency (i_b), and the interest rate in the price currency (i_p) must satisfy:

$$\frac{F}{S} = \left(\frac{1 + i_p}{1 + i_b} \right)$$

According to this formula, the base currency will trade at forward premium ($F > S$) if, and only if, the interest rate in the price currency is higher than the interest rate in the base currency ($i_p > i_b$).

- 15** B is correct. The forward exchange rate is given by

$$F_{JPY/AUD} = S_{JPY/AUD} \left(\frac{1 + i_{JPY}\tau}{1 + i_{AUD}\tau} \right) = 82.42 \left(\frac{1 + .0015 \left(\frac{90}{360} \right)}{1 + .0495 \left(\frac{90}{360} \right)} \right) \\ = 82.42 \times .98815 = 81.443$$

The forward points are $100 \times (F - S) = 100 \times (81.443 - 82.42) = 100 \times (-0.977) = -97.7$. Note that because the spot exchange rate is quoted with two decimal places, the forward points are scaled by 100.

- 16** C is correct. An ideal currency regime would have credibly fixed exchange rates among all currencies. This would eliminate currency-related uncertainty with respect to the prices of goods and services as well as real and financial assets.
- 17** C is correct. Fixed exchange rates impose severe limitations on the exercise of independent monetary policy. With a rigidly fixed exchange rate, domestic interest rates, monetary aggregates (e.g., money supply), and credit conditions are dictated by the requirement to buy/sell the currency at the rigid parity. Even

a narrow band around the parity level allows the monetary authority to exercise some discretionary control over these conditions. In general, the wider the band, the more independent control the monetary authority can exercise.

- 18 B is correct. With a currency board, the monetary authority is legally required to exchange domestic currency for a specified foreign currency at a fixed exchange rate. It cannot issue domestic currency without receiving foreign currency in exchange, and it must hold that foreign currency as a 100% reserve against the domestic currency issued. Thus, the country's monetary base (bank reserves plus notes and coins in circulation) is fully backed by foreign exchange reserves.
- 19 A is correct. A trade deficit must be exactly matched by an offsetting capital account surplus to fund the deficit. A capital account surplus reflects borrowing from foreigners (an increase in domestic liabilities) and/or selling assets to foreigners (a decrease in domestic assets). A capital account surplus is often referred to as a "capital inflow" because the net effect is foreign investment in the domestic economy.
- 20 A is correct. A devaluation of the domestic currency means domestic producers are cutting the price faced by their foreign customers. The impact on their unit sales and their revenue depends on the elasticity of demand. Expensive luxury goods exhibit high price elasticity. Hence, luxury car producers are likely to experience a sharp increase in sales and revenue due to the devaluation.
- 21 C is correct. The trade surplus cannot decline unless the capital account deficit also declines. Regardless of the mix of assets bought and sold, foreigners must buy more assets from (or sell fewer assets to) domestic issuers/investors.

SOLUTIONS

- 1 B is correct. This is the role of financial reporting. The role of financial statement analysis is to evaluate the financial reports.
- 2 C is correct. In general, analysts seek to examine the past and current performance and financial position of a company in order to form expectations about its future performance and financial position.
- 3 B is correct. The primary role of financial statement analysis is to use financial reports prepared by companies to evaluate the past, current, and potential performance and financial position of a company for the purpose of making investment, credit, and other economic decisions.
- 4 A is correct. The balance sheet portrays the current financial position. The income statement and statement of cash flows present different aspects of performance.
- 5 B is correct. Profitability is the performance aspect measured by the income statement. The balance sheet portrays the current financial position. The statement of cash flows presents a different aspect of performance.
- 6 A is correct. Owners' equity is the owners' residual interest in (i.e., residual claim on) the company's assets after deducting its liabilities, which is information presented on the balance sheet.
- 7 B is correct. A company's profitability is best evaluated using the income statement. The income statement presents information on the financial results of a company's business activities over a period of time by communicating how much revenue was generated and the expenses incurred to generate that revenue.
- 8 C is correct. A company's revenues and expenses are presented on the income statement, which is used to evaluate a company's financial results (or profitability) from business activities over a period of time. A company's current financial position is best evaluated by using the balance sheet. A company's sources of cash flow are best evaluated using the cash flow statement.
- 9 C is correct. The notes disclose choices in accounting policies, methods, and estimates.
- 10 A is correct. Information about management and director compensation is not found in the auditor's report. Disclosure of management compensation is required in the proxy statement, and some aspects of management compensation are disclosed in the notes to the financial statements.
- 11 B is correct. These are components of management commentary.
- 12 C is correct. The notes provide information that is essential to understanding the information provided in the primary statements.
- 13 C is correct. An unqualified opinion is a "clean" opinion and indicates that the financial statements present the company's performance and financial position fairly in accordance with a specified set of accounting standards.
- 14 B is correct. A qualified audit opinion is one in which there is some scope limitation or exception to accounting standards. Exceptions are described in the audit report with additional explanatory paragraphs so that the analyst can determine the importance of the exception.

- 15 B is correct. The independent audit report provides reasonable assurance that the financial statements are fairly presented, meaning that there is a high probability that the audited financial statements are free from material error, fraud, or illegal acts that have a direct effect on the financial statements.
- 16 B is correct. Interim reports are typically provided semiannually or quarterly and present the four basic financial statements and condensed notes. They are not audited. Unqualified is a type of audit opinion.
- 17 B is correct. When performing financial statement analysis, analysts should review all company sources of information as well as information from external sources regarding the economy, the industry, the company, and peer (comparable) companies.
- 18 C is correct. Ratios are an output of the process data step but are an input into the analyze/interpret data step.
- 19 A is correct. The follow-up phase involves gathering information and repeating the analysis to determine whether it is necessary to update reports and recommendations and then updating if necessary.

SOLUTIONS

- 1 C is correct. Financial statements provide information, including information about the entity's financial position, performance, and changes in financial position, to users. They do not typically provide information about users.
- 2 B is correct. The IASB is currently charged with developing International Financial Reporting Standards.
- 3 B is correct. The FASB is responsible for the Accounting Standards Codification™, the single source of nongovernmental authoritative US generally accepted accounting principles.
- 4 B is correct. Accounting standards boards should be guided by a well articulated framework. They should be independent; and while they consider input from stakeholders, the process should not be compromised by pressure from external forces, including political pressure. Accounting standards boards should have adequate resources.
- 5 C is correct. A core objective of IOSCO is to ensure that markets are fair, efficient, and transparent. The other core objectives are to reduce, not eliminate, systemic risk and to protect investors, not all users of financial statements.
- 6 A is correct. Accuracy is not an enhancing qualitative characteristic. Faithful representation, not accuracy, is a fundamental qualitative characteristic.
- 7 A is correct. Understandability is an enhancing qualitative characteristic of financial information—not a constraint.
- 8 C is correct. The *Conceptual Framework (2010)* identifies two important underlying assumptions of financial statements: accrual basis and going concern. Going concern is the assumption that the entity will continue to operate for the foreseeable future. Enterprises with the intent to liquidate or materially curtail operations would require different information for a fair presentation.
- 9 B is correct. Accrual basis reflects the effects of transactions and other events being recognized when they occur, not when the cash flows. These effects are recorded and reported in the financial statements of the periods to which they relate.
- 10 C is correct. The fundamental qualitative characteristic of faithful representation is contributed to by completeness, neutrality, and freedom from error.
- 11 B is correct. Historical cost is the consideration paid to acquire an asset.
- 12 C is correct. The amount that would be received in an orderly disposal is realizable value.
- 13 B is correct. There is no statement of changes in income. Under IAS No. 1, a complete set of financial statements includes a statement of financial position, a statement of comprehensive income, a statement of changes in equity, a statement of cash flows, and notes comprising a summary of significant accounting policies and other explanatory information.
- 14 B is correct. The elements of financial statements related to the measure of performance are income and expenses.
- 15 A is correct. The elements of financial statements related to the measurement of financial position are assets, liabilities, and equity.
- 16 A is correct. Timeliness is not a characteristic of a coherent financial reporting framework. Consistency, transparency, and comprehensiveness are characteristics of a coherent financial reporting framework.

- 17 B is correct. Rules-based, principles-based, and objectives-oriented approaches are recognized approaches to standard-setting.
- 18 A is correct. A discussion of the impact would be the most meaningful, although B would also be useful.

SOLUTIONS

- 1 C is correct. IAS No. 1 states that expenses may be categorized by either nature or function.
- 2 C is correct. Cost of goods sold is a classification by function. The other two expenses represent classifications by nature.
- 3 C is correct. Gross margin is revenue minus cost of goods sold. Answer A represents net income and B represents operating income.
- 4 B is correct. Under IFRS, income includes increases in economic benefits from increases in assets, enhancement of assets, and decreases in liabilities.
- 5 B is correct. Net revenue is revenue for goods sold during the period less any returns and allowances, or \$1,000,000 minus \$100,000 = \$900,000.
- 6 C is correct. The preferred method is the percentage-of-completion method. The completed contract method should be used under US GAAP only when the outcome cannot be measured reliably. A method similar to, but not referred to as, the cost recovery method is used under IFRS when the outcome cannot be measured reliably.
- 7 A is correct. Under the completed contract method, no revenue would be reported until the project is completed.
- 8 A is correct. The installment method apportions the cash receipt between cost recovered and profit using the ratio of profit to sales value (i.e., $\$3,000,000 \div \$5,000,000 = 60$ percent). Argo will, therefore, recognize \$600,000 in profit for 2009 ($\$1,000,000$ cash received \times 60 percent).
- 9 A is correct. Under the cost recovery method, the company would not recognize any profit until the cash amounts paid by the buyer exceeded Argo's cost of \$2,000,000.
- 10 C is correct. Revenue for barter transactions should be measured based on the fair value of revenue from similar non-barter transactions with unrelated parties.
- 11 A is correct. Apex is not the owner of the goods and should only report its net commission as revenue.
- 12 C is correct. Under the converged accounting standards, the incremental costs of obtaining a contract and certain costs incurred to fulfill a contract must be capitalized. If a company expensed these incremental costs in the years prior to adopting the converged standards, all else being equal, its profitability will appear higher under the converged standards.
- 13 B is correct. Under the first in, first out (FIFO) method, the first 10,000 units sold came from the October purchases at £10, and the next 2,000 units sold came from the November purchases at £11.
- 14 C is correct. Under the weighted average cost method:

October purchases	10,000 units	\$100,000
November purchases	5,000 units	\$55,000
Total	15,000 units	\$155,000

$$\$155,000 / 15,000 \text{ units} = \$10.3333 \times 12,000 \text{ units} = \$124,000.$$

- 15 B is correct. The last in, first out (LIFO) method is not permitted under IFRS. The other two methods are permitted.

- 16 A is correct. Straight-line depreciation would be $(\$600,000 - \$50,000)/10$, or \$55,000.
- 17 C is correct. Double-declining balance depreciation would be $\$600,000 \times 20\%$ (twice the straight-line rate). The residual value is not subtracted from the initial book value to calculate depreciation. However, the book value (carrying amount) of the asset will not be reduced below the estimated residual value.
- 18 C is correct. This would result in the highest amount of depreciation in the first year and hence the lowest amount of net income relative to the other choices.
- 19 A is correct. A fire may be infrequent, but it would still be part of continuing operations and reported in the profit and loss statement. Discontinued operations relate to a decision to dispose of an operating division.
- 20 C is correct. If a company changes an accounting policy, the financial statements for all fiscal years shown in a company's financial report are presented, if practical, as if the newly adopted accounting policy had been used throughout the entire period; this retrospective application of the change makes the financial results of any prior years included in the report comparable. Notes to the financial statements describe the change and explain the justification for the change.
- 21 C is correct. The weighted average number of shares outstanding for 2009 is 1,050,000. Basic earnings per share would be \$1,000,000 divided by 1,050,000, or \$0.95.
- 22 B is correct. The formula to calculate diluted EPS is as follows:

Diluted EPS = $(\text{Net income} - \text{Preferred dividends}) / [\text{Weighted average number of shares outstanding} + (\text{New shares that would have been issued at option exercise} - \text{Shares that could have been purchased with cash received upon exercise}) \times (\text{Proportion of year during which the financial instruments were outstanding})]$.

The underlying assumption is that outstanding options are exercised, and then the proceeds from the issuance of new shares are used to repurchase shares already outstanding:

$$\text{Proceeds from option exercise} = 100,000 \times \$20 = \$2,000,000$$

$$\text{Shares repurchased} = \$2,000,000 / \$25 = 80,000$$

The net increase in shares outstanding is thus $100,000 - 80,000 = 20,000$.

Therefore, the diluted EPS for CWC = $(\$12,000,000 - \$800,000) / 2,020,000 = \$5.54$.

- 23 A is correct. Basic and diluted EPS are equal for a company with a simple capital structure. A company that issues only common stock, with no financial instruments that are potentially convertible into common stock has a simple capital structure. Basic EPS is calculated using the weighted average number of shares outstanding.
- 24 B is correct. LB has warrants in its capital structure; if the exercise price is less than the weighted average market price during the year, the effect of their conversion is to increase the weighted average number of common shares outstanding, causing diluted EPS to be lower than basic EPS. If the exercise price is equal to the weighted average market price, the number of shares issued equals the number of shares repurchased. Therefore, the weighted average number of common shares outstanding is not affected and diluted EPS equals basic EPS. If the exercise price is greater than the weighted average market price, the effect

of their conversion is anti-dilutive. As such, they are not included in the calculation of basic EPS. LB's basic EPS is \$1.22 [= (\$3,350,000 – \$430,000)/2,400,000]. Stock dividends are treated as having been issued retroactively to the beginning of the period.

- 25 A is correct. With stock options, the treasury stock method must be used. Under that method, the company would receive \$100,000 (10,000 × \$10) and would repurchase 6,667 shares (\$100,000/\$15). The shares for the denominator would be:

Shares outstanding	1,000,000
Options exercises	10,000
Treasury shares purchased	(6,667)
Denominator	1,003,333

- 26 C is correct.

$$\begin{aligned}
 \text{Diluted EPS} &= (\text{Net income}) / (\text{Weighted average number of shares outstanding} + \text{New common shares that would have been issued at conversion}) \\
 &= \$200,000,000 / [50,000,000 + (2,000,000 \times 2)] \\
 &= \$3.70
 \end{aligned}$$

The diluted EPS assumes that the preferred dividend is not paid and that the shares are converted at the beginning of the period.

- 27 A is correct. When a company has stock options outstanding, diluted EPS is calculated as if the financial instruments had been exercised and the company had used the proceeds from the exercise to repurchase as many shares possible at the weighted average market price of common stock during the period. As a result, the conversion of stock options increases the number of common shares outstanding but has no effect on net income available to common shareholders. The conversion of convertible debt increases the net income available to common shareholders by the after-tax amount of interest expense saved. The conversion of convertible preferred shares increases the net income available to common shareholders by the amount of preferred dividends paid; the numerator becomes the net income.
- 28 B is correct. Common size income statements facilitate comparison across time periods (time-series analysis) and across companies (cross-sectional analysis) by stating each line item of the income statement as a percentage of revenue. The relative performance of different companies can be more easily assessed because scaling the numbers removes the effect of size. A common size income statement states each line item on the income statement as a percentage of revenue. The standardization of each line item makes a common size income statement useful for identifying differences in companies' strategies.
- 29 C is correct. Comprehensive income includes both net income and other comprehensive income.

$$\begin{aligned}
 \text{Other comprehensive income} &= \text{Unrealized gain on available-for-sale securities} - \text{Unrealized loss on derivatives accounted for as hedges} + \text{Foreign currency translation gain on consolidation} \\
 &= \$5 \text{ million} - \$3 \text{ million} + \$2 \text{ million} \\
 &= \$4 \text{ million}
 \end{aligned}$$

Alternatively,

$$\text{Comprehensive income} - \text{Net income} = \text{Other comprehensive income}$$

$$\begin{aligned}\text{Comprehensive income} &= (\text{Ending shareholders equity} - \text{Beginning shareholders equity}) + \text{Dividends} \\ &= (\$493 \text{ million} - \$475 \text{ million}) + \$1 \text{ million} \\ &= \$18 \text{ million} + \$1 \text{ million} = \$19 \text{ million}\end{aligned}$$

Net income is \$15 million so other comprehensive income is \$4 million.

- 30 A is correct. Other comprehensive income includes items that affect shareholders' equity but are not reflected in the company's income statement. In consolidating the financial statements of foreign subsidiaries, the effects of translating the subsidiaries' balance sheet assets and liabilities at current exchange rates are included as other comprehensive income.

SOLUTIONS

- 1 B is correct. Assets are resources controlled by a company as a result of past events.
- 2 A is correct. Assets = Liabilities + Equity and, therefore, Assets – Liabilities = Equity.
- 3 A is correct. A classified balance sheet is one that classifies assets and liabilities as current or non-current and provides a subtotal for current assets and current liabilities. A liquidity-based balance sheet broadly presents assets and liabilities in order of liquidity.
- 4 B is correct. The balance sheet omits important aspects of a company's ability to generate future cash flows, such as its reputation and management skills. The balance sheet measures some assets and liabilities based on historical cost and measures others based on current value. Market value of shareholders' equity is updated continuously. Shareholders' equity reported on the balance sheet is updated for reporting purposes and represents the value that was current at the end of the reporting period.
- 5 B is correct. Balance sheet information is as of a specific point in time, and items measured at current value reflect the value that was current at the end of the reporting period. For all financial statement items, an item should be recognized in the financial statements only if it is probable that any future economic benefit associated with the item will flow to or from the entity and if the item has a cost or value that can be measured with reliability.
- 6 B is correct. Payments due within one operating cycle of the business, even if they will be settled more than one year after the balance sheet date, are classified as current liabilities. Payment received in advance of the delivery of a good or service creates an obligation or liability. If the obligation is to be fulfilled at least one year after the balance sheet date, it is recorded as a non-current liability, such as deferred revenue or deferred income. Payments that the company has the unconditional right to defer for at least one year after the balance sheet may be classified as non-current liabilities.
- 7 A is correct. A liquidity-based presentation, rather than a current/non-current presentation, may be used by such entities as banks if broadly presenting assets and liabilities in order of liquidity is reliable and more relevant.
- 8 B is correct. Goodwill is a long-term asset, and the others are all current assets.
- 9 C is correct. Both the cost of inventory and property, plant, and equipment include delivery costs, or costs incurred in bringing them to the location for use or resale.
- 10 A is correct. Current liabilities are those liabilities, including debt, due within one year. Preferred refers to a class of stock. Convertible refers to a feature of bonds (or preferred stock) allowing the holder to convert the instrument into common stock.
- 11 B is correct. The cash received from customers represents an asset. The obligation to provide a product in the future is a liability called "unearned income" or "unearned revenue." As the product is delivered, revenue will be recognized and the liability will be reduced.

- 12 C is correct. A contra asset account is netted against (i.e., reduces) the balance of an asset account. The allowance for doubtful accounts reduces the balance of accounts receivable. Accumulated depreciation, not depreciation expense, is a contra asset account. Sales returns and allowances create a contra account that reduce sales, not an asset.
- 13 C is correct. Under IFRS, inventories are carried at historical cost, unless net realizable value of the inventory is less. Under US GAAP, inventories are carried at the lower of cost or market.
- 14 C is correct. Paying rent in advance will reduce cash and increase prepaid expenses, both of which are assets.
- 15 C is correct. Accrued liabilities are expenses that have been reported on a company's income statement but have not yet been paid.
- 16 A is correct. Initially, goodwill is measured as the difference between the purchase price paid for an acquisition and the fair value of the acquired, not acquiring, company's net assets (identifiable assets less liabilities).
- 17 C is correct. Impairment write-downs reduce equity in the denominator of the debt-to-equity ratio but do not affect debt, so the debt-to-equity ratio is expected to increase. Impairment write-downs reduce total assets but do not affect revenue. Thus, total asset turnover is expected to increase.
- 18 B is correct. Vertical common-size analysis involves stating each balance sheet item as a percentage of total assets. Total assets are the sum of total liabilities (£35 million) and total stockholders' equity (£55 million), or £90 million. Total liabilities are shown on a vertical common-size balance sheet as (£35 million/£90 million) ≈ 39%.
- 19 B is correct. For financial assets classified as trading securities, unrealized gains and losses are reported on the income statement and flow to shareholders' equity as part of retained earnings.
- 20 C is correct. For financial assets classified as available for sale, unrealized gains and losses are not recorded on the income statement and instead are part of *other comprehensive income*. Accumulated other comprehensive income is a component of Shareholders' equity.
- 21 A is correct. Financial assets classified as held to maturity are measured at amortised cost. Gains and losses are recognized only when realized.
- 22 B is correct. The non-controlling interest in consolidated subsidiaries is shown separately as part of shareholders' equity.
- 23 C is correct. The item "retained earnings" is a component of shareholders' equity.
- 24 B is correct. Share repurchases reduce the company's cash (an asset). Shareholders' equity is reduced because there are fewer shares outstanding and treasury stock is an offset to owners' equity.
- 25 B is correct. Common-size analysis (as presented in the reading) provides information about composition of the balance sheet and changes over time. As a result, it can provide information about an increase or decrease in a company's financial leverage.
- 26 A is correct. The current ratio provides a comparison of assets that can be turned into cash relatively quickly and liabilities that must be paid within one year. The other ratios are more suited to longer-term concerns.
- 27 A is correct. The cash ratio determines how much of a company's near-term obligations can be settled with existing amounts of cash and marketable securities.

28 C is correct. The debt-to-equity ratio, a solvency ratio, is an indicator of financial risk.

29 B is correct. The quick ratio ($[\text{Cash} + \text{Marketable securities} + \text{Receivables}] \div \text{Current liabilities}$) is $1.44 ([= 1,884 + 486 + 2,546] \div 3,416)$. Given the placement of other financial assets between cash and receivables, it is reasonable to assume these are highly liquid and are probably marketable securities.

30 C is correct. The financial leverage ratio ($\text{Total assets} \div \text{Total equity}$) is $1.58 (= 13,374 \div 8,491)$.

31 C is correct. The presence of goodwill on Company A's balance sheet signifies that it has made one or more acquisitions in the past. The current, cash, and quick ratios are lower for Company A than for the sector average. These lower liquidity ratios imply above-average liquidity risk. The total debt, long-term debt-to-equity, debt-to-equity, and financial leverage ratios are lower for Company B than for the sector average. These lower solvency ratios imply below-average solvency risk.

Current ratio is $(35/35) = 1.00$ for Company A, versus $(48/28) = 1.71$ for the sector average.

Cash ratio is $(5 + 5)/35 = 0.29$ for Company A, versus $(7 + 2)/28 = 0.32$ for the sector average.

Quick ratio is $(5 + 5 + 5)/35 = 0.43$ for Company A, versus $(7 + 2 + 12)/28 = 0.75$ for the sector average.

Total debt ratio is $(55/100) = 0.55$ for Company B, versus $(63/100) = 0.63$ for the sector average.

Long-term debt-to-equity ratio is $(20/45) = 0.44$ for Company B, versus $(28/37) = 0.76$ for the sector average.

Debt-to-equity ratio is $(55/45) = 1.22$ for Company B, versus $(63/37) = 1.70$ for the sector average.

Financial leverage ratio is $(100/45) = 2.22$ for Company B, versus $(100/37) = 2.70$ for the sector average.

32 A is correct. The quick ratio is defined as $(\text{Cash and cash equivalents} + \text{Marketable securities} + \text{receivables}) \div \text{Current liabilities}$. For Company A, this calculation is $(5 + 5 + 5)/35 = 0.43$.

33 C is correct. The financial leverage ratio is defined as $\text{Total assets} \div \text{Total equity}$. For Company B, total assets are 100 and total equity is 45; hence, the financial leverage ratio is $100/45 = 2.22$.

34 A is correct. The cash ratio is defined as $(\text{Cash} + \text{Marketable securities})/\text{Current liabilities}$. Company A's cash ratio, $(5 + 5)/35 = 0.29$, is higher than $(5 + 0)/25 = 0.20$ for Company B.

SOLUTIONS

- 1 B is correct. Operating, investing, and financing are the three major classifications of activities in a cash flow statement. Revenues, expenses, and net income are elements of the income statement. Inflows, outflows, and net flows are items of information in the statement of cash flows.
- 2 B is correct. Purchases and sales of long-term assets are considered investing activities. Note that if the transaction had involved the exchange of a building for other than cash (for example, for another building, common stock of another company, or a long-term note receivable), it would have been considered a significant non-cash activity.
- 3 B is correct. The purchase and sale of securities considered cash equivalents and securities held for trading are considered operating activities even for companies in which this activity is not a primary business activity.
- 4 C is correct. Payment of dividends is a financing activity under US GAAP. Payment of interest and receipt of dividends are included in operating cash flows under US GAAP. Note that IFRS allow companies to include receipt of interest and dividends as either operating or investing cash flows and to include payment of interest and dividends as either operating or financing cash flows.
- 5 C is correct. Non-cash transactions, if significant, are reported as supplementary information, not in the investing or financing sections of the cash flow statement.
- 6 C is correct. Because no cash is involved in non-cash transactions, these transactions are not incorporated in the cash flow statement. However, non-cash transactions that significantly affect capital or asset structures are required to be disclosed either in a separate note or a supplementary schedule to the cash flow statement.
- 7 C is correct. Interest expense is always classified as an operating cash flow under US GAAP but may be classified as either an operating or financing cash flow under IFRS.
- 8 C is correct. Taxes on income are required to be separately disclosed under IFRS and US GAAP. The disclosure may be in the cash flow statement or elsewhere.
- 9 A is correct. The operating section may be prepared under the indirect method. The other sections are always prepared under the direct method.
- 10 A is correct. Under the indirect method, the operating section would begin with net income and adjust it to arrive at operating cash flow. The other two items would appear in the operating section under the direct method.
- 11 C is correct. The primary argument in favor of the direct method is that it provides information on the specific sources of operating cash receipts and payments. Arguments for the indirect method include that it mirrors a forecasting approach and it is easier and less costly.
- 12 C is correct. The amount of cash collected from customers during the quarter is equal to beginning accounts receivable plus revenues minus ending accounts receivable: $\$66 \text{ million} + \$72 \text{ million} - \$55 \text{ million} = \83 million . A reduction in accounts receivable indicates that cash collected during the quarter was greater than revenue on an accrual basis.

- 13 B is correct. An addition to net income is made when there is a loss on the retirement of debt, which is a non-operating loss. A gain on the sale of an asset and a decrease in deferred tax liability are both subtracted from net-income.
- 14 A is correct. Revenues of \$100 million minus the increase in accounts receivable of \$10 million equal \$90 million cash received from customers. The increase in accounts receivable means that the company received less in cash than it reported as revenue.
- 15 A is correct.

$$\begin{aligned}\text{Operating cash flows} &= \text{Cash received from customers} - (\text{Cash paid to suppliers} + \text{Cash paid to employees} \\ &\quad + \text{Cash paid for other operating expenses} \\ &\quad + \text{Cash paid for interest} + \text{Cash paid for income taxes})\end{aligned}$$

$$\begin{aligned}\text{Cash received from customers} &= \text{Revenue} - \text{Decrease in accounts receivable} \\ &= \$37 - (\$19 - \$22) = \$40 \text{ million}\end{aligned}$$

$$\begin{aligned}\text{Cash paid to suppliers} &= \text{Cost of goods sold} + \text{Decrease in inventory} - \text{Increase in accounts payable} \\ &= \$16 + (\$40 - \$36) - (\$12 - \$14) = \\ &\quad \$22 \text{ million}\end{aligned}$$

Therefore, the company's operating cash flow = \$40 – \$22 – Cash paid for salaries – Cash paid for interest – Cash paid for taxes = \$40 – \$22 – \$6 – \$2 – \$4 = \$6 million.

- 16 C is correct. Cost of goods sold of \$80 million plus the increase in inventory of \$5 million equals purchases from suppliers of \$85 million. The increase in accounts payable of \$2 million means that the company paid \$83 million in cash (\$85 million minus \$2 million) to its suppliers.
- 17 A is correct. Cost of goods sold of \$75 million less the decrease in inventory of \$6 million equals purchases from suppliers of \$69 million. The increase in accounts payable of \$2 million means that the company paid \$67 million in cash (\$69 million minus \$2 million).
- 18 C is correct. Beginning salaries payable of \$3 million plus salaries expense of \$20 million minus ending salaries payable of \$1 million equals \$22 million. Alternatively, the expense of \$20 million plus the \$2 million decrease in salaries payable equals \$22 million.
- 19 C is correct. Cash received from customers = Sales + Decrease in accounts receivable = 254.6 + 4.9 = 259.5. Cash paid to suppliers = Cost of goods sold + Increase in inventory – Increase in accounts payable = 175.9 + 8.8 – 2.6 = 182.1.
- 20 C is correct. Interest expense of \$19 million less the increase in interest payable of \$3 million equals interest paid of \$16 million. Tax expense of \$6 million plus the decrease in taxes payable of \$4 million equals taxes paid of \$10 million.
- 21 B is correct. All dollar amounts are in millions. Net income (NI) for 2010 is \$35. This amount is the increase in retained earnings, \$25, plus the dividends paid, \$10. Depreciation of \$25 is added back to net income, and the increases in accounts receivable, \$5, and in inventory, \$3, are subtracted from net income because they are uses of cash. The decrease in accounts payable is also a use of cash and, therefore, a subtraction from net income. Thus, cash flow from operations is \$25 + \$10 + \$25 – \$5 – \$3 – \$7 = \$45.

- 22 A is correct. Selling price (cash inflow) minus book value equals gain or loss on sale; therefore, gain or loss on sale plus book value equals selling price (cash inflow). The amount of loss is given—\$2 million. To calculate the book value of the equipment sold, find the historical cost of the equipment and the accumulated depreciation on the equipment.
- Beginning balance of equipment of \$100 million plus equipment purchased of \$10 million minus ending balance of equipment of \$105 million equals the historical cost of equipment sold, or \$5 million.
 - Beginning accumulated depreciation of \$40 million plus depreciation expense for the year of \$8 million minus ending balance of accumulated depreciation of \$46 million equals accumulated depreciation on the equipment sold, or \$2 million.
 - Therefore, the book value of the equipment sold was \$5 million minus \$2 million, or \$3 million.
 - Because the loss on the sale of equipment was \$2 million, the amount of cash received must have been \$1 million.
- 23 A is correct. The increase of \$42 million in common stock and additional paid-in capital indicates that the company issued stock during the year. The increase in retained earnings of \$15 million indicates that the company paid \$10 million in cash dividends during the year, determined as beginning retained earnings of \$100 million plus net income of \$25 million minus ending retained earnings of \$115 million, which equals \$10 million in cash dividends.
- 24 B is correct. To derive operating cash flow, the company would make the following adjustments to net income: Add depreciation (a non-cash expense) of \$2 million; add the decrease in accounts receivable of \$3 million; add the increase in accounts payable of \$5 million; and subtract the increase in inventory of \$4 million. Total additions would be \$10 million, and total subtractions would be \$4 million, which gives net additions of \$6 million.
- 25 C is correct. An overall assessment of the major sources and uses of cash should be the first step in evaluating a cash flow statement.
- 26 B is correct. The primary source of cash is operating activities. The primary use of cash is investing activities. Interest received for Telefónica is classified as an investing activity.
- 27 A is correct. The amount of cash paid to suppliers is calculated as follows:
- $$\begin{aligned} &= \text{Cost of goods sold} - \text{Decrease in inventory} - \text{Increase in accounts payable} \\ &= \$27,264 - \$501 - \$1,063 \\ &= \$25,700. \end{aligned}$$
- 28 B is correct. An appropriate method to prepare a common-size cash flow statement is to show each line item on the cash flow statement as a percentage of net revenue. An alternative way to prepare a statement of cash flows is to show each item of cash inflow as a percentage of total inflows and each item of cash outflows as a percentage of total outflows.
- 29 B is correct. Free cash flow to the firm can be computed as operating cash flows plus after-tax interest expense less capital expenditures.
- 30 A is correct. This ratio is an interest coverage ratio, measuring a company's ability to meet its interest obligations and indicating a company's solvency. This coverage ratio is based on cash flow information; another common coverage ratio uses a measure based on the income statement (earnings before interest, taxes, depreciation, and amortisation).

SOLUTIONS

- 1 C is correct. Cross-sectional analysis involves the comparison of companies with each other for the same time period. Technical analysis uses price and volume data as the basis for investment decisions. Time-series or trend analysis is the comparison of financial data across different time periods.
- 2 C is correct. Solvency ratios are used to evaluate the ability of a company to meet its long-term obligations. An analyst is more likely to use activity ratios to evaluate how efficiently a company uses its assets. An analyst is more likely to use liquidity ratios to evaluate the ability of a company to meet its short-term obligations.
- 3 A is correct. The current ratio is a liquidity ratio. It compares the net amount of current assets expected to be converted into cash within the year with liabilities falling due in the same period. A current ratio of 1.0 would indicate that the company would have just enough current assets to pay current liabilities.
- 4 C is correct. The fixed charge coverage ratio is a coverage ratio that relates known fixed charges or obligations to a measure of operating profit or cash flow generated by the company. Coverage ratios, a category of solvency ratios, measure the ability of a company to cover its payments related to debt and leases.
- 5 C is correct. The analyst is *unlikely* to reach the conclusion given in Statement C because days of sales outstanding increased from 23 days in FY1 to 25 days in FY2 to 28 days in FY3, indicating that the time required to collect receivables has increased over the period. This is a negative factor for Spherion's liquidity. By contrast, days of inventory on hand dropped over the period FY1 to FY3, a positive for liquidity. The company's increase in days payable, from 35 days to 40 days, shortened its cash conversion cycle, thus also contributing to improved liquidity.
- 6 A is correct. The company is becoming increasingly less solvent, as evidenced by its debt-to-equity ratio increasing from 0.35 to 0.50 from FY3 to FY5. The amount of a company's debt and equity do not provide direct information about the company's liquidity position.

Debt to equity:

FY5: $2,000/4,000 = 0.5000$

FY4: $1,900/4,500 = 0.4222$

FY3: $1,750/5,000 = 0.3500$
- 7 C is correct. The decline in the company's equity indicates that the company may be incurring losses, paying dividends greater than income, or repurchasing shares. Recall that Beginning equity + New shares issuance - Shares repurchased + Comprehensive income - Dividends = Ending equity. The book value of a company's equity is not affected by changes in the market value of its common stock. An increased amount of lending does not necessarily indicate that lenders view a company as increasingly creditworthy. Creditworthiness is not evaluated based on how much a company has increased its debt but rather on its willingness and ability to pay its obligations. (Its financial strength is indicated by its solvency, liquidity, profitability, efficiency, and other aspects of credit analysis.)
- 8 C is correct. The company's problems with its inventory management system causing duplicate orders would likely result in a higher amount of inventory and would, therefore, result in a decrease in inventory turnover. A more efficient inventory management system and a write off of inventory at the beginning of

the period would both likely decrease the average inventory for the period (the denominator of the inventory turnover ratio), thus increasing the ratio rather than decreasing it.

- 9 B is correct. A write off of receivables would decrease the average amount of accounts receivable (the denominator of the receivables turnover ratio), thus increasing this ratio. Customers with weaker credit are more likely to make payments more slowly or to pose collection difficulties, which would likely increase the average amount of accounts receivable and thus decrease receivables turnover. Longer payment terms would likely increase the average amount of accounts receivable and thus decrease receivables turnover.
- 10 A is correct. The average accounts receivable balances (actual and desired) must be calculated to determine the desired change. The average accounts receivable balance can be calculated as an average day's credit sales times the DSO. For the most recent fiscal year, the average accounts receivable balance is \$15.62 million [$= (\$300,000,000/365) \times 19$]. The desired average accounts receivable balance for the next fiscal year is \$16.03 million [$= (\$390,000,000/365) \times 15$]. This is an increase of \$0.41 million ($= 16.03 \text{ million} - 15.62 \text{ million}$). An alternative approach is to calculate the turnover and divide sales by turnover to determine the average accounts receivable balance. Turnover equals 365 divided by DSO. Turnover is 19.21 ($= 365/19$) for the most recent fiscal year and is targeted to be 24.33 ($= 365/15$) for the next fiscal year. The average accounts receivable balances are \$15.62 million ($= \$300,000,000/19.21$), and \$16.03 million ($= \$390,000,000/24.33$). The change is an increase in receivables of \$0.41 million.
- 11 A is correct. Company A's current ratio of 4.0 ($= \$40,000/\$10,000$) indicates it is more liquid than Company B, whose current ratio is only 1.2 ($= \$60,000/\$50,000$). Company B is more solvent, as indicated by its lower debt-to-equity ratio of 30 percent ($= \$150,000/\$500,000$) compared with Company A's debt-to-equity ratio of 200 percent ($= \$60,000/\$30,000$).
- 12 C is correct. The company's efficiency deteriorated, as indicated by the decline in its total asset turnover ratio from 1.11 [$= 4,390/[(4,384 + 3,500)/2]$] for FY10 to 0.87 [$= 11,366/[(12,250 + 13,799)/2]$] for FY14. The decline in the total asset turnover ratio resulted from an increase in average total assets from GBP3,942 [$= (4,384 + 3,500)/2$] for FY10 to GBP13,024.5 for FY14, an increase of 230 percent, compared with an increase in revenue from GBP4,390 in FY10 to GBP11,366 in FY14, an increase of only 159 percent. The current ratio is not an indicator of efficiency.
- 13 B is correct. Comparing FY14 with FY10, the company's solvency deteriorated, as indicated by a decrease in interest coverage from 10.6 ($= 844/80$) in FY10 to 8.4 ($= 1,579/188$) in FY14. The debt-to-asset ratio increased from 0.14 ($= 602/4,384$) in FY10 to 0.27 ($= 3,707/13,799$) in FY14. This is also indicative of deteriorating solvency. In isolation, the amount of profits does not provide enough information to assess solvency.
- 14 C is correct. Comparing FY14 with FY10, the company's liquidity improved, as indicated by an increase in its current ratio from 0.71 [$= (316 + 558)/1,223$] in FY10 to 0.75 [$= (682 + 1,634)/3,108$] in FY14. Note, however, comparing only current investments with the level of current liabilities shows a decline in liquidity from 0.26 ($= 316/1,223$) in FY10 to 0.22 ($= 682/3,108$) in FY14. Debt-to-assets ratio and interest coverage are measures of solvency not liquidity.

