technical competence for practitioners. An ethical decision-making framework combined with a code of ethics may help investment professionals analyze their decisions in a way that identifies potential conflicts and negative consequences.

Knowing the rules to apply in a particular situation, although important, may not be sufficient to ensure ethical conduct if used alone. Responsible professionals in the investment industry must be able both to recognize areas that are prone to ethical pitfalls and to identify and process those circumstances and influences that can impair judgment and lead to ethical lapses.

SUMMARY

- Ethics refers to the study of making good choices. Ethics encompasses a set of moral principles and rules of conduct that provide guidance for our behavior.
- Situational influences are external factors that may shape our behavior.
- Challenges to ethical behavior include being overconfident in our own morality, underestimating the effect of situational influences, and focusing on the immediate rather than long-term outcomes or consequences of a decision.
- In any given profession, the code of ethics publicly communicates the established principles and expected behavior of its members.
- Members of a profession use specialized knowledge and skills to serve others; they share and agree to adhere to a common code of ethics to serve others and advance the profession.
- A code of ethics helps foster public confidence that members of the profession will use their specialized skills and knowledge to serve their clients and others.
- A profession is an occupational group that has specific education, expert knowledge, and a framework of practice and behavior that underpins community trust, respect, and recognition.
- The requirement to uphold high ethical standards is one clear difference between professions and craft guilds or trade bodies.
- A primary goal of professions is to establish trust among clients and among society in general.
- Common characteristics of professions include normalization of practitioner behavior, service to society, client focus, high entry standards, a body of expert knowledge, encouragement and facilitation of continuing education, monitoring of professional conduct, collegiality, recognized overseeing bodies, and encouragement of member engagement.
- The investment management profession has become increasingly global, driven by the opening of capital markets, coordination of regulation across borders, and the emergence of technology.
- Investment management professionals are trusted to draw on a body of formal knowledge and apply that knowledge with care and judgement. In comparison to clients, investment professionals are also expected to have superior financial expertise, technical knowledge, and knowledge of the applicable laws and regulations.
- As a professional body, CFA Institute gathers knowledge from practicing investment professionals, conducts rigorous examinations, and ensures practitioner involvement in developing its codes and values.

- Investment management professionals are likely to encounter dilemmas, including those with ethical implications. Professionals should consider carefully how to determine the facts of the issue and assess the implications.

- High ethical standards always matter and are of particular importance in the investment management profession, which is based almost entirely on trust. Clients trust investment professionals to use their specialized skills and knowledge to serve clients and protect client assets. All stakeholders gain long-term benefits when investment professionals adhere to high ethical standards.

- Legal standards are often rule based. Ethical conduct goes beyond legal standards, balancing self-interest with the direct and indirect consequences of behavior on others.

- A framework for ethical decision making can help people look at and evaluate a decision from different perspectives, enabling them to identify important issues, make wise decisions, and limit unintended consequences.

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PRACTICE PROBLEMS

1 Benchmarks for minimally acceptable behaviors of community members are:

   A a code of ethics.

   B laws and regulations.

   C standards of conduct.

2 Specialized knowledge and skills, a commitment to serve others, and a shared code of ethics *best* characterize a(n):

   A vocation.

   B profession.

   C occupation.

3 Which of the following *best* identifies an internal trait that may lead to poor ethical decision making?

   A Overconfidence

   B Loyalty to employer

   C Promise of money or prestige

4 Situational influences in decision making will *most likely* be minimized if:

   A strong compliance programs are in place.

   B longer-term consequences are considered.

   C individuals believe they are truthful and honest.

5 Decision makers who use a compliance approach are *most likely* to:

   A avoid situational influences.

   B oversimplify decision making.

   C consider more factors than when using an ethical decision-making approach.

6 When unethical behavior erodes trust in an investment firm, that firm is *more likely* to experience:

   A lower revenues only.

   B higher expenses only.

   C lower revenues and higher expenses.

7 Which is an example of an activity that may be legal but that CFA Institute considers unethical?

   A Making legally required disclosures in marketing materials

   B Trading while in possession of material nonpublic information

   C Disclosure by an employee of his or her own company's dishonest activity

8 An ethical decision-making framework will *most likely*:

   A include a pre-determined, uniform sequence.

   B focus exclusively on confirmable facts and relationships.

   C help avoid a decision that has unanticipated ethical consequences.

9 High ethical standards are distinguishing features of which of the following bodies?

   A Craft guilds

   B Trade bodies

   C Professional bodies

10 Fiduciary duty is a standard *most likely* to be upheld by members of a(n):

   A employer.

   B profession.

   C not-for-profit body.

11 To maintain trust, the investment management profession must be interdependent with:

   A regulators.

   B employers.

   C investment firms.

12 When an ethical dilemma occurs, an investment professional should *most likely* first raise the issue with a:

   A mentor outside the firm.

   B professional body's hotline.

   C senior individual in the firm.

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, a mastery mindset, 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.

9 C is correct. High ethical standards distinguish professions from the craft guilds or trade bodies. Unlike trade bodies, professional bodies also typically have a mission to serve society and enforce professional conduct rules for practitioners.

10 B is correct. Fiduciary duty is an obligation to deliver a high standard of care when acting for the benefit of another party. Professionals must act in the best interest of the client, exercising a reasonable level of care, skill, and diligence. Other entities—including employers, regulators, trade associations, and not-for-profit bodies—may also support an industry but are not the same as professional bodies. Unlike professions, these other entities generally do not exist to set and maintain professional standards.

11 C is correct. The investment management profession and investment firms must be interdependent to maintain trust. Employers and regulators have their own standards and practices, which may differ from regulations and standards set by professional bodies.

12 C is correct. When a dilemma occurs, raising an issue internally with a senior employee is often a good starting place and creates an opportunity for an independent internal review. Protecting the client and the firm may take priority over the position of an individual professional raising a concern.

PRACTICE PROBLEMS

1 The Standards of Practice Handbook provides guidance:
   A regarding the penalties incurred as a result of ethical violations.
   B to which all CFA Institute members and candidates must adhere.
   C through explanatory material and examples intended to be all inclusive.

2 Which of the following statements *best* describes an aspect of the Professional Conduct Program process?
   A Inquiries are not initiated in response to information provided by the media.
   B Investigations result in Disciplinary Review Committee panels for each case.
   C Investigations may include requesting a written explanation from the member or candidate.

3 A current Code of Ethics principle reads in full, "Promote the integrity:
   A and viability of the global capital markets."
   B of and uphold the rules governing capital markets."
   C and viability of the global capital markets for the ultimate benefit of society."

4 As stated in the revised 11th edition, the Standards of Professional Conduct:
   A require supervisors to focus on the detection and prevention of violations.
   B adopt separate ethical considerations for programs such as CIPM and Investment Foundations.
   C address the risks and limitations of recommendations being made to clients.

5 According to the Code of Ethics, members of CFA Institute and candidates for the CFA designation must:
   A maintain their professional competence to exercise independent professional judgment.
   B place the integrity of the investment profession and the interests of clients above their own personal interests.
   C practice in a professional and ethical manner with the public, clients, and others in the global capital markets.

6 Which of the following statements *best* describes an aspect of the Standards of Professional Conduct? Members and candidates are required to:
   A ensure any portfolio mandate followed is fair, accurate, and complete.
   B promptly disclose changes that might materially affect investment processes.
   C have a reasonable and adequate basis for decisions about client confidentiality.

7 Which of the following categories completely represents an ethical principle of CFA Institute as outlined in the *Standards of Practice Handbook*?
   A Individual professionalism
   B Responsibilities to clients and employers
   C Ethics involved in investment analysis and recommendations

8 A CFA Institute member would violate the standard for material nonpublic information by:
   A conducting price distortion practices.