- 15 B is correct. Comparing FY14 with FY10, the company's profitability deteriorated, as indicated by a decrease in its net profit margin from 11.0 percent ($= 484/4,390$) to 5.7 percent ($= 645/11,366$). Debt-to-assets ratio is a measure of solvency not an indicator of profitability. Growth in shareholders' equity, in isolation, does not provide enough information to assess profitability.
- 16 C is correct. Assuming no changes in other variables, an increase in average assets (an increase in the denominator) would decrease ROA. A decrease in either the effective tax rate or interest expense, assuming no changes in other variables, would increase ROA.
- 17 C is correct. The company's net profit margin has decreased and its financial leverage has increased. $ROA = \text{Net profit margin} \times \text{Total asset turnover}$. ROA decreased over the period despite the increase in total asset turnover; therefore, the net profit margin must have decreased.
 $\text{ROE} = \text{Return on assets} \times \text{Financial leverage}$. ROE increased over the period despite the drop in ROA; therefore, financial leverage must have increased.
- 18 C is correct. The increase in the average tax rate in FY12, as indicated by the decrease in the value of the tax burden (the tax burden equals one minus the average tax rate), offset the improvement in efficiency indicated by higher asset turnover leaving ROE unchanged. The EBIT margin, measuring profitability, was unchanged in FY12 and no information is given on liquidity.
- 19 C is correct. The difference between the two companies' ROE in 2010 is very small and is mainly the result of Company A's increase in its financial leverage, indicated by the increase in its Assets/Equity ratio from 2 to 4. The impact of efficiency on ROE is identical for the two companies, as indicated by both companies' asset turnover ratios of 1.5. Furthermore, if Company A had purchased newer equipment to replace older, depreciated equipment, then the company's asset turnover ratio (computed as sales/assets) would have declined, assuming constant sales. Company A has experienced a significant decline in its operating margin, from 10 percent to 7 percent which, all else equal, would not suggest that it is selling more products with higher profit margins.
- 20 A is correct. The P/E ratio measures the "multiple" that the stock market places on a company's EPS.
- 21 B is correct. In general, a creditor would consider a decrease in debt to total assets as positive news. A higher level of debt in a company's capital structure increases the risk of default and will, in general, result in higher borrowing costs for the company to compensate lenders for assuming greater credit risk. A decrease in either interest coverage or return on assets is likely to be considered negative news.
- 22 B is correct. The results of an analyst's financial analysis are integral to the process of developing forecasts, along with the analysis of other information and judgment of the analysts. Forecasts are not limited to a single point estimate but should involve a range of possibilities.

SOLUTIONS

- 1 C is correct. Transportation costs incurred to ship inventory to customers are an expense and may not be capitalized in inventory. (Transportation costs incurred to bring inventory to the business location can be capitalized in inventory.) Storage costs required as part of production, as well as costs incurred as a result of normal waste of materials, can be capitalized in inventory. (Costs incurred as a result of abnormal waste must be expensed.)
- 2 B is correct. Inventory expense includes costs of purchase, costs of conversion, and other costs incurred in bringing the inventories to their present location and condition. It does not include storage costs not required as part of production.
- 3 A is correct. IFRS allow the inventories of producers and dealers of agricultural and forest products, agricultural produce after harvest, and minerals and mineral products to be carried at net realisable value even if above historical cost. (US GAAP treatment is similar.)
- 4 A is correct. A perpetual inventory system updates inventory values and quantities and cost of goods sold continuously to reflect purchases and sales. The ending inventory of 800 units consists of 300 units at \$20 and 500 units at \$17.

$$(300 \times \$20) + (500 \times \$17) = \$14,500$$

- 5 A is correct. In an environment with falling inventory costs and declining inventory levels, periodic LIFO will result in a higher ending inventory value and lower cost of goods sold versus perpetual LIFO and perpetual FIFO methods. This results in a lower inventory turnover ratio, which is calculated as follows:

$$\text{Inventory turnover ratio} = \text{Cost of goods sold}/\text{Ending inventory}$$

The inventory turnover ratio using periodic LIFO is $\$39,000/\$16,000 = 244\%$ or 2.44 times.

The inventory turnover ratio using perpetual LIFO is 279% or 2.79 times, which is provided in Table 2 ($= 40,500/14,500$ from previous question).

The inventory turnover for perpetual FIFO is $\$41,400/\$13,600 = 304\%$ or 3.04 times.

- 6 B is correct. During a period of rising inventory costs, a company using the FIFO method will allocate a lower amount to cost of goods sold and a higher amount to ending inventory as compared with the LIFO method. The inventory turnover ratio is the ratio of cost of sales to ending inventory. A company using the FIFO method will produce a lower inventory turnover ratio as compared with the LIFO method. The current ratio (current assets/current liabilities) and the gross profit margin [gross profit/sales = (sales less cost of goods sold)/sales] will be higher under the FIFO method than under the LIFO method in periods of rising inventory unit costs.
- 7 A is correct. LIFO reserve is the FIFO inventory value less the LIFO inventory value. In periods of rising inventory unit costs, the carrying amount of inventory under FIFO will always exceed the carrying amount of inventory under LIFO. The LIFO reserve may increase over time as a result of the increasing difference between the older costs used to value inventory under LIFO and the

more recent costs used to value inventory under FIFO. When inventory unit levels are decreasing, the company will experience a LIFO liquidation, reducing the LIFO reserve.

- 8 A is correct. When the number of units sold exceeds the number of units purchased, a company using LIFO will experience a LIFO liquidation. If inventory unit costs have been rising from period-to-period and a LIFO liquidation occurs, it will produce an increase in gross profit as a result of the lower inventory carrying amounts of the liquidated units (lower cost per unit of the liquidated units).
- 9 B is correct. The adjusted COGS under the FIFO method is equal to COGS under the LIFO method less the increase in LIFO reserve:

$$\begin{aligned} \text{COGS (FIFO)} &= \text{COGS (LIFO)} - \text{Increase in LIFO reserve} \\ \text{COGS (FIFO)} &= £50,800 - (£4,320 - £2,600) \\ \text{COGS (FIFO)} &= £49,080 \end{aligned}$$

- 10 B is correct. Under IFRS, the reversal of write-downs is required if net realisable value increases. The inventory will be reported on the balance sheet at £1,000,000. The inventory is reported at the lower of cost or net realisable value. Under US GAAP, inventory is carried at the lower of cost or market value. After a write-down, a new cost basis is determined and additional revisions may only reduce the value further. The reversal of write-downs is not permitted.
- 11 A is correct. IFRS require the reversal of inventory write-downs if net realisable values increase; US GAAP do not permit the reversal of write-downs.
- 12 C is correct. Activity ratios (for example, inventory turnover and total asset turnover) will be positively affected by a write down to net realizable value because the asset base (denominator) is reduced. On the balance sheet, the inventory carrying amount is written down to its net realizable value and the loss in value (expense) is generally reflected on the income statement in cost of goods sold, thus reducing gross profit, operating profit, and net income.
- 13 B is correct. Cinnamon uses the weighted average cost method, so in 2008, 5,000 units of inventory were 2007 units at €10 each and 50,000 were 2008 purchases at €11. The weighted average cost of inventory during 2008 was thus $(5,000 \times 10) + (50,000 \times 11) = 50,000 + 550,000 = €600,000$, and the weighted average cost was approximately $€10.91 = €600,000 / 55,000$. Cost of sales was $€10.91 \times 45,000$, which is approximately €490,950.
- 14 C is correct. Zimt uses the FIFO method, and thus the first 5,000 units sold in 2008 depleted the 2007 inventory. Of the inventory purchased in 2008, 40,000 units were sold and 10,000 remain, valued at €11 each, for a total of €110,000.
- 15 A is correct. Zimt uses the FIFO method, so its cost of sales represents units purchased at a (no longer available) lower price. Nutmeg uses the LIFO method, so its cost of sales is approximately equal to the current replacement cost of inventory.
- 16 B is correct. Nutmeg uses the LIFO method, and thus some of the inventory on the balance sheet was purchased at a (no longer available) lower price. Zimt uses the FIFO method, so the carrying value on the balance sheet represents the most recently purchased units and thus approximates the current replacement cost.
- 17 B is correct. In a declining price environment, the newest inventory is the lowest-cost inventory. In such circumstances, using the LIFO method (selling the newer, cheaper inventory first) will result in lower cost of sales and higher profit.

- 18 B is correct. In a rising price environment, inventory balances will be higher for the company using the FIFO method. Accounts payable are based on amounts due to suppliers, not the amounts accrued based on inventory accounting.
- 19 C is correct. The write-down reduced the value of inventory and increased cost of sales in 2007. The higher numerator and lower denominator mean that the inventory turnover ratio as reported was too high. Gross margin and the current ratio were both too low.
- 20 A is correct. The reversal of the write-down shifted cost of sales from 2008 to 2007. The 2007 cost of sales was higher because of the write-down, and the 2008 cost of sales was lower because of the reversal of the write-down. As a result, the reported 2008 profits were overstated. Inventory balance in 2008 is the same because the write-down and reversal cancel each other out. Cash flow from operations is not affected by the non-cash write-down, but the higher profits in 2008 likely resulted in higher taxes and thus lower cash flow from operations.
- 21 B is correct. LIFO will result in lower inventory and higher cost of sales. Gross margin (a profitability ratio) will be lower, the current ratio (a liquidity ratio) will be lower, and inventory turnover (an efficiency ratio) will be higher.
- 22 A is correct. LIFO will result in lower inventory and higher cost of sales in periods of rising costs compared to FIFO. Consequently, LIFO results in a lower gross profit margin than FIFO.
- 23 B is correct. The LIFO method increases cost of sales, thus reducing profits and the taxes thereon.
- 24 A is correct. US GAAP do not permit inventory write-downs to be reversed.
- 25 B is correct. Both US GAAP and IFRS require disclosure of the amount of inventories recognized as an expense during the period. Only US GAAP allows the LIFO method and requires disclosure of any material amount of income resulting from the liquidation of LIFO inventory. US GAAP does not permit the reversal of prior-year inventory write downs.
- 26 B is correct. A significant increase (attributable to increases in unit volume rather than increases in unit cost) in raw materials and/or work-in-progress inventories may signal that the company expects an increase in demand for its products. If the growth of finished goods inventories is greater than the growth of sales, it could indicate a decrease in demand and a decrease in future earnings. A substantial increase in finished goods inventories while raw materials and work-in-progress inventories are declining may signal a decrease in demand for the company's products.
- 27 B is correct. During a period of rising inventory prices, a company using the LIFO method will have higher cost of goods sold and lower inventory compared with a company using the FIFO method. The inventory turnover ratio will be higher for the company using the LIFO method, thus making it appear more efficient. Current assets and gross profit margin will be lower for the company using the LIFO method, thus making it appear less liquid and less profitable.
- 28 B is correct. In an environment of declining inventory unit costs and constant or increasing inventory quantities, FIFO (in comparison with weighted average cost or LIFO) will have higher cost of goods sold (and net income) and lower inventory. Because both inventory and net income are lower, total equity is lower, resulting in a higher debt-to-equity ratio.

- 29 C is correct. The storage costs for inventory awaiting shipment to customers are not costs of purchase, costs of conversion, or other costs incurred in bringing the inventories to their present location and condition and are not included in inventory. The storage costs for the chocolate liquor occur during the production process and are thus part of the conversion costs. Excise taxes are part of the purchase cost.
- 30 C is correct. The carrying amount of inventories under FIFO will more closely reflect current replacement values because inventories are assumed to consist of the most recently purchased items. FIFO is an acceptable, but not preferred, method under IFRS. Weighted average cost, not FIFO, is the cost formula that allocates the same per unit cost to both cost of sales and inventory.
- 31 B is correct. Inventory turnover = Cost of sales/Average inventory = $41,043/7,569.5 = 5.42$. Average inventory is $(8,100 + 7,039)/2 = 7,569.5$.
- 32 B is correct. For comparative purposes, the choice of a competitor that reports under IFRS is requested because LIFO is permitted under US GAAP.
- 33 A is correct. The carrying amount of the ending inventory may differ because the perpetual system will apply LIFO continuously throughout the year, liquidating layers as sales are made. Under the periodic system, the sales will start from the last layer in the year. Under FIFO, the sales will occur from the same layers regardless of whether a perpetual or periodic system is used. Specific identification identifies the actual products sold and remaining in inventory, and there will be no difference under a perpetual or periodic system.
- 34 B is correct. The cost of sales is closest to CHF 4,550. Under FIFO, the inventory acquired first is sold first. Using Exhibit 4, a total of 310 cartons were available for sale ($100 + 40 + 70 + 100$) and 185 cartons were sold ($50 + 100 + 35$), leaving 125 in ending inventory. The FIFO cost would be as follows:

$$\begin{aligned}100 \text{ (beginning inventory)} \times 22 &= 2,200 \\40 \text{ (4 February 2009)} \times 25 &= 1,000 \\45 \text{ (23 July 2009)} \times 30 &= 1,350 \\ \text{Cost of sales} &= 2,200 + 1,000 + 1,350 = \text{CHF } 4,550\end{aligned}$$

- 35 A is correct. Gross profit will most likely increase by CHF 7,775. The net realisable value has increased and now exceeds the cost. The write-down from 2008 can be reversed. The write-down in 2008 was 9,256 [$92,560 \times (4.05 - 3.95)$]. IFRS require the reversal of any write-downs for a subsequent increase in value of inventory previously written down. The reversal is limited to the lower of the subsequent increase or the original write-down. Only 77,750 kilograms remain in inventory; the reversal is $77,750 \times (4.05 - 3.95) = 7,775$. The amount of any reversal of a write-down is recognised as a reduction in cost of sales. This reduction results in an increase in gross profit.
- 36 C is correct. Using the FIFO method to value inventories when prices are rising will allocate more of the cost of goods available for sale to ending inventories (the most recent purchases, which are at higher costs, are assumed to remain in inventory) and less to cost of sales (the oldest purchases, which are at lower costs, are assumed to be sold first).

- 37 C is correct. Karp's inventory under FIFO equals Karp's inventory under LIFO plus the LIFO reserve. Therefore, as of 31 December 2009, Karp's inventory under FIFO equals:

$$\begin{aligned}\text{Inventory (FIFO method)} &= \text{Inventory (LIFO method)} + \text{LIFO} \\ &\quad \text{reserve} \\ &= \$620 \text{ million} + 155 \text{ million} \\ &= \$775 \text{ million}\end{aligned}$$

- 38 B is correct. Karp's cost of goods sold (COGS) under FIFO equals Karp's cost of goods sold under LIFO minus the increase in the LIFO reserve. Therefore, for the year ended 31 December 2009, Karp's cost of goods sold under FIFO equals:

$$\begin{aligned}\text{COGS (FIFO method)} &= \text{COGS (LIFO method)} - \text{Increase in LIFO} \\ &\quad \text{reserve} \\ &= \$2,211 \text{ million} - (155 \text{ million} - 117 \text{ million}) \\ &= \$2,173 \text{ million}\end{aligned}$$

- 39 A is correct. Karp's net income (NI) under FIFO equals Karp's net income under LIFO plus the after-tax increase in the LIFO reserve. For the year ended 31 December 2009, Karp's net income under FIFO equals:

$$\begin{aligned}\text{NI (FIFO method)} &= \text{NI (LIFO method)} + \text{Increase in LIFO reserve} \times \\ &\quad (1 - \text{Tax rate}) \\ &= \$247 \text{ million} + 38 \text{ million} \times (1 - 20\%) \\ &= \$277.4 \text{ million}\end{aligned}$$

Therefore, the increase in net income is:

$$\begin{aligned}\text{Increase in NI} &= \text{NI (FIFO method)} - \text{NI (LIFO method)} \\ &= \$277 \text{ million} - 247 \text{ million} \\ &= \$30.4 \text{ million}\end{aligned}$$

- 40 B is correct. Karp's retained earnings (RE) under FIFO equals Karp's retained earnings under LIFO plus the after-tax LIFO reserve. Therefore, for the year ended 31 December 2009, Karp's retained earnings under FIFO equals:

$$\begin{aligned}\text{RE (FIFO method)} &= \text{RE (LIFO method)} + \text{LIFO reserve} \times (1 - \text{Tax} \\ &\quad \text{rate}) \\ &= \$787 \text{ million} + 155 \text{ million} \times (1 - 20\%) \\ &= \$911 \text{ million}\end{aligned}$$

Therefore, the increase in retained earnings is:

$$\begin{aligned}\text{Increase in RE} &= \text{RE (FIFO method)} - \text{RE (LIFO method)} \\ &= \$911 \text{ million} - 787 \text{ million} \\ &= \$124 \text{ million}\end{aligned}$$

- 41 A is correct. The cash ratio (cash and cash equivalents ÷ current liabilities) would be lower because cash would have been less under FIFO. Karp's income before taxes would have been higher under FIFO, and consequently taxes paid by Karp would have also been higher and cash would have been lower. There is no impact on current liabilities. Both Karp's current ratio and gross profit margin would have been higher if FIFO had been used. The current ratio would have been higher because inventory under FIFO increases by a larger amount than the cash decreases for taxes paid. Because the cost of goods sold under FIFO is lower than under LIFO, the gross profit margin would have been higher.

- 42 B is correct. If Karp had used FIFO instead of LIFO, the debt-to-equity ratio would have decreased. No change in debt would have occurred, but shareholders' equity would have increased as a result of higher retained earnings.
- 43 B is correct. Crux's adjusted inventory turnover ratio must be computed using cost of goods sold (COGS) under FIFO and excluding charges for increases in valuation allowances.

$$\begin{aligned} \text{COGS (adjusted)} &= \text{COGS (LIFO method)} - \text{Charges included in} \\ &\quad \text{cost of goods sold for inventory write-downs} - \text{Change} \\ &\quad \text{in LIFO reserve} \\ &= \$3,120 \text{ million} - 13 \text{ million} - (55 \text{ million} - 72 \text{ million}) \\ &= \$3,124 \text{ million} \end{aligned}$$

Note: Minus the change in LIFO reserve is equivalent to plus the decrease in LIFO reserve. The adjusted inventory turnover ratio is computed using average inventory under FIFO.

$$\text{Ending inventory (FIFO)} = \text{Ending inventory (LIFO)} + \text{LIFO reserve}$$

$$\text{Ending inventory 2009 (FIFO)} = \$480 + 55 = \$535$$

$$\text{Ending inventory 2008 (FIFO)} = \$465 + 72 = \$537$$

$$\text{Average inventory} = (\$535 + 537)/2 = \$536$$

Therefore, adjusted inventory turnover ratio equals:

$$\text{Inventory turnover ratio} = \text{COGS}/\text{Average inventory} = \$3,124/\$536 = 5.83$$

- 44 B is correct. Rolby's adjusted net profit margin must be computed using net income (NI) under FIFO and excluding charges for increases in valuation allowances.

$$\begin{aligned} \text{NI (adjusted)} &= \text{NI (FIFO method)} + \text{Charges, included in cost of goods} \\ &\quad \text{sold for inventory write-downs, after tax} \\ &= \$327 \text{ million} + 15 \text{ million} \times (1 - 30\%) \\ &= \$337.5 \text{ million} \end{aligned}$$

Therefore, adjusted net profit margin equals:

$$\text{Net profit margin} = \text{NI}/\text{Revenues} = \$337.5/\$5,442 = 6.20\%$$

- 45 A is correct. Mikko's adjusted debt-to-equity ratio is lower because the debt (numerator) is unchanged and the adjusted shareholders' equity (denominator) is higher. The adjusted shareholders' equity corresponds to shareholders' equity under FIFO, excluding charges for increases in valuation allowances. Therefore, adjusted shareholders' equity is higher than reported (unadjusted) shareholders' equity.
- 46 C is correct. Mikko's and Crux's gross margin ratios would better reflect the current gross margin of the industry than Rolby because both use LIFO. LIFO recognizes as cost of goods sold the cost of the most recently purchased units, therefore, it better reflects replacement cost. However, Mikko's gross margin ratio best reflects the current gross margin of the industry because Crux's LIFO reserve is decreasing. This could reflect a LIFO liquidation by Crux which would distort gross profit margin.
- 47 B is correct. The FIFO method shows a higher gross profit margin than the LIFO method in an inflationary scenario, because FIFO allocates to cost of goods sold the cost of the oldest units available for sale. In an inflationary environment, these units are the ones with the lowest cost.

- 48 A is correct. An inventory write-down increases cost of sales and reduces profit and reduces the carrying value of inventory and assets. This has a negative effect on profitability and solvency ratios. However, activity ratios appear positively affected by a write-down because the asset base, whether total assets or inventory (denominator), is reduced. The numerator, sales, in total asset turnover is unchanged, and the numerator, cost of sales, in inventory turnover is increased. Thus, turnover ratios are higher and appear more favorable as the result of the write-down.
- 49 B is correct. Finished goods least accurately reflect current prices because some of the finished goods are valued under the "last-in, first-out" ("LIFO") basis. The costs of the newest units available for sale are allocated to cost of goods sold, leaving the oldest units (at lower costs) in inventory. ZP values raw materials and work in process using the weighted average cost method. While not fully reflecting current prices, some inflationary effect will be included in the inventory values.
- 50 C is correct. FIFO inventory = Reported inventory + LIFO reserve = ¥608,572 + 10,120 = ¥618,692. The LIFO reserve is disclosed in Note 2 of the notes to consolidated financial statements.
- 51 A is correct. The SEC does not require companies to use the same inventory valuation method for all inventories, so this is the *least likely* reason to change accounting policies regarding inventory. The SEC is currently evaluating whether all US companies should be required to adopt IFRS. If the SEC requires companies to adopt IFRS, the LIFO method of inventory valuation would no longer be allowed.
- 52 A is correct. The inventory turnover ratio would be lower. The average inventory would be higher under FIFO and cost of products sold would be lower by the increase in LIFO reserve. LIFO is not permitted under IFRS.

Inventory turnover ratio = Cost of products sold ÷ Average inventory

2009 inventory turnover ratio as reported = 10.63 = ¥5,822,805/[(608,572 + 486,465)/2].

2009 inventory turnover ratio adjusted to FIFO as necessary = 10.34 = [¥5,822,805 - (19,660 - 10,120)]/[(608,572 + 10,120 + 486,465 + 19,660)/2].

- 53 A is correct. No LIFO liquidation occurred during 2009; the LIFO reserve increased from ¥10,120 million in 2008 to ¥19,660 million in 2009. Management stated in the MD&A that the decrease in inventories reflected the impacts of decreased sales volumes and fluctuations in foreign currency translation rates.
- 54 C is correct. Finished goods and raw materials inventories are lower in 2009 when compared to 2008. Reduced levels of inventory typically indicate an anticipated business contraction.
- 55 B is correct. The decrease in LIFO inventory in 2009 would typically indicate that more inventory units were sold than produced or purchased. Accordingly, one would expect a liquidation of some of the older LIFO layers and the LIFO reserve to decrease. In actuality, the LIFO reserve *increased* from ¥10,120 million in 2008 to ¥19,660 million in 2009. This is not to be expected and is likely caused by the increase in prices of raw materials, other production materials, and parts of foreign currencies as noted in the MD&A. An analyst should seek to confirm this explanation.
- 56 B is correct. If prices have been decreasing, write-downs under FIFO are least likely to have a significant effect because the inventory is valued at closer to the new, lower prices. Typically, inventories valued using LIFO are less likely to

incur inventory write-downs than inventories valued using weighted average cost or FIFO. Under LIFO, the *oldest* costs are reflected in the inventory carrying value on the balance sheet. Given increasing inventory costs, the inventory carrying values under the LIFO method are already conservatively presented at the oldest and lowest costs. Thus, it is far less likely that inventory write-downs will occur under LIFO; and if a write-down does occur, it is likely to be of a lesser magnitude.

SOLUTIONS

- 1 B is correct. Only costs necessary for the machine to be ready to use can be capitalized. Therefore, Total capitalized costs = $12,980 + 1,200 + 700 + 100 = \$14,980$.
- 2 C is correct. When property and equipment are purchased, the assets are recorded on the balance sheet at cost. Costs for the assets include all expenditures required to prepare the assets for their intended use. Any other costs are expensed. Costs to train staff for using the machine are not required to prepare the property and equipment for their intended use, and these costs are expensed.
- 3 B is correct. When a company constructs an asset, borrowing costs incurred directly related to the construction are generally capitalized. If the asset is constructed for sale, the borrowing costs are classified as inventory.
- 4 A is correct. Borrowing costs can be capitalized under IFRS until the tangible asset is ready for use. Also, under IFRS, income earned on temporarily investing the borrowed monies decreases the amount of borrowing costs eligible for capitalization. Therefore, Total capitalized interest = $(500 \text{ million} \times 14\% \times 2 \text{ years}) - 10 \text{ million} = 130 \text{ million}$.
- 5 B is correct. A product patent with a defined expiration date is an intangible asset with a finite useful life. A copyright with no expiration date is an intangible asset with an indefinite useful life. Goodwill is no longer considered an intangible asset under IFRS and is considered to have an indefinite useful life.
- 6 C is correct. An intangible asset with a finite useful life is amortized, whereas an intangible asset with an indefinite useful life is not.
- 7 A is correct. The costs to internally develop intangible assets are generally expensed when incurred.
- 8 C is correct. Under both International Financial Reporting Standards (IFRS) and US GAAP, if an item is acquired in a business combination and cannot be recognized as a tangible asset or identifiable intangible asset, it is recognized as goodwill. Under US GAAP, assets arising from contractual or legal rights and assets that can be separated from the acquired company are recognized separately from goodwill.
- 9 A is correct. In the fiscal year when long-lived equipment is purchased, the assets on the balance sheet increase and depreciation expense on the income statement increases because of the new long-lived asset.
- 10 B is correct. Company Z's return on equity based on year-end equity value will be 6.1%. Company Z will have an additional £200,000 of expenses compared with Company X. Company Z expensed the printer for £300,000 rather than capitalizing the printer and having a depreciation expense of £100,000 like Company X. Company Z's net income and shareholders' equity will be £150,000 lower ($= £200,000 \times 0.75$) than that of Company X.

$$\begin{aligned}\text{ROE} &= \left(\frac{\text{Net income}}{\text{Shareholders' Equity}} \right) \\ &= \frac{\text{£}600,000}{\text{£}9,850,000} \\ &= 0.61 = 6.1\%\end{aligned}$$

- 11 A is correct. If the company uses the straight-line method, the depreciation expense will be one-fifth (20 percent) of the depreciable cost in Year 1. If it uses the units-of-production method, the depreciation expense will be 19 percent ($2,000/10,500$) of the depreciable cost in Year 1. Therefore, if the company uses the straight-line method, its depreciation expense will be higher and its net income will be lower.
- 12 C is correct. The operating income or earnings before interest and taxes will be lowest for the method that results in the highest depreciation expense. The double-declining balance method results in the highest depreciation expense in the first year of use.

Depreciation expense:

$$\text{Straight line} = €1,500/5 = €300.$$

$$\text{Double-declining balance} = €1,500 \times 0.40 = €600.$$

$$\text{Units of production} = €1,500 \times 0.15 = €225.$$

- 13 C is correct. If Martinez wants to minimize tax payments in the first year of the machine's life, he should use an accelerated method, such as the double-declining balance method.
- 14 A is correct. Using the straight-line method, depreciation expense amounts to

$$\text{Depreciation expense} = (1,200,000 - 200,000)/8 \text{ years} = 125,000.$$

- 15 B is correct. Using the units-of-production method, depreciation expense amounts to

$$\text{Depreciation expense} = (1,200,000 - 200,000) \times (135,000/800,000) = 168,750.$$

- 16 A is correct. The straight-line method is the method that evenly distributes the cost of an asset over its useful life because amortization is the same amount every year.
- 17 A is correct. A higher residual value results in a lower total depreciable cost and, therefore, a lower amount of amortization in the first year after acquisition (and every year after that).
- 18 C is correct. Shifting at the end of Year 2 from double-declining balance to straight-line depreciation methodology results in depreciation expense being the same in each of Years 3, 4, and 5. Shifting to the straight-line methodology at the beginning of Year 3 results in a greater depreciation expense in Year 4 than would have been calculated using the double-declining balance method.
- Depreciation expense Year 4 (Using double-declining balance method all five years)

$$\begin{aligned} &= 2 \times \text{Annual depreciation \% using straight-line method} \times \text{Carrying amount} \\ &\quad \text{at end of Year 3} \\ &= 40\% \times \$43,200 \end{aligned}$$

Depreciation expense Year 4 with switch to straight-line method in Year 3

$$\begin{aligned} &= \frac{1}{3} \times \text{Remaining depreciable cost at start of Year 3} \\ &= \frac{1}{3} \times \$72,000 \\ &= \$24,000 \end{aligned}$$

- 19 B is correct. Using the straight-line method, accumulated amortization amounts to

$$\begin{aligned}\text{Accumulated amortization} &= [(2,300,000 - 500,000)/3 \text{ years}] \times 2 \text{ years} \\ &= 1,200,000\end{aligned}$$

- 20 B is correct. Using the units-of-production method, depreciation expense amounts to

$$\text{Depreciation expense} = 5,800,000 \times (20,000/175,000) = 662,857$$

- 21 B is correct. As shown in the following calculations, under the double-declining balance method, the annual amortization expense in Year 4 is closest to ¥9.9 million.

Annual amortization expense = $2 \times$ Straight-line amortization rate \times Net book value.

Amortization expense Year 4 = $33.3\% \times ¥29.6$ million = ¥9.9 million.

- 22 A is correct. As shown in the following calculations, at the end of Year 4, the difference between the net book values calculated using straight-line versus double-declining balance is closest to €81,400.

Net book value end of Year 4 using straight-line method = $€600,000 - [4 \times (€600,000/6)]$ = €200,000.

Net book value end of Year 4 using double-declining balance method = $€600,000 (1 - 33.33\%)^4 \approx €118,600$.

- 23 B is correct. In this case, the value increase brought about by the revaluation should be recorded directly in equity. The reason is that under IFRS, an increase in value brought about by a revaluation can only be recognized as a profit to the extent that it reverses a revaluation decrease of the same asset previously recognized in the income statement.

- 24 B is correct. The impairment loss equals £3,100,000.

$$\begin{aligned}\text{Impairment} &= \max(\text{Fair value less costs to sell; Value in use}) - \text{Net carrying amount} \\ &= \max(16,800,000 - 800,000; 14,500,000) - 19,100,000 \\ &= -3,100,000.\end{aligned}$$

- 25 B is correct. Under IFRS, an impairment loss is measured as the excess of the carrying amount over the asset's recoverable amount. The recoverable amount is the higher of the asset's fair value less costs to sell and its value in use. Value in use is a discounted measure of expected future cash flows. Under US GAAP, assessing recoverability is separate from measuring the impairment loss. If the asset's carrying amount exceeds its undiscounted expected future cash flows, the asset's carrying amount is considered unrecoverable and the impairment loss is measured as the excess of the carrying amount over the asset's fair value.

- 26 B is correct. The result on the sale of the vehicle equals

$$\begin{aligned}\text{Gain or loss on the sale} &= \text{Sale proceeds} - \text{Carrying amount} \\ &= \text{Sale proceeds} - (\text{Acquisition cost} - \text{Accumulated depreciation}) \\ &= 85,000 - \{100,000 - [((100,000 - 10,000)/9 \text{ years}) \times 3 \text{ years}]\} \\ &= 15,000.\end{aligned}$$

- 27 A is correct. Gain or loss on the sale = Sale proceeds – Carrying amount. Rearranging this equation, Sale proceeds = Carrying amount + Gain or loss on sale. Thus, Sale price = (12 million – 2 million) + (–3.2 million) = 6.8 million.
- 28 C is correct. The carrying amount of the asset on the balance sheet is reduced by the amount of the impairment loss, and the impairment loss is reported on the income statement.
- 29 A is correct. The gain or loss on the sale of long-lived assets is computed as the sales proceeds minus the carrying amount of the asset at the time of sale. This is true under the cost and revaluation models of reporting long-lived assets. In the absence of impairment losses, under the cost model, the carrying amount will equal historical cost net of accumulated depreciation.
- 30 B is correct. IFRS do not require acquisition dates to be disclosed.
- 31 A is correct. IFRS do not require fair value of intangible assets to be disclosed.
- 32 C is correct. Under US GAAP, companies are required to disclose the estimated amortization expense for the next five fiscal years. Under US GAAP, there is no reversal of impairment losses. Disclosure of the useful lives—finite or indefinite and additional related details—is required under IFRS.
- 33 B is correct. Investment property earns rent. Investment property and property, plant, and equipment are tangible and long-lived.
- 34 C is correct. When a company uses the fair value model to value investment property, changes in the fair value of the property are reported in the income statement—not in other comprehensive income.
- 35 A is correct. Investment property earns rent. Inventory is held for resale, and property, plant, and equipment are used in the production of goods and services.
- 36 C is correct. A company will change from the fair value model to either the cost model or revaluation model when the company transfers investment property to property, plant, and equipment.
- 37 A is correct. Under both the revaluation model for property, plant, and equipment and the fair model for investment property, the asset's fair value must be able to be measured reliably. Under the fair value model, net income is affected by all changes in the asset's fair value. Under the revaluation model, any increase in an asset's value to the extent that it reverses a previous revaluation decrease will be recognized on the income statement and increase net income.
- 38 A is correct. Under IFRS, when using the cost model for its investment properties, a company must disclose useful lives. The method for determining fair value, as well as reconciliation between beginning and ending carrying amounts of investment property, is a required disclosure when the fair value model is used.
- 39 C is correct. A lease can reduce the risks of obsolescence to the lessee because the lessee does not own the asset. Under a finance lease, a leased asset and a lease obligation are reported on the balance sheet, and depreciation expense and interest expense are reported on the income statement.
- 40 C is correct. Expensing rather than capitalising an investment in long-term assets will result in higher expenses and lower net income and net profit margin in the current year. Future years' incomes will not include depreciation expense related to these expenditures. Consequently, year-to-year growth in profitability will be higher. If the expenses had been capitalised, the carrying amount of the assets would have been higher and the 2009 total asset turnover would have been lower.

- 41 C is correct. In 2010, switching to an accelerated depreciation method would increase depreciation expense and decrease income before taxes, taxes payable, and net income. Cash flow from operating activities would increase because of the resulting tax savings.
- 42 B is correct. 2009 net income and net profit margin are lower because of the impairment loss. Consequently, net profit margins in subsequent years are likely to be higher. An impairment loss suggests that insufficient depreciation expense was recognized in prior years, and net income was overstated in prior years. The impairment loss is a non-cash item and will not affect operating cash flows.
- 43 A is correct. The estimated average remaining useful life is 20.75 years.

Estimate of remaining useful life = Net plant and equipment ÷ Annual depreciation expense

$$\begin{aligned} \text{Net plant and equipment} &= \text{Gross P \& E} - \text{Accumulated depreciation} \\ &= €6000 - €1850 = €4150 \end{aligned}$$

$$\begin{aligned} \text{Estimate of remaining useful life} &= \text{Net P \& E} \div \text{Depreciation expense} \\ &= €4150 \div €200 = 20.75 \end{aligned}$$

- 44 A is correct. When leases are classified as finance leases, the lessee initially reports an asset and liability at a carrying amount equal to the lower of the fair value of the leased asset or the present value of the future lease payments. Under an operating lease, the lessee does not report an asset or liability. Therefore, total asset turnover (total revenue ÷ average total assets) would be lower if the leases were classified as finance leases.
- 45 C is correct. Total liabilities-to-assets would be higher. When leases are classified as finance leases, the lessee initially reports an asset and liability at a carrying amount equal to the lower of the fair value of the leased asset or the present value of the future lease payments. Both the numerator and denominator would increase by an equal amount, but the proportional increase in the numerator is higher and the ratio would be higher. The following exhibit shows what would happen to 2009 total liabilities, assets, and total liabilities-to-assets if €200 million, the fair value of the leased equipment, is added to AMRC's total liabilities and assets. This simple example ignores the impact of accounting for the 2009 lease payment.

	2009 Actual Under Operating Lease	2009 Hypothetical Under Finance Lease
Total Liabilities	€2,750	€2,950
Total assets	€5,350	€5,550
Total liabilities-to-assets	51.4%	53.2%

The depreciation and interest expense under a finance lease tends to be higher than the operating lease payment in the early years of the lease. The finance lease would result in lower net income and net profit margin. Long-lived (fixed) assets are higher under a finance lease and fixed asset turnover is lower.

- 46 C is correct. The decision to capitalise the costs of the new computer system results in higher cash flow from operating activities; the expenditure is reported as an outflow of investing activities. The company allocates the capitalised amount over the asset's useful life as depreciation or amortisation expense rather than expensing it in the year of expenditure. Net income and total assets are higher in the current fiscal year.

- 47 B is correct. Alpha's fixed asset turnover will be lower because the capitalised interest will appear on the balance sheet as part of the asset being constructed. Therefore, fixed assets will be higher and the fixed asset turnover ratio (total revenue/average net fixed assets) will be lower than if it had expensed these costs. Capitalised interest appears on the balance sheet as part of the asset being constructed instead of being reported as interest expense in the period incurred. However, the interest coverage ratio should be based on interest payments, not interest expense (earnings before interest and taxes/interest payments), and should be unchanged. To provide a true picture of a company's interest coverage, the entire amount of interest expenditure, both the capitalised portion and the expensed portion, should be used in calculating interest coverage ratios.
- 48 C is correct. The cash flow from operating activities will be lower, not higher, because the full lease payment is treated as an operating cash outflow. With a finance lease, only the portion of the lease payment relating to interest expense potentially reduces operating cash outflows. A company reporting a lease as an operating lease will typically show higher profits in early years, because the lease expense is less than the sum of the interest and depreciation expense. The company reporting the lease as an operating lease will typically report stronger solvency and activity ratios.
- 49 A is correct. Accelerated depreciation will result in an improving, not declining, net profit margin over time, because the amount of depreciation expense declines each year. Under straight-line depreciation, the amount of depreciation expense will remain the same each year. Under the units-of-production method, the amount of depreciation expense reported each year varies with the number of units produced.
- 50 B is correct. The estimated average total useful life of a company's assets is calculated by adding the estimates of the average remaining useful life and the average age of the assets. The average age of the assets is estimated by dividing accumulated depreciation by depreciation expense. The average remaining useful life of the asset base is estimated by dividing net property, plant, and equipment by annual depreciation expense.
- 51 C is correct. The impairment loss is a non-cash charge and will not affect cash flow from operating activities. The debt to total assets and fixed asset turnover ratios will increase, because the impairment loss will reduce the carrying amount of fixed assets and therefore total assets.
- 52 A is correct. In an asset revaluation, the carrying amount of the assets increases. The increase in the asset's carrying amount bypasses the income statement and is reported as other comprehensive income and appears in equity under the heading of revaluation surplus. Therefore, shareholders' equity will increase but net income will not be affected, so return on equity will decline. Return on assets and debt to capital ratios will also decrease.

SOLUTIONS

- 1 C is correct. Because the differences between tax and financial accounting will correct over time, the resulting deferred tax liability, for which the expense was charged to the income statement but the tax authority has not yet been paid, will be a temporary difference. A valuation allowance would only arise if there was doubt over the company's ability to earn sufficient income in the future to require paying the tax.
- 2 A is correct. The taxes a company must pay in the immediate future are taxes payable.
- 3 C is correct. Higher reported tax expense relative to taxes paid will increase the deferred tax liability, whereas lower reported tax expense relative to taxes paid increases the deferred tax asset.
- 4 B is correct. If the liability is expected to reverse (and thus require a cash tax payment) the deferred tax represents a future liability.
- 5 A is correct. If the liability will not reverse, there will be no required tax payment in the future and the "liability" should be treated as equity.
- 6 C is correct. The deferred tax liability should be excluded from both debt and equity when both the amounts and timing of tax payments resulting from the reversals of temporary differences are uncertain.
- 7 C is correct. Accounting items that are not deductible for tax purposes will not be reversed and thus result in permanent differences.
- 8 C is correct. Tax credits that directly reduce taxes are a permanent difference, and permanent differences do not give rise to deferred tax.
- 9 A is correct. The capitalization will result in an asset with a positive tax base and zero carrying value. The amortization means the difference is temporary. Because there is a temporary difference on an asset resulting in a higher tax base than carrying value, a deferred tax asset is created.
- 10 B is correct. The difference is temporary, and the tax base will be lower (because of more rapid amortization) than the carrying value of the asset. The result will be a deferred tax liability.
- 11 A is correct. The advances represent a liability for the company. The carrying value of the liability exceeds the tax base (which is now zero). A deferred tax asset arises when the carrying value of a liability exceeds its tax base.
- 12 B is correct. The income tax provision in 2017 was \$54,144, consisting of \$58,772 in current income taxes, of which \$4,628 were deferred.
- 13 B is correct. The effective tax rate of 30.1 percent ($\$56,860/\$189,167$) was higher than the effective rates in 2015 and 2017.
- 14 A is correct. In 2017 the effective tax rate on foreign operations was 24.2 percent $[(\$28,140 + \$124)/\$116,704]$ and the effective US tax rate was $[(\$30,632 - \$4,752)/\$88,157] = 29.4$ percent. In 2016 the effective tax rate on foreign operations was 26.2 percent and the US rate was 35.9 percent. In 2015 the foreign rate was 24.1 percent and the US rate was 35.5 percent.
- 15 B is correct. The valuation allowance is taken against deferred tax assets to represent uncertainty that future taxable income will be sufficient to fully utilize the assets. By decreasing the allowance, Zimt is signaling greater likelihood that future earnings will be offset by the deferred tax asset.

- 16 C is correct. The valuation allowance is taken when the company will “more likely than not” fail to earn sufficient income to offset the deferred tax asset. Because the valuation allowance equals the asset, by extension the company expects *no* taxable income prior to the expiration of the deferred tax assets.
- 17 A is correct. A lower tax rate would increase net income on the income statement, and because the company has a net deferred tax liability, the net liability position on the balance sheet would also improve (be smaller).
- 18 C is correct. The reduction in the valuation allowance resulted in a corresponding reduction in the income tax provision.
- 19 B is correct. The net deferred tax liability was smaller in 2017 than it was in 2016, indicating that in addition to meeting the tax payments provided for in 2017 the company also paid taxes that had been deferred in prior periods.
- 20 C is correct. The income tax provision at the statutory rate of 34 percent is a benefit of \$112,000, suggesting that the pre-tax income was a loss of $\$112,000/0.34 = (\$329,412)$. The income tax provision was \$227,000. $(\$329,412) - \$227,000 = (\$556,412)$.
- 21 C is correct. Accounting expenses that are not deductible for tax purposes result in a permanent difference, and thus do not give rise to deferred taxes.
- 22 B is correct. Over the three-year period, changes in the valuation allowance reduced cumulative income taxes by \$1,670,000. The reductions to the valuation allowance were a result of the company being “more likely than not” to earn sufficient taxable income to offset the deferred tax assets.

SOLUTIONS

- 1 B is correct. The company receives €1 million in cash from investors at the time the bonds are issued, which is recorded as a financing activity.
- 2 B is correct. The effective interest rate is greater than the coupon rate and the bonds will be issued at a discount.
- 3 A is correct. Under US GAAP, expenses incurred when issuing bonds are generally recorded as an asset and amortised to the related expense (legal, etc.) over the life of the bonds. Under IFRS, they are included in the measurement of the liability. The related cash flows are financing activities.
- 4 C is correct. The bonds will be issued at a premium because the coupon rate is higher than the market interest rate. The future cash outflows, the present value of the cash outflows, and the total present value are as follows:

Date	Interest Payment (\$)	Present Value at Market Rate 5% (\$)	Present Value at Market Rate 5% (\$)	Total Present Value (\$)
31 December 2015	60,000.00	57,142.86		
31 December 2016	60,000.00	54,421.77		
31 December 2017	60,000.00	51,830.26		
31 December 2018	60,000.00	49,362.15		
31 December 2019	60,000.00	47,011.57		
31 December 2020	60,000.00	44,772.92		
31 December 2021	60,000.00	42,640.88		
31 December 2022	60,000.00	40,610.36		
31 December 2023	60,000.00	38,676.53		
31 December 2024	60,000.00	36,834.80	1,000,000.00	613,913.25
		<u>463,304.10</u>		<u>613,913.25</u>
				1,077,217.35
				Sales Proceeds

The following illustrates the keystrokes for many financial calculators to calculate sales proceeds of \$1,077,217.35:

Calculator Notation	Numerical Value for This Problem
N	10
% i or I/Y	5
FV	\$1,000,000.00
PMT	\$60,000.00
PV compute	X

Thus, the sales proceeds are reported on the balance sheet as an increase in long-term liability, bonds payable of \$1,077,217.

- 5 A is correct. The bonds payable reported at issue is equal to the sales proceeds. The interest payments and future value of the bond must be discounted at the market interest rate of 3% to determine the sales proceeds.

Date	Interest Payment	Present Value at Market Rate (3%)	Face Value Payment	Present Value at Market Rate (3%)	Total Present Value
31 December 2015	\$125,000.00	\$121,359.22			
31 December 2016	\$125,000.00	\$117,824.49			
31 December 2017	\$125,000.00	\$114,392.71	\$5,000,000.00	\$4,575,708.30	
Total		\$353,576.42		\$4,575,708.30	\$4,929,284.72

The following illustrates the keystrokes for many financial calculators to calculate sales proceeds of \$1,077,217.35:

Calculator Notation	Numerical Value for This Problem
N	3
% i or I/Y	3.0
FV	\$5,000,000.00
PMT	\$125,000.00
PV compute	X

- 6 B is correct. The market interest rate at the time of issuance is the effective interest rate that the company incurs on the debt. The effective interest rate is the discount rate that equates the present value of the coupon payments and face value to their selling price. Consequently, the effective interest rate is 5.50%.
- 7 B is correct. The bonds will be issued at a discount because the market interest rate is higher than the stated rate. Discounting the future payments to their present value indicates that at the time of issue, the company will record £978,938 as both a liability and a cash inflow from financing activities. Interest expense in 2010 is £58,736 (£978,938 times 6.0 percent). During the year, the company will pay cash of £55,000 related to the interest payment, but interest expense on the income statement will also reflect £3,736 related to amortisation of the initial discount (£58,736 interest expense less the £55,000 interest payment). Thus, the value of the liability at 31 December 2010 will reflect the initial value (£978,938) plus the amortised discount (£3,736), for a total of £982,674. The cash outflow of £55,000 may be presented as either an operating or financing activity under IFRS.
- 8 A is correct. The coupon rate on the bonds is higher than the market rate, which indicates that the bonds will be issued at a premium. Taking the present value of each payment indicates an issue date value of €10,210,618. The interest expense is determined by multiplying the carrying amount at the beginning of the period (€10,210,618) by the market interest rate at the time of issue (6.0 percent) for an interest expense of €612,637. The value after one year will equal the beginning value less the amount of the premium amortised to date, which is the difference between the amount paid (€650,000) and the expense accrued (€612,637) or €37,363. €10,210,618 – €37,363 = €10,173,255 or €10.17 million.
- 9 A is correct. The future cash outflows, the present value of the cash outflows, and the total present value are as follows:

Date	Interest Payment (€)	Present Value at Market Rate 6% (€)	Present Value at Market Rate 6% (€)	Total Present Value (€)
31 December 2015	700,000.00	660,377.36		
31 December 2016	700,000.00	622,997.51		
31 December 2017	700,000.00	587,733.50		
31 December 2018	700,000.00	554,465.56		
31 December 2019	700,000.00	523,080.72		
31 December 2020	700,000.00	493,472.38		
31 December 2021	700,000.00	465,539.98		
31 December 2022	700,000.00	439,188.66		
31 December 2023	700,000.00	414,328.92		
31 December 2024	700,000.00	390,876.34	10,000,000.00	5,583,947.77
		5,152,060.94		5,583,947.77
				10,736,008.71
				Sales Proceeds

The following illustrates the keystrokes for many financial calculators to calculate sales proceeds of €10,736,008.71:

Calculator Notation	Numerical Value for This Problem
N	10
% i or I/Y	6
FV	\$10,000,000.00
PMT	\$700,000.00
PV compute	X

The interest expense is calculated by multiplying the carrying amount at the beginning of the year by the effective interest rate at issuance. As a result, the interest expense at 31 December 2015 is €644,161 ($\text{€}10,736,008.71 \times 6\%$).

- 10 C is correct. The future cash outflows, the present value of the cash outflows, and the total present value are as follows:

Date	Interest Payment (\$)	Present Value at Market Rate 5% (\$)	Present Value at Market Rate 5% (\$)	Total Present Value (\$)
31 December 2015	1,200,000	1,142,857.14		
31 December 2016	1,200,000	1,088,435.37		
31 December 2017	1,200,000	1,036,605.12		
31 December 2018	1,200,000	987,242.97		
31 December 2019	1,200,000	940,231.40	30,000,000	23,505,785.00
		5,195,372.00		23,505,785.00
				28,701,157.00
				Sales Proceeds

The following illustrates the keystrokes for many financial calculators to calculate sales proceeds of \$28,701,157.00:

Calculator Notation	Numerical Value for This Problem
N	5
% i or I/Y	5
FV	\$30,000,000.00
PMT	\$1,200,000.00
PV compute	X

The following table illustrates interest expense, premium amortization, and carrying amount (amortized cost) for 2015.

Year	Carrying Amount (beginning of year)	Interest Expense (at effective interest rate of 5%)	Interest Payment (at coupon rate of 4%)	Amortization of Discount	Carrying Amount (end of year)
2015	\$28,701,157.00	\$1,435,057.85	\$1,200,000.00	\$235,057.85	\$28,936,214.85

The carrying amount at the end of the year is found by adding the amortization of the discount to the carrying amount at the beginning of the year. As a result, the carrying amount on 31 December 2015 is \$28,936,215.

Alternatively, the following illustrates the keystrokes for many financial calculators to calculate the carrying value at the end of first year of \$28,936,215:

Calculator Notation	Numerical Value for This Problem
N	4
% i or I/Y	5
FV	\$30,000,000.00
PMT	\$1,200,000.00
PV compute	X

- 11 B is correct. The interest expense for a given year is equal to the carrying amount at the beginning of the year times the effective interest of 4%. Under the effective interest rate method, the difference between the interest expense and the interest payment (based on the coupon rate and face value) is the discount amortized in the period, which increases the carrying amount annually. For 2017, the interest expense is the beginning carrying amount (\$1,944,499) times the effective interest of 4%.

Year	Carrying Amount (beginning)	Interest Expense (at effective interest of 4%)	Interest Payment (at coupon rate of 3%)	Amortization of Discount	Carrying Amount (end of year)
2015	\$1,910,964	\$76,439	\$60,000.00	\$16,439	\$1,927,403
2016	\$1,927,403	\$77,096	\$60,000.00	\$17,096	\$1,944,499
2017	\$1,944,499	\$77,780	\$60,000.00	\$17,780	\$1,962,279

- 12 B is correct. The amortization of the premium equals the interest payment minus the interest expense. The interest payment is constant and the interest expense decreases as the carrying amount decreases. As a result, the amortization of the premium increases each year.

- 13 B is correct. Under the straight-line method, the bond premium is amortized equally over the life of the bond. The annual interest payment is \$165,000 ($\$3,000,000 \times 5.5\%$) and annual amortization of the premium under the straight-line method is \$13,616 [$(\$3,040,849 - \$3,000,000)/3$]. The interest expense is the interest payment less the amortization of the premium ($\$165,000 - \$13,616 = \$151,384$).
- 14 C is correct. A gain of €3.3 million (carrying amount less amount paid) will be reported on the income statement.
- 15 B is correct. If a company decides to redeem a bond before maturity, bonds payable is reduced by the carrying amount of the debt. The difference between the cash required to redeem the bonds and the carrying amount of the bonds is a gain or loss on the extinguishment of debt. Because the call price is 104 and the face value is \$1,000,000, the redemption cost is 104% of \$1,000,000 or \$1,040,000. The company's loss on redemption would be \$50,000 (\$990,000 carrying amount of debt minus \$1,040,000 cash paid to redeem the callable bonds).
- 16 A is correct. The value of the liability for zero-coupon bonds increases as the discount is amortised over time. Furthermore, the amortised interest will reduce earnings at an increasing rate over time as the value of the liability increases. Higher relative debt and lower relative equity (through retained earnings) will cause the debt-to-equity ratio to increase as the zero-coupon bonds approach maturity.
- 17 A is correct. When interest rates rise, bonds decline in value. Thus, the carrying amount of the bonds being carried on the balance sheet is higher than the market value. The company could repurchase the bonds for less than the carrying amount, so the economic liabilities are overestimated. Because the bonds are issued at a fixed rate, there is no effect on interest coverage.
- 18 C is correct. Affirmative covenants require certain actions of the borrower. Requiring the company to perform regular maintenance on equipment pledged as collateral is an example of an affirmative covenant because it requires the company to do something. Negative covenants require that the borrower not take certain actions. Prohibiting the borrower from entering into mergers and preventing the borrower from issuing excessive additional debt are examples of negative covenants.
- 19 C is correct. Covenants protect debtholders from excessive risk taking, typically by limiting the issuer's ability to use cash or by limiting the overall levels of debt relative to income and equity. Issuing additional equity would increase the company's ability to meet its obligations, so debtholders would not restrict that ability.
- 20 C is correct. The non-current liabilities section of the balance sheet usually includes a single line item of the total amount of a company's long-term debt due after 1 year, and the current liabilities section shows the portion of a company's long-term debt due in the next 12 months. Notes to the financial statements generally present the stated and effective interest rates and maturity dates for a company's debt obligations.
- 21 B is correct. An operating lease is not recorded on the balance sheet (debt is lower), and lease payments are entirely categorised as rent (interest expense is lower.) Because the rent expense is an operating outflow but principal repayments are financing cash flows, the operating lease will result in lower cash flow from operating activity.
- 22 B is correct. The lessee will disclose the future obligation by maturity of its operating leases. The future obligations by maturity, leased assets, and lease liabilities will all be shown for finance leases.

- 23 B is correct. When a lease is classified as an operating lease, the underlying asset remains on the lessor's balance sheet. The lessor will record a depreciation expense that reduces the asset's value over time.
- 24 A is correct. A sales-type lease treats the lease as a sale of the asset, and revenue is recorded at the time of sale equal to the present value of future lease payments. Under a direct financing lease, only interest income is reported as earned. Under an operating lease, revenue from rent is reported when collected.
- 25 A is correct. A portion of the payments for capital leases, either direct financing or sales-type, is reported as interest income. With an operating lease, all revenue is recorded as rental revenue.
- 26 A is correct. An operating lease is an agreement that allows the lessee to use an asset for a period of time. Thus, an operating lease is similar to renting an asset, whereas a finance lease is equivalent to the purchase of an asset by the lessee that is directly financed by the lessor.
- 27 C is correct. If the present value of the lease payments is greater than 90% of the fair value of the asset, the lease is considered a capital lease. A lease with a term that is 75% or more of the useful life of the asset is deemed to be a capital lease. The option to purchase the asset must be deemed to be cheap (bargain purchase option), not just include the option to purchase the asset.
- 28 A is correct. A finance lease is similar to borrowing money and buying an asset; a company that enters into a finance lease as the lessee reports an asset (leased asset) and related debt (lease payable) on its balance sheet. A company that enters into a finance lease as the lessee will report interest expense and depreciation expense on its income statement. A company that enters into an operating lease will report the lease payment on its income statement. For a finance lease, only the portion of the lease payment relating to interest expense reduces operating cash flow; the portion of the lease payment that reduces the lease liability appears as a cash outflow in the financing section. A company that enters into an operating lease as the lessee will report the full lease payment as an operating cash outflow.
- 29 A is correct. A company that enters into a finance lease reports the value of both the leased asset and lease payable as the lower of the present value of future lease payments and the fair value of the leased asset. The present value of the future lease payments, €47,250,188, is lower than the fair market value of the leased asset, €49,000,000. The company will record a lease payable on the balance sheet of €47,250,188.
- 30 B is correct. An operating lease is economically similar to renting an asset. A company that enters into an operating lease as a lessee reports a lease expense on its income statement during the period it uses the asset and reports no asset or liability on its balance sheet. The operating lease is disclosed in notes to the financial statements.
- 31 C is correct. The current debt-to-total-capital ratio is $\$840 / (\$840 + \$520) = 0.62$. To adjust for the lease commitments, an analyst should add \$100 to both the numerator and denominator: $\$940 / (\$940 + \$520) = 0.64$.
- 32 C is correct. The financial leverage ratio is calculated as follows:

$$\frac{\text{Average total assets}}{\text{Average shareholder's equity}} = \frac{\$45,981 \text{ million}}{\$18,752 \text{ million}} = \$2.452 \text{ million}$$

- 33 B is correct. Company B has the lowest debt-to-equity ratio, indicating the lowest financial leverage, and the highest interest coverage ratio, indicating the greatest number of times that EBIT covers interest payments.

- 34 A is correct because the debt-to-assets (total debt)/(total assets) ratio is $(1,258 + 321)/(8,750) = 1,579/8,750 = 0.18$
- 35 B is correct. The company will report a net pension obligation of €1 million equal to the pension obligation (€10 million) less the plan assets (€9 million).
- 36 A is correct. A company that offers a defined benefit plan makes payments into a pension fund and the retirees are paid from the fund. The payments that a company makes into the fund are invested until they are needed to pay retirees. If the fair value of the fund's assets is higher than the present value of the estimated pension obligation, the plan has a surplus and the company's balance sheet will reflect a net pension asset. Because the fair value of the fund's assets is \$1,500,000,000 and the present value of estimated pension obligations is \$1,200,000,000, the company will present a net pension asset of \$300,000,000 on its balance sheet.

SOLUTIONS

- 1 B is correct. Financial reporting quality pertains to the quality of information in financial reports. High-quality financial reporting provides decision-useful information, which is relevant and faithfully represents the economic reality of the company's activities. Earnings of high quality are sustainable and provide an adequate level of return. Highest-quality financial reports reflect both high financial reporting quality and high earnings quality.
- 2 C is correct. Financial reporting quality pertains to the quality of the information contained in financial reports. High-quality financial reports provide decision-useful information that faithfully represents the economic reality of the company. Low-quality financial reports impede assessment of earnings quality. Financial reporting quality is distinguishable from earnings quality, which pertains to the earnings and cash generated by the company's actual economic activities and the resulting financial condition. Low quality earnings are not sustainable and decrease company value.
- 3 B is correct. Financial reporting quality pertains to the quality of the information contained in financial reports. If financial reporting quality is low, the information provided is not useful to assess the company's performance. Financial reporting quality is distinguishable from earnings quality, which pertains to the earnings and cash generated by the company's actual economic activities and the resulting financial condition.
- 4 B is correct. Earnings quality pertains to the earnings and cash generated by the company's actual economic activities and the resulting financial condition. Low-quality earnings are likely not sustainable over time because the company does not expect to generate the same level of earnings in the future or because earnings will not generate sufficient return on investment to sustain the company in the future. Earnings that are not sustainable decrease company value. Earnings quality is distinguishable from financial reporting quality, which pertains to the quality of the information contained in financial reports.
- 5 A is correct. Earnings that result from non-recurring activities are unsustainable. Unsustainable earnings are an example of lower-quality earnings. Recognizing earnings that result from non-recurring activities is neither a biased accounting choice or indicative of lower quality financial reporting because it faithfully represents economic events.
- 6 B is correct. At the top of the quality spectrum of financial reports are reports that conform to GAAP, are decision useful, and have earnings that are sustainable and offer adequate returns. In other words, these reports have both high financial reporting quality and high earnings quality.
- 7 A is correct. Financial reports span a quality continuum from high to low based on decision-usefulness and earnings quality (see Exhibit 2 of the reading). The lowest-quality reports portray fictitious events, which may misrepresent the company's performance and/or obscure fraudulent misappropriation of the company's assets.
- 8 B is correct. Deferring research and development (R&D) investments into the next reporting period is an example of earnings management by taking a *real* action.
- 9 B is correct. High-quality financial reports offer useful information, meaningful information that is relevant and faithfully represents actual performance. Although low earnings quality may not be desirable, if the reported earnings

are representative of actual performance, they are consistent with high-quality financial reporting. Highest-quality financial reports reflect both high financial reporting quality and high earnings quality.

- 10 B is correct. Aggressive accounting choices aim to enhance the company's reported performance by inflating the amount of revenues, earnings, and/or operating cash flow reported in the period. Consequently, the financial performance for the current period would most likely exhibit an upward bias.
- 11 C is correct. Accounting choices are considered conservative if they decrease the company's reported performance and financial position in the current period. Conservative choices may increase the amount of debt reported on the balance sheet. Conservative accounting choices may decrease the amount of revenues, earnings, and/or operating cash flow reported in the current period and increase those amounts in later periods.
- 12 A is correct. Conservatism reduces the possibility of litigation and, by extension, litigation costs. Rarely, if ever, is a company sued because it understated good news or overstated bad news. Accounting conservatism is a type of bias in financial reporting that decreases a company's reported performance in the current period. Conservatism directly conflicts with the characteristic of neutrality.
- 13 A is correct. Managers often have incentives to meet or beat market expectations, particularly if management compensation is linked to increases in stock prices or to reported earnings.
- 14 B is correct. Managers may be motivated to understate earnings in the current period and increase the probability of meeting or exceeding the next period's earnings target.
- 15 C is correct. Typically, conditions of opportunity, motivation, and rationalization exist when individuals issue low-quality financial reports. Rationalization exists when an individual is concerned about a choice and needs to be able to justify it to herself or himself. If the manager is concerned about a choice in a financial reports, she or he may ask for other opinions to convince herself or himself that it is okay.
- 16 C is correct. In a period of strong financial performance, managers may pursue accounting choices that increase the probability of exceeding next period's earnings forecasts. By accelerating expense recognition or delaying revenue recognition, managers may increase earnings in the next period and increase the likelihood of exceeding next period's earnings targets.
- 17 B is correct. Motivation can result from pressure to meet some criteria for personal reasons, such as a bonus, or corporate reasons, such as concern about financing in the future. Poor internal controls and an inattentive board of directors offer opportunities to issue low-quality financial reports.
- 18 A is correct. The possibility of bond covenant violations may motivate managers to inflate earnings in the current period. By inflating earnings in the current period, the company may be able to avoid the consequences associated with violating bond covenants.
- 19 A is correct. Opportunities to issue low quality financial reports include internal conditions such as an ineffective board of directors and external conditions such as accounting standards that provide scope for divergent choices. Pressure to achieve some performance level and corporate concerns about financing in the future are examples of motivations to issue low-quality financial reports. Typically, three conditions exist when low-quality financial reports are issued: opportunity, motivation, and rationalization.

- 20 C is correct. An audit is intended to provide assurance that the company's financial reports are presented fairly, thus providing discipline regarding financial reporting quality. Regulatory agencies usually require that the financial statements of publicly traded companies be audited by an independent auditor to provide assurance that the financial statements conform to accounting standards. Privately held companies may also choose to obtain audit opinions either voluntarily or because an outside party requires it. An audit is not typically intended to detect fraud. An audit is based on sampling and it is possible that the sample might not reveal misstatements.
- 21 B is correct. If a company uses a non-GAAP financial measure in an SEC filing, it is required to provide the most directly comparable GAAP measure with equivalent prominence in the filing. In addition, the company is required to provide a reconciliation between the non-GAAP measure and the equivalent GAAP measure. Similarly, IFRS require that any non-IFRS measures included in financial reports must be defined and their potential relevance explained. The non-IFRS measures must be reconciled with IFRS measures.
- 22 B is correct. If a company wants to increase reported earnings, the company's managers may reduce the allowance for uncollected accounts and uncollected accounts expense reported in the period. Decreasing the useful life of depreciable assets would increase depreciation expense and decrease earnings in the current period. Classifying a purchase as an expense rather than a capital expenditure would decrease earnings in the current period. The use of accrual accounting may result in estimates included in financial reports, because all facts associated with events may not be known at the time of recognition. These estimates can be grounded in reality or can be managed by the company to present a desired financial picture.
- 23 B is correct. Bias in revenue recognition can lead to manipulation of information presented in financial reports. Addressing the question as to whether revenue is higher or lower than the previous period is not sufficient to determine if there is bias in revenue recognition. Additional analytical procedures must be performed to provide warning signals of accounting malfeasance. Barter transactions are difficult to value properly and may result in bias in revenue recognition. Policies that make it easier to prematurely recognize revenue, such as revenue being recognized before goods are shipped to customers, may be a warning sign of accounting malfeasance.
- 24 A is correct. Managers can temporarily show a higher cash flow from operations by stretching the accounts payable credit period. In other words, the managers delay payments until the next accounting period. Applying all non-cash discount amortization against interest capitalized causes reported interest expenses and operating cash outflow to be higher, resulting in a lower cash flow provided by operations. Shifting the classification of interest paid from financing to operating cash flows lowers the cash flow provided by operations.
- 25 C is correct. If a company's days sales outstanding (DSO) is increasing relative to competitors, this may be a signal that revenues are being recorded prematurely or are even fictitious. There are numerous analytical procedures that can be performed to provide evidence of manipulation of information in financial reporting. These warning signs are often linked to bias associated with revenue recognition and expense recognition policies.
- 26 B is correct. If the ratio of cash flow to net income for a company is consistently below 1 or has declined repeatedly over time, this may be a signal of manipulation of information in financial reports through aggressive accrual accounting

policies. When net income is consistently higher than cash provided by operations, one possible explanation is that the company may be using aggressive accrual accounting policies to shift current expenses to later periods.

- 27 C is correct. To extrapolate historical earnings trends, an analyst should consider making pro forma analytical adjustments of prior years' earnings to reflect in those prior years a reasonable share of the current period's restructuring and impairment charges.

SOLUTIONS

- 1 C is correct. For a large, diversified company, margin changes in different business segments may offset each other. Furthermore, margins are most likely to be stable in mature industries.
- 2 C is correct. Accounts receivable turnover is equal to $365/19$ (collection period in days) = 19.2 for 2003 and needs to equal $365/15$ = 24.3 in 2004 for Galambos to meet its goal. Sales/turnover equals the accounts receivable balance. For 2003, $\$300,000,000/19.2 = \$15,625,000$, and for 2004, $\$400,000,000/24.3 = \$16,460,905$. The difference of \$835,905 is the increase in receivables needed for Galambos to achieve its goal.
- 3 C is correct. Credit analysts consider both business risk and financial risk.
- 4 A is correct. Requiring that net income be positive would eliminate companies that report a positive return on equity only because both net income and shareholders' equity are negative.
- 5 B is correct. A lower value of debt/total assets indicates greater financial strength. Requiring that a company's debt/total assets be below a certain cutoff point would allow the analyst to screen out highly leveraged and, therefore, potentially financially weak companies.
- 6 C is correct. Survivorship bias exists when companies that merge or go bankrupt are dropped from the database and only surviving companies remain. Look-ahead bias involves using updated financial information in back-testing that would not have been available at the time the decision was made. Back-testing involves testing models in prior periods and is not, itself, a bias.
- 7 C is correct. Financial statements should be adjusted for differences in accounting standards (as well as accounting and operating choices). These adjustments should be made prior to common-size and ratio analysis.
- 8 A is correct. LIFO is not permitted under IFRS.
- 9 C is correct. To convert LIFO inventory to FIFO inventory, the entire LIFO reserve must be added back: $\$600,000 + \$70,000 = \$670,000$.
- 10 C is correct. The company made no additions to or deletions from the fixed asset account during the year, so depreciation expense is equal to the difference in accumulated depreciation at the beginning of the year and the end of the year, or \$0.4 million. Average age is equal to accumulated depreciation/depreciation expense, or $\$1.6/\$0.4 = 4$ years. Average depreciable life is equal to ending gross investment/depreciation expense = $\$2.8/\$0.4 = 7$ years.
- 11 C is correct. Tangible book value removes all intangible assets, including goodwill, from the balance sheet.
- 12 B is correct. Operating leases can be used as an off-balance-sheet financing technique because neither the asset nor liability appears on the balance sheet. Inventory and capital leases are reported on the balance sheet.
- 13 C is correct. The present value of future operating lease payments would be added to total assets and total liabilities.

SOLUTIONS

- 1 C is correct. Corporate governance is the arrangement of checks, balances, and incentives a company needs to minimize and manage the conflicting interests between insiders and external shareholders.
- 2 B is correct. Compared with other stakeholder groups, customers tend to be less concerned with, and affected by, a company's financial performance.
- 3 A is correct. Shareholder and manager interests can diverge with respect to risk tolerance. In some cases, shareholders with diversified investment portfolios can have a fairly high risk tolerance because specific company risk can be diversified away. Managers are typically more risk averse in their corporate decision making to better protect their employment status.
- 4 B is correct. The election of directors is considered an ordinary resolution and, therefore, requires only a simple majority of votes to be passed.
- 5 B is correct. Often, policies on related-party transactions require that such transactions or matters be voted on by the board (or shareholders), excluding the director holding the interest.
- 6 B is correct. The board typically ensures that the company has an appropriate enterprise risk management system in place.
- 7 A is correct. Social media has become a powerful tool for stakeholders to instantly broadcast information with little cost or effort and to compete with company management in influencing public sentiment.
- 8 C is correct. The presence of a sizable affiliated stockholder (such as an individual, family trust, endowment, or private equity fund) can shield a company from the effects of voting by outside shareholders.
- 9 C is correct. The risks of poor corporate governance have long been understood by analysts and shareholders. In contrast, the practice of considering environmental and social factors has been slower to take hold.
- 10 A is correct. Negative screening, which refers to the practice of excluding certain sectors or companies that violate accepted standards in such areas as human rights or environmental concerns, is the most common ESG investment strategy (implementation method).

SOLUTIONS

- 1 C is correct.

$$NPV = -50,000 + \frac{15,000}{1.08} + \frac{15,000}{1.08^2} + \frac{20,000}{1.08^3} + \frac{10,000}{1.08^4} + \frac{5,000}{1.08^5}$$

$$NPV = -50,000 + 13,888.89 + 12,860.08 + 15,876.64 + 7,350.30 \\ + 3,402.92$$

$$NPV = -50,000 + 53,378.83 = 3,378.83$$

The IRR, found with a financial calculator, is 10.88 percent.

- 2 C is correct.

Year	0	1	2	3	4	5
Cash flow	-50,000	15,000	15,000	20,000	10,000	5,000
Cumulative cash flow	-50,000	-35,000	-20,000	0	10,000	15,000
Discounted cash flow	-50,000	13,888.89	12,860.08	15,876.64	7,350.30	3,402.92
Cumulative DCF	-50,000	-36,111.11	-23,251.03	-7,374.38	-24.09	3,378.83

As the table shows, the cumulative cash flow offsets the initial investment in exactly three years. The payback period is 3.00 years. The discounted payback period is between four and five years. The discounted payback period is 4 years plus $24.09/3,402.92 = 0.007$ of the fifth year cash flow, or $4.007 = 4.01$ years. The discounted payback period is $4.01 - 3.00 = 1.01$ years longer than the payback period.

- 3 B is correct.

$$NPV = \sum_{t=0}^3 \frac{CF_t}{(1+r)^t} = -100 + \frac{40}{1.20} + \frac{80}{1.20^2} + \frac{120}{1.20^3} = \$58.33$$

- 4 C is correct. The IRR can be found using a financial calculator or with trial and error. Using trial and error, the total PV is equal to zero if the discount rate is 28.79 percent.

Year	Cash Flow	Present Value			
		28.19%	28.39%	28.59%	28.79%
0	-150,000	-150,000	-150,000	-150,000	-150,000
1	100,000	78,009	77,888	77,767	77,646
2	120,000	73,025	72,798	72,572	72,346
Total		1,034	686	338	-8

A more precise IRR of 28.7854 percent has a total PV closer to zero.

- 5 A is correct.

$$The NPV = -750 + \sum_{t=1}^7 \frac{175}{1.10^t} = -750 + 851.97 = 101.97 \text{ million won.}$$

The IRR, found with a financial calculator, is 14.02 percent. (The PV is -750, N = 7, and PMT = 175.)

- 6 B is correct.

Year	0	1	2	3	4	5	6	7
Cash flow	-750	175	175	175	175	175	175	175
Cumulative cash flow	-750	-575	-400	-225	-50	125	300	475

The payback period is between four and five years. The payback period is four years plus $50/175 = 0.29$ of the fifth year cash flow, or 4.29 years.

Year	0	1	2	3	4	5	6	7
Cash flow	-750	175	175	175	175	175	175	175
Discounted cash flow	-750	159.09	144.63	131.48	119.53	108.66	98.78	89.80
Cumulative DCF	-750	-590.91	-446.28	-314.80	-195.27	-86.61	12.17	101.97

The discounted payback period is between five and six years. The discounted payback period is five years plus $86.61/98.78 = 0.88$ of the sixth year cash flow, or 5.88 years.

- 7 C is correct.

$$\text{The present value of future cash flows is } PV = \frac{2,000}{0.08} = 25,000$$

$$\text{The profitability index is } PI = \frac{PV}{\text{Investment}} = \frac{25,000}{20,000} = 1.25$$

- 8 C is correct.

$$PV = \sum_{t=1}^7 \frac{115}{1.10^t} + \frac{50}{1.10^7} = 585.53 \text{ million euros}$$

$$PI = \frac{585.53}{375} = 1.56$$

- 9 B is correct. The IRR would stay the same because both the initial outlay and the after-tax cash flows double, so that the return on each dollar invested remains the same. All of the cash flows and their present values double. The difference between total present value of the future cash flows and the initial outlay (the NPV) also doubles.
- 10 A is correct. If the cumulative cash flow in one year equals the outlay and additional cash flows are not very large, this scenario is possible. For example, assume the outlay is 100, the cash flow in Year 1 is 100 and the cash flow in Year 2 is 5. The required return is 10 percent. This project would have a payback of 1.0 years, an NPV of -4.96, and an IRR of 4.77 percent.
- 11 A is correct. The vertical intercept changes from 60 to 65 (NPV when cost of capital is 0%), and the horizontal intercept (IRR, when NPV equals zero) changes from 21.86 percent to 20.68 percent.
- 12 C is correct. When valuing mutually exclusive projects, the decision should be made with the NPV method because this method uses the most realistic discount rate, namely the opportunity cost of funds. In this example, the reinvestment rate for the NPV method (here 10 percent) is more realistic than the reinvestment rate for the IRR method (here 21.86 percent or 18.92 percent).
- 13 B is correct. For these projects, a discount rate of 13.16 percent would yield the same NPV for both (an NPV of 6.73).
- 14 C is correct. Discount rates of 0 percent and approximately 61.8 percent both give a zero NPV.

Rate	0%	20%	40%	60%	61.8%	80%	100%
NPV	0.00	4.40	3.21	0.29	0.00	-3.02	-6.25

- 15 A is correct. The crossover rate is the discount rate at which the NPV profiles for two projects cross; it is the only point where the NPVs of the projects are the same.
- 16 B is correct. The vertical axis represents a discount rate of zero. The point where the profile crosses the vertical axis is simply the sum of the cash flows.
- 17 C is correct. The horizontal axis represents an NPV of zero. By definition, the project's IRR equals an NPV of zero.
- 18 B is correct. Costs to finance the project are taken into account when the cash flows are discounted at the appropriate cost of capital; including interest costs in the cash flows would result in double-counting the cost of debt.

SOLUTIONS

- 1 B is correct. The cost of equity is defined as the rate of return required by stockholders.
- 2 B is correct. Debt is generally less costly than preferred or common stock. The cost of debt is further reduced if interest expense is tax deductible.
- 3 C is correct. First calculate the growth rate using the sustainable growth calculation, and then calculate the cost of equity using the rearranged dividend discount model:

$$g = (1 - \text{Dividend payout ratio})(\text{Return on equity}) = (1 - 0.30)(15\%) = 10.5\%$$

$$r_e = (D_1/P_0) + g = (\$2.30/\$45) + 10.50\% = 15.61\%$$

- 4 C is correct. $FV = \$1,000$; $PMT = \$40$; $N = 10$; $PV = \$900$

Solve for i . The six-month yield, i , is 5.3149%

$$\text{YTM} = 5.3149\% \times 2 = 10.62985\%$$

$$r_d(1 - t) = 10.62985\%(1 - 0.38) = 6.5905\%$$

- 5 C is correct. The bond rating approach depends on knowledge of the company's rating and can be compared with yields on bonds in the public market.
- 6 B is correct. The company can issue preferred stock at 6.5%.

$$P_p = \$1.75/0.065 = \$26.92$$

- 7 B is correct.

$$\text{Cost of equity} = D_1/P_0 + g = \$1.50/\$30 + 7\% = 5\% + 7\% = 12\%$$

$$D/(D + E) = 0.8033/1.8033 = 0.445$$

$$\text{WACC} = [(0.445)(0.08)(1 - 0.4)] + [(0.555)(0.12)] = 8.8\%$$

- 8 B is correct. The weighted average cost of capital, using weights derived from the current capital structure, is the best estimate of the cost of capital for the average-risk project of a company.
- 9 C is correct.

$$w_d = \$63/(\$220 + 63) = 0.223$$

$$w_e = \$220/(\$220 + 63) = 0.777$$

- 10 B is correct. Asset risk does not change with a higher debt-to-equity ratio. Equity risk rises with higher debt.
- 11 B is correct. The debt-to-equity ratio of the new product should be used when making the adjustment from the asset beta, derived from the comparables, to the equity beta of the new product.
- 12 B is correct.

Capital structure:

Market value of debt: $FV = \$10,000,000$, $PMT = \$400,000$, $N = 10$,

$I/YR = 13.65\%$. Solving for PV gives the answer \$7,999,688.