    B   inappropriately causing others to act.

    C   inadequately maintaining investment records.

9 According to the Duties to Clients standard, suitability requires members and candidates in an advisory relationship with a client to:

    A   place their clients' interests before their own interests.

    B   consider investments in the context of the client's total portfolio.

    C   not knowingly make misrepresentations relating to recommendations.

10 As part of the Duties to Clients standard, members and candidates must:

    A   document client financial constraints after an initial investment action.

    B   maintain an equal balance of interests owed to their clients and employers.

    C   deal fairly and objectively with all clients when engaging in professional activities.

11 The Duties to Employers standard states that members and candidates must not:

    A   accept any gifts that might compromise their independence and objectivity.

    B   deprive their employer of their skills and abilities as related to their employment.

    C   accept compensation competing with their employer's interest and with the written consent of all parties involved.

12 The Investment Analysis, Recommendations, and Actions standard states that members and candidates must:

    A   find an investment suitable for their client before making a recommendation.

    B   make reasonable efforts to ensure that performance presentation is fair, accurate, and complete.

    C   distinguish between fact and opinion in the presentation of investment analysis and recommendations.

13 Based on the Conflicts of Interest standard, members and candidates must:

    A   disclose, as required by law, those conflicts interfering with their professional duties.

    B   disclose, as appropriate, any benefit paid to others for the recommendation of products.

    C   seek employer approval before prioritizing their investment transactions over those clients.

14 The Responsibilities as a CFA Institute Member or CFA Candidate Standard explicitly states a requirement regarding:

    A   loyalty.

    B   responsibility of supervisors.

    C   reference to the CFA Program.

SOLUTIONS

1 B is correct. The *Standards of Practice Handbook* provides guidance to which CFA Institute members and candidates are required to adhere.

A is incorrect because the *Handbook* provides guidance in understanding the interconnectedness of the aspirational and practical principles (not regarding penalties for violations) of the Code of Ethics and Standards of Conduct.

C is incorrect because although the *Standards of Practice Handbook* provides hypothetical but factual situations, the explanatory material and examples are not intended to be all inclusive.

2 C is correct. When an inquiry is initiated, the Professional Conduct staff conducts an investigation that may include requesting a written explanation from the member or candidate.

A is incorrect because Professional Conduct inquiries can be initiated in response to information provided by the media. CFA Institute staff may become aware of questionable conduct by a member or candidate through the media, regulatory notices, or another public source.

B is incorrect because although the Disciplinary Review Committee (DRC) is responsible for enforcement of the Code and Standards in conjunction with the Professional Conduct Program (PCP), only in the event that a member or candidate does not accept the charges and proposed sanction is the matter referred to a panel composed of DRC members.

3 C is correct. One of the principles in the Code of Ethics was updated to reflect the role that the capital markets have in society as a whole.

A is incorrect because it is incomplete, missing the additional language to reflect the role that the capital markets have in society as a whole.

B is incorrect because this is the old principle as written in the Code of Ethics, which was recently updated to reflect the role of the capital markets in society as a whole.

4 C is correct. Given the constant development of new and exotic financial instruments and strategies, the standard regarding communicating with clients now includes an implicit requirement to discuss the risks and limitations of recommendations being made to clients.

A is incorrect because the updated standard for members and candidates with supervision or authority over others within their firms stresses broader compliance expectations, which include the detection and prevention aspects of the original version that was the prior focus.

B is incorrect because the updated standard not only maintains the integrity of the CFA Program but also expands the same (not separate) ethical considerations when members or candidates participate in such programs as the CIPM Program and the Investment Foundations Certificate.

5 B is correct. Members of CFA Institute and candidates for the CFA designation must place the integrity of the investment profession and the interests of clients above their own personal interests.

A is incorrect because members of CFA Institute and candidates for the CFA designation must maintain and improve their professional competence and strive to maintain and improve the competence of other investment professionals. The exercise of independent professional judgment is associated with using reasonable care.

C is incorrect because members of CFA Institute and candidates for the CFA designation must practice and encourage others to practice in a professional and ethical manner that will reflect credibly on themselves and the profession. Members are supposed to act with integrity, competence, diligence, and respect and in an ethical manner with the public, clients, and other market participants.

6   B is correct. The current Standards of Professional Conduct requires members and candidates to promptly disclose any changes that might materially affect investment processes.

A is incorrect because under Standard III.C.2 Suitability, when members and candidates are responsible for managing a portfolio according to a specific mandate, they must take only investment actions that are consistent with the stated objectives of the portfolio. The "fair, accurate, and complete" criterion relates to the Standard III D Performance Presentation.

C is incorrect because under Standard III.E.1, 2, 3 Preservation of Confidentiality, members and candidates must keep information about current clients confidential unless the information concerns illegal activities on the part of the client, disclosure is required by law, or the client permits disclosure. No decisions on confidentiality are required, with the "reasonable and adequate basis" criterion related to Standard V.A.2 Diligence and Reasonable Basis.

7   A is correct. Within the *Standards of Practice Handbook*, CFA Institute addresses ethical principles for the profession, including individual professionalism; responsibilities to capital markets, clients, and employers; ethics involved in investment analysis; recommendations, and actions; and possible conflicts of interest.

B is incorrect because it does not include responsibilities to capital markets.

C is incorrect because the ethical principles not only address ethics involved in investment analysis and recommendations but also address actions.

8   B is correct. Under Standard II.A Material Nonpublic Information, members having material nonpublic information that could affect the value of an investment must not cause others to act on the information.

A is incorrect because price distortion is mentioned in the Standard II.B Market Manipulation, not Standard II.A Material Nonpublic Information.

C is incorrect because the maintenance of appropriate records to support investment analyses is noted in Standard V.C Record Retention, not Standard II.A Material Nonpublic Information.

9   B is correct. Standard III.C.1c Suitability states that when members and candidates are in an advisory relationship with a client, they must judge the suitability of investments in the context of the client's total portfolio.

A is incorrect because this is a requirement addressed under Standard III.A Loyalty, Prudence, and Care, not Standard III.C.1c Suitability.

C is incorrect because this is a requirement addressed under Standard I.C Misrepresentation, not Standard III.C.1c Suitability.

10 C is correct. Under the III.B Fair Dealing section of the Duty to Clients standard, members and candidates must deal fairly and objectively with all clients when providing investment analysis, making investment recommendations, taking investment action, or engaging in other professional activities.

A is incorrect because under Standard III.C.1a Suitability, a section of Duties to Clients, members and candidates in an advisory relationship must make a reasonable inquiry into a client's financial constraints prior to (not after) taking investment action and must reassess and update this regularly.

B is incorrect because under Standard III.A Loyalty, Prudence, and Care, members and candidates must act for the benefit of their clients and place their clients' interests before (not maintain an equal balance with) their employer's or their own interests.

11 B is correct. The IV.A Loyalty section of the Duties to Employers standard states that members and candidates cannot deprive their employer of the advantage of their skills and abilities in matters related to their employment.

A is incorrect because accepting gifts that might compromise a member or candidate's independence and objectivity is addressed by Standard I.B Independence and Objectivity, a section of Professionalism, not under Standard IV Duties to Employers.

C is incorrect because IV.B Additional Compensation Arrangements, part of the Duties to Employers standard, permits members and candidates to accept compensation that competes with their employer's interest if they obtain written consent from all parties involved.

12 C is correct. The V.B.4 Communications with Clients and Prospective Clients section of the Investment Analysis, Recommendations, and Actions standard states that members and candidates must distinguish between fact and opinion in the presentation of investment analysis and recommendations.

A is incorrect because this standard is discussed in the III.C.1b Suitability section of the Duties to Clients standard.

B is incorrect because performance presentation is discussed in the III.D Performance Presentation section of the Duties to Clients standard.