Market value of equity: 1.2 million shares outstanding at \$10 = \$12,000,000

Market value of debt	\$7,999,688	40%
Market value of equity	12,000,000	60%
Total capital	\$19,999,688	100%

To raise \$7.5 million of new capital while maintaining the same capital structure, the company would issue $\$7.5 \text{ million} \times 40\% = \3.0 million in bonds, which results in a before-tax rate of 16 percent.

$$r_d(1 - t) = 0.16(1 - 0.3) = 0.112 \text{ or } 11.2\%$$

$$r_e = 0.03 + 2.2(0.10 - 0.03) = 0.184 \text{ or } 18.4\%$$

$$\text{WACC} = [0.40(0.112)] + [0.6(0.184)] = 0.0448 + 0.1104 = 0.1552 \text{ or } 15.52\%$$

13 B is correct.

$$r_e = 0.0425 + (1.3)(0.0482) = 0.1052 \text{ or } 10.52\%$$

14 B is correct.

$$\begin{aligned} \text{WACC} &= [(\€900/\€3300) \cdot 0.0925 (1 - 0.375)] + [(\€2400/\€3300)(0.1052)] \\ &= 0.0923 \text{ or } 9.23\% \end{aligned}$$

15 A is correct.

$$\text{Asset beta} = \text{Unlevered beta} = 1.3 / (1 + [(1 - 0.375)(\€900/\€2400)]) = 1.053$$

16 C is correct.

$$\text{Project beta} = 1.053 \{1 + [(1 - 0.375)(\€80/\€20)]\} = 1.053 \{3.5\} = 3.686$$

17 C is correct.

$$r_e = 0.0425 + 3.686(0.0482 + 0.0188) = 0.2895 \text{ or } 28.95\%$$

18 C is correct.

Cost of equity without the country risk premium:

$$r_e = 0.0425 + 3.686(0.0482) = 0.2202 \text{ or } 22.02\%$$

Cost of equity with the country risk premium:

$$r_e = 0.0425 + 3.686(0.0482 + 0.0188) = 0.2895 \text{ or } 28.95\%$$

Weighted average cost of capital without the country risk premium:

$$\begin{aligned} \text{WACC} &= [0.80(0.0925)(1 - 0.375)] + [0.20(0.2202)] = 0.04625 + 0.04404 \\ &= 0.09038 \text{ or } 9.03 \text{ percent} \end{aligned}$$

Weighted average cost of capital with the country risk premium:

$$\begin{aligned} \text{WACC} &= [0.80(0.0925)(1 - 0.375)] + [0.20(0.2895)] = 0.04625 + 0.0579 \\ &= 0.1042 \text{ or } 10.42 \text{ percent} \end{aligned}$$

NPV without the country risk premium:

$$\begin{aligned} \text{NPV} &= \frac{\€48 \text{ million}}{(1 + 0.0903)^1} + \frac{\€52 \text{ million}}{(1 + 0.0903)^2} + \frac{\€54.4 \text{ million}}{(1 + 0.0903)^3} - \€100 \text{ million} \\ &= \€44.03 \text{ million} + 43.74 \text{ million} + 41.97 \text{ million} - \€100 \text{ million} \\ &= \€29.74 \text{ million} \end{aligned}$$

NPV with the country risk premium:

$$\begin{aligned} \text{NPV} &= \frac{\text{€48 million}}{(1 + 0.1042)^1} + \frac{\text{€52 million}}{(1 + 0.1042)^2} + \frac{\text{€54.4 million}}{(1 + 0.1042)^3} - \text{€100 million} \\ &= \text{€43.47 million} + 42.65 \text{ million} + 40.41 \text{ million} - \text{€100 million} \\ &= \text{€26.53 million} \end{aligned}$$

19 B is correct.

$$\text{Asset betas: } \beta_{\text{equity}} / [1 + (1 - t)(D/E)]$$

$$\text{Relevant} = 1.702 / [1 + (0.77)(0)] = 1.702$$

$$\text{ABJ} = 2.8 / [1 + (0.77)(0.003)] = 2.7918$$

$$\text{Opus} = 3.4 / [1 + ((0.77)(0.013))] = 3.3663$$

20 C is correct.

Weights are determined based on relative market values:

Pure-Play	Market Value of Equity in Millions	Proportion of Total
Relevant	\$3,800	0.5490
ABJ	2,150	0.3106
Opus	972	0.1404
Total	\$6,922	1.0000

$$\begin{aligned} \text{Weighted average beta} &= (0.5490)(1.702) + (0.3106)(2.7918) + (0.1404)(3.3572) \\ &= 2.27. \end{aligned}$$

21 B is correct.

$$\text{Asset beta} = 2.27$$

$$\text{Levered beta} = 2.27 \{1 + [(1 - 0.23)(0.01)]\} = 2.2875$$

$$\text{Cost of equity capital} = 0.0525 + (2.2875)(0.07) = 0.2126 \text{ or } 21.26\%$$

22 C is correct.

$$\text{For debt: } FV = 2,400,000; PV = 2,156,000; n = 10; PMT = 150,000$$

$$\text{Solve for } i. i = 0.07748. \text{ YTM} = 15.5\%$$

$$\text{Before-tax cost of debt} = 15.5\%$$

$$\begin{aligned} \text{Market value of equity} &= 1 \text{ million shares outstanding} + 1 \text{ million newly} \\ &\text{issued shares} = 2 \text{ million shares at \$8} = \$16 \text{ million} \end{aligned}$$

$$\text{Total market capitalization} = \$2.156 \text{ million} + \$16 \text{ million} = \$18.156 \text{ million}$$

$$\text{Levered beta} = 2.27 \{1 + [(1 - 0.23)(2.156/16)]\} = 2.27 (1.1038) = 2.5055$$

$$\text{Cost of equity} = 0.0525 + 2.5055 (0.07) = 0.2279 \text{ or } 22.79\%$$

$$\text{Debt weight} = \$2.156/\$18.156 = 0.1187$$

$$\text{Equity weight} = \$16/\$18.156 = 0.8813$$

$$\begin{aligned} \text{TagOn's MCC} &= [(0.1187)(0.155)(1 - 0.23)] + [(0.8813)(0.2279)] \\ &= 0.01417 + 0.20083 \\ &= 0.2150 \text{ or } 21.50\% \end{aligned}$$

- 23 A is correct. The relevant cost is the marginal cost of debt. The before-tax marginal cost of debt can be estimated by the yield to maturity on a comparable outstanding. After adjusting for tax, the after-tax cost is $7(1 - 0.4) = 7(0.6) = 4.2\%$.
- 24 C is correct. The expected return is the sum of the expected dividend yield plus expected growth. The expected growth is $(1 - 0.4)15\% = 9\%$. The expected dividend yield is $\$2.18/\$28 = 7.8\%$. The sum is 16.8%.
- 25 B is correct. Using the CAPM approach, $4\% + 1.3(9\%) = 15.7\%$.
- 26 C is correct. Inferring the asset beta for the public company: unlevered beta = $1.75/[1 + (1 - 0.35)(0.90)] = 1.104$. Relevering to reflect the target debt ratio of the private firm: levered beta = $1.104 \times [1 + (1 - 0.30)(1.00)] = 1.877$.
- 27 C is correct. The country equity premium can be estimated as the sovereign yield spread times the volatility of the country's stock market relative to its bond market. Paragon's equity premium is $(10.5\% - 4.5\%) \times (35\%/25\%) = 6\% \times 1.4 = 8.40\%$.

SOLUTIONS

- 1 C is correct. The companies' degree of operating leverage should be the same, consistent with C. Sales risk refers to the uncertainty of the number of units produced and sold and the price at which units are sold. Business risk is the joint effect of sales risk and operating risk.
- 2 C is correct. The degree of operating leverage is the elasticity of operating earnings with respect to the number of units produced and sold. As an elasticity, the degree of operating leverage measures the sensitivity of operating earnings to a change in the number of units produced and sold.
- 3 C is correct. Because DOL is 4, if unit sales increase by 5 percent, Fulcrum's operating earnings are expected to increase by $4 \times 5\% = 20\%$. The calculation for DOL is:

$$\begin{aligned} \text{DOL} &= \frac{(40 \text{ million})(\$100 - \$65)}{[(40 \text{ million})(\$100 - \$65)] - \$1.05 \text{ billion}} \\ &= \frac{\$1.400 \text{ billion}}{\$1.400 \text{ billion} - \$1.05 \text{ billion}} = \frac{\$1.4}{\$0.35} = 4 \end{aligned}$$

- 4 C is correct. Business risk reflects operating leverage and factors that affect sales (such as those given).
- 5 B is correct. Grundlegend's degree of operating leverage is the same as Basic Company's, whereas Grundlegend's degree of total leverage and degree of financial leverage are higher.
- 6 B is correct.

$$\text{Operating breakeven units} = \frac{\text{¥1,290 million}}{(\text{¥3,529} - \text{¥1,500})} = 635,781.173 \text{ units}$$

$$\text{Operating breakeven sales} = \text{¥3,529} \times 635,781.173 \text{ units} = \text{¥2,243,671,760}$$

or

$$\text{Operating breakeven sales} = \frac{\text{¥1,290 million}}{1 - (\text{¥1,500}/\text{¥3,529})} = \text{¥2,243,671,760}$$

$$\begin{aligned} \text{Total breakeven} &= \frac{\text{¥1,290 million} + \text{¥410 million}}{(\text{¥3,529} - \text{¥1,500})} = \frac{\text{¥1,700 million}}{\text{¥2,029}} \\ &= 837,851.1582 \text{ units} \end{aligned}$$

$$\text{Breakeven sales} = \text{¥3,529} \times 837,851.1582 \text{ units} = \text{¥2,956,776,737}$$

or

$$\text{Breakeven sales} = \frac{\text{¥1,700 million}}{1 - (\text{¥1,500}/\text{¥3,529})} = \text{¥2,956,776,737}$$

- 7 A is correct. For The Gearing Company,

$$Q_{BE} = \frac{F + C}{P - V} = \frac{\$40 \text{ million} + \$20 \text{ million}}{\$200 - \$120} = 750,000$$

For Hebelkraft, Inc.,

$$Q_{BE} = \frac{F + C}{P - V} = \frac{\$90 \text{ million} + \$20 \text{ million}}{\$200 - \$100} = 1,100,000$$

- 8 C is correct. Sales risk is defined as uncertainty with respect to the price or quantity of goods and services sold. 4G has a higher standard deviation of unit sales than Qphone; in addition, 4G's standard deviation of unit sales stated as a fraction of its level of unit sales, at $25,000/1,000,000 = 0.025$, is greater than the comparable ratio for Qphone, $10,000/1,500,000 = 0.0067$.
- 9 B is correct. Business risk is associated with operating earnings. Operating earnings are affected by sales risk (uncertainty with respect to price and quantity), and operating risk (the operating cost structure and the level of fixed costs).
- 10 C is correct. Operating risk refers to the risk arising from the mix of fixed and variable costs.

11 B is correct. DOL = $\frac{Q(P - V)}{Q(P - V) - F}$

$$\text{DOL @ } \frac{1,000,000(\$108 - \$72)}{1,000,000 \text{ units}} = 2.67$$

- 12 C is correct. Degree of financial leverage is

$$\begin{aligned} \text{DFL} &= \frac{[Q(P - V) - F]}{[Q(P - V) - F - C]} \\ &= \frac{1,000,000(\$108 - \$72) - \$22,500,000}{1,000,000(\$108 - \$72) - \$22,500,000 - \$9,000,000} = 3.00 \end{aligned}$$

- 13 B is correct. The degree of operating leverage of Qphone is 1.4. The percentage change in operating income is equal to the DOL times the percentage change in units sold, therefore:

$$\text{Percentage change in operating income} = (\text{DOL}) \left(\begin{array}{l} \text{Percentage change} \\ \text{in units sold} \end{array} \right) = (1.4)(15\%) = 21\%$$

- 14 C is correct. The breakeven quantity is computed

$$Q_{BE} = \frac{F + C}{P - V} = \frac{(\$22,500,000 + \$9,000,000)}{(\$108 - \$72)} = 875,000$$

- 15 C is correct. 4G, Inc.'s degree of total leverage can be shown to equal 8, whereas Qphone Corp.'s degree of total leverage is only $\text{DOL} \times \text{DFL} = 1.4 \times 1.15 = 1.61$. Therefore, a 10 percent increase in unit sales will mean an 80 percent increase in net income for 4G, but only a 16.1 percent increase in net income for Qphone Corp. The calculation for 4G, Inc.'s DTL is

$$\begin{aligned} \text{DTL} &= \frac{Q(P - V)}{Q(P - V) - F - C} \\ &= \frac{1,000,000(\$108 - \$72)}{1,000,000(\$108 - \$72) - \$22,500,000 - \$9,000,000} = 8.00 \end{aligned}$$

- 16 A is correct. Degree of total leverage is defined as the percentage change in net income divided by the percentage change in units sold.

SOLUTIONS

- 1 B is correct.

Current ratio = Current assets/Current Liabilities = Current assets/
€100 million = 2.5

Therefore, current assets = €250 million

Quick ratio = (Current assets – Inventory)/ Current Liabilities = (€250 million – Inventory)/€100 million = 1.5

Therefore, Inventory = **€100 million**

- 2 C is correct.

Number of days of inventory = \$2,300/(\$20,000/365) = 41.975 days

Number of days of receivables = \$2,500/(\$25,000/365) = 36.5 days

Operating cycle = 41.975 + 36.5 days = **78.475 days**

Note: The net operating cycle is 47.9 days.

Purchases = \$20,000 + \$2,300 – \$2,000 = \$20,300

Number of days of payables = \$1,700/(\$20,300/365) = 30.567 days

The net operating cycle is 78.475 – 30.567 = 47.908 days

- 3 A is correct.

Number of days of inventory = \$2,000/(\$30,000/365) = 24.333 days

Number of days of receivables = \$3,000/(\$40,000/365) = 27.375 days

Operating cycle = 24.333 + 27.375 days = 51.708 days

Purchases = \$30,000 + \$2,000 – \$1,500 = \$30,500

Number of days of payables = \$4,000/(\$30,500/365) = 47.869 days

The net operating cycle is 51.708 – 47.869 = **3.839 days**

- 4 C is correct.

Bond equivalent yield = [(\$10,000 – 9,725)/\$9,725] × (365/182) =
5.671 percent

- 5 C is correct. A higher level of uncollectible accounts may occur, but a longer average collection period will certainly occur.

- 6 C is correct.

$$\text{Cost} = \left(1 + \frac{0.02}{0.98}\right)^{365/40} - 1 = 20.24 \text{ percent}$$

7 B is correct.

$$\begin{aligned}\text{Line cost} &= \frac{\text{Interest} + \text{Commitment fee}}{\text{Net Proceed}} \times 12 \\ &= \frac{(0.072 \times \$1,000,000 \times 1/12) + (0.005 \times \$1,000,000 \times 1/12)}{\$1,000,000} \times 12 \\ &= \frac{\$6,000 + 416.67}{\$1,000,000} \times 12 = 0.077 \text{ or } 7.7 \text{ percent}\end{aligned}$$

$$\begin{aligned}\text{Banker's acceptance cost} &= \frac{\text{Interest}}{\text{Net Proceed}} \times 12 \\ &= \frac{(0.071 \times \$1,000,000 \times 1/12)}{\$1,000,000 - (0.071 \times \$1,000,000 \times 1/12)} \times 12 \\ &= \frac{\$5,916.67}{\$994,083.33} \times 12 = 0.0714 \text{ or } 7.14 \text{ percent}\end{aligned}$$

$$\begin{aligned}\text{Commercial paper cost} &= \frac{\text{Interest} + \text{Dealer's commission} + \text{Backup costs}}{\text{Net proceed}} \times 12 \\ &= \frac{(0.069 \times \$1,000,000 \times 1/12) + (0.0025 \times \$1,000,000 \times 1/12) + (0.003333 \times \$1,000,000 \times 1/12)}{\$1,000,000 - (0.069 \times \$1,000,000 \times 1/12)} \times 12 \\ &= \frac{\$5,750 + 208.33 + 277.78}{\$1,000,000 - 5,750} \times 12 = 0.0753 \text{ or } 7.53 \text{ percent}\end{aligned}$$

8 B is correct.

Company A: $\$1.0 \text{ million}/(\$5.0 \text{ million}/365) = 73.0 \text{ days}$

Company B: $\$1.2 \text{ million}/(\$3.0 \text{ million}/365) = 146.0 \text{ days}$

Company C: $\$0.8 \text{ million}/(\$2.5 \text{ million}/365) = 116.8 \text{ days}$

Company D: $\$0.1 \text{ million}/(\$0.5 \text{ million}/365) = 73.0 \text{ days}$

9 B is correct.

Company A: $\$6.0 \text{ million}/\$1.2 \text{ million} = 5.00$

Company B: $\$4.0 \text{ million}/\$1.5 \text{ million} = 2.67$

Company C: $\$3.0 \text{ million}/\$1.0 \text{ million} = 3.00$

Company D: $\$0.6 \text{ million}/\$0.2 \text{ million} = 3.00$

10 B is correct.

20X1: 73 days

20X2: 70.393

Note: If the number of days decreased from 20X1 to 20X2, the receivable turnover increased.

11 A is correct.

Company B increased its accounts receivable (A/R) turnover and reduced its number of days of receivables between 20X1 and 20X2.

Company	20X1		20X2	
	A/R Turnover	Number of Days of Receivables	A/R Turnover	Number of Days of Receivables
A	5.000	73.000	5.000	73.000
B	2.500	146.000	2.667	136.875
C	3.125	116.800	3.000	121.667
D	5.000	73.000	3.000	121.667

12 B is correct.

Company A number of days of inventory = $100 - 73 = 27$ days

Company D number of days of inventory = $145 - 121.67 = 23.33$ days

Company A's turnover = $365/27 = 13.5$ times

Company D's inventory turnover = $365/23.3 = 15.6$ times

SOLUTIONS

- 1 A is correct. Combining assets into a portfolio should reduce the portfolio's volatility. Specifically, "individuals and institutions should hold portfolios to reduce risk." As illustrated in the reading, however, risk reduction may not be as great during a period of dramatic economic change.
- 2 A is correct. Combining assets into a portfolio should reduce the portfolio's volatility. The portfolio approach does not necessarily provide downside protection or guarantee that the portfolio always will avoid losses.
- 3 B is correct. As illustrated in the reading, portfolios reduce risk more than they increase returns.
- 4 A is correct. The excess reserves invested by banks need to be relatively liquid. Although investment companies and non-life insurance companies have high liquidity needs, the liquidity need for banks is on average the greatest.
- 5 B is correct. Most foundations and endowments are established with the intent of having perpetual lives. Although defined benefit plans and life insurance companies have portfolios with a long time horizon, they are not perpetual.
- 6 A is correct. Income is necessary to meet the cash flow obligation to retirees. Although defined benefit plans have a need for income, the need for liquidity typically is quite low. A retiree may need life insurance; however, a defined benefit plan does not need insurance.
- 7 B is correct. Investment companies manage investments in mutual funds. Although endowments and insurance companies may own mutual funds, they do not issue or redeem shares of mutual funds.
- 8 C is correct. The client's objectives and constraints are established in the investment policy statement and are used to determine the client's target asset allocation, which occurs in the execution step of the portfolio management process.
- 9 A is correct. Securities are analyzed in the execution step. In the planning step, a client's objectives and constraints are used to develop the investment policy statement.
- 10 B is correct. Portfolio monitoring and rebalancing occurs in the feedback step of the portfolio management process.
- 11 C is correct. Portfolio 3 has the same equity exposure as Portfolio 1 and has a higher exposure to alternative assets, which have greater volatility (as discussed in the section of the reading comparing the endowments from Yale University and the University of Virginia).
- 12 B is correct. Open-end funds trade at their net asset value per share, whereas closed-end funds and exchange traded funds can trade at a premium or a discount.
- 13 A is correct. Exchange traded funds do not have capital gain distributions. If an investor sells shares of an ETF (or open-end mutual fund or closed-end mutual fund), the investor may have a capital gain or loss on the shares sold; however, the gain (or loss) from the sale is not a distribution.
- 14 A is correct. Hedge funds are currently exempt from the reporting requirements of a typical public investment company.
- 15 B is correct. Buyout funds or private equity firms make only a few large investments in private companies with the intent of selling the restructured companies in three to five years. Venture capital funds also have a short time horizon; however, these funds consist of many small investments in companies with the expectation that only a few will have a large payoff (and that most will fail).

SOLUTIONS

- 1 C is correct. -10.1% is the holding period return, which is calculated as: $(3,050 - 3,450 + 51.55)/3,450$, which is comprised of a dividend yield of $1.49\% = 51.55/(3,450)$ and a capital loss yield of $-11.59\% = -400/(3,450)$.
- 2 B is correct. $[(1 + 0.14)(1 - 0.10)(1 - 0.02)] - 1 = 0.0055 = 0.55\%$.
- 3 A is correct. $[(1 + 0.22)(1 - 0.25)(1 + 0.11)]^{(1/3)} - 1 = 1.0157^{(1/3)} - 1 = 0.0052 = 0.52\%$
- 4 A is correct. The geometric mean return compounds the returns instead of the amount invested.
- 5 B is correct. The annualized rate of return for ETF 2 is $12.05\% = (1.0110^{52/5}) - 1$, which is greater than the annualized rate of ETF 1, $11.93\% = (1.0461^{365/146}) - 1$, and ETF 3, $11.32\% = (1.1435^{12/15}) - 1$. Despite having the lowest value for the periodic rate, ETF 2 has the highest annualized rate of return because of the reinvestment rate assumption and the compounding of the periodic rate.
- 6 A is correct. The asset's returns are not used to calculate the portfolio's variance [only the assets' weights, standard deviations (or variances), and covariances (or correlations) are used].
- 7 C is correct.

$$\begin{aligned}\sigma_{port} &= \sqrt{w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2w_1 w_2 \rho_{1,2} \sigma_1 \sigma_2} \\ &= \sqrt{(0.3)^2 (20\%)^2 + (0.7)^2 (12\%)^2 + 2(0.3)(0.7)(0.40)(20\%)(12\%)} \\ &= (0.3600\% + 0.7056\% + 0.4032\%)^{0.5} = (1.4688\%)^{0.5} = 12.11\%\end{aligned}$$

- 8 A is correct.

$$\begin{aligned}\sigma_{port} &= \sqrt{w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2w_1 w_2 Cov(R_1 R_2)} \\ &= \sqrt{(0.3)^2 (20\%)^2 + (0.7)^2 (12\%)^2 + 2(0.3)(0.7)(-0.0240)} \\ &= (0.3600\% + 0.7056\% - 1.008\%)^{0.5} = (0.0576\%)^{0.5} = 2.40\%\end{aligned}$$

- 9 C is correct. A portfolio standard deviation of 14.40% is the weighted average, which is possible only if the correlation between the securities is equal to 1.0.
- 10 B is correct. A portfolio standard deviation of 14.40% 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 must equal 0.0240, calculated as: $Cov(R_1, R_2) = \rho_{12} \sigma_1 \sigma_2 = (1.0)(20\%)(12\%) = 2.40\% = 0.0240$.
- 11 B is correct. $(1 + 0.080)/(1 + 0.0210) - 1 = 5.8\%$
- 12 A is correct. $(1 + 0.065)/(1 + 0.0210) - 1 = 4.3\%$
- 13 A is correct. $(1 + 0.058)/(1 + 0.0250) - 1 = 3.2\%$
- 14 B is correct. $(1 + 0.043)/(1 + 0.0250) - 1 = 1.8\%$
- 15 C is correct. Brokerage commissions are negotiated with the brokerage firm. A security's liquidity impacts the operational efficiency of trading costs. Specifically, liquidity impacts the bid–ask spread and can impact the stock price (if the ability to sell the stock is impaired by the uncertainty associated with being able to sell the stock).

- 16 C is correct. Historical data over long periods of time indicate that there exists a positive risk–return relationship, which is a reflection of an investor's risk aversion.
- 17 A is correct. A risk-free asset has a variance of zero and is not dependent on whether the investor is risk neutral, risk seeking or risk averse. That is, given that the utility function of an investment is expressed as $U = E(r) - \frac{1}{2}A\sigma^2$, where A is the measure of risk aversion, then the sign of A is irrelevant if the variance is zero (like that of a risk-free asset).
- 18 C is correct. The most risk-averse investor has the indifference curve with the greatest slope.
- 19 A is correct. A negative value in the given utility function indicates that the investor is a risk seeker.
- 20 C is correct. Investment 3 has the highest rate of return. Risk is irrelevant to a risk-neutral investor, who would have a measure of risk aversion equal to 0. Given the utility function, the risk-neutral investor would obtain the greatest amount of utility from Investment 3.

Investment	Expected Return (%)	Expected Standard Deviation (%)	Utility $A = 0$
1	18	2	0.1800
2	19	8	0.1900
3	20	15	0.2000
4	18	30	0.1800

- 21 C is correct. Investment 4 provides the highest utility value (0.2700) for a risk-seeking investor, who has a measure of risk aversion equal to -2 .

Investment	Expected Return (%)	Expected Standard Deviation (%)	Utility $A = -2$
1	18	2	0.1804
2	19	8	0.1964
3	20	15	0.2225
4	18	30	0.2700

- 22 B is correct. Investment 2 provides the highest utility value (0.1836) for a risk-averse investor who has a measure of risk aversion equal to 2 .

Investment	Expected Return (%)	Expected Standard Deviation (%)	Utility $A = 2$
1	18	2	0.1796
2	19	8	0.1836
3	20	15	0.1775
4	18	30	0.0900

- 23 A is correct. Investment 1 provides the highest utility value (0.1792) for a risk-averse investor who has a measure of risk aversion equal to 4 .

Investment	Expected Return (%)	Expected Standard Deviation (%)	Utility $A = 4$
1	18	2	0.1792
2	19	8	0.1772
3	20	15	0.1550
4	18	30	0.0000

- 24 A is correct. The CAL is the combination of the risk-free asset with zero risk and the portfolio of all risky assets that provides for the set of feasible investments. Allowing for borrowing at the risk-free rate and investing in the portfolio of all risky assets provides for attainable portfolios that dominate risky assets below the CAL.
- 25 B is correct. The CAL represents the set of all feasible investments. Each investor's indifference curve determines the optimal combination of the risk-free asset and the portfolio of all risky assets, which must lie on the CAL.
- 26 C is correct.

$$\begin{aligned}R_p &= w_1 \times R_1 + (1 - w_1) \times R_2 \\R_p &= w_1 \times 16\% + (1 - w_1) \times 12\% \\15\% &= 0.75(16\%) + 0.25(12\%)\\&\quad\end{aligned}$$

- 27 A is correct.

$$\begin{aligned}\sigma_{port} &= \sqrt{w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2w_1 w_2 \rho_{1,2} \sigma_1 \sigma_2} \\&= \sqrt{(0.5)^2 (20\%)^2 + (0.5)^2 (20\%)^2 + 2(0.5)(0.5)(-0.15)(20\%)(20\%)} \\&= (1.0000\% + 1.0000\% - 0.3000\%)^{0.5} = (1.7000\%)^{0.5} = 13.04\%\end{aligned}$$

- 28 B is correct.

$$\begin{aligned}\sigma_{port} &= \sqrt{w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2w_1 w_2 \rho_{1,2} \sigma_1 \sigma_2} \\&= \sqrt{(0.5)^2 (20\%)^2 + (0.5)^2 (20\%)^2 + 2(0.5)(0.5)(0.00)(20\%)(20\%)} \\&= (1.0000\% + 1.0000\% + 0.0000\%)^{0.5} = (2.0000\%)^{0.5} = 14.14\%\end{aligned}$$

- 29 B is correct. The contribution of each individual asset's variance (or standard deviation) to the portfolio's volatility decreases as the number of assets in the equally weighted portfolio increases. The contribution of the co-movement measures between the assets increases (i.e., covariance and correlation) as the number of assets in the equally weighted portfolio increases. The following equation for the variance of an equally weighted portfolio illustrates these

points: $\sigma_p^2 = \frac{\bar{\sigma}^2}{N} + \frac{N-1}{N} COV = \frac{\bar{\sigma}^2}{N} + \frac{N-1}{N} \bar{\rho} \bar{\sigma}^2$.

- 30 C is correct. The co-movement measures between the assets increases (i.e., covariance and correlation) as the number of assets in the equally weighted portfolio increases. The contribution of each individual asset's variance (or

standard deviation) to the portfolio's volatility decreases as the number of assets in the equally weighted portfolio increases. The following equation for the variance of an equally weighted portfolio illustrates these points:

$$\sigma_p^2 = \frac{\bar{\sigma}^2}{N} + \frac{N-1}{N} \overline{COV} = \frac{\bar{\sigma}^2}{N} + \frac{N-1}{N} \bar{\rho} \bar{\sigma}^2$$

- 31 A is correct. Higher correlations will produce less diversification benefits provided that the other components of the portfolio standard deviation do not change (i.e., the weights and standard deviations of the individual assets).
- 32 C is correct. Asset 2 and Asset 3 have returns that are the same for Outcome 2, but the exact opposite returns for Outcome 1 and Outcome 3; therefore, because they move in opposite directions at the same magnitude, they are perfectly negatively correlated.
- 33 C is correct. An equally weighted portfolio of Asset 2 and Asset 3 will have the lowest portfolio standard deviation, because for each outcome, the portfolio has the same expected return (they are perfectly negatively correlated).
- 34 A is correct. An equally weighted portfolio of Asset 1 and Asset 2 has the highest level of volatility of the three pairs. All three pairs have the same expected return; however, the portfolio of Asset 1 and Asset 2 provides the least amount of risk reduction.
- 35 C is correct. The efficient frontier does not account for the risk-free rate. The efficient frontier is the set of all attainable risky assets with the highest expected return for a given level of risk or the lowest amount of risk for a given level of return.
- 36 C is correct. The global minimum-variance portfolio is the portfolio on the minimum-variance frontier with the lowest standard deviation. Although the portfolio is attainable, when the risk-free asset is considered, the global minimum-variance portfolio is not the optimal risky portfolio.
- 37 B is correct. The Markowitz efficient frontier has higher rates of return for a given level of risk. With respect to the minimum-variance portfolio, the Markowitz efficient frontier is the set of portfolios above the global minimum-variance portfolio that dominates the portfolios below the global minimum-variance portfolio.
- 38 A is correct. The use of leverage and the combination of a risk-free asset and the optimal risky asset will dominate the efficient frontier of risky assets (the Markowitz efficient frontier).
- 39 B is correct. The CAL dominates the efficient frontier at all points except for the optimal risky portfolio. The ability of the investor to purchase additional amounts of the optimal risky portfolio by borrowing (i.e., buying on margin) at the risk-free rate makes higher rates of return for levels of risk greater than the optimal risky asset possible.
- 40 C is correct. Each individual investor's optimal mix of the risk-free asset and the optimal risky asset is determined by the investor's risk preference.

SOLUTIONS

- 1 B is correct. A capital allocation line (CAL) plots the expected return and total risk of combinations of the risk-free asset and a risky asset (or a portfolio of risky assets).
- 2 B is correct. A portfolio of the risk-free asset and a risky asset or a portfolio of risky assets can result in a better risk-return tradeoff than an investment in only one type of an asset, because the risk-free asset has zero correlation with the risky asset.
- 3 B is correct. Investors will have different optimal portfolios depending on their indifference curves. The optimal portfolio for each investor is the one with highest utility; that is, where the CAL is tangent to the individual investor's highest possible indifference curve.
- 4 B is correct. Although the optimal risky portfolio is the market portfolio, highly risk-averse investors choose to invest most of their wealth in the risk-free asset.
- 5 B is correct. Although the capital allocation line includes all possible combinations of the risk-free asset and any risky portfolio, the capital market line is a special case of the capital allocation line, which uses the market portfolio as the optimal risky portfolio.
- 6 A is correct. The market includes all risky assets, or anything that has value; however, not all assets are tradable, and not all tradable assets are investable.
- 7 A is correct. The optimal risky portfolio is the market portfolio. Capital market theory assumes that investors have homogeneous expectations, which means that all investors analyze securities in the same way and are rational. That is, investors use the same probability distributions, use the same inputs for future cash flows, and arrive at the same valuations. Because their valuations of all assets are identical, all investors will invest in the same optimal risky portfolio (i.e., the market portfolio).
- 8 C is correct. Theoretically, any point above the CML is not achievable and any point below the CML is dominated by and inferior to any point on the CML.
- 9 B is correct. As one moves further to the right of point M on the capital market line, an increasing amount of borrowed money is being invested in the market portfolio. This means that there is negative investment in the risk-free asset, which is referred to as a leveraged position in the risky portfolio.
- 10 A is correct. The combinations of the risk-free asset and the market portfolio on the CML where returns are less than the returns on the market portfolio are termed 'lending' portfolios.
- 11 C is correct. Investors are capable of avoiding nonsystematic risk by forming a portfolio of assets that are not highly correlated with one another, thereby reducing total risk and being exposed only to systematic risk.
- 12 B is correct. Nonsystematic risk is specific to a firm, whereas systematic risk affects the entire economy.
- 13 B is correct. Only systematic risk is priced. Investors do not receive any return for accepting nonsystematic or diversifiable risk.
- 14 C is correct. The sum of systematic variance and nonsystematic variance equals the total variance of the asset. References to total risk as the sum of systematic risk and nonsystematic risk refer to variance, not to risk.
- 15 B is correct. In the market model, $R_i = \alpha_i + \beta_i R_m + e_i$, the intercept, α_i , and slope coefficient, β_i , are estimated using historical security and market returns.

- 16 B is correct. In the market model, $R_i = \alpha_i + \beta_i R_m + e_i$, the slope coefficient, β_i , is an estimate of the asset's systematic or market risk.
- 17 A is correct. In the market model, $R_i = \alpha_i + \beta_i R_m + e_i$, the intercept, α_i , and slope coefficient, β_i , are estimated using historical security and market returns. These parameter estimates then are used to predict firm-specific returns that a security may earn in a future period.
- 18 A is correct. Security 1 has the highest total variance; $0.0625 = 0.25^2$ compared to Security 2 and Security 3 with a total variance of 0.0400.
- 19 C is correct. Security 3 has the highest beta value; $1.07 = \frac{\rho_{3,m}\sigma_3}{\sigma_m} = \frac{(0.80)(20\%)}{15\%}$ compared to Security 1 and Security 2 with beta values of 1.00 and 0.93, respectively.
- 20 B is correct. Security 2 has the lowest beta value; $0.93 = \frac{\rho_{2,m}\sigma_2}{\sigma_m} = \frac{(0.70)(20\%)}{15\%}$ compared to Security 1 and 3 with beta values of 1.00 and 1.07, respectively.
- 21 B is correct. The average beta of all assets in the market, by definition, is equal to 1.0.
- 22 A is correct. The security characteristic line is a plot of the excess return of the security on the excess return of the market. In such a graph, Jensen's alpha is the intercept and the beta is the slope.
- 23 B is correct. The security market line (SML) is a graphical representation of the capital asset pricing model, with beta risk on the x-axis and expected return on the y-axis.
- 24 B is correct. The security market line applies to any security, efficient or not. The CAL and the CML use the total risk of the asset (or portfolio of assets) rather than its systematic risk, which is the only risk that is priced.
- 25 A is correct. The CAPM shows that the primary determinant of expected return for an individual asset is its beta, or how well the asset correlates with the market.
- 26 A is correct. If an asset's beta is negative, the required return will be less than the risk-free rate in the CAPM. When combined with a positive market return, the asset reduces the risk of the overall portfolio, which makes the asset very valuable. Insurance is an example of a negative beta asset.
- 27 B is correct. In the CAPM, the market risk premium is the difference between the return on the market and the risk-free rate, which is the same as the return in excess of the market return.
- 28 B is correct. The expected return of Security 1, using the CAPM, is $12.0\% = 3\% + 1.5(6\%)$; $E(R_i) = R_f + \beta_i[E(R_m) - R_f]$.
- 29 B is correct. The expected risk premium for Security 2 is 8.4%, $(11.4\% - 3\%)$, indicates that the expected market risk premium is 6%; therefore, since the risk-free rate is 3% the expected rate of return for the market is 9%. That is, using the CAPM, $E(R_i) = R_f + \beta_i[E(R_m) - R_f]$, $11.4\% = 3\% + 1.4(X\%)$, where $X\% = (11.4\% - 3\%)/1.4 = 6.0\% = \text{market risk premium}$.
- 30 C is correct. Security 3 has the highest beta; thus, regardless of the value for the risk-free rate, Security 3 will have the highest expected return:

$$E(R_i) = R_f + \beta_i[E(R_m) - R_f]$$

- 31 C is correct. Security 3 has the highest beta; thus, regardless of the risk-free rate the expected return of Security 3 will be most sensitive to a change in the expected market return.

- 32 C is correct. Jensen's alpha adjusts for systematic risk, and M -squared and the Sharpe Ratio adjust for total risk.
- 33 C is correct. The sign of Jensen's alpha indicates whether or not the portfolio has outperformed the market. If alpha is positive, the portfolio has outperformed the market; if alpha is negative, the portfolio has underperformed the market.
- 34 A is the correct. M -squared adjusts for risk using standard deviation (i.e., total risk).
- 35 B is correct. If the estimated return of an asset is above the SML (the expected return), the asset has a lower level of risk relative to the amount of expected return and would be a good choice for investment (i.e., undervalued).
- 36 A is correct. The homogeneity assumption refers to all investors having the same economic expectation of future cash flows. If all investors have the same expectations, then all investors should invest in the same optimal risky portfolio, therefore implying the existence of only one optimal portfolio (i.e., the market portfolio).
- 37 B is correct. The homogeneous expectations assumption means that all investors analyze securities in the same way and are rational. That is, they use the same probability distributions, use the same inputs for future cash flows, and arrive at the same valuations. Because their valuation of all assets is identical, they will generate the same optimal risky portfolio, which is the market portfolio.
- 38 C is correct. This is because of the plot of the excess return of the security on the excess return of the market. In such a graph, Jensen's alpha is the intercept and the beta is the slope.
- 39 C is correct. Since managers are concerned with maximizing risk-adjusted returns, securities with a higher value of Jensen's alpha, α_p , should have a higher weight.
- 40 C is correct. Since managers are concerned with maximizing risk-adjusted returns, securities with greater nonsystematic risk should be given less weight in the portfolio.

SOLUTIONS

- 1 C is correct. Depending on circumstances, a written IPS or its equivalent may be required by law or regulation and a written IPS is certainly consistent with best practices. The mere fact that a written IPS is prepared for a client, however, does not *ensure* that risk and return objectives will in fact be achieved.
- 2 A is correct. A written IPS is best seen as a communication instrument allowing clients and portfolio managers to mutually establish investment objectives and constraints.
- 3 B is correct. A written IPS, to be successful, must incorporate a full understanding of the client's situation and requirements. As stated in the reading, "The IPS will be developed following a fact finding discussion with the client."
- 4 B is correct. The major components of an IPS are listed in Section 2.2 of the reading. *Investment Guidelines* are described as the section that provides information about how policy may be executed, including investment constraints. *Statement of Duties and Responsibilities* "detail[s] the duties and responsibilities of the client, the custodian of the client's assets, the investment managers, and so forth." *Investment Objectives* is "a section explaining the client's objectives in investing."
- 5 C is correct. The major components of an IPS are listed in Section 2.2 of the reading. Strategic Asset Allocation (also known as the policy portfolio) and Rebalancing Policy are often included as appendices to the IPS. The *Statement of Duties and Responsibilities*, however, is an integral part of the IPS and is unlikely to be placed in an appendix.
- 6 B is correct. According to the reading, "The sections of an IPS that are most closely linked to the client's distinctive needs are those dealing with investment objectives and constraints." *Investment Guidelines* "[provide] information about how policy may be executed, including investment constraints." *Procedures* "[detail] the steps to be taken to keep the IPS current and the procedures to follow to respond to various contingencies." *Statement of Duties and Responsibilities* "detail[s] the duties and responsibilities of the client, the custodian of the client's assets, the investment managers, and so forth."
- 7 A is correct. Because the return objective specifies a target return *relative to* the FTSE 100 Index, the objective is best described as a relative return objective.
- 8 C is correct. Risk attitude is a subjective factor and measuring risk attitude is difficult. Oftentimes, investment managers use psychometric questionnaires, such as those developed by Grable and Joo (2004), to assess a client's willingness to take risk.
- 9 B is correct. The reference to the DAX marks this response as a relative risk objective. Value at risk establishes a minimum value of loss expected during a specified time period at a given level of probability. A statement of maximum allowed absolute loss (€2.5 million) is an absolute risk objective.
- 10 C is correct. Measuring willingness to take risk (risk tolerance, risk aversion) is an exercise in applied psychology. Instruments attempting to measure risk attitudes exist, but they are clearly less objective than measurements of ability to take risk. Ability to take risk is based on relatively objective traits such as expected income, time horizon, and existing wealth relative to liabilities.

- 11 A is correct. The volatility of the client's income and the significant support needs for his mother and himself suggest that the client has a low ability to take risk. The client's trading experience and his responses to the risk assessment questionnaire indicate that the client has an above average willingness to take risk.
- 12 B is correct. On the one hand, the client has a stable, high income and no dependents. On the other hand, she exhibits above average risk aversion. Her ability to take risk is high, but her willingness to take risk is low.
- 13 A is correct. The client's financial objectives are long term. Her stable employment indicates that her immediate liquidity needs are modest. The children will not go to college until 10 or more years later. Her time horizon is best described as being long term.
- 14 B is correct. The unpredictable nature of property and casualty (P&C) claims forces P&C insurers to allocate a substantial proportion of their investments into liquid, short maturity assets. This need for liquidity also forces P&C companies to accept investments with relatively low expected returns. Liquidity is of less concern to life insurance companies given the greater predictability of life insurance payouts.
- 15 B is correct. When a client has a restriction in trading, such as this obligation to refrain from trading, the IPS "should note this constraint so that the portfolio manager does not inadvertently trade the stock on the client's behalf."
- 16 A is correct. The correlation between US equities and Brazilian equities is 0.76. The correlations between US equities and East Asian equities and the correlation between US equities and European equities both exceed 0.76. Lower correlations indicate a greater degree of separation between asset classes. Therefore, using solely the data given in the table, returns on Brazilian equities are most sharply distinguished from returns on US equities.
- 17 C is correct. Strategic asset allocation depends on several principles. As stated in the reading, "One principle is that a portfolio's systematic risk accounts for most of its change in value over the long run." A second principle is that, "the returns to groups of like assets... predictably reflect exposures to certain sets of systematic factors." This latter principle establishes that returns on asset classes primarily reflect the systematic risks of the classes.
- 18 C is correct. As the reading states, "an asset class should contain homogeneous assets... paired correlations of securities would be high within an asset class, but should be lower versus securities in other asset classes."
- 19 B is correct. Tactical asset allocation allows actual asset allocation to deviate from that of the strategic asset allocation (policy portfolio) of the IPS. Tactical asset allocation attempts to take advantage of temporary dislocations from the market conditions and assumptions that drove the policy portfolio decision.
- 20 A is correct. The core–satellite approach to constructing portfolios is defined as "investing the majority of the portfolio on a passive or low active risk basis while a minority of the assets is managed aggressively in smaller portfolios."

SOLUTIONS

- 1 B is correct. For individuals, risk management concerns maximizing utility while taking risk consistent with individual's level of risk tolerance.
- 2 A is correct. Many decision makers focus on return, which is not something that is easily controlled, as opposed to risk, or exposure to risk, which may actually be managed or controlled
- 3 C is correct. Risks need to be defined and measured so as to be consistent with the entity's chosen level of risk tolerance and target for returns or other outcomes.
- 4 A is correct. Risk governance is the top-down process that defines risk tolerance, provides risk oversight and guidance to align risk with enterprise goals.
- 5 C is correct. While risk infrastructure, which a risk management framework must address, refers to the people and systems required to track risk exposures, there is no requirement to actually name the responsible individuals.
- 6 A is correct. In establishing a risk management system, determining risk tolerance must happen before specific risks can be accepted or reduced. Risk tolerance defines the appetite for risk. Risk budgeting determine how or where the risk is taken and quantifies the tolerable risk by specific metrics. Risk exposures can then be measured and compared against the acceptable risk.
- 7 C is correct. *Risk infrastructure* refers to the people and systems required to track risk exposures and perform most of the quantitative risk analysis to allow an assessment of the organization's risk profile. The risk management infrastructure identifies, measures, and monitors risks (among other things).
- 8 C is correct. Risk governance is not about specifying methods to mitigate risk at the business line level. Rather, it is about establishing an appropriate level of risk for the entire enterprise. Specifics of dealing with risk fall under risk management and the risk infrastructure framework.
- 9 A is correct. The risk management committee is a part of the risk governance structure at the operational level—as such, it does not approve the governing body's policies.
- 10 B is correct. When risk tolerance has been determined, the risk framework should be geared toward measuring, managing, and complying with the risk tolerance, or aligning risk exposure with risk tolerance. The risk tolerance decision begins by looking at what shortfalls within an organization would cause it to fail to achieve some critical goals and what are the organization's risk drivers.
- 11 C is correct. If a company has the ability to adapt quickly to adverse events may allow for a higher risk tolerance. There are other factors, such as beliefs of board members and a stable market environment, which may but should not affect risk tolerance.
- 12 A is correct. Risk budgeting does not include determining the target return. Risk budgeting quantifies and allocates the tolerable risk by specific metrics.
- 13 A is correct. The process of risk budgeting forces the firm to consider risk tradeoffs. As a result, the firm should choose to invest where the return per unit of risk is the highest.

- 14 A is correct. A financial risk originates from the financial markets. Credit risk is one of three financial risks identified in the reading: Credit risk is the chance of loss due to an outside party defaulting on an obligation. Solvency risk depends at least in part on factors internal to the organization and operational risk is an *internal* risk arising from the people and processes within the organization.
- 15 B is correct. Liquidity risk is also called transaction cost risk. When the bid–ask spread widens, purchase and sale transactions become increasingly costly. The risk arises from the uncertainty of the spread.
- 16 C is correct. Settlement risk is related to default risk, but deals with the timing of payments rather than the risk of default.
- 17 A is correct. The VaR measure indicates the probability of a loss of at least a certain level in a time period.
- 18 C is correct. Risk acceptance is similar to self-insurance. An entity choosing to self-insure may set up a reserve fund to cover losses. Buying insurance is a form of risk transfer and using derivatives is a form of risk-shifting, not risk acceptance.
- 19 C is correct. Among the risk-modification methods of risk avoidance, risk acceptance, risk transfer, and risk shifting none has a clear advantage. One must weigh benefits and costs in light of the firm's risk tolerance when choosing the method to use.

SOLUTIONS

- 1 A is correct. Drivers of fintech include extremely rapid growth in data (including their quantity, types, sources, and quality) and technological advances enabling the capture and extraction of information from it.
- 2 B is correct. Big Data is collected from many different sources and is in a variety of formats, including structured data (e.g., SQL tables or CSV files), semi-structured data (e.g., HTML code), and unstructured data (e.g., video messages).
- 3 C is correct. Overfitting occurs when the ML model learns the input and target dataset too precisely. In this case, the model has been “over trained” on the data and is treating noise in the data as true parameters. An ML model that has been overfitted is not able to accurately predict outcomes using a different dataset and may be too complex.
- 4 A is correct. Through the Text Analytics application of natural language processing (NLP), models using NLP analysis may incorporate non-traditional information to evaluate what people are saying—via their preferences, opinions, likes, or dislikes—in the attempt to identify trends and short-term indicators about a company, a stock, or an economic event that might have a bearing on future performance.
- 5 B is correct. Research suggests that robo-advisers tend to offer fairly conservative advice, providing a cost-effective and easily accessible form of financial guidance to underserved populations, such as the mass affluent and mass market segments.
- 6 C is correct. There is increasing interest in monitoring risk in real-time. To do so, relevant data must be taken by a firm, mapped to known risks, and identified while moving within the firm. Data may be aggregated for reporting purposes or used as inputs to risk models.
- 7 C is correct. Global financial markets have undergone substantial change as markets have fragmented into multiple trading destinations consisting of electronic exchanges, alternative trading systems, and so-called dark pools. In such an environment, when markets are continuously reflecting real-time information and continuously changing conditions, algorithmic trading has been viewed as an important tool.
- 8 C is correct. DLT has the potential to streamline the existing, often complex and labor intensive post-trade processes in securities markets by providing close to real-time trade verification, reconciliation, and settlement, thereby reducing related complexity, time, and costs.
- 9 A is correct. Through tokenization—the process of representing ownership rights to physical assets on a blockchain or distributed ledger—DLT has the potential to streamline this rights process by creating a single, digital record of ownership with which to verify ownership title and authenticity, including all historical activity.

SOLUTIONS

- 1 C is correct. Takabe is best characterized as an information-motivated trader. Takabe believes that his model provides him superior information about the movements in the stock market and his motive for trading is to profit from this information.
- 2 B is correct. Beach is an investor. He is simply investing in risky assets consistent with his level of risk aversion. Beach is not hedging any existing risk or using information to identify and trade mispriced securities. Therefore, he is not a hedger or an information-motivated trader.
- 3 A is correct. Smith is a hedger. The short position on the BRL futures contract offsets the BRL long position in three months. She is hedging the risk of the BRL depreciating against the USD. If the BRL depreciates, the value of the cash inflow goes down in USD terms but there is a gain on the futures contracts.
- 4 A is correct. Regulation of arbitrageurs' profits is not a function of the financial system. The financial system facilitates the allocation of capital to the best uses and the purposes for which people use the financial system, including borrowing money.
- 5 C is correct. The purchase of real estate properties is a transaction in the alternative investment market.
- 6 B is correct. The 90-day commercial paper and negotiable certificates of deposit are money market instruments.
- 7 B is correct. This transaction is a sale in the primary market. It is a sale of shares from the issuer to the investor and funds flow to the issuer of the security from the purchaser.
- 8 A is correct. Warrants are least likely to be part of the fund. Warrant holders have the right to buy the issuer's common stock. Thus, warrants are typically classified as equity and are least likely to be a part of a fixed-income mutual fund. Commercial paper and repurchase agreements are short-term fixed-income securities.
- 9 C is correct. When investors want to sell their shares, investors of an open-end fund sell the shares back to the fund whereas investors of a closed-end fund sell the shares to others in the secondary market. Closed-end funds are available to new investors but they must purchase shares in the fund in the secondary market. The shares of a closed-end fund trade at a premium or discount to net asset value.
- 10 A is correct. Once you have entered into a forward contract, it is difficult to exit from the contract. As opposed to a futures contract, trading out of a forward contract is quite difficult. There is no exchange of cash at the origination of a forward contract. There is no exchange on a forward contract until the maturity of the contract.
- 11 A is correct. Harris is least likely to find counterparty risk associated with a futures contract. There is limited counterparty risk in a futures contract because the clearinghouse is on the other side of every contract.
- 12 B is correct. Buying a put option on the dollar will ensure a minimum exchange rate but does not have to be exercised if the exchange rate moves in a favorable direction. Forward and futures contracts would lock in a fixed rate but would not allow for the possibility to profit in case the value of the dollar three months later in the spot market turns out to be greater than the value in the forward or futures contract.

- 13 B is correct. The agreement between the publisher and the paper supplier to respectively buy and supply paper in the future at a price agreed upon today is a forward contract.
- 14 B is correct. SPDRs trade in the secondary market and are a pooled investment vehicle.
- 15 B is correct. The holder of the call option will exercise the call options if the price is above the exercise price of \$120 per share. Note that if the stock price is above \$120 but less than \$123, the option would be exercised even though the net result for the option buyer after considering the premium is a loss. For example, if the stock price is \$122, the option buyer would exercise the option to make $\$2 = \$122 - \$120$ per share, resulting in a loss of $\$1 = \$3 - \$2$ after considering the premium. It is better to exercise and have a loss of only \$1, however, rather than not exercise and lose the entire \$3 premium.
- 16 B is correct. The investment companies that create exchange-traded funds (ETFs) are financial intermediaries. ETFs are securities that represent ownership in the assets held by the fund. The transaction costs of trading shares of ETFs are substantially lower than the combined costs of trading the underlying assets of the ETF.
- 17 B is correct. The process can best be described as arbitrage because it involves buying and selling instruments, whose values are closely related, at different prices in different markets.
- 18 A is correct. Robert's exposure to the risk of the stock of the Michelin Group is long. The exposure as a result of the long call position is long. The exposure as a result of the short put position is also long. Therefore, the combined exposure is long.
- 19 B is correct. The maximum leverage ratio is $1.82 = 100\% \text{ position} \div 55\% \text{ equity}$. The maximum leverage ratio associated with a position financed by the minimum margin requirement is one divided by the minimum margin requirement.
- 20 C is correct. The return is 50 percent. If the position had been unleveraged, the return would be $20\% = (60 - 50)/50$. Because of leverage, the return is $50\% = 2.5 \times 20\%$.
- Another way to look at this problem is that the equity contributed by the trader (the minimum margin requirement) is $40\% = 100\% \div 2.5$. The trader contributed $\$20 = 40\% \text{ of } \50 per share . The gain is \$10 per share, resulting in a return of $50\% = 10/20$.
- 21 B is correct. The return is -15.4% percent.

$$\text{Total cost of the purchase} = \$16,000 = 500 \times \$32$$

$$\text{Equity invested} = \$12,000 = 0.75 \times \$16,000$$

$$\text{Amount borrowed} = \$4,000 = 16,000 - 12,000$$

$$\text{Interest paid at month end} = \$80 = 0.02 \times \$4,000$$

$$\text{Dividend received at month end} = \$250 = 500 \times \$0.50$$

$$\text{Proceeds on stock sale} = \$14,000 = 500 \times \$28$$

$$\text{Total commissions paid} = \$20 = \$10 + \$10$$

$$\text{Net gain/loss} = -\$1,850 = -16,000 - 80 + 250 + 14,000 - 20$$

$$\text{Initial investment including commission on purchase} = \$12,010$$

$$\text{Return} = -15.4\% = -\$1,850/\$12,010$$

22 A is correct. She will need to contribute €3,760 as margin. In view of the possibility of a loss, if the stock price goes up, she will need to contribute $\frac{40}{100} \times €9,400 = €3,760$. Rogers will need to leave the proceeds from the short sale ($€9,400 = 200 \times €47$) on deposit.

23 B is correct. A margin call will first occur at a price of \$17.86. Because you have contributed half and borrowed the remaining half, your initial equity is 50 percent of the initial stock price, or $\frac{1}{2} \times \$25 = \12.50 . If P is the subsequent price, your equity would change by an amount equal to the change in price. So, your equity at price P would be $\$12.50 + (P - 25)$. A margin call will occur when the percentage margin drops to 30 percent. So, the price at which a margin call will occur is the solution to the following equation.

$$\frac{\text{Equity}/\text{Share}}{\text{Price}/\text{Share}} = \frac{12.50 + P - 25}{P} = 30\%$$

The solution is $P = \$17.86$.

24 B is correct. An instruction regarding when to fill an order is considered a validity instruction.

25 C is correct. The market is 9.95 bid, offered at 10.02. The best bid is at €9.95 and the best offer is €10.02.

26 C is correct. This order is said to make a new market. The new buy order is at ¥123.40, which is better than the current best bid of ¥123.35. Therefore, the buy order is making a new market. Had the new order been at ¥123.35, it would be said to make the market. Because the new buy limit order is at a price less than the best offer of ¥123.80, it will not immediately execute and is not taking the market.

27 A is correct. This order is said to take the market. The new sell order is at \$54.62, which is at the current best bid. Therefore, the new sell order will immediately trade with the current best bid and is taking the market.

28 B is correct. The maximum possible loss is \$1,300. If the stock price crosses \$50, the stop buy order will become valid and will get executed at a maximum limit price of \$55. The maximum loss per share is $\$13 = \$55 - \$42$, or \$1,300 for 100 shares.

29 B is correct. The most appropriate order is a good-till-cancelled stop sell order. This order will be acted on if the stock price declines below a specified price (in this case, \$27.50). This order is sometimes referred to as a good-till-cancelled stop loss sell order. You are generally bullish about the stock, as indicated by no immediate intent to sell, and would expect a loss on short selling the stock. A stop buy order is placed to buy a stock when the stock is going up.

30 B is correct. The investment bank bears the risk that the issue may be undersubscribed at the offering price. If the entire issue is not sold, the investment bank underwriting the issue will buy the unsold securities at the offering price.

31 B is correct. This sale is a private placement. As the company is already publicly traded, the share sale is clearly not an initial public offering. The sale also does not involve a shelf registration because the company is not selling shares to the public on a piecemeal basis.

32 A is correct. This offering is a rights offering. The company is distributing rights to buy stock at a fixed price to existing shareholders in proportion to their holdings.

33 C is correct. Order III (time of arrival of 9:53:04) has precedence. In the order precedence hierarchy, the first rule is price priority. Based on this rule, sell orders II, III, and IV get precedence over order I. The next rule is display

precedence at a given price. Because order II is a hidden order, orders III and IV get precedence. Finally, order III gets precedence over order IV based on time priority at same price and same display status.

- 34 C is correct. The order for 500 shares would get cancelled; there would be no fill. Li is willing to buy at CNY 74.25 or less but the minimum offer price in the book is CNY 74.30; therefore, no part of the order would be filled. Because Li's order is immediate-or-cancel, it would be cancelled.
- 35 B is correct. Ian's average trade price is:

$$\text{£19.92} = \frac{300 \times \text{£}20.02 + 400 \times \text{£}19.89 + 200 \times \text{£}19.84}{300 + 400 + 200}$$

Ian's sell order first fills with the most aggressively priced buy order, which is Mary's order for 300 shares at £20.02. Ian still has 700 shares for sale. The next most aggressively priced buy order is Ann's order for 400 shares at £19.89. This order is filled. Ian still has 300 shares for sale. The next most aggressively priced buy order is Paul's order for 200 shares at £19.84. A third trade takes place. Ian still has 100 shares for sale.

The next buy order is Keith's order for 1,000 shares at £19.70. However, this price is below Ian's limit price of £19.83. Therefore, no more trade is possible.

- 36 C is correct. In such a market, well-informed traders will find it easy to trade and their trading will make the market more informationally efficient. In a liquid market, it is easier for informed traders to fill their orders. Their trading will cause prices to incorporate their information and the prices will be more in line with the fundamental values.
- 37 C is correct. Ensure that investors in the stock market achieve a rate of return that is at least equal to the risk-free rate of return is least likely to be included as an objective of market regulation. Stocks are risky investments and there would be occasions when a stock market investment would not only have a return less than the risk-free rate but also a negative return. Minimizing agency costs and ensuring that financial markets are fair and orderly are objectives of market regulation.

SOLUTIONS

- 1 C is correct. A security market index represents the value of a given security market, market segment, or asset class.
- 2 A is correct. Security market indexes are constructed and managed like a portfolio of securities.
- 3 A is correct. The first decision is identifying the target market that the index is intended to represent because the target market determines the investment universe and the securities available for inclusion in the index.
- 4 C is correct. The difference between a price return index and a total return index consisting of identical securities and weights is the income generated over time by the underlying securities. If the securities in the index do not generate income, both indexes will be identical in value.
- 5 A is correct. At inception, the values of the price return and total return versions of an index are equal.
- 6 B is correct. The price return is the sum of the weighted returns of each security. The return of Able is 20 percent $[(12 - 10)/10]$; of Baker is -5 percent $[(19 - 20)/20]$; and of Charlie is 0 percent $[(30 - 30)/30]$. The price return index assigns a weight of 1/3 to each asset; therefore, the price return is $1/3 \times [20\% + (-5\%) + 0\%] = 5\%$.
- 7 C is correct. The total return of an index is calculated on the basis of the change in price of the underlying securities plus the sum of income received or the sum of the weighted total returns of each security. The total return of Able is 27.5 percent; of Baker is 0 percent; and of Charlie is 6.7 percent:

$$\text{Able: } (12 - 10 + 0.75)/10 = 27.5\%$$

$$\text{Baker: } (19 - 20 + 1)/20 = 0\%$$

$$\text{Charlie: } (30 - 30 + 2)/30 = 6.7\%$$

An equal-weighted index applies the same weight (1/3) to each security's return; therefore, the total return = $1/3 \times (27.5\% + 0\% + 6.7\%) = 11.4\%$.

- 8 B is correct. The price return of the price-weighted index is the percentage change in price of the index: $(68 - 75)/75 = -9.33\%$.

Security	Beginning of Period Price (£)	End of Period Price (£)
ABC	25.00	27.00
DEF	35.00	25.00
GHI	15.00	16.00
TOTAL	75.00	68.00

- 9 B is correct. The price return of the index is $(48,250,000 - 53,750,000)/53,750,000 = -10.23\%$.

Security	Beginning of Period Price (¥)	Shares Outstanding	Beginning of Period Value (¥)	End of Period Price (¥)	End of Period Value (¥)
	Beginning of Period Value (¥)		End of Period Value (¥)	End of Period Value (¥)	
MNO	2,500	5,000	12,500,000	2,700	13,500,000
QRS	3,500	7,500	26,250,000	2,500	18,750,000

Security	Beginning of Period Price (¥)	Shares Outstanding	Beginning of Period Value (¥)	End of Period Price (¥)	End of Period Value (¥)
XYZ	1,500	10,000	15,000,000	1,600	16,000,000
Total			53,750,000		48,250,000

- 10 B is correct. The total return of the market-capitalization-weighted index is calculated below:

Security	Beginning of Period Value (¥)	End of Period Value (¥)	Total Dividends (¥)	Total Return (%)
MNO	12,500,000	13,500,000	500,000	12.00
QRS	26,250,000	18,750,000	1,125,000	-24.29
XYZ	15,000,000	16,000,000	1,000,000	13.33
Total	53,750,000	48,250,000	2,625,000	-5.35

- 11 A is correct. The target market determines the investment universe and the securities available for inclusion in the index.
- 12 A is correct. The sum of prices at the beginning of the period is 96; the sum at the end of the period is 100. Regardless of the divisor, the price return is $100/96 - 1 = 0.042$ or 4.2 percent.

- 13 B is correct. It is the percentage change in the market value over the period:

$$\text{Market value at beginning of period: } (20 \times 300) + (50 \times 300) + (26 \times 2,000) \\ = 73,000$$

$$\text{Market value at end of period: } (22 \times 300) + (48 \times 300) + (30 \times 2,000) = \\ 81,000$$

Percentage change is $81,000/73,000 - 1 = 0.1096$ or 11.0 percent with rounding.

- 14 C is correct. With an equal-weighted index, the same amount is invested in each security. Assuming \$1,000 is invested in each of the three stocks, the index value is \$3,000 at the beginning of the period and the following number of shares is purchased for each stock:

Security A: 50 shares

Security B: 20 shares

Security C: 38.46 shares.

Using the prices at the beginning of the period for each security, the index value at the end of the period is \$3,213.8: $(\$22 \times 50) + (\$48 \times 20) + (\$30 \times 38.46)$. The price return is $\$3,213.8/\$3,000 - 1 = 7.1\%$.

- 15 A is correct. In the price weighting method, the divisor must be adjusted so the index value immediately after the split is the same as the index value immediately prior to the split.
- 16 C is correct. The main source of return differences arises from outperformance of small-cap securities or underperformance of large-cap securities. In an equal-weighted index, securities that constitute the largest fraction of the market are underrepresented and securities that constitute only a small fraction of the market are overrepresented. Thus, higher equal-weighted index returns will occur if the smaller-cap equities outperform the larger-cap equities.
- 17 C is correct. "Float" is the number of shares available for public trading.

- 18 B is correct. Fundamental weighting leads to indexes that have a value tilt.
- 19 C is correct. Rebalancing refers to adjusting the weights of constituent securities in an index to maintain consistency with the index's weighting method.
- 20 B is correct. Changing market prices will cause weights that were initially equal to become unequal, thus requiring rebalancing.
- 21 C is correct. Reconstitution is the process by which index providers review the constituent securities, re-apply the initial criteria for inclusion in the index, and select which securities to retain, remove, or add. Constituent securities that no longer meet the criteria are replaced with securities that do. Thus, reconstitution reduces the likelihood that the index includes securities that are not representative of the target market.
- 22 C is correct. Security market indexes play a critical role as proxies for asset classes in asset allocation models.
- 23 A is correct. Security market indexes are used as proxies for measuring market or systematic risk, not as measures of systematic risk.
- 24 B is correct. Sector indexes provide a means to determine whether a portfolio manager is more successful at stock selection or sector allocation.
- 25 C is correct. Style indexes represent groups of securities classified according to market capitalization, value, growth, or a combination of these characteristics.
- 26 A is correct. The large number of fixed-income securities—combined with the lack of liquidity of some securities—makes it costly and difficult for investors to replicate fixed-income indexes.
- 27 C is correct. An aggregate fixed-income index can be subdivided by market sector (government, government agency, collateralized, corporate), style (maturity, credit quality), economic sector, or some other characteristic to create more narrowly defined indexes.
- 28 C is correct. Coupon frequency is not a dimension on which fixed-income indexes are based.
- 29 A is correct. Commodity indexes consist of futures contracts on one or more commodities.
- 30 C is correct. The performance of commodity indexes can be quite different from that of the underlying commodities because the indexes consist of futures contracts on the commodities rather than the actual commodities.
- 31 B is correct. It is not a real estate index category.
- 32 B is correct. Hedge funds are not required to report their performance to any party other than their investors. Therefore, each hedge fund decides to which database(s) it will report its performance. Thus, for a hedge fund index, constituents determine the index rather than index providers determining the constituents.
- 33 A is correct. Voluntary performance reporting may lead to survivorship bias, and poorer performing hedge funds will be less likely to report their performance.
- 34 C is correct. The fixed-income market has more issuers and securities than the equity market.

SOLUTIONS

- 1 C is correct. Today's price change is independent of the one from yesterday, and in an efficient market, investors will react to new, independent information as it is made public.
- 2 A is correct. Reducing the number of market participants can accentuate market imperfections and impede market efficiency (e.g., restrictions on foreign investor trading).
- 3 A is correct. According to theory, reducing the restrictions on trading will allow for more arbitrage trading, thereby promoting more efficient pricing. Although regulators argue that short selling exaggerates downward price movements, empirical research indicates that short selling is helpful in price discovery.
- 4 C is correct. Regulation to restrict unfair use of nonpublic information encourages greater participation in the market, which increases market efficiency. Regulators (e.g., US SEC) discourage illegal insider trading by issuing penalties to violators of their insider trading rules.
- 5 A is correct. Restricting short selling will reduce arbitrage trading, which promotes market efficiency. Permitting foreign investor trading increases market participation, which makes markets more efficient. Penalizing insider trading encourages greater market participation, which increases market efficiency.
- 6 B is correct. A security's intrinsic value and market value should be equal when markets are efficient.
- 7 B is correct. The intrinsic value of an undervalued asset is greater than the market value of the asset, where the market value is the transaction price at which an asset can be currently bought or sold.
- 8 B is correct. The market value is the transaction price at which an asset can be currently bought or sold.
- 9 A is correct. The weak-form efficient market hypothesis is defined as a market where security prices fully reflect all market data, which refers to all past price and trading volume information.
- 10 B is correct. In semi-strong-form efficient markets, security prices reflect all publicly available information.
- 11 B is correct. If all public information should already be reflected in the market price, then the abnormal trading profit will be equal to zero when fundamental analysis is used.
- 12 B is correct. The strong-form efficient market hypothesis assumes all information, public or private, has already been reflected in the prices.
- 13 B is correct. Costs associated with active trading strategies would be difficult to recover; thus, such active trading strategies would have difficulty outperforming passive strategies on a consistent after-cost basis.
- 14 B is correct. In a semi-strong-form efficient market, passive portfolio strategies should outperform active portfolio strategies on a risk-adjusted basis.
- 15 B is correct. Technical analysts use past prices and volume to predict future prices, which is inconsistent with the weakest form of market efficiency (i.e., weak-form market efficiency). Weak-form market efficiency states that investors cannot earn abnormal returns by trading on the basis of past trends in price and volume.

- 16 C is correct. Fundamental analysts use publicly available information to estimate a security's intrinsic value to determine if the security is mispriced, which is inconsistent with the semi-strong form of market efficiency. Semi-strong-form market efficiency states that investors cannot earn abnormal returns by trading based on publicly available information.
- 17 C is correct. If markets are not semi-strong-form efficient, then fundamental analysts are able to use publicly available information to estimate a security's intrinsic value and identify misvalued securities. Technical analysis is not able to earn abnormal returns if markets are weak-form efficient. Passive portfolio managers outperform fundamental analysis if markets are semi-strong-form efficient.
- 18 A is correct. Operating inefficiencies reduce market efficiency.
- 19 C is correct. If markets are efficient, the information from the annual report is reflected in the stock prices; therefore, the gradual changes must be from the release of additional information.
- 20 B is correct. The excess returns in January are not attributed to any new information or news; however, research has found that part of the seasonal pattern can be explained by tax-loss selling and portfolio window dressing.
- 21 A is correct. Finding significant abnormal returns does not necessarily indicate that markets are inefficient or that abnormal returns can be realized by applying the strategy to future time periods. Abnormal returns are considered market anomalies because they may be the result of the model used to estimate the expected returns or may be the result of underestimating transaction costs or other expenses associated with implementing the strategy, rather than because of market inefficiency.
- 22 B is correct. Trading based on historical momentum indicates that price patterns exist and can be exploited by using historical price information. A momentum trading strategy that produces abnormal returns contradicts the weak form of the efficient market hypothesis, which states that investors cannot earn abnormal returns on the basis of past trends in prices.
- 23 A is correct. Higher than average dividend yield is a characteristic of a value stock, along with low price-to-earnings and low market-to-book ratios. Growth stocks are characterized by low dividend yields and high price-to-earnings and high market-to-book ratios.
- 24 A is correct. The efficient market hypothesis and asset-pricing models only require that the market is rational. Behavioral finance is used to explain *some* of the market anomalies as irrational decisions.
- 25 B is correct. Behavioral theories of loss aversion can explain observed overreaction in markets, such that investors dislike losses more than comparable gains (i.e., risk is not symmetrical).
- 26 C is correct. Behavioral theories of loss aversion allow for the possibility that the dislike for risk is not symmetrical, which allows for loss aversion to explain observed overreaction in markets such that investors dislike losses more than they like comparable gains.

SOLUTIONS

- 1 C is correct. The company is not obligated to make dividend payments. It is at the discretion of the company whether or not it chooses to pay dividends.
- 2 B is correct. Statutory voting is the type of equity voting right that grants one vote per share owned.
- 3 A is correct. Preference shares do not have to be either callable or putable.
- 4 C is correct. Participating preference shares entitle shareholders to receive an additional dividend if the company's profits exceed a pre-determined level.
- 5 B is correct. Private equity securities do not have market-determined quoted prices.
- 6 C is correct. Venture capital investments can be used to provide mezzanine financing to companies in their early stage of development.
- 7 B is correct. Regulatory and investor relations costs are lower for private equity firms than for public firms. There are no stock exchange, regulatory, or shareholder involvements with private equity, whereas for public firms these costs can be high.
- 8 C is correct. The trends in emerging markets have not led to the stability of foreign exchange markets.
- 9 A is correct. In an unsponsored DR, the depository bank owns the voting rights to the shares. The bank purchases the shares, places them into a trust, and then sells shares in the trust—not the underlying shares—in other markets.
- 10 A is correct. The listing fees on Level III sponsored ADRs are high.
- 11 C is correct. An ETF is used to gain exposure to a basket of securities (equity, fixed income, commodity futures, etc.).
- 12 A is correct. The formula states $R_t = (P_t - P_{t-1} + D_t)/P_{t-1}$. Therefore, total return = $(42 - 50 + 2)/50 = -12.0\%$.
- 13 A is correct. The depreciated value of the euro will create an additional loss in the form of currency return that is lower than the ETF's return.
- 14 C is correct. Some equity securities do not pay dividends, and therefore the standard deviation of dividends cannot be used to measure the risk of all equity securities.
- 15 A is correct. Putable shares, whether common or preference, give the investor the option to sell the shares back to the issuer at a pre-determined price. This pre-determined price creates a floor for the share's price that reduces the uncertainty of future cash flows for the investor (i.e., lowers risk relative to the other two types of shares listed).
- 16 C is correct. Issuing shares in the primary (and secondary) market *reduces* a company's return on equity because it increases the total amount of equity capital invested in the company (i.e., the denominator in the ROE formula).
- 17 C is correct. Capital is raised to ensure the company's existence only when it is required. It is not a typical goal of raising capital.
- 18 A is correct. A company's book value increases when a company retains its net income.
- 19 A is correct. The book value of the company is equal to total assets minus total liabilities, which is $\text{€}12,000,000 - \text{€}7,500,000 = \text{€}4,500,000$.

- 20 A is correct. A company's market value is affected by management's decisions. Management's decisions can directly affect the company's *book* value, which can then affect its market value.
- 21 B is correct. A company's ROE is calculated as (NI_t/BVE_{t-1}) . For 2009, the BVE_{t-1} is equal to the beginning total assets minus the beginning total liabilities, which equals $\text{£}50,000,000 - \text{£}35,000,000 = \text{£}15,000,000$. Therefore, $ROE_{2009} = \text{£}2,000,000/\text{£}15,000,000 = 13.3\%$.
- 22 C is correct. A company's ROE will increase if it issues debt to repurchase outstanding shares of equity.
- 23 B is correct. The cost of equity is not easily determined. It is dependent on investors' required rate of return on equity, which reflects the different risk levels of investors and their expectations about the company's future cash flows.
- 24 B is correct. Companies try to raise funds at the lowest possible cost. Therefore, cost of equity is used as a proxy for the minimum required rate of return.

SOLUTIONS

- 1 C is correct. Tactical asset allocation involves timing investments in asset classes and does not make use of industry analysis.
- 2 C is correct. A sector rotation strategy is conducted by investors wishing to time investment in industries through an analysis of fundamentals and/or business-cycle conditions.
- 3 B is correct. Determination of a company's competitive environment depends on understanding its industry.
- 4 A is correct. The Russell system uses three tiers, whereas the other two systems are based on four tiers or levels.
- 5 B is correct. Personal care products are classified as consumer staples in the "Description of Representative Sectors."
- 6 C is correct. Automotive manufacturers are classified as consumer discretionary. Consumer discretionary companies derive a majority of revenue from the sale of consumer-related products for which demand tends to exhibit a high degree of economic sensitivity—that is, high demand during periods of economic expansion and low demand during periods of contraction.
- 7 C is correct. Commercial systems are generally updated more frequently than government systems, and include only publicly traded for-profit companies.
- 8 B is correct. Business-cycle sensitivity falls on a continuum and is not a discrete "either-or" phenomenon.
- 9 C is correct. Cyclical companies are sensitive to the business cycle, with low product demand during periods of economic contraction and high product demand during periods of economic expansion. They, therefore, experience wider-than-average fluctuations in product demand.
- 10 C is correct. Customers' flexibility as to when they purchase the product makes the product more sensitive to the business cycle.
- 11 C is correct. Varying conditions of recession or expansion around the world would affect the comparisons of companies with sales in different regions of the world.
- 12 B is correct. Constructing a peer group is a subjective process, and a logical starting point is to begin with a commercially available classification system. This system will identify a group of companies that may have properties comparable to the business activity of interest.
- 13 A is correct because it is a false statement. Reviewing the annual report to find management's discussion about the competitive environment and specific competitors is a suggested step in the process of constructing a peer group.
- 14 B is correct. The company could be in more than one peer group depending on the demand drivers for the business segments, although the multiple business segments may make it difficult to classify the company.
- 15 C is correct. For the automobile industry, the high capital requirements and other elements mentioned in the reading provide high barriers to entry, and recognition that auto factories are generally only of use for manufacturing cars implies a high barrier to exit.
- 16 C is correct. A slow pace of product innovation often means that customers prefer to stay with suppliers they know, implying stable market shares.

- 17 C is correct. Capacity increases in providing legal services would not involve several factors that would be important to the other two industries, including the need for substantial fixed capital investments or, in the case of a restaurant, outfitting rental or purchased space. These requirements would tend to slow down, respectively, steel production and restaurant expansion.
- 18 B is correct. Vision typically deteriorates at advanced ages. An increased number of older adults implies more eyewear products will be purchased.
- 19 B is correct. As their educational level increases, workers are able to perform more skilled tasks, earn higher wages, and as a result, have more income left for discretionary expenditures.
- 20 A is correct. Seeking economies of scale would tend to reduce per-unit costs and increase profit.
- 21 C is correct. The embryonic stage is characterized by slow growth and high prices.
- 22 C is correct. The growth phase is not likely to experience price wars because expanding industry demand provides companies the opportunity to grow even without increasing market share. When industry growth is stagnant, companies may only be able to grow by increasing market share, e.g., by engaging in price competition.
- 23 B is correct. The industry life-cycle model shows how demand evolves through time as an industry passes from the embryonic stage through the stage of decline.
- 24 A is correct. Industry consolidation and relatively high barriers to entry are two characteristics of a mature-stage industry.
- 25 C is correct. The relatively few members of the industry generally try to avoid price competition.
- 26 C is correct. With short lead times, industry capacity can be rapidly increased to satisfy demand, but it may also lead to overcapacity and lower profits.
- 27 A is correct. An industry that has high barriers to entry generally requires substantial physical capital and/or financial investment. With weak pricing power in the industry, finding a buyer for excess capacity (i.e., to exit the industry) may be difficult.
- 28 C is correct. Economic profit is earned and value created for shareholders when the company earns returns above the company's cost of capital.
- 29 B is correct. As displayed in Exhibit 4, the alcoholic beverage industry is concentrated and possesses strong pricing power.
- 30 A is correct. Companies with low cost strategies must be able to invest in productivity-improving equipment and finance that investment at a low cost of capital. Market share and pricing depend on whether the strategy is pursued defensively or offensively.
- 31 A is correct. The cost structure is an appropriate element when analyzing the supply of the product, but analysis of demand relies on the product's differentiating characteristics and the customers' needs and wants.
- 32 C is correct. The corporate profile would provide an understanding of these elements.

SOLUTIONS

- 1 A is correct. The current market price of the stock exceeds the upper bound of the analyst's estimate of the intrinsic value of the stock.
- 2 A is correct. The market price is less than the estimated intrinsic, or fundamental, value.
- 3 C is correct. Asset-based valuation models calculate the intrinsic value of equity by subtracting liabilities from the market value of assets.
- 4 C is correct. FCFE can be used in a form of present value, or discounted cash flow, model. Both EV and price to free cash flow are forms of multiplier models.
- 5 C is correct. Multiplier valuation models (in the form of P/B) and asset-based valuation models (in the form of adjustments to book value) use book value, whereas present value models typically discount future expected cash flows.
- 6 B is correct. To use a discounted cash flow model, the analyst will require FCFE or dividend data. In addition, the analyst will need data to calculate an appropriate discount rate.
- 7 B is correct. The FCFE model assumes that dividend-paying capacity is reflected in FCFE.
- 8 C is correct. According to the dividend discount model, the intrinsic value of a stock today is the present value of all future dividends. In this case, the intrinsic value is the present value of D_1 , D_2 , and P_2 . Note that P_2 is the present value at Period 2 of all future dividends from Period 3 to infinity.
- 9 A is correct. In the FCFE model, the intrinsic value of stock is calculated by discounting expected future FCFE to present value. No further adjustments are required.
- 10 C is correct. Dividend discount models can be used for a stock that pays a current dividend or a stock that is expected to pay a dividend. FCFE can be used for both of those stocks and for stocks that do not, or are not expected to, pay dividends in the near future. Both of these models are forms of present value models.
- 11 B is correct. The expected annual dividend is $4.80\% \times \$25 = \1.20 . The value of a preferred share is $\$1.20/0.0449 = \26.73 .
- 12 B is correct. The required rate of return, r , can vary widely depending on the inputs and is not unique. A preferred stock with a constant dividend would not have a growth rate to estimate, and the investor's time horizon would have no effect on the calculation of intrinsic value.
- 13 C is correct. $P_0 = D_1/(r - g) = 1.75(1.092)/(0.123 - 0.092) = \61.65 .
- 14 C is correct. According to the Gordon growth model, $V_0 = D_1/(r - g)$. In this case, $D_1 = \$2.00 \times 1.04 = \2.08 , so $V_0 = \$2.08/(0.07 - 0.04) = \$69.3333 = \$69.33$.
- 15 A is correct. The current price of €22.56 is less than the intrinsic value (V_0) of €24.64; therefore, the stock appears to be currently undervalued. According to the two-stage dividend discount model:

$$V_0 = \sum_{t=1}^n \frac{D_0(1 + g_S)^t}{(1 + r)^t} + \frac{V_n}{(1 + r)^n} \text{ and } V_n = \frac{D_{n+1}}{r - g_L}$$

$$\begin{aligned} D_{n+1} &= D_0(1 + g_S)^n(1 + g_L) \\ D_1 &= €1.60 \times 1.09 = €1.744 \end{aligned}$$

$$\begin{aligned}
 D_2 &= €1.60 \times (1.09)^2 = €1.901 \\
 D_3 &= €1.60 \times (1.09)^3 = €2.072 \\
 D_4 &= €1.60 \times (1.09)^4 = €2.259 \\
 D_5 &= [€1.60 \times (1.09)^4](1.04) = €2.349 \\
 V_4 &= €2.349 / (0.12 - 0.04) = €29.363 \\
 V_0 &= \frac{1.744}{(1.12)^1} + \frac{1.901}{(1.12)^2} + \frac{2.072}{(1.12)^3} + \frac{2.259}{(1.12)^4} + \frac{29.363}{(1.12)^4} \\
 &= 1.557 + 1.515 + 1.475 + 1.436 + 18.661 \\
 &= €24.64 \text{ (which is greater than the current price of €22.56)}
 \end{aligned}$$

16 C is correct.

$$\begin{aligned}
 V_0 &= \frac{D_1}{(1+r)} + \frac{D_2}{(1+r)^2} + \frac{P_2}{(1+r)^2} \\
 &= \frac{0.70}{(1.083)} + \frac{0.80}{(1.083)^2} + \frac{31.29}{(1.083)^2} \\
 &= \$28.01
 \end{aligned}$$

Note that $D_1 = 0.58(1.20) = 0.70$, $D_2 = 0.58(1.20)(1.15) = 0.80$, and $P_2 = D_3/(k-g) = 0.80(1.056)/(0.083 - 0.056) = 31.29$

17 B is correct.

$$\begin{aligned}
 V_0 &= \frac{D_1}{(1+r)} + \frac{D_2}{(1+r)^2} + \frac{D_3}{(1+r)^3} + \frac{D_4}{(1+r)^4} + \frac{P_4}{(1+r)^4} \\
 &= \frac{468}{(1.12)} + \frac{486.72}{(1.12)^2} + \frac{506.19}{(1.12)^3} + \frac{526.44}{(1.12)^4} + \frac{9000}{(1.12)^4} \\
 &= ¥7,120
 \end{aligned}$$

18 B is correct. The Gordon growth model (also known as the constant growth model) can be used to value dividend-paying companies in a mature phase of growth. A stable dividend growth rate is often a plausible assumption for such companies.