13 B is correct. The VI.C Referral Fees section of the Conflicts of Interest standard requires members and candidates to disclose to their employer, clients, and prospective clients, as appropriate, any compensation, consideration, or benefit received from or paid to others for the recommendation of products or services.

A is incorrect because the VI.A Disclosure of Conflicts section of the Conflicts of Interest standard requires members and candidates to make full and fair disclosure of all matters (not limited to legal requirements) that could reasonably be expected to impair their independence and objectivity or interfere with respective duties to their clients, prospective clients, and employer.

C is incorrect because the VI.B Priority of Transactions section of the Conflicts of Interest standard requires members and candidates to give priority to investment transactions for clients and employers versus those in which a member or candidate is the beneficial owner. This requirement is not waived by an employer's approval.

14 C is correct. The VII.B Reference to CFA Institute, the CFA Designation, and the CFA Program section of the Responsibilities as a CFA Institute Member or CFA Candidate standard explicitly states the appropriate manner to make reference to CFA Institute, CFA Institute membership, the CFA designation, or candidacy in the CFA Program.

A is incorrect because Standard VII Responsibilities as a CFA Institute Member or CFA Candidate standard does not refer to loyalty. Loyalty is addressed in two other standards, Standard III.A Loyalty, Prudence, and Care and Standard IV.A Loyalty.

B is incorrect because Standard VII Responsibilities as a CFA Institute Member or CFA Candidate standard does not refer to the responsibility of supervisors. The responsibility of supervisors is addressed in Standard IV.C Responsibility of Supervisors.

PRACTICE PROBLEMS

Unless otherwise stated in the question, all individuals in the following questions are CFA Institute members or candidates in the CFA Program and, therefore, are subject to the CFA Institute Code of Ethics and Standards of Professional Conduct.

1 Smith, a research analyst with a brokerage firm, decides to change his recommendation for the common stock of Green Company, Inc., from a "buy" to a "sell." He mails this change in investment advice to all the firm's clients on Wednesday. The day after the mailing, a client calls with a buy order for 500 shares of Green Company. In this circumstance, Smith should:

   A Accept the order.

   B Advise the customer of the change in recommendation before accepting the order.

   C Not accept the order because it is contrary to the firm's recommendation.

2 Which statement about a manager's use of client brokerage commissions violates the Code and Standards?

   A A client may direct a manager to use that client's brokerage commissions to purchase goods and services for that client.

   B Client brokerage commissions should be used to benefit the client and should be commensurate with the value of the brokerage and research services received.

   C Client brokerage commissions may be directed to pay for the investment manager's operating expenses.

3 Jamison is a junior research analyst with Howard & Howard, a brokerage and investment banking firm. Howard & Howard's mergers and acquisitions department has represented the Britland Company in all of its acquisitions for the past 20 years. Two of Howard & Howard's senior officers are directors of various Britland subsidiaries. Jamison has been asked to write a research report on Britland. What is the best course of action for her to follow?

   A Jamison may write the report but must refrain from expressing any opinions because of the special relationships between the two companies.

   B Jamison should not write the report because the two Howard & Howard officers serve as directors for subsidiaries of Britland.

   C Jamison may write the report if she discloses the special relationships with the company in the report.

4 Which of the following statements clearly *conflicts* with the recommended procedures for compliance presented in the CFA Institute *Standards of Practice Handbook*?

   A Firms should disclose to clients the personal investing policies and procedures established for their employees.

   B Prior approval must be obtained for the personal investment transactions of all employees.

   C For confidentiality reasons, personal transactions and holdings should not be reported to employers unless mandated by regulatory organizations.

5 Bronson provides investment advice to the board of trustees of a private university endowment fund. The trustees have provided Bronson with the fund's financial information, including planned expenditures. Bronson receives a

phone call on Friday afternoon from Murdock, a prominent alumnus, requesting that Bronson fax him comprehensive financial information about the fund. According to Murdock, he has a potential contributor but needs the information that day to close the deal and cannot contact any of the trustees. Based on the CFA Institute Standards, Bronson should:

A Send Murdock the information because disclosure would benefit the client.

B Not send Murdock the information to preserve confidentiality.

C Send Murdock the information, provided Bronson promptly notifies the trustees.

6 Willier is the research analyst responsible for following Company X. All the information he has accumulated and documented suggests that the outlook for the company's new products is poor, so the stock should be rated a weak "hold." During lunch, however, Willier overhears a financial analyst from another firm whom he respects offer opinions that conflict with Willier's forecasts and expectations. Upon returning to his office, Willier releases a strong "buy" recommendation to the public. Willier:

A Violated the Standards by failing to distinguish between facts and opinions in his recommendation.

B Violated the Standards because he did not have a reasonable and adequate basis for his recommendation.

C Was in full compliance with the Standards.

7 An investment management firm has been hired by ETV Corporation to work on an additional public offering for the company. The firm's brokerage unit now has a "sell" recommendation on ETV, but the head of the investment banking department has asked the head of the brokerage unit to change the recommendation from "sell" to "buy." According to the Standards, the head of the brokerage unit would be permitted to:

A Increase the recommendation by no more than one increment (in this case, to a "hold" recommendation).

B Place the company on a restricted list and give only factual information about the company.

C Assign a new analyst to decide if the stock deserves a higher rating.

8 Albert and Tye, who recently started their own investment advisory business, have registered to take the Level III CFA examination. Albert's business card reads, "Judy Albert, CFA Level II." Tye has not put anything about the CFA designation on his business card, but promotional material that he designed for the business describes the CFA requirements and indicates that Tye participates in the CFA Program and has completed Levels I and II. According to the Standards:

A Albert has violated the Standards, but Tye has not.

B Tye has violated the Standards, but Albert has not.

C Both Albert and Tye have violated the Standards.

9 Scott works for a regional brokerage firm. He estimates that Walkton Industries will increase its dividend by US$1.50 a share during the next year. He realizes that this increase is contingent on pending legislation that would, if enacted, give Walkton a substantial tax break. The US representative for Walkton's home district has told Scott that, although she is lobbying hard for the bill and prospects for its passage are favorable, concern of the US Congress over the federal deficit could cause the tax bill to be voted down. Walkton Industries has not made any statements about a change in dividend policy. Scott writes in his

research report, "We expect Walkton's stock price to rise by at least US$8.00 a share by the end of the year because the dividend will increase by US$1.50 a share. Investors buying the stock at the current time should expect to realize a total return of at least 15% on the stock." According to the Standards:

A   Scott violated the Standards because he used material inside information.

B   Scott violated the Standards because he failed to separate opinion from fact.

C   Scott violated the Standards by basing his research on uncertain predictions of future government action.

10 Which one of the following actions will help to ensure the fair treatment of brokerage firm clients when a new investment recommendation is made?

A   Informing all people in the firm in advance that a recommendation is to be disseminated.

B   Distributing recommendations to institutional clients prior to individual accounts.

C   Minimizing the time between the decision and the dissemination of a recommendation.

11 The mosaic theory holds that an analyst:

A   Violates the Code and Standards if the analyst fails to have knowledge of and comply with applicable laws.

B   Can use material public information and nonmaterial nonpublic information in the analyst's analysis.

C   Should use all available and relevant information in support of an investment recommendation.

12 Jurgen is a portfolio manager. One of her firm's clients has told Jurgen that he will compensate her beyond the compensation provided by her firm on the basis of the capital appreciation of his portfolio each year. Jurgen should:

A   Turn down the additional compensation because it will result in conflicts with the interests of other clients' accounts.

B   Turn down the additional compensation because it will create undue pressure on her to achieve strong short-term performance.

C   Obtain permission from her employer prior to accepting the compensation arrangement.

13 One of the discretionary accounts managed by Farnsworth is the Jones Corporation employee profit-sharing plan. Jones, the company president, recently asked Farnsworth to vote the shares in the profit-sharing plan in favor of the slate of directors nominated by Jones Corporation and against the directors sponsored by a dissident stockholder group. Farnsworth does not want to lose this account because he directs all the account's trades to a brokerage firm that provides Farnsworth with useful information about tax-free investments. Although this information is not of value in managing the Jones Corporation account, it does help in managing several other accounts. The brokerage firm providing this information also offers the lowest commissions for trades and provides best execution. Farnsworth investigates the director issue, concludes that the management-nominated slate is better for the long-run performance of the company than the dissident group's slate, and votes accordingly. Farnsworth:

A   Violated the Standards in voting the shares in the manner requested by Jones but not in directing trades to the brokerage firm.

B   Did not violate the Standards in voting the shares in the manner requested by Jones or in directing trades to the brokerage firm.

   C   Violated the Standards in directing trades to the brokerage firm but not in voting the shares as requested by Jones.

14 Brown works for an investment counseling firm. Green, a new client of the firm, is meeting with Brown for the first time. Green used another counseling firm for financial advice for years, but she has switched her account to Brown's firm. After spending a few minutes getting acquainted, Brown explains to Green that she has discovered a highly undervalued stock that offers large potential gains. She recommends that Green purchase the stock. Brown has committed a violation of the Standards. What should she have done differently?

   A   Brown should have determined Green's needs, objectives, and tolerance for risk before making a recommendation of any type of security.

   B   Brown should have thoroughly explained the characteristics of the company to Green, including the characteristics of the industry in which the company operates.

   C   Brown should have explained her qualifications, including her education, training, and experience and the meaning of the CFA designation.

15 Grey recommends the purchase of a mutual fund that invests solely in long-term US Treasury bonds. He makes the following statements to his clients:

   I.   "The payment of the bonds is guaranteed by the US government; therefore, the default risk of the bonds is virtually zero."

   II. "If you invest in the mutual fund, you will earn a 10% rate of return each year for the next several years based on historical performance of the market."

  Did Grey's statements violate the CFA Institute Code and Standards?

   A   Neither statement violated the Code and Standards.

   B   Only statement I violated the Code and Standards.

   C   Only statement II violated the Code and Standards.

16 Anderb, a portfolio manager for XYZ Investment Management Company—a registered investment organization that advises investment firms and private accounts—was promoted to that position three years ago. Bates, her supervisor, is responsible for reviewing Anderb's portfolio account transactions and her required monthly reports of personal stock transactions. Anderb has been using Jonelli, a broker, almost exclusively for brokerage transactions for the portfolio account. For securities in which Jonelli's firm makes a market, Jonelli has been giving Anderb lower prices for personal purchases and higher prices for personal sales than Jonelli gives to Anderb's portfolio accounts and other investors. Anderb has been filing monthly reports with Bates only for those months in which she has no personal transactions, which is about every fourth month. Which of the following is *most likely* to be a violation of the Code and Standards?

   A   Anderb failed to disclose to her employer her personal transactions.

   B   Anderb owned the same securities as those of her clients.

   C   Bates allowed Anderb to use Jonelli as her broker for personal trades.

17 Which of the following is a correct statement of a member's or candidate's duty under the Code and Standards?

   A   In the absence of specific applicable law or other regulatory requirements, the Code and Standards govern the member's or candidate's actions.

B A member or candidate is required to comply only with applicable local laws, rules, regulations, or customs, even though the Code and Standards may impose a higher degree of responsibility or a higher duty on the member or candidate.

C A member or candidate who trades securities in a securities market where no applicable local laws or stock exchange rules regulate the use of material nonpublic information may take investment action based on material nonpublic information.

18 Ward is scheduled to visit the corporate headquarters of Evans Industries. Ward expects to use the information he obtains there to complete his research report on Evans stock. Ward learns that Evans plans to pay all of Ward's expenses for the trip, including costs of meals, hotel room, and air transportation. Which of the following actions would be the *best* course for Ward to take under the Code and Standards?

A Accept the expense-paid trip and write an objective report.

B Pay for all travel expenses, including costs of meals and incidental items.

C Accept the expense-paid trip but disclose the value of the services accepted in the report.

19 Which of the following statements is *correct* under the Code and Standards?

A CFA Institute members and candidates are prohibited from undertaking independent practice in competition with their employer.

B Written consent from the employer is necessary to permit independent practice that could result in compensation or other benefits in competition with a member's or candidate's employer.

C Members and candidates are prohibited from making arrangements or preparations to go into a competitive business before terminating their relationship with their employer.

20 Smith is a financial analyst with XYZ Brokerage Firm. She is preparing a purchase recommendation on JNI Corporation. Which of the following situations is *most likely* to represent a conflict of interest for Smith that would have to be disclosed?

A Smith frequently purchases items produced by JNI.

B XYZ holds for its own account a substantial common stock position in JNI.

C Smith's brother-in-law is a supplier to JNI.

21 Michelieu tells a prospective client, "I may not have a long-term track record yet, but I'm sure that you'll be very pleased with my recommendations and service. In the three years that I've been in the business, my equity-oriented clients have averaged a total return of more than 26% a year." The statement is true, but Michelieu only has a few clients, and one of his clients took a large position in a penny stock (against Michelieu's advice) and realized a huge gain. This large return caused the average of all of Michelieu's clients to exceed 26% a year. Without this one investment, the average gain would have been 8% a year. Has Michelieu violated the Standards?

A No, because Michelieu is not promising that he can earn a 26% return in the future.

B No, because the statement is a true and accurate description of Michelieu's track record.

C Yes, because the statement misrepresents Michelieu's track record.

22 An investment banking department of a brokerage firm often receives material nonpublic information that could have considerable value if used in advising the firm's brokerage clients. In order to conform to the Code and Standards, which one of the following is the best policy for the brokerage firm?

    A Permanently prohibit both "buy" and "sell" recommendations of the stocks of clients of the investment banking department.

    B Establish physical and informational barriers within the firm to prevent the exchange of information between the investment banking and brokerage operations.

    C Monitor the exchange of information between the investment banking department and the brokerage operation.

23 Stewart has been hired by Goodner Industries, Inc., to manage its pension fund. Stewart's duty of loyalty, prudence, and care is owed to:

    A The management of Goodner.

    B The participants and beneficiaries of Goodner's pension plan.

    C The shareholders of Goodner.

24 Which of the following statements is a stated purpose of disclosure in Standard VI(C)–Referral Fees?

    A Disclosure will allow the client to request discounted service fees.

    B Disclosure will help the client evaluate any possible partiality shown in the recommendation of services.

    C Disclosure means advising a prospective client about the referral arrangement once a formal client relationship has been established.

25 Rose, a portfolio manager for a local investment advisory firm, is planning to sell a portion of his personal investment portfolio to cover the costs of his child's academic tuition. Rose wants to sell a portion of his holdings in Household Products, but his firm recently upgraded the stock to "strong buy." Which of the following describes Rose's options under the Code and Standards?

    A Based on his firm's "buy" recommendation, Rose cannot sell the shares because he would be improperly prospering from the inflated recommendation.

    B Rose is free to sell his personal holdings once his firm is properly informed of his intentions.

    C Rose can sell his personal holdings but only when a client of the firm places an order to buy shares of Household.

26 A former hedge fund manager, Jackman, has decided to launch a new private wealth management firm. From his prior experiences, he believes the new firm needs to achieve US$1 million in assets under management in the first year. Jackman offers a $10,000 incentive to any adviser who joins his firm with the minimum of $200,000 in committed investments. Jackman places notice of the opening on several industry web portals and career search sites. Which of the following is *correct* according to the Code and Standards?