19 C is correct. The Gordon growth model is best suited to valuing mature companies. The two-stage model is best for companies that are transitioning from a growth stage to a mature stage. The three-stage model is appropriate for young companies just entering the growth phase.

20 A is correct. The company is a mature company with a steadily growing dividend rate. The two-stage (or multistage) model is unnecessary because the dividend growth rate is expected to remain stable. Although an FCFE model could be used, that model is more often chosen for companies that currently pay no dividends.

21 C is correct. The justified forward P/E is calculated as follows:

$$\frac{P_0}{E_1} = \frac{\frac{D_1}{r-g}}{E_1}$$

P/E is inversely related to the required rate of return, r , and directly related to the growth rate, g , and the dividend payout ratio, D/E .

- 22 A is correct. Multiples based on comparables are grounded in the law of one price and take into account historical multiple values. In contrast, P/E multiples based on fundamentals can be based on the Gordon growth model, which takes into account future expected dividends.
- 23 A is correct. The statement is inaccurate in both respects. Although multiples can be calculated from historical data, forecasted values can be used as well. For companies without accounting earnings, several other multiples can be used. These multiples are often specific to a company's industry or sector and include price-to-sales and price-to-cash flow.
- 24 A is correct. Tanaka shares are most likely overvalued. As the table below shows, all the 2009 multiples are currently above their 2005–2008 averages.

Year	P/E	P/CF	P/R
2005	4.9	5.4	1.2
2006	6.1	8.6	1.5
2007	8.3	7.3	1.9
2008	9.2	7.9	2.3
Average	7.1	7.3	1.7

- 25 B is correct.

$$\frac{P_0}{E_1} = \frac{\frac{D_1}{E_1}}{r - g} = \frac{\frac{2.7}{5.7}}{0.0835 - 0.0275} = 8.5$$

- 26 B is correct. P/E = Current price/EPS, and Estimated P/E = Current price/Estimated EPS.

$$\text{Alpha P/E} = \$57.32/\$3.82 = 15.01$$

$$\text{Alpha estimated P/E} = \$57.32/4.75 = 12.07$$

$$\text{Delta P/E} = \$18.93/\$1.35 = 14.02$$

$$\text{Delta estimated P/E} = \$18.93/\$1.40 = 13.52$$

- 27 C is correct. Relative to the others, Pioneer Trust has the lowest P/E multiple and the P/B multiple is tied for the lowest with Prime Bank. Given the law of one price, similar companies should trade at similar P/B and P/E levels. Thus, based on the information presented, Pioneer is most likely to be undervalued.
- 28 C is correct. Enterprise value is calculated as the market value of equity plus the market value of debt and preferred stock minus short-term investments. Therefore, the market value of equity is enterprise value minus the market value of debt and preferred stock plus short-term investments.

- 29 A is correct. Operating income may be used in place of EBITDA when calculating the enterprise value multiple. EBITDA may be used when company earnings are negative because EBITDA is usually positive. The book value of debt cannot be used in place of market value of debt.

- 30 A is correct.

$$\text{EV} = 10.2 \times 22,000,000 = \$224,400,000$$

$$\begin{aligned}\text{Equity value} &= \text{EV} - \text{Debt} + \text{Cash} \\ &= 224,400,000 - 56,000,000 + 1,500,000 \\ &= \$169,900,000\end{aligned}$$

- 31 B is correct. The market value of debt must be calculated and taken out of the enterprise value. Enterprise value, sometimes known as the cost of a takeover, is the cost of the purchase of the company, which would include the assumption of the company's debts at market value.
- 32 B is correct. Intangible assets are hard to value. Therefore, asset-based valuation models work best for companies that do not have a high proportion of intangible assets.
- 33 A is correct. Asset-based valuations are most often used when an analyst is valuing private enterprises. Both B and C are considerations in asset-based valuations but are more likely to be reasons to avoid that valuation model rather than reasons to use it.
- 34 B is correct. According to the reading, analysts may have not have access to market quotations for company debt.
- 35 A is correct. Although all models can be used to compare various companies, multiplier models have the advantage of reducing varying fundamental data points into a format that allows direct comparisons. As long as the analyst applies the data in a consistent manner for all the companies, this approach provides useful comparative data.
- 36 B is correct. Very small changes in inputs, such as required rate of return or dividend growth rate, can result in large changes to the valuation model output. Some present value models, such as FCFE models, can be used to value companies without dividends. Also, the intrinsic value of a security is independent of the investor's holding period.

SOLUTIONS

- 1 A is correct. The tenor of the bond is the time remaining until the bond's maturity date. Although the bond had a maturity of 10 years at issuance (original maturity), it was issued four years ago. Thus, there are six years remaining until the maturity date.
B is incorrect because the nominal rate is the coupon rate, i.e., the interest rate that the issuer agrees to pay each year until the maturity date. Although interest is paid semi-annually, the nominal rate is 10%, not 5%. C is incorrect because it is the bond's price, not its redemption value (also called principal amount, principal value, par value, face value, nominal value, or maturity value), that is equal to 102% of the par value.
- 2 C is correct. A capital market security has an original maturity longer than one year.
A is incorrect because a perpetual bond does not have a stated maturity date. Thus, the sovereign bond, which has a maturity of 15 years, cannot be a perpetual bond. B is incorrect because a pure discount bond is a bond issued at a discount to par value and redeemed at par. Some sovereign bonds (e.g., Treasury bills) are pure discount bonds, but others are not.
- 3 C is correct. The coupon rate that applies to the interest payment due on 30 June is based on the three-month Libor rate prevailing on 31 March. Thus, the coupon rate is $1.55\% + 0.65\% = 2.20\%$.
- 4 B is correct. The indenture, also referred to as trust deed, is the legal contract that describes the form of the bond, the obligations of the issuer, and the rights of the bondholders.
A is incorrect because covenants are only one element of a bond's indenture. Covenants are clauses that specify the rights of the bondholders and any actions that the issuer is obligated to perform or prohibited from performing. C is incorrect because a debenture is a type of bond.
- 5 B is correct. A surety bond is an external credit enhancement, i.e., a guarantee received from a third party. If the issuer defaults, the guarantor who provided the surety bond will reimburse investors for any losses, usually up to a maximum amount called the penal sum.
A is incorrect because covenants are legally enforceable rules that borrowers and lenders agree upon when the bond is issued. C is incorrect because overcollateralization is an internal, not external, credit enhancement. Collateral is a guarantee underlying the debt above and beyond the issuer's promise to pay, and overcollateralization refers to the process of posting more collateral than is needed to obtain or secure financing. Collateral, such as assets or securities pledged to ensure debt payments, is not provided by a third party. Thus, overcollateralization is not an external credit enhancement.
- 6 B is correct. Affirmative (or positive) covenants enumerate what issuers are required to do and are typically administrative in nature. A common affirmative covenant describes what the issuer intends to do with the proceeds from the bond issue.
A and C are incorrect because imposing a limit on the issuer's leverage ratio or on the percentage of the issuer's gross assets that can be sold are negative covenants. Negative covenants prevent the issuer from taking actions that could reduce its ability to make interest payments and repay the principal.

- 7 B is correct. Prohibiting the issuer from investing in risky projects restricts the issuer's potential business decisions. These restrictions are referred to as negative bond covenants.
A and C are incorrect because paying taxes as they come due and maintaining the current lines of business are positive covenants.
- 8 C is correct. Bonds sold in a country and denominated in that country's currency by an entity from another country are referred to as foreign bonds.
A is incorrect because Eurobonds are bonds issued outside the jurisdiction of any single country. B is incorrect because global bonds are bonds issued in the Eurobond market and at least one domestic country simultaneously.
- 9 A is correct. Eurobonds are typically issued as bearer bonds, i.e., bonds for which the trustee does not keep records of ownership. In contrast, domestic and foreign bonds are typically registered bonds for which ownership is recorded by either name or serial number.
B is incorrect because Eurobonds are typically issued as bearer bonds, not registered bonds. C is incorrect because Eurobonds are typically subject to lower, not greater, regulation than domestic and foreign bonds.
- 10 C is correct. The original issue discount tax provision requires the investor to include a prorated portion of the original issue discount in his taxable income every tax year until maturity. The original issue discount is equal to the difference between the bond's par value and its original issue price.
A is incorrect because the original issue discount tax provision allows the investor to increase his cost basis in the bond so that when the bond matures, he faces no capital gain or loss. B is incorrect because the original issue discount tax provision does not require any tax deduction in the year the bond is purchased or afterwards.
- 11 C is correct. A fully amortized bond calls for equal cash payments by the bond's issuer prior to maturity. Each fixed payment includes both an interest payment component and a principal repayment component such that the bond's outstanding principal amount is reduced to zero by the maturity date.
A and B are incorrect because a bullet bond or plain vanilla bond only make interest payments prior to maturity. The entire principal repayment occurs at maturity.
- 12 C is correct. A cap in a floating-rate note (capped FRN) prevents the coupon rate from increasing above a specified maximum rate. This feature benefits the issuer in a rising interest rate environment because it sets a limit to the interest rate paid on the debt.
A is incorrect because a bond with a step-up coupon is one in which the coupon, which may be fixed or floating, increases by specified margins at specified dates. This feature benefits the bondholders, not the issuer, in a rising interest rate environment because it allows bondholders to receive a higher coupon in line with the higher market interest rates. B is incorrect because inflation-linked bonds have their coupon payments and/or principal repayment linked to an index of consumer prices. If interest rates increase as a result of inflation, this feature is a benefit for the bondholders, not the issuer.
- 13 C is correct. In contrast to fixed-rate bonds that decline in value in a rising interest rate environment, floating-rate notes (FRNs) are less affected when interest rates increase because their coupon rates vary with market interest rates and are reset at regular, short-term intervals. Consequently, FRNs are favored by investors who believe that interest rates will rise.

- A is incorrect because an inverse floater is a bond whose coupon rate has an inverse relationship to the reference rate, so when interest rates rise, the coupon rate on an inverse floater decreases. Thus, inverse floaters are favored by investors who believe that interest rates will decline, not rise. B is incorrect because fixed rate-bonds decline in value in a rising interest rate environment. Consequently, investors who expect interest rates to rise will likely avoid investing in fixed-rate bonds.
- 14 C is correct. Capital-indexed bonds pay a fixed coupon rate that is applied to a principal amount that increases in line with increases in the index during the bond's life. If the consumer price index increases by 2%, the coupon rate remains unchanged at 6%, but the principal amount increases by 2% and the coupon payment is based on the inflation-adjusted principal amount. On the first coupon payment date, the inflation-adjusted principal amount is $1,000 \times (1 + 0.02) = 1,020$ and the semi-annual coupon payment is equal to $(0.06 \times 1,020) \div 2 = 30.60$.
- 15 A is correct. A put provision provides bondholders the right to sell the bond back to the issuer at a predetermined price prior to the bond's maturity date. B is incorrect because a make-whole call provision is a form of call provision; i.e., a provision that provides the issuer the right to redeem all or part of the bond before its maturity date. A make-whole call provision requires the issuer to make a lump sum payment to the bondholders based on the present value of the future coupon payments and principal repayments not paid because of the bond being redeemed early by the issuer. C is incorrect because an original issue discount provision is a tax provision relating to bonds issued at a discount to par value. The original issue discount tax provision typically requires the bondholders to include a prorated portion of the original issue discount (i.e., the difference between the par value and the original issue price) in their taxable income every tax year until the bond's maturity date.
- 16 B is correct. A call provision (callable bond) gives the issuer the right to redeem all or part of the bond before the specified maturity date. If market interest rates decline or the issuer's credit quality improves, the issuer of a callable bond can redeem it and replace it by a cheaper bond. Thus, the call provision is beneficial to the issuer.
- A is incorrect because a put provision (putable bond) is beneficial to the bondholders. If interest rates rise, thus lowering the bond's price, the bondholders have the right to sell the bond back to the issuer at a predetermined price on specified dates. C is incorrect because a conversion provision (convertible bond) is beneficial to the bondholders. If the issuing company's share price increases, the bondholders have the right to exchange the bond for a specified number of common shares in the issuing company.
- 17 A is correct. A put feature is beneficial to the bondholders. Thus, the price of a putable bond will typically be higher than the price of an otherwise similar non-putable bond.
- B is incorrect because a call feature is beneficial to the issuer. Thus, the price of a callable bond will typically be lower, not higher, than the price of an otherwise similar non-callable bond. C is incorrect because a conversion feature is beneficial to the bondholders. Thus, the price of a convertible bond will typically be higher, not lower, than the price of an otherwise similar non-convertible bond.
- 18 C is correct. A zero-coupon, or pure discount, bond pays no interest; instead, it is issued at a discount to par value and redeemed at par. As a result, the interest earned is implied and equal to the difference between the par value and the purchase price.

- 19 A is correct. Covenants specify the rights of the bondholders and any actions that the issuer is obligated to perform or is prohibited from performing.
- 20 A is correct. A covered bond is a debt obligation backed by a segregated pool of assets called a “cover pool.” When the assets that are included in the cover pool become non-performing (i.e., the assets are not generating the promised cash flows), the issuer must replace them with performing assets.
- 21 C is correct. Negative covenants enumerate what issuers are prohibited from doing. Restrictions on debt, including maintaining a minimum interest coverage ratio or a maximum debt usage ratio, are typical examples of negative covenants.
- 22 B is correct. Positive (or affirmative) covenants are typically administrative in nature and do not impose additional costs on the issuer, whereas negative covenants are frequently costly.
- 23 B is correct. A bond that is fully amortized is characterized by a fixed periodic payment schedule that reduces the bond’s outstanding principal amount to zero by the maturity date. The stream of £230.97 payments reflects the cash flows of a fully amortized bond with a coupon rate of 5% and annual interest payments.
- 24 B is correct. A credit-linked coupon bond has a coupon that changes when the bond’s credit rating changes. Because credit ratings tend to decline the most during recessions, credit-linked coupon bonds may thus provide some general protection against a poor economy by offering increased coupon payments when credit ratings decline.
- 25 B is correct. Deferred coupon bonds pay no coupon for their first few years but then pay higher coupons than they otherwise normally would for the remainder of their life. Deferred coupon bonds are common in project financing when the assets being developed may not generate any income during the development phase, thus not providing cash flows to make interest payments. A deferred coupon bond allows the issuer to delay interest payments until the project is completed and the cash flows generated by the assets can be used to service the debt.
- 26 C is correct. A putable bond is beneficial for the bondholder by guaranteeing a prespecified selling price at the redemption date, thus offering protection when interest rates rise and bond prices decline. Relative to a one-time put bond that incorporates a single sellback opportunity, a multiple put bond offers more frequent sellback opportunities, thus providing the most benefit to bondholders.
- 27 C is correct. An American call option gives the issuer the right to call the bond at any time starting on the first call date.
- 28 A is correct. The conversion premium is the difference between the convertible bond’s price and its conversion value.

SOLUTIONS

- 1 C is correct. In most countries, the largest issuers of bonds are the national and local governments as well as financial institutions. Thus, the bond market sector with the smallest amount of bonds outstanding is the non-financial corporate sector.
- 2 B is correct. The distinction between investment grade and non-investment grade debt relates to differences in credit quality, not tax status or maturity dates. Debt markets are classified based on the issuer's creditworthiness as judged by the credit ratings agencies. Ratings of Baa3 or above by Moody's Investors Service or BBB- or above by Standard & Poor's and Fitch Ratings are considered investment grade, whereas ratings below these levels are referred to as non-investment grade (also called high yield, speculative, or junk).
- 3 A is correct. Eurobonds are issued internationally, outside the jurisdiction of any single country. B is incorrect because foreign bonds are considered international bonds, but they are issued in a specific country, in the currency of that country, by an issuer domiciled in another country. C is incorrect because municipal bonds are US domestic bonds issued by a state or local government.
- 4 B is correct. Asset-backed securities (ABS) are securitized debt instruments created by securitization, a process that involves transferring ownership of assets from the original owners to a special legal entity. The special legal entity then issues securities backed by the transferred assets. The assets' cash flows are used to pay interest and repay the principal owed to the holders of the securities. Assets that are typically used to create securitized debt instruments include loans (such as mortgage loans) and receivables (such as credit card receivables). The structured finance sector includes such securitized debt instruments (also called asset-backed securities).
- 5 B is correct. Many emerging countries lag developed countries in the areas of political stability, property rights, and contract enforcement. Consequently, emerging market bonds usually exhibit higher risk than developed markets bonds. A is incorrect because emerging markets bonds typically offer higher (not lower) yields than developed markets bonds to compensate investors for the higher risk. C is incorrect because emerging markets bonds usually benefit from higher (not lower) growth prospects than developed markets bonds.
- 6 B is correct. The coupon rate of a floating-rate bond is expressed as a reference rate plus a spread. Different reference rates are used depending on where the bond is issued and its currency denomination, but one of the most widely used set of reference rates is Libor. A and C are incorrect because a bond's spread and frequency of coupon payments are typically set when the bond is issued and do not change during the bond's life.
- 7 A is correct. Changes in the coupon rate of interest on a floating-rate bond that uses a Libor reference rate are due to changes in the reference rate (for example, 90-day Libor), which resets periodically. "Therefore, the coupon rate adjusts to the level of market interest rates (plus the spread) each time the reference rate is reset."
- 8 C is correct. Interbank offered rates are used as reference rates not only for floating-rate bonds, but also for other debt instruments including mortgages, derivatives such as interest rate and currency swaps, and many other financial contracts and products. A and B are incorrect because an interbank offered rate such as Libor or Euribor is a set of reference rates (not a single reference rate) for different borrowing periods of up to one year (not 10 years).

- 9 A is correct. In an underwritten offering (also called firm commitment offering), the investment bank (called the underwriter) guarantees the sale of the bond issue at an offering price that is negotiated with the issuer. Thus, the underwriter takes the risk of buying the newly issued bonds from the issuer, and then reselling them to investors or to dealers who then sell them to investors. B and C are incorrect because the bond issuing mechanism where an investment bank acts as a broker and receives a commission for selling the bonds to investors, and incurs less risk associated with selling the bonds, is a best efforts offering (not an underwritten offering).
- 10 A is correct. In major developed bond markets, newly issued sovereign bonds are sold to the public via an auction. B and C are incorrect because sovereign bonds are rarely issued via private placements or best effort offerings.
- 11 A is correct. Private placements are typically non-underwritten, unregistered bond offerings that are sold only to a single investor or a small group of investors.
- 12 B is correct. A shelf registration allows certain authorized issuers to offer additional bonds to the general public without having to prepare a new and separate offering circular. The issuer can offer multiple bond issuances under the same master prospectus, and only has to prepare a short document when additional bonds are issued. A is incorrect because the grey market is a forward market for bonds about to be issued. C is incorrect because a private placement is a non-underwritten, unregistered offering of bonds that are not sold to the general public but directly to an investor or a small group of investors.
- 13 B is correct. Secondary bond markets are where bonds are traded between investors. A is incorrect because newly issued bonds (whether from corporate issuers or other types of issuers) are issued in primary (not secondary) bond markets. C is incorrect because the major participants in secondary bond markets globally are large institutional investors and central banks (not retail investors).
- 14 C is correct. In over-the-counter (OTC) markets, buy and sell orders are initiated from various locations and then matched through a communications network. Most bonds are traded in OTC markets. A is incorrect because on organized exchanges, buy and sell orders may come from anywhere, but the transactions must take place at the exchange according to the rules imposed by the exchange. B is incorrect because open market operations refer to central bank activities in secondary bond markets. Central banks buy and sell bonds, usually sovereign bonds issued by the national government, as a means to implement monetary policy.
- 15 C is correct. Liquidity in secondary bond markets refers to the ability to buy or sell bonds quickly at prices close to their fair market value. A and B are incorrect because a liquid secondary bond market does not guarantee that a bond will sell at the price sought by the investor, or that the investor will not face a loss on his or her investment.
- 16 A is correct. The vast majority of corporate bonds are traded in over-the-counter (OTC) markets that use electronic trading platforms through which users submit buy and sell orders. Settlement of trades in the OTC markets occurs by means of a simultaneous exchange of bonds for cash on the books of the clearing system “on a paperless, computerized book-entry basis.”
- 17 C is correct. Sovereign bonds are usually unsecured obligations of the national government issuing the bonds; they are not backed by collateral, but by the taxing authority of the national government. A is incorrect because bonds issued

by local governments are non-sovereign (not sovereign) bonds. B is incorrect because sovereign bonds are typically unsecured (not secured) obligations of a national government.

- 18 C is correct. Bonds issued in the sovereign's currency and a strong domestic savings base are both favorable sovereign rating factors. It is common to observe a higher credit rating for sovereign bonds issued in local currency because of the sovereign's ability to tax its citizens and print its own currency. Although there are practical limits to the sovereign's taxing and currency-printing capacities, each tends to support a sovereign's ability to repay debt. A strong domestic savings base is advantageous because it supports the sovereign's ability to issue debt in local currency to domestic investors.
- 19 A is correct. Floaters are bonds with a floating rate of interest that resets periodically based on changes in the level of a reference rate, such as Libor. Because changes in the reference rate reflect changes in market interest rates, price changes of floaters are far less pronounced than those of fixed-rate bonds, such as coupon bonds and discount bonds. Thus, investors holding floaters are less exposed to interest rate risk than investors holding fixed-rate discount or coupon bonds.
- 20 C is correct. Agency bonds are issued by quasi-government entities. These entities are agencies and organizations usually established by national governments to perform various functions for them. A and B are incorrect because local and national governments issue non-sovereign and sovereign bonds, respectively.
- 21 B is correct. The IMF is a multilateral agency that issues supranational bonds. A and C are incorrect because sovereign bonds and quasi-government bonds are issued by national governments and by entities that perform various functions for national governments, respectively.
- 22 C is correct. Bonds issued by levels of government below the national level—such as provinces, regions, states, cities, and local government authorities—are classified as non-sovereign government bonds. These bonds are typically not guaranteed by the national government.
- 23 C is correct. Companies use commercial paper not only as a source of funding working capital and seasonal demand for cash, but also as a source of interim financing for long-term projects until permanent financing can be arranged. A is incorrect because there is a secondary market for trading commercial paper, although trading is limited except for the largest issues. B is incorrect because commercial paper is issued by companies across the risk spectrum, although only the strongest, highly rated companies issue *low-cost* commercial paper.
- 24 A is correct. Commercial paper, whether US commercial paper or Eurocommercial paper, is negotiable—that is, investors can buy and sell commercial paper on secondary markets. B is incorrect because Eurocommercial paper can be denominated in any currency. C is incorrect because Eurocommercial paper may be issued on an interest-bearing (or yield) basis or a discount basis.
- 25 B is correct. With a serial maturity structure, a stated number of bonds mature and are paid off on a pre-determined schedule before final maturity. With a sinking fund arrangement, the issuer is required to set aside funds over time to retire the bond issue. Both result in a pre-determined portion of the issue being paid off according to a pre-determined schedule.
- 26 A is correct. A sinking fund arrangement is a way to reduce credit risk by making the issuer set aside funds over time to retire the bond issue. B and C are incorrect because a sinking fund arrangement has no effect on inflation risk or interest rate risk.

- 27 C is correct. Wholesale funds available for banks include central bank funds, interbank funds, and negotiable certificates of deposit. A and B are incorrect because demand deposits (also known as checking accounts) and money market accounts are retail deposits (not wholesale funds).
- 28 B is correct. A negotiable certificate of deposit (CD) allows any depositor (initial or subsequent) to sell the CD in the open market prior to maturity. A is incorrect because negotiable CDs are mostly available in large (not small) denominations. Large-denomination negotiable CDs are an important source of wholesale funds for banks, whereas small-denomination CDs are not. C is incorrect because a penalty is imposed if the depositor withdraws funds prior to maturity for non-negotiable (instead of negotiable) CDs.
- 29 B is correct. A repurchase agreement (repo) can be viewed as a collateralized loan where the security sold and subsequently repurchased represents the collateral posted. A and C are incorrect because interbank deposits and negotiable certificates of deposit are unsecured deposits—that is, there is no collateral backing the deposit.
- 30 A is correct. Repo margins vary by transaction and are negotiated bilaterally between the counterparties.
- 31 A is correct. The repo margin (the difference between the market value of the underlying collateral and the value of the loan) is a function of the supply and demand conditions of the collateral. The repo margin is typically lower if the underlying collateral is in short supply or if there is a high demand for it. B and C are incorrect because the repo margin is usually higher (not lower) when the maturity of the repurchase agreement is long and when the credit risk associated with the underlying collateral is high.

SOLUTIONS

- 1 B is correct. The bond price is closest to 101.36. The price is determined in the following manner:

$$PV = \frac{PMT}{(1+r)^1} + \frac{PMT}{(1+r)^2} + \frac{PMT + FV}{(1+r)^3}$$

where:

PV = present value, or the price of the bond

PMT = coupon payment per period

FV = future value paid at maturity, or the par value of the bond

r = market discount rate, or required rate of return per period

$$PV = \frac{5.5}{(1+0.05)^1} + \frac{5.5}{(1+0.05)^2} + \frac{5.5 + 100}{(1+0.05)^3}$$

$$PV = 5.24 + 4.99 + 91.13 = 101.36$$

- 2 C is correct. The bond price is closest to 98.11. The formula for calculating the price of this bond is:

$$PV = \frac{PMT}{(1+r)^1} + \frac{PMT + FV}{(1+r)^2}$$

where:

PV = present value, or the price of the bond

PMT = coupon payment per period

FV = future value paid at maturity, or the par value of the bond

r = market discount rate, or required rate of return per period

$$PV = \frac{3}{(1+0.04)^1} + \frac{3+100}{(1+0.04)^2} = 2.88 + 95.23 = 98.11$$

- 3 A is correct. The bond price is closest to 95.00. The bond has six semiannual periods. Half of the annual coupon is paid in each period with the required rate of return also being halved. The price is determined in the following manner:

$$PV = \frac{PMT}{(1+r)^1} + \frac{PMT}{(1+r)^2} + \frac{PMT}{(1+r)^3} + \frac{PMT}{(1+r)^4} + \frac{PMT}{(1+r)^5} + \frac{PMT + FV}{(1+r)^6}$$

where:

PV = present value, or the price of the bond

PMT = coupon payment per period

FV = future value paid at maturity, or the par value of the bond

r = market discount rate, or required rate of return per period

$$PV = \frac{4.5}{(1 + 0.055)^1} + \frac{4.5}{(1 + 0.055)^2} + \frac{4.5}{(1 + 0.055)^3} + \frac{4.5}{(1 + 0.055)^4} + \frac{4.5}{(1 + 0.055)^5} + \frac{4.5 + 100}{(1 + 0.055)^6}$$

$$PV = 4.27 + 4.04 + 3.83 + 3.63 + 3.44 + 75.79 = 95.00$$

- 4 B is correct. The bond price is closest to 96.28. The formula for calculating this bond price is:

$$PV = \frac{PMT}{(1 + r)^1} + \frac{PMT}{(1 + r)^2} + \frac{PMT}{(1 + r)^3} + \frac{PMT + FV}{(1 + r)^4}$$

where:

PV = present value, or the price of the bond

PMT = coupon payment per period

FV = future value paid at maturity, or the par value of the bond

r = market discount rate, or required rate of return per period

$$PV = \frac{2}{(1 + 0.03)^1} + \frac{2}{(1 + 0.03)^2} + \frac{2}{(1 + 0.03)^3} + \frac{2 + 100}{(1 + 0.03)^4}$$

$$PV = 1.94 + 1.89 + 1.83 + 90.62 = 96.28$$

- 5 B is correct. The bond price is closest to 112.54. The formula for calculating this bond price is:

$$PV = \frac{PMT}{(1 + r)^1} + \frac{PMT}{(1 + r)^2} + \frac{PMT}{(1 + r)^3} + \dots + \frac{PMT + FV}{(1 + r)^{14}}$$

where:

PV = present value, or the price of the bond

PMT = coupon payment per period

FV = future value paid at maturity, or the par value of the bond

r = market discount rate, or required rate of return per period

$$PV = \frac{2.5}{(1 + 0.015)^1} + \frac{2.5}{(1 + 0.015)^2} + \frac{2.5}{(1 + 0.015)^3} + \dots + \frac{2.5}{(1 + 0.015)^{13}} + \frac{2.5 + 100}{(1 + 0.015)^{14}}$$

$$PV = 2.46 + 2.43 + 2.39 + \dots + 2.06 + 83.21 = 112.54$$

- 6 B is correct. The price of the zero-coupon bond is closest to 51.67. The price is determined in the following manner:

$$PV = \frac{100}{(1 + r)^N}$$

where:

PV = present value, or the price of the bond

r = market discount rate, or required rate of return per period

N = number of evenly spaced periods to maturity

$$PV = \frac{100}{(1 + 0.045)^{15}}$$

$$PV = 51.67$$

- 7 B is correct. The price difference between Bonds A and B is closest to 3.77. One method for calculating the price difference between two bonds with an identical term to maturity is to use the following formula:

$$PV = \frac{PMT}{(1 + r)^1} + \frac{PMT}{(1 + r)^2}$$

where:

PV = price difference

PMT = coupon difference per period

r = market discount rate, or required rate of return per period

In this case the coupon difference is $(5\% - 3\%)$, or 2%.

$$PV = \frac{2}{(1 + 0.04)^1} + \frac{2}{(1 + 0.04)^2} = 1.92 + 1.85 = 3.77$$

- 8 A is correct. Bond A offers the lowest yield-to-maturity. When a bond is priced at a premium above par value the yield-to-maturity (YTM), or market discount rate is less than the coupon rate. Bond A is priced at a premium, so its YTM is below its 5% coupon rate. Bond B is priced at par value so its YTM is equal to its 6% coupon rate. Bond C is priced at a discount below par value, so its YTM is above its 5% coupon rate.
- 9 B is correct. Bond B will most likely experience the smallest percent change in price if market discount rates increase by 100 basis points. A higher-coupon bond has a smaller percentage price change than a lower-coupon bond when their market discount rates change by the same amount (the coupon effect). Also, a shorter-term bond generally has a smaller percentage price change than a longer-term bond when their market discount rates change by the same amount (the maturity effect). Bond B will experience a smaller percent change in price than Bond A because of the coupon effect. Bond B will also experience a smaller percent change in price than Bond C because of the coupon effect and the maturity effect.
- 10 B is correct. The bond price is most likely to change by less than 5%. The relationship between bond prices and market discount rate is not linear. The percentage price change is greater in absolute value when the market discount rate goes down than when it goes up by the same amount (the convexity effect). If a 100 basis point decrease in the market discount rate will cause the price of the bond to increase by 5%, then a 100 basis point increase in the market discount rate will cause the price of the bond to decline by an amount less than 5%.
- 11 B is correct. Generally, for two bonds with the same time-to-maturity, a lower coupon bond will experience a greater percentage price change than a higher coupon bond when their market discount rates change by the same amount. Bond B and Bond C have the same time-to-maturity (5 years); however, Bond B offers a lower coupon rate. Therefore, Bond B will likely experience a greater percentage change in price in comparison to Bond C.

12 A is correct. Bond A will likely experience the greatest percent change in price due to the coupon effect and the maturity effect. For two bonds with the same time-to-maturity, a lower-coupon bond has a greater percentage price change than a higher-coupon bond when their market discount rates change by the same amount. Generally, for the same coupon rate, a longer-term bond has a greater percentage price change than a shorter-term bond when their market discount rates change by the same amount. Relative to Bond C, Bond A and Bond B both offer the same lower coupon rate of 6%; however, Bond A has a longer time-to-maturity than Bond B. Therefore, Bond A will likely experience the greater percentage change in price if the market discount rates for all three bonds increase by 100 basis points.

13 A is correct. The bond price is closest to 101.93. The price is determined in the following manner:

$$PV = \frac{PMT}{(1 + Z_1)^1} + \frac{PMT + FV}{(1 + Z_2)^2}$$

where:

PV = present value, or the price of the bond

PMT = coupon payment per period

FV = future value paid at maturity, or the par value of the bond

Z_1 = spot rate, or the zero-coupon yield, for Period 1

Z_2 = spot rate, or the zero-coupon yield, for Period 2

$$PV = \frac{5}{(1 + 0.03)^1} + \frac{5 + 100}{(1 + 0.04)^2}$$

$$PV = 4.85 + 97.08 = 101.93$$

14 B is correct. The bond price is closest to 101.46. The price is determined in the following manner:

$$PV = \frac{PMT}{(1 + Z_1)^1} + \frac{PMT}{(1 + Z_2)^2} + \frac{PMT + FV}{(1 + Z_3)^3}$$

where:

PV = present value, or the price of the bond

PMT = coupon payment per period

FV = future value paid at maturity, or the par value of the bond

Z_1 = spot rate, or the zero-coupon yield, or zero rate, for period 1

Z_2 = spot rate, or the zero-coupon yield, or zero rate, for period 2

Z_3 = spot rate, or the zero-coupon yield, or zero rate, for period 3

$$PV = \frac{10}{(1 + 0.08)^1} + \frac{10}{(1 + 0.09)^2} + \frac{10 + 100}{(1 + 0.095)^3}$$

$$PV = 9.26 + 8.42 + 83.78 = 101.46$$

- 15** B is correct. The bond price is closest to 95.28. The formula for calculating this bond price is:

$$PV = \frac{PMT}{(1 + Z_1)^1} + \frac{PMT}{(1 + Z_2)^2} + \frac{PMT + FV}{(1 + Z_3)^3}$$

where:

PV = present value, or the price of the bond

PMT = coupon payment per period

FV = future value paid at maturity, or the par value of the bond

*Z*₁ = spot rate, or the zero-coupon yield, or zero rate, for period 1

*Z*₂ = spot rate, or the zero-coupon yield, or zero rate, for period 2

*Z*₃ = spot rate, or the zero-coupon yield, or zero rate, for period 3

$$PV = \frac{8}{(1 + 0.08)^1} + \frac{8}{(1 + 0.09)^2} + \frac{8 + 100}{(1 + 0.10)^3}$$

$$PV = 7.41 + 6.73 + 81.14 = 95.28$$

- 16** C is correct. The bond price is closest to 92.76. The formula for calculating this bond price is:

$$PV = \frac{PMT}{(1 + Z_1)^1} + \frac{PMT}{(1 + Z_2)^2} + \frac{PMT + FV}{(1 + Z_3)^3}$$

where:

PV = present value, or the price of the bond

PMT = coupon payment per period

FV = future value paid at maturity, or the par value of the bond

*Z*₁ = spot rate, or the zero-coupon yield, or zero rate, for period 1

*Z*₂ = spot rate, or the zero-coupon yield, or zero rate, for period 2

*Z*₃ = spot rate, or the zero-coupon yield, or zero rate, for period 3

$$PV = \frac{7}{(1 + 0.08)^1} + \frac{7}{(1 + 0.09)^2} + \frac{7 + 100}{(1 + 0.10)^3}$$

$$PV = 6.48 + 5.89 + 80.39 = 92.76$$

- 17** B is correct. The yield-to-maturity is closest to 9.92%. The formula for calculating the price of Bond Z is:

$$PV = \frac{PMT}{(1 + Z_1)^1} + \frac{PMT}{(1 + Z_2)^2} + \frac{PMT + FV}{(1 + Z_3)^3}$$

where:

PV = present value, or the price of the bond

PMT = coupon payment per period

FV = future value paid at maturity, or the par value of the bond

*Z*₁ = spot rate, or the zero-coupon yield, or zero rate, for period 1

*Z*₂ = spot rate, or the zero-coupon yield, or zero rate, for period 2

*Z*₃ = spot rate, or the zero-coupon yield, or zero rate, for period 3

$$PV = \frac{6}{(1 + 0.08)^1} + \frac{6}{(1 + 0.09)^2} + \frac{6 + 100}{(1 + 0.10)^3}$$

$$PV = 5.56 + 5.05 + 79.64 = 90.25$$

Using this price, the bond's yield-to-maturity can be calculated as:

$$PV = \frac{PMT}{(1 + r)^1} + \frac{PMT}{(1 + r)^2} + \frac{PMT + FV}{(1 + r)^3}$$

$$90.25 = \frac{6}{(1 + r)^1} + \frac{6}{(1 + r)^2} + \frac{6 + 100}{(1 + r)^3}$$

$$r = 9.92\%$$

- 18 A is correct. Bond dealers usually quote the flat price. When a trade takes place, the accrued interest is added to the flat price to obtain the full price paid by the buyer and received by the seller on the settlement date. The reason for using the flat price for quotation is to avoid misleading investors about the market price trend for the bond. If the full price were to be quoted by dealers, investors would see the price rise day after day even if the yield-to-maturity did not change. That is because the amount of accrued interest increases each day. Then after the coupon payment is made the quoted price would drop dramatically. Using the flat price for quotation avoids that misrepresentation. The full price, flat price plus accrued interest, is not usually quoted by bond dealers. Accrued interest is included in not added to the full price and bond dealers do not generally quote the full price.