    A A member or candidate is eligible for the new position and incentive if he or she can arrange for enough current clients to switch to the new firm and if the member or candidate discloses the incentive fee.

    B A member or candidate may not accept employment with the new firm because Jackman's incentive offer violates the Code and Standards.

C A member or candidate is not eligible for the new position unless he or she is currently unemployed because soliciting the clients of the member's or candidate's current employer is prohibited.

27 Carter works for Invest Today, a local asset management firm. A broker that provides Carter with proprietary research through client brokerage arrangements is offering a new trading service. The broker is offering low-fee, execution-only trades to complement its traditional full-service, execution-and-research trades. To entice Carter and other asset managers to send additional business its way, the broker will apply the commissions paid on the new service toward satisfying the brokerage commitment of the prior full-service arrangements. Carter has always been satisfied with the execution provided on the full-service trades, and the new low-fee trades are comparable to the fees of other brokers currently used for the accounts that prohibit soft dollar arrangements.

   A Carter can trade for his accounts that prohibit soft dollar arrangements under the new low-fee trading scheme.

   B Carter cannot use the new trading scheme because the commissions are prohibited by the soft dollar restrictions of the accounts.

   C Carter should trade only through the new low-fee scheme and should increase his trading volume to meet his required commission commitment.

28 Rule has worked as a portfolio manager for a large investment management firm for the past 10 years. Rule earned his CFA charter last year and has decided to open his own investment management firm. After leaving his current employer, Rule creates some marketing material for his new firm. He states in the material, "In earning the CFA charter, a highly regarded credential in the investment management industry, I further enhanced the portfolio management skills learned during my professional career. While completing the examination process in three consecutive years, I consistently received the highest possible scores on the topics of Ethics, Alternative Investments, and Portfolio Management." Has Rule violated Standard VII(B)–Reference to CFA Institute, the CFA Designation, and the CFA Program in his marketing material?

   A Rule violated Standard VII(B) in stating that he completed the exams in three consecutive years.

   B Rule violated Standard VII(B) in stating that he received the highest scores in the topics of Ethics, Alternative Investments, and Portfolio Management.

   C Rule did not violate Standard VII(B).

29 Stafford is a portfolio manager for a specialized real estate mutual fund. Her firm clearly describes in the fund's prospectus its soft dollar policies. Stafford decides that entering the CFA Program will enhance her investment decision-making skill and decides to use the fund's soft dollar account to pay the registration and exam fees for the CFA Program. Which of the following statements is *most likely* correct?

   A Stafford did not violate the Code and Standards because the prospectus informed investors of the fund's soft dollar policies.

   B Stafford violated the Code and Standards because improving her investment skills is not a reasonable use of the soft dollar account.

   C Stafford violated the Code and Standards because the CFA Program does not meet the definition of research allowed to be purchased with brokerage commissions.

30 Long has been asked to be the keynote speaker at an upcoming investment conference. The event is being hosted by one of the third-party investment managers currently used by his pension fund. The manager offers to cover all

conference and travel costs for Long and make the conference registrations free for three additional members of his investment management team. To ensure that the conference obtains the best speakers, the host firm has arranged for an exclusive golf outing for the day following the conference on a local championship-caliber course. Which of the following is *least likely* to violate Standard I(B)?

A   Long may accept only the offer to have his conference-related expenses paid by the host firm.

B   Long may accept the offer to have his conference-related expenses paid and may attend the exclusive golf outing at the expense of the hosting firm.

C   Long may accept the entire package of incentives offered to speak at this conference.

31   Andrews, a private wealth manager, is conducting interviews for a new research analyst for his firm. One of the candidates is Wright, an analyst with a local investment bank. During the interview, while Wright is describing his analytical skills, he mentions a current merger in which his firm is acting as the adviser. Andrews has heard rumors of a possible merger between the two companies, but no releases have been made by the companies concerned. Which of the following actions by Andrews is *least likely* a violation of the Code and Standards?

A   Waiting until the next day before trading on the information to allow time for it to become public.

B   Notifying all investment managers in his firm of the new information so none of their clients are disadvantaged.

C   Placing the securities mentioned as part of the merger on the firm's restricted trading list.

32   Pietro, president of Local Bank, has hired the bank's market maker, Vogt, to seek a merger partner. Local is currently not listed on a stock exchange and has not reported that it is seeking strategic alternatives. Vogt has discussed the possibility of a merger with several firms, but they have all decided to wait until after the next period's financial data are available. The potential buyers believe the results will be worse than the results of prior periods and will allow them to pay less for Local Bank.

Pietro wants to increase the likelihood of structuring a merger deal quickly. Which of the following actions would *most likely* be a violation of the Code and Standards?

A   Pietro could instruct Local Bank to issue a press release announcing that it has retained Vogt to find a merger partner.

B   Pietro could place a buy order for 2,000 shares (or four times the average weekly volume) through Vogt for his personal account.

C   After confirming with Local's chief financial officer, Pietro could instruct Local to issue a press release reaffirming the firm's prior announced earnings guidance for the full fiscal year.

33   ABC Investment Management acquires a new, very large account with two concentrated positions. The firm's current policy is to add new accounts for the purpose of performance calculation after the first full month of management. Cupp is responsible for calculating the firm's performance returns. Before the end of the initial month, Cupp notices that one of the significant holdings of the new accounts is acquired by another company, causing the value of the investment to double. Because of this holding, Cupp decides to account for the new portfolio as of the date of transfer, thereby allowing ABC Investment to reap the positive impact of that month's portfolio return.

   A Cupp did not violate the Code and Standards because the GIPS standards allow composites to be updated on the date of large external cash flows.

   B Cupp did not violate the Code and Standards because companies are allowed to determine when to incorporate new accounts into their composite calculation.

   C Cupp violated the Code and Standards because the inclusion of the new account produces an inaccurate calculation of the monthly results according to the firm's stated policies.

34 Cannan has been working from home on weekends and occasionally saves correspondence with clients and completed work on her home computer. Because of worsening market conditions, Cannan is one of several employees released by her firm. While Cannan is looking for a new job, she uses the files she saved at home to request letters of recommendation from former clients. She also provides to prospective clients some of the reports as examples of her abilities.

   A Cannan violated the Code and Standards because she did not receive permission from her former employer to keep or use the files after her employment ended.

   B Cannan did not violate the Code and Standards because the files were created and saved on her own time and computer.

   C Cannan violated the Code and Standards because she is prohibited from saving files on her home computer.

35 Quinn sat for the Level III CFA exam this past weekend. He updates his resume with the following statement: "In finishing the CFA Program, I improved my skills related to researching investments and managing portfolios. I will be eligible for the CFA charter upon completion of the required work experience."

   A Quinn violated the Code and Standards by claiming he improved his skills through the CFA Program.

   B Quinn violated the Code and Standards by incorrectly stating that he is eligible for the CFA charter.

   C Quinn did not violate the Code and Standards with his resume update.

36 During a round of golf, Rodriguez, chief financial officer of Mega Retail, mentions to Hart, a local investment adviser and long-time personal friend, that Mega is having an exceptional sales quarter. Rodriguez expects the results to be almost 10% above the current estimates. The next day, Hart initiates the purchase of a large stake in the local exchange-traded retail fund for her personal account.

   A Hart violated the Code and Standards by investing in the exchange-traded fund that included Mega Retail.

   B Hart did not violate the Code and Standards because she did not invest directly in securities of Mega Retail.

   C Rodriguez did not violate the Code and Standards because the comments made to Hart were not intended to solicit an investment in Mega Retail.

37 Park is very frustrated after taking her Level II exam. While she was studying for the exam, to supplement the curriculum provided, she ordered and used study material from a third-party provider. Park believes the additional material focused her attention on specific topic areas that were not tested while ignoring other areas. She posts the following statement on the provider's discussion board: "I am very dissatisfied with your firm's CFA Program Level II material. I found the exam extremely difficult and myself unprepared for specific questions after using your product. How could your service provide such limited

instructional resources on the analysis of inventories and taxes when the exam had multiple questions about them? I will not recommend your products to other candidates."

A Park violated the Code and Standards by purchasing third-party review material.

B Park violated the Code and Standards by providing her opinion on the difficulty of the exam.

C Park violated the Code and Standards by providing specific information on topics tested on the exam.

38 Paper was recently terminated as one of a team of five managers of an equity fund. The fund had two value-focused managers and terminated one of them to reduce costs. In a letter sent to prospective employers, Paper presents, with written permission of the firm, the performance history of the fund to demonstrate his past success.

A Paper did not violate the Code and Standards.

B Paper violated the Code and Standards by claiming the performance of the entire fund as his own.

C Paper violated the Code and Standards by including the historical results of his prior employer.

39 Townsend was recently appointed to the board of directors of a youth golf program that is the local chapter of a national not-for-profit organization. The program is beginning a new fund-raising campaign to expand the number of annual scholarships it provides. Townsend believes many of her clients make annual donations to charity. The next week in her regular newsletter to all clients, she includes a small section discussing the fund-raising campaign and her position on the organization's board.

A Townsend did not violate the Code and Standards.

B Townsend violated the Code and Standards by soliciting donations from her clients through the newsletter.

C Townsend violated the Code and Standards by not getting approval of the organization before soliciting her clients.

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 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.

7   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.

8   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).

9   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.

10 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).

11 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.

12 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.

13 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.

14 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.

15 The correct answer i*s* 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.

16 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.

17 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.

18 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.

19 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 prepa-
rations 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 prohibi-
tion against undertaking independent practice.

20 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.

21 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 guarantee-
ing future results, his words are still a misrepresentation of his performance
history.

22 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 infor-
mation 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.

23 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 manage-
ment of the company or the company's shareholders.

24 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 refer-
ral fees, to be effective, should be made to prospective clients before entering
into a formal client relationship with them.

25 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.

26 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.

27 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.

28 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.

29 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.

30 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.

31 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.

32 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.

33 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.

34 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.

35 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.

36 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).

37 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.

38 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.

39 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.

PRACTICE PROBLEMS

1   An investment management firm that does not adopt the GIPS standards could mischaracterize its overall performance by presenting a performance history:

   A   that includes terminated portfolios.

   B   composed of a single top-performing portfolio.

   C   for an investment mandate over all periods since the firm's inception.

2   Which of the following statements regarding GIPS compliance is correct?

   A   Plan sponsors and consultants that manage assets can claim compliance with GIPS.

   B   Software that calculates performance in a manner consistent with the GIPS standards can claim compliance with GIPS.

   C   Investment management firms can comply with GIPS requirements by limiting their compliance claims to the standards they have chosen to follow.

3   Each composite of a GIPS-compliant firm must consist of:

   A   multiple portfolios.

   B   portfolios selected on an *ex post* basis.

   C   portfolios managed according to a similar investment strategy.

4   Verification of a firm's claim of compliance with the GIPS standards is performed:

   A   by firm personnel.

   B   on a firm-wide basis.

   C   to ensure the accuracy of a specific composite presentation.

SOLUTIONS

1 B is correct. Selecting a top-performing portfolio to represent a firm's overall investment results for a specific mandate, also known as using representative accounts, is a misleading practice that is not allowed under the GIPS standards. A is incorrect because including terminated portfolios is consistent with the GIPS standards. If the firm instead presented a performance history that excludes terminated portfolios, however, such a practice would be misleading and not allowed under the GIPS standards. C is incorrect because presenting performance for its mandate covering all periods since the firm's inception is consistent with the GIPS standards. If the firm instead presented performance for a selected period during which it produced excellent returns or outperformed its benchmark, however, such a practice would be misleading and not allowed under the GIPS standards.

2 A is correct. Plan sponsors and consultants can make a claim of compliance if they actually manage assets for which they are making a claim of compliance. B is incorrect because software (and the vendors that supply software) cannot be GIPS compliant. Software can assist firms in achieving compliance with the GIPS standards, but only an investment management firm can claim compliance. C is incorrect because a firm has only two options regarding compliance with the GIPS standards: fully comply with all requirements of the GIPS standards and claim compliance through the use of the GIPS Compliance Statement; or not comply with all requirements of the GIPS standards and not claim compliance with, or make any reference to, the GIPS standards.

3 C is correct. A composite is an aggregation of one or more portfolios managed according to a similar investment mandate, objective, or strategy. For example, if a GIPS-compliant firm presents performance for a global equity composite (the composite), the composite must include portfolios that are managed, or have historically been managed, according to the firm's global equity strategy. A is incorrect because a composite is an aggregation of one or more portfolios managed according to a similar investment mandate, objective, or strategy. A composite may consist of a single portfolio when it is the only portfolio managed according to a particular mandate. B is incorrect because the determination of which portfolio(s) to include in a composite should be done according to pre-established criteria (*ex ante* basis), not after the fact (*ex post* basis).

4 B is correct. Verification is performed with respect to an entire firm, not on specific composites.

PRACTICE PROBLEMS

1   With respect to the Global Investment Performance Standards, which of the following is one of the nine sections containing investment performance provisions?

    A   Real Estate.

    B   Derivatives.

    C   Legal and Ethical Considerations.

2   According to the Fundamentals of Compliance section of the Global Investment Performance Standards, issues that a firm must consider when claiming compliance include all of the following *except*:

    A   replicating performance.

    B   properly defining the firm.

    C   documenting firm policies and procedures used in establishing and maintaining compliance with the Standards.

3   G&F Advisors claims compliance with the Global Investment Performance Standards (GIPS) in its marketing materials. The compliant presentation includes a footnote which indicates that the firm has been verified by an independent third party. An additional note states that G&F is in compliance with the GIPS standards except for its private equity investments. Is it *likely* that G&F violated the GIPS standards?

    A   No, because the footnotes meet the requirements of the Standards.

    B   No, because the provisions do not apply to the private equity investments.

    C   Yes, because they cannot claim compliance unless all requirements of the Standard are met.

4   The GIPS standards are instrumental in:

    A   enabling regulatory enforcement of investment performance reporting.

    B   establishing best practices for calculating and presenting investment performance.

    C   eliminating barriers to entry in markets with no investment performance standards.

5   A key feature of the GIPS standards is that:

    A   they strive to cover the unique characteristics of each asset class.

    B   firms must adhere to all requirements of the standards to claim compliance.

    C   actual, discretionary, fee-paying portfolios may be excluded from a composite under limited conditions.

6   What is the minimum period of compliant performance that a 12-year-old firm must present to comply with the GIPS standards?

    A   Five years

    B   Ten years

    C   Twelve years

7   To claim compliance with the GIPS standards, a firm is required to:

    A   adhere to certain calculation methodologies.

    B   conduct an independent third-party verification of its claim of compliance.

    C perform periodic internal compliance checks of its investment performance process.

8 Adherence to the GIPS standards is reinforced by:

    A the sanctioning authority of sponsoring organizations.

    B the higher priority placed on compliance with GIPS over conflicting regulations.

    C a strong commitment to ethical integrity in fair representation and full disclosure.

9 Which of the following statements concerning the requirements of GIPS Fundamentals of Compliance is correct?

    A Firms claiming compliance have full discretion over the dissemination of their compliant presentation.

    B Firms may claim partial compliance with the standards provided the performance presented is not false or misleading.

    C The definition of the firm creates defined boundaries whereby total firm assets and the basis for firm-wide compliance are determined.