- 19 B is correct. The bond's full price is 103.10. The price is determined in the following manner:

As of the beginning of the coupon period on 10 April 2014, there are 2.5 years (5 semiannual periods) to maturity. These five semiannual periods occur on 10 October 2014, 10 April 2015, 10 October 2015, 10 April 2016 and 10 October 2016.

$$PV = \frac{PMT}{(1 + r)^1} + \frac{PMT}{(1 + r)^2} + \frac{PMT}{(1 + r)^3} + \frac{PMT}{(1 + r)^4} + \frac{PMT + FV}{(1 + r)^5}$$

where:

PV = present value

PMT = coupon payment per period

FV = future value paid at maturity, or the par value of the bond

r = market discount rate, or required rate of return per period

$$PV = \frac{2.5}{(1 + 0.02)^1} + \frac{2.5}{(1 + 0.02)^2} + \frac{2.5}{(1 + 0.02)^3} + \frac{2.5}{(1 + 0.02)^4} + \frac{2.5 + 100}{(1 + 0.02)^5}$$

$$PV = 2.45 + 2.40 + 2.36 + 2.31 + 92.84 = 102.36$$

The accrued interest period is identified as 66/180. The number of days between 10 April 2014 and 16 June 2014 is 66 days based on the 30/360 day count convention. (This is 20 days remaining in April + 30 days in May + 16 days in June = 66 days total). The number of days between coupon periods is assumed to be 180 days using the 30/360 day convention.

$$PV^{Full} = PV \times (1 + r)^{66/180}$$

$$PV^{Full} = 102.36 \times (1.02)^{66/180} = 103.10$$

- 20** C is correct. The accrued interest per 100 of par value is closest to 0.92. The accrued interest is determined in the following manner: The accrued interest period is identified as 66/180. The number of days between 10 April 2014 and 16 June 2014 is 66 days based on the 30/360 day count convention. (This is 20 days remaining in April + 30 days in May + 16 days in June = 66 days total). The number of days between coupon periods is assumed to be 180 days using the 30/360 day convention.

$$\text{Accrued interest} = \frac{t}{T} \times PMT$$

where:

t = number of days from the last coupon payment to the settlement date

T = number of days in the coupon period

t/T = fraction of the coupon period that has gone by since the last payment

PMT = coupon payment per period

DS

$$\text{Accrued interest} = \frac{66}{180} \times \frac{5.00}{2} = 0.92$$

- 21** A is correct. The flat price of 102.18 is determined by subtracting the accrued interest (from question 20) from the full price (from question 19).

$$PV^{Flat} = PV^{Full} - \text{Accrued Interest}$$

$$PV^{Flat} = 103.10 - 0.92 = 102.18$$

- 22** B is correct. For bonds not actively traded or not yet issued, matrix pricing is a price estimation process that uses market discount rates based on the quoted prices of similar bonds (similar times-to-maturity, coupon rates, and credit quality).

- 23** A is correct. Matrix pricing is used in underwriting new bonds to get an estimate of the required yield spread over the benchmark rate. The benchmark rate is typically the yield-to-maturity on a government bond having the same, or close to the same, time-to-maturity. The spread is the difference between the yield-to-maturity on the new bond and the benchmark rate. The yield spread is the additional compensation required by investors for the difference in the credit risk, liquidity risk, and tax status of the bond relative to the government bond.

In matrix pricing, the market discount rates of comparable bonds and the yield-to-maturity on a government bond having a similar time-to-maturity are not estimated. Rather they are known and used to estimate the required yield spread of a new bond.

- 24 B is correct. The formula for calculating this bond's yield-to-maturity is:

$$PV = \frac{PMT}{(1+r)^1} + \frac{PMT}{(1+r)^2} + \frac{PMT}{(1+r)^3} + \cdots + \frac{PMT}{(1+r)^{39}} + \frac{PMT + FV}{(1+r)^{40}}$$

where:

PV = present value, or the price of the bond

PMT = coupon payment per period

FV = future value paid at maturity, or the par value of the bond

r = market discount rate, or required rate of return per period

$$111 = \frac{2.5}{(1+r)^1} + \frac{2.5}{(1+r)^2} + \frac{2.5}{(1+r)^3} + \cdots + \frac{2.5}{(1+r)^{39}} + \frac{2.5 + 100}{(1+r)^{40}}$$

$$r = 0.0209$$

To arrive at the annualized yield-to-maturity, the semiannual rate of 2.09% must be multiplied by two. Therefore, the yield-to-maturity is equal to $2.09\% \times 2 = 4.18\%$.

- 25 B is correct. The annual yield-to-maturity, stated for a periodicity of 12, is 7.21%. It is calculated as follows:

$$PV = \frac{FV}{(1+r)^N}$$

$$75 = \left(\frac{100}{(1+r)^{4 \times 12}} \right)$$

$$\frac{100}{75} = (1+r)^{48}$$

$$1.33333^{1/48} = [(1+r)^{48}]^{1/48}$$

$$1.33333^{0.02083} = (1+r)$$

$$1.00601 = (1+r)$$

$$1.00601 - 1 = r$$

$$0.00601 = r$$

$$r \times 12 = 0.07212, \text{ or approximately } 7.21\%$$

- 26 A is correct. The yield-to-maturity, stated for a periodicity of 12 (monthly periodicity), is 3.87%. The formula to convert an annual percentage rate (annual yield-to-maturity) from one periodicity to another is as follows:

$$\left(1 + \frac{APR_m}{m}\right)^m = \left(1 + \frac{APR_n}{n}\right)^n$$

$$\left(1 + \frac{0.03897}{2}\right)^2 = \left(1 + \frac{APR_{12}}{12}\right)^{12}$$

$$(1.01949)^2 = \left(1 + \frac{APR_{12}}{12}\right)^{12}$$

$$1.03935 = \left(1 + \frac{APR_{12}}{12}\right)^{12}$$

$$(1.03935)^{1/12} = \left[\left(1 + \frac{APR_{12}}{12}\right)^{12}\right]^{1/12}$$

$$1.00322 = \left(1 + \frac{APR_{12}}{12}\right)$$

$$1.00322 - 1 = \left(\frac{APR_{12}}{12}\right)$$

$$APR_{12} = 0.00322 \times 12 = 0.03865, \text{ or approximately } 3.87\%.$$

- 27 B is correct. The yield-to-maturity is 5.77%. The formula for calculating this bond's yield-to-maturity is:

$$PV = \frac{PMT}{(1+r)^1} + \frac{PMT}{(1+r)^2} + \frac{PMT}{(1+r)^3} + \cdots + \frac{PMT}{(1+r)^9} + \frac{PMT + FV}{(1+r)^{10}}$$

where:

PV = present value, or the price of the bond

PMT = coupon payment per period

FV = future value paid at maturity, or the par value of the bond

r = market discount rate, or required rate of return per period

$$101 = \frac{3}{(1+r)^1} + \frac{3}{(1+r)^2} + \frac{3}{(1+r)^3} + \cdots + \frac{3}{(1+r)^9} + \frac{3 + 100}{(1+r)^{10}}$$

$$r = 0.02883$$

To arrive at the annualized yield-to-maturity, the semiannual rate of 2.883% must be multiplied by two. Therefore, the yield-to-maturity is equal to $2.883\% \times 2 = 5.77\%$ (rounded).

- 28 C is correct. The yield-to-first-call is 6.25%. Given the first call date is exactly three years away, the formula for calculating this bond's yield-to-first-call is:

$$PV = \frac{PMT}{(1+r)^1} + \frac{PMT}{(1+r)^2} + \frac{PMT}{(1+r)^3} + \cdots + \frac{PMT}{(1+r)^5} + \frac{PMT + FV}{(1+r)^6}$$

where:

PV = present value, or the price of the bond

PMT = coupon payment per period

FV = call price paid at call date

r = market discount rate, or required rate of return per period

$$101 = \frac{3}{(1+r)^1} + \frac{3}{(1+r)^2} + \frac{3}{(1+r)^3} + \dots + \frac{3}{(1+r)^5} + \frac{3+102}{(1+r)^6}$$

$$r = 0.03123$$

To arrive at the annualized yield-to-first-call, the semiannual rate of 3.123% must be multiplied by two. Therefore, the yield-to-first-call is equal to $3.123\% \times 2 = 6.25\%$ (rounded).

- 29 C is correct. The yield-to-second-call is 5.94%. Given the second call date is exactly four years away, the formula for calculating this bond's yield-to-second-call is:

$$PV = \frac{PMT}{(1+r)^1} + \frac{PMT}{(1+r)^2} + \frac{PMT}{(1+r)^3} + \dots + \frac{PMT}{(1+r)^7} + \frac{PMT + FV}{(1+r)^8}$$

where:

PV = present value, or the price of the bond

PMT = coupon payment per period

FV = call price paid at call date

r = market discount rate, or required rate of return per period

$$101 = \frac{3}{(1+r)^1} + \frac{3}{(1+r)^2} + \frac{3}{(1+r)^3} + \dots + \frac{3}{(1+r)^7} + \frac{3+101}{(1+r)^8}$$

$$r = 0.0297$$

To arrive at the annualized yield-to-second-call, the semiannual rate of 2.97% must be multiplied by two. Therefore, the yield-to-second-call is equal to $2.97\% \times 2 = 5.94\%$.

- 30 B is correct. The yield-to-worst is 5.77%. The bond's yield-to-worst is the lowest of the sequence of yields-to-call and the yield-to-maturity. From above, we have the following yield measures for this bond:

Yield-to-first-call: 6.25%

Yield-to-second-call: 5.94%

Yield-to-maturity: 5.77%

Thus, the yield-to-worst is 5.77%.

- 31 B is correct. The discount or required margin is 236 basis points. Given the floater has a maturity of two years and is linked to 6-month Libor, the formula for calculating discount margin is:

$$PV = \frac{\frac{(Index + QM) \times FV}{m}}{\left(1 + \frac{Index + DM}{m}\right)^1} + \frac{\frac{(Index + QM) \times FV}{m}}{\left(1 + \frac{Index + DM}{m}\right)^2} + \dots + \frac{\frac{(Index + QM) \times FV}{m}}{\left(1 + \frac{Index + DM}{m}\right)^4} + FV$$

where:

PV = present value, or the price of the floating-rate note = 97

Index = reference rate, stated as an annual percentage rate = 0.01

QM = quoted margin, stated as an annual percentage rate = 0.0080

FV = future value paid at maturity, or the par value of the bond = 100

m = periodicity of the floating-rate note, the number of payment periods per year = 2

DM = discount margin, the required margin stated as an annual percentage rate

Substituting given values in:

$$97 = \frac{\frac{(0.01 + 0.0080) \times 100}{2}}{\left(1 + \frac{0.01 + DM}{2}\right)^1} + \frac{\frac{(0.01 + 0.0080) \times 100}{2}}{\left(1 + \frac{0.01 + DM}{2}\right)^2} + \dots + \frac{\frac{(0.01 + 0.0080) \times 100}{2}}{\left(1 + \frac{0.01 + DM}{2}\right)^4} + 100$$

$$97 = \frac{0.90}{\left(1 + \frac{0.01 + DM}{2}\right)^1} + \frac{0.90}{\left(1 + \frac{0.01 + DM}{2}\right)^2} + \frac{0.90}{\left(1 + \frac{0.01 + DM}{2}\right)^3} + \frac{0.90 + 100}{\left(1 + \frac{0.01 + DM}{2}\right)^4}$$

To calculate DM, begin by solving for the discount rate per period:

$$97 = \frac{0.90}{(1+r)^1} + \frac{0.90}{(1+r)^2} + \frac{0.90}{(1+r)^3} + \frac{0.90 + 100}{(1+r)^4}$$

$$r = 0.0168$$

Now, solve for DM:

$$\frac{0.01 + DM}{2} = 0.0168$$

$$DM = 0.0236$$

The discount margin for the floater is equal to 236 basis points.

- 32 A is correct. FRN X will be priced at a premium on the next reset date because the quoted margin of 0.40% is greater than the discount or required margin of 0.32%. The premium amount is the present value of the extra or “excess” interest payments of 0.08% each quarter (0.40% – 0.32%). FRN Y will be priced at par value on the next reset date since there is no difference between the quoted and discount margins. FRN Z will be priced at a discount since the quoted margin is less than the required margin.

- 33 C is correct. The bond equivalent yield is closest to 3.78%. It is calculated as:

$$AOR = \left(\frac{\text{Year}}{\text{Days}} \right) \times \left(\frac{FV - PV}{PV} \right)$$

where:

PV = present value, principal amount, or the price of the money market instrument

FV = future value, or the redemption amount paid at maturity including interest

Days = number of days between settlement and maturity

Year = number of days in the year

AOR = add-on rate, stated as an annual percentage rate (also, called bond equivalent yield).

$$AOR = \left(\frac{365}{350} \right) \times \left(\frac{100 - 96.5}{96.5} \right)$$

$$AOR = 1.04286 \times 0.03627$$

$$AOR = 0.03783 \text{ or approximately } 3.78\%$$

- 34 C is correct. The bond equivalent yield is closest to 4.40%. The present value of the banker's acceptance is calculated as:

$$PV = FV \times \left(1 - \frac{\text{Days}}{\text{Year}} \times DR \right)$$

where:

PV = present value, or price of the money market instrument

FV = future value paid at maturity, or face value of the money market instrument

Days = number of days between settlement and maturity

Year = number of days in the year

DR = discount rate, stated as an annual percentage rate

$$PV = 100 \times \left(1 - \frac{\text{Days}}{\text{Year}} \times DR \right)$$

$$PV = 100 \times \left(1 - \frac{180}{360} \times 0.0425 \right)$$

$$PV = 100 \times (1 - 0.02125)$$

$$PV = 100 \times 0.97875$$

$$PV = 97.875$$

The bond equivalent yield (AOR) is calculated as:

$$AOR = \left(\frac{\text{Year}}{\text{Days}} \right) \times \left(\frac{FV - PV}{PV} \right)$$

where:

PV = present value, principal amount, or the price of the money market instrument

FV = future value, or the redemption amount paid at maturity including interest

Days = number of days between settlement and maturity

Year = number of days in the year

AOR = add-on rate (bond equivalent yield), stated as an annual percentage rate

$$AOR = \left(\frac{365}{180} \right) \times \left(\frac{100 - PV}{PV} \right)$$

$$AOR = \left(\frac{365}{180} \right) \times \left(\frac{100 - 97.875}{97.875} \right)$$

$$AOR = 2.02778 \times 0.02171$$

$$AOR = 0.04402, \text{ or approximately } 4.40\%$$

Note that the PV is calculated using an assumed 360-day year and the AOR (bond equivalent yield) is calculated using a 365-day year.

- 35 B is correct. All bonds on a par curve are assumed to have similar, not different, credit risk. Par curves are obtained from spot curves and all bonds used to derive the par curve are assumed to have the same credit risk, as well as the same periodicity, currency, liquidity, tax status, and annual yields. A par curve is a sequence of yields-to-maturity such that each bond is priced at par value.
- 36 B is correct. The spot curve, also known as the strip or zero curve, is the yield curve constructed from a sequence of yields-to-maturities on zero-coupon bonds. The par curve is a sequence of yields-to-maturity such that each bond is priced at par value. The forward curve is constructed using a series of forward rates, each having the same timeframe.
- 37 B is correct. The forward rate can be interpreted to be the incremental or marginal return for extending the time-to-maturity of an investment for an additional time period. The add-on rate (bond equivalent yield) is a rate quoted for money market instruments such as bank certificates of deposit and indexes such as Libor and Euribor. Yield-to-maturity is the internal rate of return on the bond's cash flows—the uniform interest rate such that when the bond's future cash flows are discounted at that rate, the sum of the present values equals the price of the bond. It is the implied market discount rate.
- 38 B is correct. The 3 year implied spot rate is closest to 1.94%. It is calculated as the geometric average of the one-year forward rates:

$$(1.0080 \times 1.0112 \times 1.0394) = (1 + z_3)^3$$

$$1.05945 = (1 + z_3)^3$$

$$[1.05945]^{1/3} = [(1 + z_3)^3]^{1/3}$$

$$1.01944 = 1 + z_3$$

$$1.01944 - 1 = z_3$$

$$0.01944 = z_3, z_3 = 1.944\% \text{ or approximately } 1.94\%$$

- 39 B is correct. The value per 100 of par value is closest to 105.01. Using the forward curve, the bond price is calculated as follows:

$$\frac{3.5}{1.0080} + \frac{103.5}{(1.0080 \times 1.0112)} = 3.47 + 101.54 = 105.01$$

- 40 C is correct. The spread component of a specific bond's yield-to-maturity is least likely impacted by changes in inflation of its currency of denomination. The effect of changes in macroeconomic factors, such as the expected rate of inflation in the currency of denomination, is seen mostly in changes in the benchmark yield. The spread or risk premium component is impacted by microeconomic factors specific to the bond and bond issuer including tax status and quality rating.

- 41 A is correct. The I-spread, or interpolated spread, is the yield spread of a specific bond over the standard swap rate in that currency of the same tenor. The yield spread in basis points over an actual or interpolated government bond is known as the G-spread. The Z-spread (zero-volatility spread) is the constant spread such that is added to each spot rate such that the present value of the cash flows matches the price of the bond.
- 42 B is correct. The G-spread is closest to 285 bps. The benchmark rate for UK fixed-rate bonds is the UK government benchmark bond. The Euro interest rate spread benchmark is used to calculate the G-spread for Euro-denominated corporate bonds, not UK bonds. The G-spread is calculated as follows:

Yield-to-maturity on the UK corporate bond:

$$100.65 = \frac{5}{(1+r)^1} + \frac{5}{(1+r)^2} + \frac{105}{(1+r)^3}, r = 0.04762 \text{ or } 476 \text{ bps}$$

Yield-to-maturity on the UK government benchmark bond:

$$100.25 = \frac{2}{(1+r)^1} + \frac{2}{(1+r)^2} + \frac{102}{(1+r)^3}, r = 0.01913 \text{ or } 191 \text{ bps}$$

The G-spread is $476 - 191 = 285$ bps.

- 43 A is correct. The value of the bond is closest to 92.38. The calculation is:

$$\begin{aligned} PV &= \frac{PMT}{(1+z_1+Z)^1} + \frac{PMT}{(1+z_2+Z)^2} + \frac{PMT+FV}{(1+z_3+Z)^3} \\ &= \frac{5}{(1+0.0486+0.0234)^1} + \frac{5}{(1+0.0495+0.0234)^2} + \frac{105}{(1+0.0565+0.0234)^3} \\ &= \frac{5}{1.0720} + \frac{5}{1.15111} + \frac{105}{1.25936} = 4.66 + 4.34 + 83.38 = 92.38 \end{aligned}$$

- 44 C is correct. The option value in basis points per year is subtracted from the Z-spread to calculate the option-adjusted spread (OAS). The Z-spread is the constant yield spread over the benchmark spot curve. The I-spread is the yield spread of a specific bond over the standard swap rate in that currency of the same tenor.

SOLUTIONS

- 1 B is correct. Securitization increases the funds available for banks to lend because it allows banks to remove loans from their balance sheets and issue bonds that are backed by those loans. Securitization repackages relatively simple debt obligations, such as bank loans, into more complex, not simpler, structures. Securitization involves transferring ownership of assets from the original owner—in this case, the banks—into a special legal entity. As a result, banks do not maintain ownership of the securitized assets.
- 2 C is correct. By removing the wall between ultimate investors and originating borrowers, investors can achieve better legal claims on the underlying mortgages and portfolios of receivables. This transparency allows investors to tailor interest rate risk and credit risk to their specific needs.
- 3 C is correct. Securitization allows for the creation of tradable securities with greater liquidity than the original loans on a bank's balance sheet. Securitization results in lessening the roles of intermediaries, which increases disintermediation. Securitization is a process in which relatively simple debt obligations, such as loans, are repackaged into more complex structures.
- 4 A is correct. In a securitization, the special purpose entity (SPE) is the special legal entity responsible for the issuance of the asset-backed securities. The servicer, not the SPE, is responsible for both the collection of payments from the borrowers and the recovery of underlying assets if the borrowers default on their loans.
- 5 C is correct. The first €25 (€5 + €20) million in default are absorbed by the subordinated classes (C and B). The senior Class A bonds will only experience a loss when defaults exceed €25 million.
- 6 A is correct. Time tranching is the process in which a set of bond classes or tranches is created that allow investors a choice in the type of prepayment risk, extension or contraction, that they prefer to bear. Senior and subordinated bond classes are used in credit tranching. Credit tranching structures allow investors to choose the amount of credit risk that they prefer to bear. Fully and partially amortizing loans are two types of amortizing loans.
- 7 C is correct. In a partially amortizing loan, the sum of all the scheduled principal repayments is less than the amount borrowed. The last payment is for the remaining unpaid mortgage balance and is called the "balloon payment."
- 8 B is correct. Contraction risk is the risk that when interest rates decline, actual prepayments will be higher than forecasted. Extension risk is the risk that when interest rates rise, prepayments will be lower than forecasted. Yield maintenance results from prepayment penalties; the lender is protected from loss in yield by the imposition of prepayment penalties.
- 9 A is correct. In a recourse loan, the lender has a claim against the borrower for the shortfall between the amount of the mortgage balance outstanding and the proceeds received from the sale of the property. A prepayment option is a benefit to the borrower and would thus not offer protection to the lender. An interest-only mortgage requires no principal repayment for a number of years and will not protect the lender from strategic default by the borrower.
- 10 B is correct. Bank Nederlandse has a claim against Marolf for 1.5 million EUR, the shortfall between the amount of the mortgage balance outstanding and the proceeds received from the sale of the property. This indicates that the mortgage loan is a recourse loan. The recourse/non-recourse feature indicates the

rights of a lender in foreclosure. If Marolf had a non-recourse loan, the bank would have only been entitled to the proceeds from the sale of the underlying property, or 2.5 million EUR. A bullet loan is a special type of interest-only mortgage for which there are no scheduled principal payments over the entire term of the loan. Since the unpaid balance is less than the original mortgage loan, it is unlikely that Marolf has an interest only mortgage.

- 11 A is correct. Because the loan has a non-recourse feature, the lender can only look to the underlying property to recover the outstanding mortgage balance and has no further claim against the borrower. The lender is simply entitled to foreclose on the home and sell it.
- 12 A is correct. Non-agency RMBS are credit enhanced, either internally or externally, to make the securities more attractive to investors. The most common forms of internal credit enhancements are senior/subordinated structures, reserve accounts, and overcollateralization. Conforming mortgages are used as collateral for agency (not non-agency) mortgage pass-through securities. An agency RMBS, rather than a non-agency RMBS, issued by a GSE (government sponsored enterprise), is guaranteed by the respective GSE.
- 13 B is correct. Extension risk is the risk that when interest rate rise, fewer prepayments will occur. Homeowners will be reluctant to give up the benefit of a contractual interest rate that is lower. As a result, the mortgage pass-through security becomes longer in maturity than anticipated at the time of purchase.
- 14 C is correct. Using CMOs, securities can be created to closely satisfy the asset/liability needs of institutional investors. The creation of a CMO cannot eliminate prepayment risk; it can only distribute the various forms of this risk among various classes of bondholders. The collateral of CMOs are mortgage-related products, not the mortgages themselves.
- 15 C is correct. For a CMO with multiple sequential-pay tranches, the longest-term tranche will have the lowest contraction (prepayments greater than forecasted) risk because of the protection against this risk offered by the other tranches. The longest-term tranche is likely to have the highest average life and extension risk because it is the last tranche repaid in a sequential-pay tranche.
- 16 A is correct. PAC tranches have limited (but not complete) protection against both extension risk and contraction risk. This protection is provided by the support tranches. A sequential-pay tranche can protect against either extension risk or contraction risk but not both of these risks. The CMO structure with sequential-pay tranches allows investors concerned about extension risk to invest in shorter-term tranches and those concerned about contraction risk to invest in the longer-term tranches.
- 17 C is correct. The greater predictability of cash flows provided in the planned amortization class (PAC) tranches comes at the expense of support tranches. As a result, investors in support tranches are exposed to higher extension risk and contraction risk than investors in PAC tranches. Investors will be compensated for bearing this risk because support tranches have a higher expected return than PAC tranches.
- 18 B is correct. CPR is an annualized rate, which indicates the percentage of the outstanding mortgage pool balance at the beginning of the year that is expected to be prepaid by the end of the year.
- 19 C is correct. When interest rates decline, a mortgage pass-through security is subject to contraction risk. Contraction risk is the risk that when interest rates decline, actual prepayments will be higher than forecasted because borrowers

will refinance at now-available lower interest rates. Thus, a security backed by mortgages will have a shorter maturity than was anticipated when the security was purchased.

- 20 A is correct. If commercial mortgage loans are non-recourse loans, the lender can only look to the income-producing property backing the loan for interest and principal repayment. If there is a default, the lender looks to the proceeds from the sale of the property for repayment and has no recourse against the borrower for any unpaid mortgage loan balance. Call protection and prepayment penalty points protect against prepayment risk.
- 21 A is correct. With CMBS, investors have considerable call protection. An investor in a RMBS is exposed to considerable prepayment risk, but with CMBS, call protection is available to the investor at the structure and loan level. The call protection results in CMBS trading in the market more like a corporate bond than a RMBS. Both internal credit enhancement and the debt-service-coverage (DSC) ratio address credit risk, not prepayment risk.
- 22 A is correct. If specific ratios of debt to service coverage are needed, and those ratios cannot be met at the loan level, subordination is used to achieve the desired credit rating. Call protection protects investors against prepayment risk. Balloon payments increase the risk of the underlying loans.
- 23 B is correct. In a non-recourse CMBS, the lender can look only to the income-producing property backing the loan for interest and principal repayment. If a default occurs, the lender can use only the proceeds from the sale of the property for repayment and has no recourse to the borrower for any unpaid balance.
- 24 B is correct. A critical feature that differentiates CMBSs from RMBSs is the call protection provided to investors. An investor in a RMBS is exposed to considerable prepayment risk because the borrower has the right to prepay the loan before maturity. CMBSs provide investors with considerable call protection that comes either at the structure level or at the loan level.
- 25 A is correct. An excess spread account, sometimes called excess interest cash flow, is a form of internal credit enhancement that limits credit risk. It is an amount that can be retained and deposited into a reserve account and that can serve as a first line of protection against losses. An excess spread account does not limit prepayment risk, extension, or contraction.
- 26 C is correct. During the lockout period, the cash flow that is paid out to owners of credit card receivable asset-backed securities is based only on finance charges collected and fees.
- 27 B is correct. CMOs are designed to redistribute cash flows of mortgage-related products to different bond classes or tranches through securitization. Although CMOs do not eliminate prepayment risk, they distribute prepayment risk among various classes of bondholders.

SOLUTIONS

- 1 A is correct. A capital gain is least likely to contribute to the investor's total return. There is no capital gain (or loss) because the bond is held to maturity. The carrying value of the bond at maturity is par value, the same as the redemption amount. When a fixed-rate bond is held to its maturity, the investor receives the principal payment at maturity. This principal payment is a source of return for the investor. A fixed-rate bond pays periodic coupon payments, and the reinvestment of these coupon payments is a source of return for the investor. The investor's total return is the redemption of principal at maturity and the sum of the reinvested coupons.
- 2 C is correct. Because the fixed-rate bond is held to maturity (a "buy-and-hold" investor), interest rate risk arises entirely from changes in coupon reinvestment rates. Higher interest rates increase income from reinvestment of coupon payments, and lower rates decrease income from coupon reinvestment. There will not be a capital gain or loss because the bond is held until maturity. The carrying value at the maturity date is par value, the same as the redemption amount. The redemption of principal does not expose the investor to interest rate risk. The risk to a bond's principal is credit risk.
- 3 A is correct. Capital gains (losses) arise if a bond is sold at a price above (below) its constant-yield price trajectory. A point on the trajectory represents the carrying value of the bond at that time. That is, the capital gain/loss is measured from the bond's carrying value, the point on the constant-yield price trajectory, and not from the original purchase price. The carrying value is the original purchase price plus the amortized amount of the discount if the bond is purchased at a price below par value. If the bond is purchased at a price above par value, the carrying value is the original purchase price minus (not plus) the amortized amount of the premium. The amortized amount for each year is the change in the price between two points on the trajectory.
- 4 C is correct. The future value of reinvested cash flows at 8% after five years is closest to 41.07 per 100 of par value.

$$\left[7 \times (1.08)^4\right] + \left[7 \times (1.08)^3\right] + \left[7 \times (1.08)^2\right] + \left[7 \times (1.08)^1\right] + 7 = 41.0662$$

The 6.07 difference between the sum of the coupon payments over the five-year holding period (35) and the future value of the reinvested coupons (41.07) represents the "interest-on-interest" gain from compounding.

- 5 B is correct. The capital loss is closest to 3.31 per 100 of par value. After five years, the bond has four years remaining until maturity and the sale price of the bond is 96.69, calculated as:

$$\frac{7}{(1.08)^1} + \frac{7}{(1.08)^2} + \frac{7}{(1.08)^3} + \frac{107}{(1.08)^4} = 96.69$$

The investor purchased the bond at a price equal to par value (100). Because the bond was purchased at a price equal to its par value, the carrying value is par value. Therefore, the investor experienced a capital loss of $96.69 - 100 = -3.31$.

- 6 B is correct. The investor's five-year horizon yield is closest to 6.62%. After five years, the sale price of the bond is 96.69 (from problem 5) and the future value of reinvested cash flows at 8% is 41.0662 (from problem 4) per 100 of par value. The total return is 137.76 (= 41.07 + 96.69), resulting in a realized five-year horizon yield of 6.62%:

$$100.00 = \frac{137.76}{(1+r)^5}, \quad r = 0.0662$$

- 7 A is correct. The bond's approximate modified duration is closest to 2.78. Approximate modified duration is calculated as:

$$\text{ApproxModDur} = \frac{(PV_-) - (PV_+)}{2 \times (\Delta \text{Yield}) \times (PV_0)}$$

Lower yield-to-maturity by 5 bps to 2.95%:

$$PV_- = \frac{5}{(1+0.0295)^1} + \frac{5}{(1+0.0295)^2} + \frac{5+100}{(1+0.0295)^3} = 105.804232$$

Increase yield-to-maturity by 5 bps to 3.05%:

$$PV_+ = \frac{5}{(1+0.0305)^1} + \frac{5}{(1+0.0305)^2} + \frac{5+100}{(1+0.0305)^3} = 105.510494$$

$$PV_0 = 105.657223, \Delta \text{Yield} = 0.0005$$

$$\text{ApproxModDur} = \frac{105.804232 - 105.510494}{2 \times 0.0005 \times 105.657223} = 2.78$$

- 8 C is correct. A bond's modified duration cannot be larger than its Macaulay duration. The formula for modified duration is:

$$\text{ModDur} = \frac{\text{MacDur}}{1+r}$$

where r is the bond's yield-to-maturity per period. A bond's yield-to-maturity has an effective lower bound of 0, and thus the denominator $1+r$ term has a lower bound of 1. Therefore, ModDur will typically be less than MacDur.

Effective duration is a measure of curve duration. Modified duration is a measure of yield duration.

- 9 C is correct. The bond's Macaulay duration is closest to 2.83. Macaulay duration (MacDur) is a weighted average of the times to the receipt of cash flow. The weights are the shares of the full price corresponding to each coupon and principal payment.

Period	Cash Flow	Present Value	Weight	Period × Weight
1	6	5.555556	0.058575	0.058575
2	6	5.144033	0.054236	0.108472
3	106	84.146218	0.887190	2.661570
		94.845806	1.000000	2.828617

Thus, the bond's Macaulay duration (MacDur) is 2.83.

Alternatively, Macaulay duration can be calculated using the following closed-form formula:

$$\text{MacDur} = \left\{ \frac{1+r}{r} - \frac{1+r + [N \times (c-r)]}{c \times [(1+r)^N - 1] + r} \right\} - (t/T)$$

$$\text{MacDur} = \left\{ \frac{1.08}{0.08} - \frac{1.08 + [3 \times (0.06 - 0.08)]}{0.06 \times [(1.08)^3 - 1] + 0.08} \right\} - 0$$

$$\text{MacDur} = 13.50 - 10.67 = 2.83$$

- 10 A is correct. The interest rate risk of a fixed-rate bond with an embedded call option is best measured by effective duration. A callable bond's future cash flows are uncertain because they are contingent on future interest rates. The issuer's decision to call the bond depends on future interest rates. Therefore, the yield-to-maturity on a callable bond is not well defined. Only effective duration, which takes into consideration the value of the call option, is the appropriate interest rate risk measure. Yield durations like Macaulay and modified durations are not relevant for a callable bond because they assume no changes in cash flows when interest rates change.
- 11 A is correct. Key rate duration is used to measure a bond's sensitivity to a shift at one or more maturity segments of the yield curve which result in a change to yield curve shape. Modified and effective duration measure a bond's sensitivity to parallel shifts in the entire curve.
- 12 B is correct. The effective duration of the pension fund's liabilities is closest to 14.99. The effective duration is calculated as follows:

$$\text{EffDur} = \frac{(PV_-) - (PV_+)}{2 \times (\Delta\text{Curve}) \times (PV_0)}$$

$$PV_0 = 455.4, PV_+ = 373.6, PV_- = 510.1, \text{ and } \Delta\text{Curve} = 0.0100.$$

$$\text{EffDur} = \frac{510.1 - 373.6}{2 \times 0.0100 \times 455.4} = 14.99$$

- 13 B is correct. A bond's yield-to-maturity is inversely related to its Macaulay duration: The higher the yield-to-maturity, the lower its Macaulay duration and the lower the interest rate risk. A higher yield-to-maturity decreases the weighted average of the times to the receipt of cash flow, and thus decreases the Macaulay duration.

A bond's coupon rate is inversely related to its Macaulay duration: The lower the coupon, the greater the weight of the payment of principal at maturity. This results in a higher Macaulay duration. Zero-coupon bonds do not pay periodic coupon payments; therefore, the Macaulay duration of a zero-coupon bond is its time-to-maturity.

- 14 A is correct. The presence of an embedded put option reduces the effective duration of the bond, especially when rates are rising. If interest rates are low compared with the coupon rate, the value of the put option is low and the impact of the change in the benchmark yield on the bond's price is very similar to the impact on the price of a non-putable bond. But when benchmark interest rates rise, the put option becomes more valuable to the investor. The ability to

sell the bond at par value limits the price depreciation as rates rise. The presence of an embedded put option reduces the sensitivity of the bond price to changes in the benchmark yield, assuming no change in credit risk.

- 15 A is correct. The portfolio's modified duration is closest to 7.62. Portfolio duration is commonly estimated as the market-value-weighted average of the yield durations of the individual bonds that compose the portfolio.

The total market value of the bond portfolio is $170,000 + 120,000 + 100,000 = 390,000$.

The portfolio duration is $5.42 \times (170,000/390,000) + 8.44 \times (120,000/390,000) + 10.38 \times (100,000/390,000) = 7.62$.

- 16 A is correct. A limitation of calculating a bond portfolio's duration as the weighted average of the yield durations of the individual bonds is that this measure implicitly assumes a parallel shift to the yield curve (all rates change by the same amount in the same direction). In reality, interest rate changes frequently result in a steeper or flatter yield curve. This approximation of the "theoretically correct" portfolio duration is *more* accurate when the yield curve is flatter (less steeply sloped). An advantage of this approach is that it can be used with portfolios that include bonds with embedded options. Bonds with embedded options can be included in the weighted average using the effective durations for these securities.

- 17 B is correct. Bond B has the greatest money duration per 100 of par value. Money duration (MoneyDur) is calculated as the annual modified duration (AnnModDur) times the full price (PV^{Full}) of the bond including accrued interest. Bond B has the highest money duration per 100 of par value.

$$\text{MoneyDur} = \text{AnnModDur} \times PV^{Full}$$

$$\text{MoneyDur of Bond A} = 5.42 \times 85.00 = 460.70$$

$$\text{MoneyDur of Bond B} = 8.44 \times 80.00 = 675.20$$

$$\text{MoneyDur of Bond C} = 7.54 \times 85.78 = 646.78$$

- 18 B is correct. The PVBP is closest to 0.0648. The formula for the price value of a basis point is:

$$\text{PVBP} = \frac{(PV_-) - (PV_+)}{2}$$

where:

PVBP = price value of a basis point

PV_- = full price calculated by lowering the yield-to-maturity by one basis point

PV_+ = full price calculated by raising the yield-to-maturity by one basis point

Lowering the yield-to-maturity by one basis point to 4.99% results in a bond price of 85.849134:

$$PV_- = \frac{3}{(1 + 0.0499)^1} + \cdots + \frac{3 + 100}{(1 + 0.0499)^9} = 85.849134$$

Increasing the yield-to-maturity by one basis point to 5.01% results in a bond price of 85.719638:

$$PV_+ = \frac{3}{(1 + 0.0501)^1} + \cdots + \frac{3 + 100}{(1 + 0.0501)^9} = 85.719638$$

$$PVBP = \frac{85.849134 - 85.719638}{2} = 0.06475$$

Alternatively, the PVBP can be derived using modified duration:

$$\text{ApproxModDur} = \frac{(PV_-) - (PV_+)}{2 \times (\Delta \text{Yield}) \times (PV_0)}$$

$$\text{ApproxModDur} = \frac{85.849134 - 85.719638}{2 \times 0.0001 \times 85.784357} = 7.548$$

$$PVBP = 7.548 \times 85.784357 \times 0.0001 = 0.06475$$

- 19 B is correct. Convexity measures the “second order” effect on a bond’s percentage price change given a change in yield-to-maturity. Convexity adjusts the percentage price change estimate provided by modified duration to better approximate the true relationship between a bond’s price and its yield-to-maturity which is a curved line (convex). Duration estimates the change in the bond’s price along the straight line that is tangent to this curved line (“first order” effect). Yield volatility measures the magnitude of changes in the yields along the yield curve.
- 20 B is correct. The bond’s approximate convexity is closest to 70.906. Approximate convexity (ApproxCon) is calculated using the following formula:

$$\text{ApproxCon} = [PV_- + PV_+ - (2 \times PV_0)] / (\Delta \text{Yield}^2 \times PV_0)$$

where:

PV = new price when the yield-to-maturity is decreased

PV_+ = new price when the yield-to-maturity is increased

PV_0 = original price

ΔYield = change in yield-to-maturity

$$\text{ApproxCon} = [98.782 + 98.669 - (2 \times 98.722)] / (0.001^2 \times 98.722) = 70.906$$

- 21 C is correct. The expected percentage price change is closest to 1.78%. The convexity-adjusted percentage price change for a bond given a change in the yield-to-maturity is estimated by:

$$\% \Delta PV^{Full} \approx [-\text{AnnModDur} \times \Delta \text{Yield}] + [0.5 \times \text{AnnConvexity} \times (\Delta \text{Yield})^2]$$

$$\% \Delta PV^{Full} \approx [-7.020 \times (-0.0025)] + [0.5 \times 65.180 \times (-0.0025)^2] = 0.017754, \text{ or } 1.78\%$$

- 22 B is correct. The expected percentage price change is closest to -3.49%. The convexity-adjusted percentage price change for a bond given a change in the yield-to-maturity is estimated by:

$$\% \Delta PV^{Full} \approx [-\text{AnnModDur} \times \Delta \text{Yield}] + [0.5 \times \text{AnnConvexity} \times (\Delta \text{Yield})^2]$$

$$\% \Delta PV^{Full} \approx [-7.140 \times 0.005] + [0.5 \times 66.200 \times (0.005)^2] = -0.034873, \text{ or } -3.49\%$$

- 23 B is correct. If the term structure of yield volatility is downward-sloping, then short-term bond yields-to-maturity have greater volatility than for long-term bonds. Therefore, long-term yields are more stable than short-term yields. Higher volatility in short-term rates does not necessarily mean that the level of short-term rates is higher than long-term rates. With a downward-sloping term structure of yield volatility, short-term bonds will not always experience greater price fluctuation than long-term bonds. The estimated percentage change in a bond price depends on the modified duration and convexity as well as on the yield-to-maturity change.
- 24 C is correct. When the holder of a bond experiences a one-time parallel shift in the yield curve, the Macaulay duration statistic identifies the number of years necessary to hold the bond so that the losses (or gains) from coupon reinvestment offset the gains (or losses) from market price changes. The duration gap is the difference between the Macaulay duration and the investment horizon. Modified duration approximates the percentage price change of a bond given a change in its yield-to-maturity.
- 25 C is correct. The duration gap is equal to the bond's Macaulay duration minus the investment horizon. In this case, the duration gap is positive, and price risk dominates coupon reinvestment risk. The investor risk is to higher rates. The investor is hedged against interest rate risk if the duration gap is zero; that is, the investor's investment horizon is equal to the bond's Macaulay duration. The investor is at risk of lower rates only if the duration gap is negative; that is, the investor's investment horizon is greater than the bond's Macaulay duration. In this case, coupon reinvestment risk dominates market price risk.
- 26 C is correct. The duration gap is closest to 4.158. The duration gap is a bond's Macaulay duration minus the investment horizon. The approximate Macaulay duration is the approximate modified duration times one plus the yield-to-maturity. It is 12.158 ($= 11.470 \times 1.06$). Given an investment horizon of eight years, the duration gap for this bond at purchase is positive: $12.158 - 8 = 4.158$. When the investment horizon is less than the Macaulay duration of the bond, the duration gap is positive, and price risk dominates coupon reinvestment risk.
- 27 A is correct. The price increase was most likely caused by a decrease in the bond's credit spread. The ratings upgrade most likely reflects a lower expected probability of default and/or a greater level of recovery of assets if default occurs. The decrease in credit risk results in a smaller credit spread. The increase in the bond price reflects a decrease in the yield-to-maturity due to a smaller credit spread. The change in the bond price was not due to a change in liquidity risk or an increase in the benchmark rate.