10 According to the Fundamentals of Compliance—Requirements section of the GIPS standards, a firm must:

    A include in total firm assets those assigned to a sub-advisor selected by the firm.

    B alter historical composite performance after a significant change in the firm's organization occurs.

    C represent that the calculation methodology used by the firm is "in accordance with the Global Investment Performance Standards" when presenting performance.

11 The Fundamentals of Compliance section of the GIPS standards recommends that firms:

    A conduct a verification.

    B adopt a limited definition of the firm, regardless of the actual name of the individual investment management company.

    C annually provide existing clients with compliant presentations for each composite on the firm's list of composite descriptions.

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.

4   B is correct. Given the growth in the types and number of financial entities, the globalization of the investment process, and the increased competition among investment management firms, the establishment of GIPS has led to an accepted set of best practices for calculating and presenting investment performance that is readily comparable among investment firms, regardless of geographic location. A is incorrect because the GIPS standards are a voluntary set of best practices that recognize that investment practices, regulation, performance measurement, and reporting of performance vary considerably from country to country. The standards are based on a "self-regulation" model rather than a legally enforceable regulatory model. C is incorrect because the GIPS standards are designed to encourage fair, global competition among investment firms without creating or eliminating market entry barriers. Presenting performance in accordance with the GIPS standards enables firms to compete on an equal footing regardless of geographic location or the stage of development of local market investment reporting practices.

5   B is correct. To claim compliance, firms must comply with all requirements of the GIPS standards, including any updates. Because meeting the objectives of fair representation and full disclosure is likely to require more than adhering to the minimum requirements, firms should also adhere to the recommendations of the standards to achieve best practice. A is incorrect because the GIPS standards do not address every aspect of performance measurement or cover unique aspects of each asset class. The GIPS standards will continue to evolve over time to address additional areas of investment performance. C is incorrect because the GIPS standards require firms to include all actual, discretionary, fee-paying portfolios in at least one composite defined by investment strategy. There are no exceptions to this requirement for portfolios meeting this definition.

6   B is correct. After a firm presents a minimum of 5 years of GIPS-compliant performance, the firm must present an additional year of performance for each year since its inception, building up to a minimum of 10 years of GIPS-compliant performance. Accordingly, a firm in existence for 12 years must present, at a minimum, 10 years of compliant performance to comply with the GIPS standards.

7   A is correct. The GIPS standards require firms to adhere to certain calculation methodologies and to make specific disclosures along with the firm's performance. B is incorrect because firms may choose (but are not required) to have an independent third-party verification to claim compliance with the GIPS standards. Verification is merely a recommendation of the GIPS standards. Being verified is considered best practice. C is incorrect because the GIPS standards strongly encourage (but do not require) firms to perform periodic

internal compliance checks of their investment performance process. Internal compliance checks do instill confidence in the validity of the performance presented as well as in the claim of compliance.

8 C is correct. Given the voluntary, "self-regulatory" nature of the GIPS standards, adherence to the standards requires firms to be strongly committed to ethical integrity in the reporting of performance that upholds the principles of fair representation and full disclosure. A is incorrect because sponsoring organizations lack the authority to sanction firms that falsely claim compliance with the GIPS standards. Compliance with the standards is voluntary, and firms "self-regulate" their claim of compliance. B is incorrect because where laws or regulations conflict with the GIPS standards, firms are required to comply with the laws and regulations and fully disclose the conflict in the compliant presentation. Complying with regulations takes priority over compliance with GIPS.

9 C is correct. According to Section 0 of the Fundamentals of Compliance, the definition of the firm is the foundation for firm-wide compliance with the GIPS standards and creates defined boundaries whereby total firm assets can be determined. A is incorrect because according to GIPS Provision 0.A.9, to claim compliance with the GIPS standards, firms cannot choose to whom they present a compliant presentation and must make every reasonable effort to provide a compliant presentation to all prospective clients. B is incorrect because according to GIPS Provision 0.A.6, if a firm does not meet all of the requirements of the GIPS standards, it must not represent or make any statements that may indicate partial compliance with the standards.

10 A is correct. According to GIPS Provision 0.A.14, total firm assets must include assets assigned to a sub-advisor provided the firm has discretion over selecting the sub-advisor. B is incorrect because according to GIPS Provision 0.A.15, changes in a firm's organization must not lead to alteration of historical composite performance. C is incorrect because according to GIPS Provision 0.A.7, statements referring to the calculation methodology as being "in accordance", "in compliance", or "consistent" with the Global Investment Performance Standards, or similar statements, are prohibited.

11 A is correct. According to Section 0.B.2 of the Fundamentals of Compliance—Recommendations of the GIPS standards, it is recommended that firms perform an independent, third-party verification of the firm's claim of compliance. B is incorrect because Section 0.B.3 of the Fundamentals of Compliance—Recommendations of the GIPS standards recommends that firms adopt the broadest (rather than limited), most meaningful definition of the firm. The scope of firm definition should include all geographical offices operating under a common brand name regardless of the actual name of the individual investment management company. C is incorrect because Section 0.B.4 of the Fundamentals of Compliance—Recommendations of the GIPS standards recommends that firms annually provide each existing client with a compliant presentation of the composite in which the client's portfolio is included. The standards do not recommend that firms provide compliant presentations for each composite maintained by the firm.

SUMMARY

In this reading, we have explored a foundation topic in investment mathematics, the time value of money. We have developed and reviewed the following concepts for use in financial applications:

- The interest rate, r, is the required rate of return; r is also called the discount rate or opportunity cost.

- An interest rate can be viewed as the sum of the real risk-free interest rate and a set of premiums that compensate lenders for risk: an inflation premium, a default risk premium, a liquidity premium, and a maturity premium.

- The future value, FV, is the present value, PV, times the future value factor, $(1 + r)^N$.

- The interest rate, r, makes current and future currency amounts equivalent based on their time value.

- The stated annual interest rate is a quoted interest rate that does not account for compounding within the year.

- The periodic rate is the quoted interest rate per period; it equals the stated annual interest rate divided by the number of compounding periods per year.

- The effective annual rate is the amount by which a unit of currency will grow in a year with interest on interest included.

- An annuity is a finite set of level sequential cash flows.

- There are two types of annuities, the annuity due and the ordinary annuity. The annuity due has a first cash flow that occurs immediately; the ordinary annuity has a first cash flow that occurs one period from the present (indexed at $t = 1$).

- On a time line, we can index the present as 0 and then display equally spaced hash marks to represent a number of periods into the future. This representation allows us to index how many periods away each cash flow will be paid.

- Annuities may be handled in a similar approach as single payments if we use annuity factors rather than single-payment factors.

- The present value, PV, is the future value, FV, times the present value factor, $(1 + r)^{-N}$.

- The present value of a perpetuity is A/r, where A is the periodic payment to be received forever.

- It is possible to calculate an unknown variable, given the other relevant variables in time value of money problems.

- The cash flow additivity principle can be used to solve problems with uneven cash flows by combining single payments and annuities.

PRACTICE PROBLEMS

1   The table below gives current information on the interest rates for two two-year and two eight-year maturity investments. The table also gives the maturity, liquidity, and default risk characteristics of a new investment possibility (Investment 3). All investments promise only a single payment (a payment at maturity). Assume that premiums relating to inflation, liquidity, and default risk are constant across all time horizons.

Investment	Maturity (in Years)	Liquidity	Default Risk	Interest Rate (%)
1	2	High	Low	2.0
2	2	Low	Low	2.5
3	7	Low	Low	r_3
4	8	High	Low	4.0
5	8	Low	High	6.5

Based on the information in the above table, address the following:

   A   Explain the difference between the interest rates on Investment 1 and Investment 2.