SOLUTIONS

- 1 A is correct. Credit migration risk or downgrade risk refers to the risk that a bond issuer's creditworthiness may deteriorate or migrate lower. The result is that investors view the risk of default to be higher, causing the spread on the issuer's bonds to widen.
- 2 C is correct. Market liquidity risk refers to the risk that the price at which investors transact may be different from the price indicated in the market. Market liquidity risk is increased by (1) less debt outstanding and/or (2) a lower issue credit rating. Because Stedsmart Ltd is comparable to Fignermeo Ltd except for less publicly traded debt outstanding, it should have higher market liquidity risk.
- 3 A is correct. First mortgage debt is senior secured debt and has the highest priority of claims. First mortgage debt also has the highest expected recovery rate. First mortgage debt refers to the pledge of specific property. Neither senior unsecured nor junior subordinate debt has any claims on specific assets.
- 4 B is correct. Whether or not secured assets are sufficient for the claims against them does not influence priority of claims. Any deficiency between pledged assets and the claims against them becomes senior unsecured debt and still adheres to the guidelines of priority of claims.
- 5 C is correct. Both analysts and ratings agencies have difficulty foreseeing future debt-financed acquisitions.
- 6 C is correct. Goodwill is viewed as a lower quality asset compared with tangible assets that can be sold and more easily converted into cash.
- 7 C is correct. The value of assets in relation to the level of debt is important to assess the collateral of the company; that is, the quality and value of the assets that support the debt levels of the company.
- 8 B is correct. The growth prospects of the industry provide the analyst insight regarding the capacity of the company.
- 9 A is correct. The construction company is both highly leveraged, which increases credit risk, and in a highly cyclical industry, which results in more volatile earnings.
- 10 B is correct. The interest expense is €113 million and EBITDA = Operating profit + Depreciation and amortization = €894 + 249 million = €1,143 million. EBITDA interest coverage = EBITDA/Interest expense = 1,143/113 = 10.12 times.
- 11 B is correct. Total debt is €1,613 million with Total capital = Total debt + Shareholders' equity = €1,613 + 4,616 = €6,229 million. The Debt/Capital ratio = 1,613/6,229 = 25.90%.
- 12 A is correct. If the debt of the company remained unchanged but FFO increased, more cash is available to service debt compared to the previous year. Additionally, the debt/capital ratio has improved. It would imply that the ability of Pay Handle Ltd to service their debt has improved.
- 13 A is correct. Based on four of the five credit ratios, Grupa Zywiec SA's credit quality is superior to that of the industry.
- 14 A is correct. Davide Campari-Milano S.p.A. has more financial leverage and less interest coverage than Associated British Foods plc, which implies greater credit risk.

- 15 C is correct. Low demand implies wider yield spreads, while heavy supply will widen spreads even further.
- 16 C is correct. Credit risk is the risk of loss resulting from the borrower failing to make full and timely payments of interest and/or principal.
- 17 C is correct. Market liquidity risk is the risk that the price at which investors can actually transact—buying or selling—may differ from the price indicated in the market.
- 18 C is correct. Loss severity is the portion of a bond's value (including unpaid interest) an investor loses in the event of default.
- 19 B is correct. The two components of credit risk are default probability and loss severity. In the event of default, loss severity is the portion of a bond's value (including unpaid interest) an investor loses. A and C are incorrect because spread and market liquidity risk are credit-related risks, not components of credit risk.
- 20 A is correct. Credit risk has two components: default risk and loss severity. Because default risk is quite low for most high-quality debt issuers, bond investors tend to focus more on this likelihood and less on the potential loss severity.
- 21 B is correct. The expected loss for a given debt instrument is the default probability multiplied by the loss severity given default. The loss severity is often expressed as $(1 - \text{Recovery rate})$.
- 22 A is correct. Senior subordinated debt is ranked lower than senior unsecured debt and thus has a lower priority of payment.
- 23 C is correct. The highest-ranked unsecured debt is senior unsecured debt. Lower-ranked debt includes senior subordinated debt. A and B are incorrect because mortgage debt and second lien loans are secured and higher ranked.
- 24 C is correct. According to the absolute priority of claims, in the event of bankruptcy, creditors with a secured claim have the right to the value of that specific property before any other claim.
- 25 A is correct. A second lien has a secured interest in the pledged assets. Second lien debt ranks higher in priority of payment than senior unsecured and senior subordinated debt and thus would most likely have a higher recovery rate.
- 26 A is correct. Notching is the process for moving ratings up or down relative to the issuer rating when rating agencies consider secondary factors, such as priority of claims in the event of a default and the potential loss severity.
- 27 C is correct. Structural subordination can arise when a corporation with a holding company structure has debt at both its parent holding company and operating subsidiaries. Debt at the operating subsidiaries is serviced by the cash flow and assets of the subsidiaries before funds are passed to the parent holding company.
- 28 C is correct. The issuer credit rating usually applies to its senior unsecured debt.
- 29 A is correct. Second lien debt is secured debt, which is senior to unsecured debt and to subordinated debt.
- 30 C is correct. An issuer credit rating usually applies to its senior unsecured debt.
- 31 A is correct. Recognizing different payment priorities, and thus the potential for higher (or lower) loss severity in the event of default, the rating agencies have adopted a notching process whereby their credit ratings on issues can be moved up or down from the issuer rating (senior unsecured).

- 32** C is correct. As a general rule, the higher the senior unsecured rating, the smaller the notching adjustment. Thus, for corporate bonds rated Aa2/AA, the rating agencies will typically apply smaller rating adjustments, or notches, to the related issue.
- 33** A is correct. Credit migration is the risk that a bond issuer's creditworthiness deteriorates, or migrates lower. Over time, credit ratings can migrate significantly from what they were at the time a bond was issued. An investor should not assume that an issuer's credit rating will remain the same from the time of purchase through the entire holding period.
- 34** B is correct. An industry with a high number of suppliers reduces the suppliers' negotiating power, thus helping companies control expenses and aiding in the servicing of debt.
- 35** A is correct. Credit analysis starts with industry structure—for example, by looking at the major forces of competition, followed by an analysis of industry fundamentals—and then turns to examination of the specific issuer.
- 36** C is correct. Credit analysts can make judgments about management's character by evaluating the use of aggressive accounting policies, such as timing revenue recognition. This activity is a potential warning flag for other behaviors or actions that may adversely affect an issuer's creditworthiness.
- 37** B is correct. Capacity refers to the ability of a borrower to service its debt. Capacity is determined through credit analysis of an issuer's industry and of the specific issuer.
- 38** A is correct. Credit analysts can make judgments about management's character in a number of ways, including by observing its use of aggressive accounting policies and/or tax strategies. An example of this aggressiveness is recognizing revenue prematurely.
- 39** C is correct. The debt/capital and debt/EBITDA ratios are used to assess a company's leverage. Higher leverage ratios indicate more leverage and thus higher credit risk. Company C's debt/capital (46.3%) and debt/EBITDA (2.5×) leverage ratios are higher than those for Companies A and B.
- 40** B is correct. The EBITDA/interest expense and EBIT/interest expense ratios are coverage ratios. Coverage ratios measure an issuer's ability to meet its interest payments. A higher ratio indicates better credit quality. Company B's EBITDA/interest expense (62.4×) and EBIT/interest expense (58.2×) coverage ratios are higher than those for Companies A and C.
- 41** C is correct because Company Y has a higher ratio of free cash flow after dividends to debt than Company X, not lower, as shown in the following table.

$$\text{Free cash flow after dividends as a \% of debt} = \frac{\text{FCF after dividends}}{\text{Debt}}$$

	Company X	Company Y
Cash flow from operations	£3.3	£14.0
Less		
Net capital expenditures	−0.8	−1.1
Dividends	−0.3	−6.1
Free cash flow after dividends	<hr/> £2.2	<hr/> £6.8
Debt	£12.2	£29.8

	Company X	Company Y
Free cash flow after dividends as a % of debt	(2.2/12.2) × 100	(6.8/29.8) × 100
Free cash flow after dividends as a % of debt	18.0%	22.8%

A is incorrect. Company Y has a lower debt/capital ratio than Company X, as shown in the following table.

$$\text{Debt divided by Capital (\%)} = \frac{\text{Debt}}{(\text{Debt} + \text{Equity})}$$

	Company X	Company Y
Debt	£12.2	£29.8
Capital		
Debt	12.2	29.8
+ Equity	1.3	64.0
Capital	£13.5	£93.8
Debt/Capital (%)	(12.2/13.5) × 100	(29.8/93.8) × 100
Debt/Capital (%)	90.4%	31.8%

B is incorrect because Company Y has a lower debt/EBITDA ratio than Company Y, not higher, as shown in the following table.

	Company X	Company Y
Operating income	£1.1	£13.3
EBIT	£1.1	£13.3
plus		
Depreciation	1.0	3.8
Amortization	0.0	0.0
EBITDA	£2.1	£17.1
Debt	£12.2	£29.8
Debt/EBITDA	12.2/2.1	29.8/17.1
Debt/EBITDA	5.81	1.74

- 42 A is correct. Compared with Company Y, based on both their debt/capital ratios and their ratios of free cash flow after dividends to debt, which are measures of leverage commonly used in credit analysis, Company X is more highly leveraged, as shown in the following table.

$$\text{Debt divided by Capital (\%)} = \frac{\text{Debt}}{(\text{Debt} + \text{Equity})}$$

	Company X	Company Y
Debt	£2.2	£29.8

(continued)

	Company X	Company Y
Capital		
Debt	2.2	29.8
+ Equity	4.3	64.0
Capital	$\pounds 6.5$	$\pounds 93.8$
Debt/Capital (%)	$(12.2/13.5) \times 100$	$(29.8/93.8) \times 100$
Debt/Capital (%)	90.4%	31.8%

$$\text{Free cash flow after dividends as a \% of debt} = \frac{\text{FCF after dividends}}{\text{Debt}}$$

	Company X	Company Y
Cash flow from operations	$\pounds 3.3$	$\pounds 14.0$
Less		
Net capital expenditures	−0.8	−1.1
Dividends	−0.3	−6.1
Free cash flow after dividends	$\pounds 2.2$	$\pounds 6.8$
Debt	$\pounds 12.2$	$\pounds 29.8$
Free cash flow after dividends as a \% of debt	$(2.2/12.2) \times 100$	$(6.8/29.8) \times 100$
Free cash flow after dividends as a \% of debt	18.0%	22.8%

- 43 B is correct. In weak financial markets, including weak markets for equities, credit spreads will widen.
- 44 B is correct. Weakening economic conditions will push investors to desire a greater risk premium and drive overall credit spreads wider.
- 45 C is correct. In periods of heavy new issue supply, credit spreads will widen if demand is insufficient.
- 46 C is correct. Non-sovereign governments typically must balance their operating budgets and lack the discretion to use monetary policy as many sovereigns can.
- 47 A is correct. Most investors in investment-grade debt focus on spread risk—that is, the effect of changes in spreads on prices and returns—while in high-yield analysis, the focus on default risk is relatively greater.
- 48 B is correct. Among the most important considerations in sovereign credit analysis is growth and age distribution of population. A relatively young and growing population contributes to growth in GDP and an expanding tax base and relies less on social services, pensions, and health care relative to an older population.

SOLUTIONS

- 1 C is correct. A derivative is a financial instrument that transforms the performance of the underlying. The transformation of performance function of derivatives is what distinguishes it from mutual funds and exchange traded funds that pass through the returns of the underlying.
- A is incorrect because derivatives, in contrast to mutual funds and exchange traded funds, do not simply pass through the returns of the underlying at payout. B is incorrect because a derivative transforms rather than replicates the performance of the underlying.
- 2 B is correct. Over-the counter-derivatives markets are customized and mostly unregulated. As a result, over-the-counter markets are less transparent in comparison with the high degree of transparency and standardization associated with exchange-traded derivative markets.
- A is incorrect because exchange-traded derivatives are standardized, whereas over-the counter derivatives are customized. C is incorrect because exchange-traded derivatives are characterized by a high degree of transparency because all transactions are disclosed to exchanges and regulatory agencies, whereas over-the-counter derivatives are relatively opaque.
- 3 C is correct. Exchanged-traded derivatives are guaranteed by a clearinghouse against default.
- A is incorrect because traded derivatives are characterized by a relatively high degree of regulation. B is incorrect because the terms of exchange-traded derivatives terms are specified by the exchange.
- 4 C is correct. A credit default swap (CDS) is a derivative in which the credit protection seller provides protection to the credit protection buyer against the credit risk of a separate party. CDS are classified as a contingent claim.
- A is incorrect because futures contracts are classified as forward commitments. B is incorrect because interest rate swaps are classified as forward commitments.
- 5 B is correct. Forward commitments represent an obligation to buy or sell the underlying asset at an agreed upon price at a future date.
- A is incorrect because the right to buy or sell the underlying asset is a characteristic of contingent claims, not forward commitments. C is incorrect because a credit default swap provides a promise to provide credit protection to the credit protection buyer in the event of a credit event such as a default or credit downgrade and is classified as a contingent claim.
- 6 A is correct. Options are classified as a contingent claim which provides payoffs that are non-linearly related to the performance of the underlying.
- B is incorrect because forwards are classified as a forward commitment, which provides payoffs that are linearly related to the performance of the underlying. C is incorrect because interest-rate swaps are classified as a forward commitment, which provides payoffs that are linearly related to the performance of the underlying.
- 7 A is correct. An interest rate swap is defined as a derivative in which two parties agree to exchange a series of cash flows: One set of cash flows is variable, and the other set can be variable or fixed.

- B is incorrect because a credit derivative is a derivative contract in which the credit protection seller provides protection to the credit protection buyer. C is incorrect because a call option gives the buyer the right to purchase the underlying from the seller.
- 8 C is correct. Interest rate swaps and forwards are over-the-counter contracts that are privately negotiated and are both subject to default. Futures contracts are traded on an exchange, which provides a credit guarantee and protection against default.
- A is incorrect because futures are exchange-traded contracts which provide daily settlement of gains and losses and a credit guarantee by the exchange through its clearinghouse. B is incorrect because futures are exchange-traded contracts which provide daily settlement of gains and losses and a credit guarantee by the exchange through its clearinghouse.
- 9 B is correct. The buyer of the option pays the option premium to the seller of the option at the initiation of the contract. The option premium represents the value of the option, whereas futures and forwards have a value of zero at the initiation of the contract.
- A is incorrect because no money changes hands between parties at the initiation of the futures contract, thus the value of the futures contract is zero at initiation. C is incorrect because no money changes hands between parties at the initiation of the forward contract, thus the value of the forward contract is zero at initiation.
- 10 B is correct. A credit derivative is a derivative contract in which the credit protection seller provides protection to the credit protection buyer against the credit risk of a third party.
- A is incorrect because the clearinghouse provides a credit guarantee to both the buyer and the seller of a futures contract, whereas a credit derivative is between two parties, in which the credit protection seller provides a credit guarantee to the credit protection buyer. C is incorrect because futures contracts require that both the buyer and the seller of the futures contract provide a cash deposit for a portion of the futures transaction into a margin account, often referred to as a performance bond or good faith deposit.
- 11 A is correct. Derivative markets typically have greater liquidity than the underlying spot market as a result of the lower capital required to trade derivatives compared with the underlying. Derivatives also have lower transaction costs and lower capital requirements than the underlying.
- B is incorrect because transaction costs for derivatives are lower than the underlying spot market. C is incorrect because derivatives markets have lower capital requirements than the underlying spot market.
- 12 B is correct. One of the benefits of derivative markets is that derivatives create trading strategies not otherwise possible in the underlying spot market, thus providing opportunities for more effective risk management than simply replicating the payoff of the underlying.
- A is incorrect because effective risk management is one of the primary purposes associated with derivative markets. C is incorrect because one of the operational advantages associated with derivatives is that it is easier to go short compared to the underlying spot market.
- 13 A is correct. The benefits of derivatives, such as low transaction costs, low capital requirements, use of leverage, and the ease in which participants can go short, also can result in excessive speculative trading. These activities can lead to defaults on the part of speculators and creditors.

B is incorrect because arbitrage activities tend to bring about a convergence of prices to intrinsic value. C is incorrect because asymmetric performance is not itself destabilizing.

- 14 C is correct. The law of one price occurs when market participants engage in arbitrage activities so that identical assets sell for the same price in different markets.

A is incorrect because the law of one price refers to identical assets. B is incorrect because it refer to arbitrage not the law of one price.

- 15 A is correct. Arbitrage opportunities exist when the same asset or two equivalent combinations of assets that produce the same results sell for different prices. When this situation occurs, market participants would buy the asset in the cheaper market and simultaneously sell it in the more expensive market, thus earning a riskless arbitrage profit without committing any capital.

B is incorrect because it is not the definition of an arbitrage opportunity. C is incorrect because it is not the definition of an arbitrage opportunity.

SOLUTIONS

- 1 A is correct. An illiquid position is a limit to arbitrage because it may be difficult to realize gains of an illiquid offsetting position. A significant opportunity arises from a sufficiently large price differential or a small price differential that can be employed on a very large scale.
- 2 A is correct. Some arbitrage opportunities represent such small price discrepancies that they are only worth exploiting if the transaction costs are low. An arbitrage opportunity may require short-selling assets at costs that eliminate any profit potential. If the law of one price holds, there is no arbitrage opportunity.
- 3 C is correct. Arbitrage is a type of transaction undertaken when two assets or portfolios produce identical results but sell for different prices. A trader buys the asset or portfolio with the lower price and sells the asset or portfolio with the higher price, generating a net inflow of funds at the start of the holding period. Because the two assets or portfolios produce identical results, a long position in one and short position in the other means that at the end of the holding period, the payoffs offset. Therefore, there is no money gained or lost at the end of the holding period, so there is no risk.
- 4 B is correct. The forward price is agreed upon at the start of the contract and is the fixed price at which the underlying will be purchased (or sold) at expiration. Payment is made at expiration. The value of the forward contract may change over time, but the forward price does not change.
- 5 C is correct. The price of a forward contract is a contractually fixed price, established at initiation, at which the underlying will be purchased (or sold) at expiration. The value of a forward contract at initiation is zero; therefore, the forward price is greater than the value of the forward contract at initiation.
- 6 B is correct. The value of the forward contract, unlike its price, will adjust as market conditions change. The forward price is fixed at initiation.
- 7 A is correct. When a forward contract expires, if the spot price is higher than the forward price, the long party profits from paying the lower forward price for the underlying. Therefore, the forward contract has a positive value to the long party and a negative value to the short party. However, if the forward price is higher than the spot price, the short party profits from receiving the higher forward price (the contract value is positive to the short party and negative to the long party).
- 8 B is correct. At initiation, the forward price is the future value of the spot price (spot price compounded at the risk-free rate over the life of the contract). If the forward price were set to the spot price or the present value of the spot price, it would be possible for one side to earn an arbitrage profit by selling the asset and investing the proceeds until contract expiration.
- 9 A is correct. The forward price of each stock is found by compounding the spot price by the risk-free rate for the period and then subtracting the future value of any benefits and adding the future value of any costs. In the absence of any benefits or costs, the one-year forward prices of BWQ and ZER should be equal. After subtracting the benefits related to BWQ, the one-year forward price of BWQ is lower than the one-year forward price of ZER.
- 10 A is correct. An asset's forward price is increased by the future value of any costs and decreased by the future value of any benefits: $F_0(T) = S_0(1 + r)^T - (\gamma - \theta)(1 + r)^T$. If the net cost of carry (benefits less costs) is positive, the forward price is lower than if the net cost of carry was zero.

- 11 C is correct. When a commodity's storage costs exceed its convenience yield benefits, the net cost of carry (benefits less costs) is negative. Subtracting this negative amount from the spot price compounded at the risk-free rate results in an addition to the compounded spot price. The result is a commodity forward price which is higher than the spot price compounded. The commodity's forward price is less than the spot price compounded when the convenience yield benefits exceed the storage costs and the commodity's forward price is the same as the spot price compounded when the costs equal the benefits.
- 12 C is correct. The convenience yield is a benefit of holding the asset and generally exists when a commodity is in short supply. The future value of the convenience yield is subtracted from the compounded spot price and reduces the commodity's forward price relative to its spot price. The opportunity cost is the risk-free rate. In the absence of carry costs, the forward price is the spot price compounded at the risk-free rate and will exceed the spot price. Dividends are benefits that reduce the forward price but the lack of dividends has no effect on the spot price relative to the forward price of a commodity in short supply.
- 13 B is correct. When interest rates are constant, forwards and futures will likely have the same prices. The price differential will vary with the volatility of interest rates. In addition, if futures prices and interest rates are uncorrelated, forward and futures prices will be the same. If futures prices are positively correlated with interest rates, futures contracts are more desirable to holders of long positions than are forwards. This is because rising prices lead to future profits that are reinvested in periods of rising interest rates, and falling prices lead to losses that occur in periods of falling interest rates. If futures prices are negatively correlated with interest rates, futures contracts are less desirable to holders of long positions than are forwards. The more desirable contract will tend to have the higher price.
- 14 C is correct. Futures contracts are marked-to-market on a daily basis. The accumulated gains and losses from the previous day's trading session are deducted from the accounts of those holding losing positions and transferred to the accounts of those holding winning positions. Futures contracts trade on an exchange, forward contracts are over-the-counter transactions. Typically both forward and futures contracts are initiated at a zero value.
- 15 A is correct. If futures prices and interest rates are negatively correlated, forwards are more desirable to holders of long positions than are futures. This is because rising prices lead to futures profits that are reinvested in periods of falling interest rates. It is better to receive all of the cash at expiration under such conditions. If futures prices and interest rates are uncorrelated, forward and futures prices will be the same. If futures prices are positively correlated with interest rates, futures contracts are more desirable to holders of long positions than are forwards.
- 16 B is correct. Valuation of the swap during its life appeals to replication and the principle of arbitrage. Valuation consists of reproducing the remaining payments on the swap with other transactions. The value of that replication strategy is the value of the swap. The swap price is typically set such that the swap contract has a value of zero at initiation. The value of a swap contract will change during the life of the contract as the value of the underlying changes in value.
- 17 C is correct. Replication is the key to pricing a swap. The swap price is determined at initiation by replication. The value (not the price) of the swap is typically zero at initiation and the fixed swap price is typically determined such that the value of the swap will be zero at initiation.

- 18 B is correct. The principal of replication articulates that the valuation of a swap is the present value of all the net cash flow payments from the swap, not simply the present value of the fixed payments of the swap or the present value of the underlying at the end of the contract.
- 19 B is correct. If the underlying has a value equal to the exercise price at expiration, both options will have zero value since they both have the same exercise price. For example, if the exercise price is \$25 and at expiration the underlying price is \$25, both the call option and the put option will have a value of zero. The value of an option cannot fall below zero. The holder of an option is not obligated to exercise the option; therefore, the options each have a minimum value of zero. If the call has a positive value, the put, by definition, must have a zero value and vice versa. Both cannot have a positive value.
- 20 C is correct. A European put option will be valuable at expiration if the exercise price is greater than the underlying price. The holder can put (deliver) the underlying and receive the exercise price which is higher than the spot price. A European put option would be worthless if the exercise price was equal to or less than the underlying price.
- 21 B is correct. The value of a European call option at expiration is the greater of zero or the value of the underlying minus the exercise price.
- 22 B is correct. A European call option with two months until expiration will typically have positive time value, where time value reflects the value of the uncertainty that arises from the volatility in the underlying. The call option has a zero exercise value if the spot price is below the exercise price. The exercise value of a European call option is $\text{Max}(0, S_t - X)$, where S_t is the current spot price at time t and X is the exercise price.
- 23 A is correct. When the price of the underlying is below the exercise price for a put, the option is said to be in-the-money. If the price of the underlying is the same as the exercise price, the put is at-the-money and if it is above the exercise price, the put is out-of-the-money.
- 24 A is correct. An in-the-money European put option decreases in value with an increase in the risk-free rate. A higher risk-free rate reduces the present value of any proceeds received on exercise.
- 25 A is correct. The value of a European call option is inversely related to the exercise price. A lower exercise price means there are more potential outcomes at which the call expires in-the-money. The option value will be greater the lower the exercise price. For a higher exercise price, the opposite is true. Both the time to expiration and the volatility of the underlying are directly (positively) related to the value of a European call option.
- 26 B is correct. The value of a European call option is inversely related to the exercise price and directly related to the time to expiration. Option 1 and Option 2 have the same exercise price; however, Option 2 has a longer time to expiration. Consequently, Option 2 would likely have a higher value than Option 1. Option 2 and Option 3 have the same time to expiration; however, Option 2 has a lower exercise price. Thus, Option 2 would likely have a higher value than Option 3.
- 27 B is correct. The value of a European put option can be either directly or indirectly related to time to expiration. The direct effect is more common, but the inverse effect can prevail the longer the time to expiration, the higher the risk-free rate, and the deeper in-the-money is the put. The value of a European put option is directly related to the exercise price and the volatility of the underlying.

- 28 B is correct. Prior to expiration, the lowest value of a European put is the greater of zero or the present value of the exercise price minus the value of the underlying.
- 29 C is correct. Payments, such as dividends, reduce the value of the underlying which increases the value of a European put option. Carrying costs reduce the value of a European put option. An increase in the risk-free interest rate may decrease the value of a European put option.
- 30 A is correct. A long bond can be synthetically created by combining a long asset, a long put, and a short call. A fiduciary call is created by combining a long call with a risk free bond. A protective put is created by combining a long asset with a long put.
- 31 B is correct. According to put-call parity, a synthetic call can be constructed by combining a long asset, long put, and short bond positions.
- 32 C is correct. The actual probabilities of the up and down moves in the underlying do not appear in the binomial option pricing model, only the pseudo or "risk-neutral" probabilities. Both the spot price of the underlying and two possible prices one period later are required by the binomial option pricing model.
- 33 C is correct. Prior to expiration, an American call option will typically have a value in the market that is greater than its exercise value. Although the American option is at-the-money and therefore has an exercise value of zero, the time value of the call option would likely lead to the option having a positive market value.
- 34 B is correct. At expiration, the values of American and European call options are effectively the same; both are worth the greater of zero and the exercise value.
- 35 A is correct. When a dividend is declared, an American call option will have a higher value than a European call option because an American call option holder can exercise early to capture the value of the dividend. At expiration, both types of call options are worth the greater of zero and the exercise value. A change in the risk-free rate does not affect the relative values of American and European call options.
- 36 A is correct. Put-call forward parity demonstrates that the outcome of a protective put with a forward contract (long put, long risk-free bond, long forward contract) equals the outcome of a fiduciary call (long call, long risk-free bond). The outcome of a protective put with a forward contract is also equal to the outcome of a protective put with asset (long put, long asset).

SOLUTIONS

- 1 C is correct. Long-only equity funds are typically considered traditional investments and real estate and commodities are typically classified as alternative investments.
- 2 B is correct. The majority of private equity activity involves leveraged buyouts. Merger arbitrage and market neutral are strategies used by hedge funds.
- 3 B is correct. Hedge funds may use a variety of strategies (event-driven, relative value, macro and equity hedge), generally have a low correlation with traditional investments, and may take long and short positions.
- 4 A is correct. Alternative investments are characterized as typically having low levels of transparency.
- 5 A is correct. There are many approaches to managing alternative investment funds but typically these funds are actively managed.
- 6 A is correct. Investing in alternative investments is often pursued through such special vehicles as hedge funds and private equity funds, which have flexibility to use leverage. Alternative investments include investments in such assets as real estate, which is an illiquid asset, and investments in such special vehicles as private equity and hedge funds, which may make investments in illiquid assets and take short positions. Obtaining information on strategies used and identifying reliable measures of risk and return are challenges of investing in alternatives.
- 7 A is correct. The historically higher returns to most categories of alternative investments compared with traditional investments result in potentially higher returns to a portfolio containing alternative investments. The less than perfect correlation with traditional investments results in portfolio risk (standard deviation) being less than the weighted average of the standard deviations of the investments. This has potential to increase the Sharpe ratio in spite of the historically higher standard deviation of returns of most categories of alternative investments.
- 8 B is correct. Adding alternative investments to a portfolio may provide diversification benefits because of these investments' less than perfect correlation with other assets in the portfolio. As a result, allocating a portion of one's funds to alternatives could potentially result in an improved risk–return relationship. Challenges to allocating a portion of a portfolio to alternative investments include obtaining reliable measures of risk and return as well as selecting portfolio managers for the alternative investments.
- 9 C is correct. Hedge funds of funds have multi-layered fee structures, while the fee structure for a single hedge fund is less complex. Funds of funds presumably have some expertise in conducting due diligence on hedge funds and may be able to negotiate more favorable redemption terms than could an individual investor in a single hedge fund.
- 10 A is correct. Private equity funds and hedge funds are typically structured as partnerships where investors are limited partners (LP) and the fund is the general partner (GP). The management fee for private equity funds is based on committed capital whereas for hedge funds the management fees are based on assets under management. For most private equity funds, the general partner does not earn an incentive fee until the limited partners have received their initial investment back.

- 11 A is correct. Timberland offers an income stream based on the sale of timber products as a component of total return and has historically generated returns not highly correlated with other asset classes.
- 12 A is correct. Long–short positions are used by both types of hedge funds to potentially profit from anticipated market or security moves. Event-driven strategies use a bottom-up approach and seek to profit from short-term events typically involving a corporate action, such as an acquisition or a restructuring. Macro strategies seek to profit from expected movements in evolving economic variables.
- 13 A is correct. Margin calls can magnify losses. To meet the margin call, the hedge fund manager may be forced to liquidate a losing position in a security, which, depending on the position size, could exert further price pressure on the security, resulting in further losses. Restrictions on redemptions, such as lockup and notice periods, may allow the manager to close positions in a more orderly manner and minimize forced-sale liquidations of losing positions.
- 14 A is correct. The seed stage supports market research and product development and is generally the first stage at which venture capital funds invest. The seed stage follows the angel investing stage. In the angel investing stage, funds are typically provided by individuals (often friends or family), rather than a venture capital fund, to assess an idea's potential and to transform the idea into a plan. Mezzanine-stage financing is provided by venture capital funds to prepare the portfolio company for its IPO.
- 15 A is correct. A repeat sales index uses the changes in price of repeat-sale properties to construct the index. Sample selection bias is a significant drawback because the properties that sell in each period vary and may not be representative of the overall market the index is meant to cover. The properties that transact are not a random sample and may be biased toward properties that changed in value. Understated volatility and reliance on subjective appraisals by experts are drawbacks of an appraisal index.
- 16 B is correct. Publicly traded infrastructure securities, which include shares of companies, exchange-traded funds, and listed funds that invest in infrastructure, provide the benefits of transparent governance, liquidity, reasonable fees, market prices, and the ability to diversify across underlying assets. Direct investment in infrastructure involves a large capital investment in any single project, resulting in high concentration risks. Direct investment in infrastructure provides control over the assets and the opportunity to capture the assets' full value.
- 17 C is correct. Fundamental growth strategies take long positions in companies identified, using fundamental analysis, to have high growth and capital appreciation. Fundamental value strategies use fundamental analysis to identify undervalued companies. Market-neutral strategies use quantitative and/or fundamental analysis to identify under- and overvalued companies.
- 18 A is correct. It should be possible to identify the benchmark against which the fund gauges its performance in the hedge fund due diligence process. It should also be possible to establish the range of markets in which the fund invests as well as the fund's general strategy. Hedge funds consider their strategies, systems, and processes to be proprietary and are unwilling to provide too much information to potential investors.
- 19 B is correct. Private equity funds can realize an immediate cash exit in a trade sale. Using this strategy, the portfolio company is typically sold to a strategic buyer.

- 20 C is correct. The higher the loan-to-value ratio, the higher leverage is for a real estate investment, which increases the risk to both debt and equity investors.
- 21 C is correct. A publicly traded infrastructure security, such as an exchange-traded MLP, provides the benefit of liquidity.
- 22 B is correct. A brownfield investment is an investment in an existing infrastructure asset, which is more likely to have a history of steady cash flows compared with that of a greenfield investment. Growth opportunities and returns are expected to be lower for brownfield investments, which are less risky than greenfield investments.
- 23 B is correct. Investing in an existing infrastructure asset with the intent to privatize, lease, or sell and lease back the asset is referred to as a brownfield investment. An economic infrastructure asset supports economic activity and includes such assets as transportation and utility assets. Hospitals are social infrastructure assets, which are focused on human activities.
- 24 B is correct. Many practitioners believe that liquidity discounts are necessary to reflect fair value. This has resulted in some funds having two NAVs - for trading and reporting. The fund may use average quotes for reporting purposes but apply liquidity discounts for trading purposes.
- 25 B is correct. Formative-stage financing occurs when the company is still in the process of being formed and encompasses several financing steps. Angel investing capital is typically raised in this early stage of financing.
- 26 B is correct. Roll yield refers to the difference between the spot price of a commodity and the price specified by its futures contract (or the difference between two futures contracts with different expiration dates). When futures prices are higher than the spot price, the commodity forward curve is upward sloping, and the prices are referred to as being in contango. Contango occurs when there is little or no convenience yield.
- 27 B is correct. The net investor return is 12.54%, calculated as:

End of year capital = \$250 million \times 1.16 = \$290 million

Management fee = \$290 million \times 2% = \$5.8 million

Hurdle amount = 8% of \$250 million = \$20 million;

Incentive fee = $(\$290 - \$250 - \$20 - \$5.8)$ million \times 20% = \$2.84 million

Total fees to United Capital = $(\$5.8 + \$2.84)$ million = \$8.64 million

Investor net return: $(\$290 - \$250 - \$8.64) / \$250 = 12.54\%$

- 28 A is correct because the net investor return is 7.9%, calculated as:

First, note that "1 and 10" refers to a 1% management fee, and a 10% incentive fee.

End of year capital = GBP140 million + GBP80 million = GBP220 million

Management fee = GBP220 million \times 1% = GBP2.2 million

Incentive fee = $(\text{GBP}220 - \text{GBP}200)$ million \times 10% = GBP2 million

Total fees to Capricorn = $(\text{GBP}2.2 + \text{GBP}2)$ million = GBP4.2 million

Investor net return: $(\text{GBP}220 - \text{GBP}200 - \text{GBP}4.2) / \text{GBP}200 = 7.9\%$

- 29 A is correct. Rotunda earns a management fee of \$7.20 million but does not earn an incentive fee because the year-end fund value net of management fee does not exceed the high-water mark of \$357 million.

Rotunda fees:

End-of-year AUM = Prior year-end AUM \times (1 + Fund return) = \$288 million \times 1.25 = \$360 million

\$360 million \times 2% = \$7.20 million management fee

\$360 million – \$7.2 million = \$352.8 million AUM net of management fee

The year-end AUM net of fees does not exceed the \$357 million high-water mark. Therefore, no incentive fee is earned.

- 30** C is correct. The management fee for the year is

$$\$642 \times 0.02 = \$12.84 \text{ million.}$$

Because the ending value exceeds the high-water mark, the hedge fund can collect an incentive fee. The incentive fee is

$$\{(\$642 - [\$610 \times (1 + 0.04)])\} \times 0.20 = \$1.52 \text{ million.}$$

The net return to the investor for the year is

$$[(\$642 - \$12.84 - \$1.52)/\$583.1] - 1 \approx 0.07638 \approx 7.64\%.$$

- 31** B is correct. Total fees paid to all funds (underlying funds and Ash Lawn) are \$12.75 million, consisting of underlying fund fees of \$9.26 million and Ash Lawn fees of \$3.49 million, calculated as follows:

Underlying fund fees:

Management fee = \$133 million \times 0.02 = \$2.66 million.

Incentive fee = (\$133 – \$100) million \times 0.20 = \$6.60 million.

Total underlying fund fees (\$2.66 + \$6.60) million = \$9.26 million.

Ash Lawn fees:

AUM at end of year, net of underlying fund fees = \$133 million – \$9.26 million = \$123.74 million.

Ash Lawn management fee = \$123.74 million \times 0.01 = \$1.24 million (rounded).

AUM net of underlying fund fees and Ash Lawn management fee = (\$123.74 – \$1.24) million = \$122.50 million (rounded).

Ash Lawn incentive fee = (\$122.50 – \$100) million \times 0.10 = \$2.25 million (rounded).

Total Ash Lawn fees = (\$1.24 + \$2.25) million = \$3.49 million (rounded).

Total fees of underlying funds and Ash Lawn:

(\$9.26 + \$3.49) million = \$12.75 million (rounded).

- 32** A is correct. Infrastructure projects involving construction have more risk than investments in existing assets with a demonstrated cash flow or investments in assets that are expected to generate regular cash flows because the assets will be leased back to a government.
- 33** B is correct. A clawback provision requires the general partner in a private equity fund to return any funds distributed (to the general partner) as incentive fees until the limited partners have received back their initial investments and the contracted portion of the total profits. A high hurdle rate will result in

distributions occurring only after the fund achieves a specified return. A high hurdle rate decreases the likelihood of, but does not prevent, excess distributions. Management fees, not incentive fees, are based on committed capital.

- 34 B is correct. Until the committed capital is fully drawn down and invested, the management fee for a private equity fund is based on committed capital, not invested capital.
- 35 C is correct. The private equity fund can estimate the company's value by discounting the expected free cash flow to equity using the cost of equity, which is a discounted cash flow approach. A negative EBITDA number implies negative net income, which makes net income multiples, a comparable approach, inapplicable for valuation. In order to use an asset-based approach, the private equity fund needs the market value of its liabilities, not just the market value of its assets.
- 36 C is correct. Downside risk measures focus on the left side of the return distribution curve where losses occur. The standard deviation of returns assumes that returns are normally distributed. Many alternative investments do not exhibit close-to-normal distribution of returns, which is a crucial assumption for the validity of a standard deviation as a comprehensive risk measure. Assuming normal probability distributions when calculating these measures will lead to an underestimation of downside risk for a negatively skewed distribution. Both the Sortino ratio and the value-at-risk measure are both measures of downside risk.
- 37 C is correct. Investment risk should be monitored by a chief risk officer who is separated from the investment process. Risk factors monitored include leverage, sector, and individual position limits as well as counterparty risks. Independent (as opposed to in-house) valuation of underlying positions should be performed and reviewed on a regular basis. Third-party custody of assets can help reduce the chance of fraud.