   B   Estimate the default risk premium.

   C   Calculate upper and lower limits for the interest rate on Investment 3, r_3.

2   A couple plans to set aside $20,000 per year in a conservative portfolio projected to earn 7 percent a year. If they make their first savings contribution one year from now, how much will they have at the end of 20 years?

3   Two years from now, a client will receive the first of three annual payments of $20,000 from a small business project. If she can earn 9 percent annually on her investments and plans to retire in six years, how much will the three business project payments be worth at the time of her retirement?

4   To cover the first year's total college tuition payments for his two children, a father will make a $75,000 payment five years from now. How much will he need to invest today to meet his first tuition goal if the investment earns 6 percent annually?

5   A client can choose between receiving 10 annual $100,000 retirement payments, starting one year from today, or receiving a lump sum today. Knowing that he can invest at a rate of 5 percent annually, he has decided to take the lump sum. What lump sum today will be equivalent to the future annual payments?

6   You are considering investing in two different instruments. The first instrument will pay nothing for three years, but then it will pay $20,000 per year for four years. The second instrument will pay $20,000 for three years and $30,000 in the fourth year. All payments are made at year-end. If your required rate of return on these investments is 8 percent annually, what should you be willing to pay for:

   A   The first instrument?

   B   The second instrument (use the formula for a four-year annuity)?

7 Suppose you plan to send your daughter to college in three years. You expect her to earn two-thirds of her tuition payment in scholarship money, so you estimate that your payments will be $10,000 a year for four years. To estimate whether you have set aside enough money, you ignore possible inflation in tuition payments and assume that you can earn 8 percent annually on your investments. How much should you set aside now to cover these payments?

8 A client plans to send a child to college for four years starting 18 years from now. Having set aside money for tuition, she decides to plan for room and board also. She estimates these costs at $20,000 per year, payable at the beginning of each year, by the time her child goes to college. If she starts next year and makes 17 payments into a savings account paying 5 percent annually, what annual payments must she make?

9 A couple plans to pay their child's college tuition for 4 years starting 18 years from now. The current annual cost of college is C$7,000, and they expect this cost to rise at an annual rate of 5 percent. In their planning, they assume that they can earn 6 percent annually. How much must they put aside each year, starting next year, if they plan to make 17 equal payments?

10 The nominal risk-free rate is *best* described as the sum of the real risk-free rate and a premium for:

A maturity.

B liquidity.

C expected inflation.

11 Which of the following risk premiums is most relevant in explaining the difference in yields between 30-year bonds issued by the US Treasury and 30-year bonds issued by a small private issuer?

A Inflation

B Maturity

C Liquidity

12 A bank quotes a stated annual interest rate of 4.00%. If that rate is equal to an effective annual rate of 4.08%, then the bank is compounding interest:

A daily.

B quarterly.

C semiannually.

13 The value in six years of $75,000 invested today at a stated annual interest rate of 7% compounded quarterly is *closest* to:

A $112,555.

B $113,330.

C $113,733.

14 A client requires £100,000 one year from now. If the stated annual rate is 2.50% compounded weekly, the deposit needed today is *closest* to:

A £97,500.

B £97,532.

C £97,561.

15 For a lump sum investment of ¥250,000 invested at a stated annual rate of 3% compounded daily, the number of months needed to grow the sum to ¥1,000,000 is *closest* to:

A 555.

B 563.

   C 576.

16 Given a €1,000,000 investment for four years with a stated annual rate of 3% compounded continuously, the difference in its interest earnings compared with the same investment compounded daily is *closest* to:

   A €1.

   B €6.

   C €455.

17 An investment pays €300 annually for five years, with the first payment occurring today. The present value (PV) of the investment discounted at a 4% annual rate is *closest* to:

   A €1,336.

   B €1,389.

   C €1,625.

18 A perpetual preferred stock makes its first quarterly dividend payment of $2.00 in five quarters. If the required annual rate of return is 6% compounded quarterly, the stock's present value is *closest* to:

   A $31.

   B $126.

   C $133.

19 A saver deposits the following amounts in an account paying a stated annual rate of 4%, compounded semiannually:

Year	End of Year Deposits ($)
1	4,000
2	8,000
3	7,000
4	10,000

At the end of Year 4, the value of the account is *closest* to:

   A $30,432

   B $30,447

   C $31,677

20 An investment of €500,000 today that grows to €800,000 after six years has a stated annual interest rate *closest* to:

   A 7.5% compounded continuously.

   B 7.7% compounded daily.

   C 8.0% compounded semiannually.

21 A sweepstakes winner may select either a perpetuity of £2,000 a month beginning with the first payment in one month or an immediate lump sum payment of £350,000. If the annual discount rate is 6% compounded monthly, the present value of the perpetuity is:

   A less than the lump sum.

   B equal to the lump sum.

   C greater than the lump sum.

22 At a 5% interest rate per year compounded annually, the present value (PV) of a 10-year ordinary annuity with annual payments of $2,000 is $15,443.47. The PV of a 10-year annuity due with the same interest rate and payments is *closest* to:

A $14,708.

B $16,216.

C $17,443.

23 Grandparents are funding a newborn's future university tuition costs, estimated at $50,000/year for four years, with the first payment due as a lump sum in 18 years. Assuming a 6% effective annual rate, the required deposit today is *closest* to:

A $60,699.

B $64,341.

C $68,201.

24 The present value (PV) of an investment with the following year-end cash flows (CF) and a 12% required annual rate of return is *closest* to:

Year	Cash Flow (€)
1	100,000
2	150,000
5	−10,000

A €201,747.

B €203,191.

C €227,573.

25 A sports car, purchased for £200,000, is financed for five years at an annual rate of 6% compounded monthly. If the first payment is due in one month, the monthly payment is *closest* to:

A £3,847.

B £3,867.

C £3,957.

26 Given a stated annual interest rate of 6% compounded quarterly, the level amount that, deposited quarterly, will grow to £25,000 at the end of 10 years is *closest* to:

A £461.

B £474.

C £836.

27 Given the following timeline and a discount rate of 4% a year compounded annually, the present value (PV), as of the end of Year 5 (PV_5), of the cash flow received at the end of Year 20 is *closest* to:

A $22,819.

B $27,763.

C $28,873.

28 A client invests €20,000 in a four-year certificate of deposit (CD) that annually pays interest of 3.5%. The annual CD interest payments are automatically reinvested in a separate savings account at a stated annual interest rate of 2% compounded monthly. At maturity, the value of the combined asset is *closest* to:

A €21,670.

B €22,890.

C €22,950.

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 percent < r_3 < 4.5 percent.
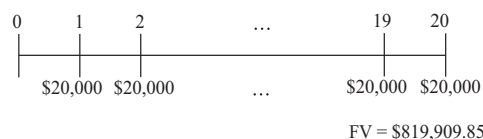
2   **i.** Draw a time line.
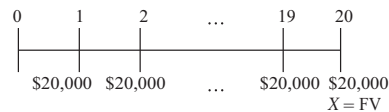
   ii. Identify the problem as the future value of an annuity.

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

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

$$= \$20,000\left[\frac{(1+0.07)^{20} - 1}{0.07}\right]$$

$$= \$819,909.85$$

   **iv.** Alternatively, use a financial calculator.

Notation Used on Most Calculators	Numerical Value for This Problem
N	20
%i	7
PV	n/a (= 0)
FV **compute**	X
PMT	$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.
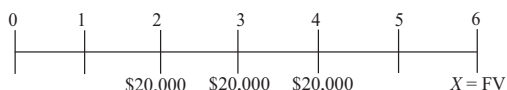
ii. Recognize the problem as the future value of a delayed annuity. Delaying the payments requires two calculations.

**iii.** Use the formula for the future value of an annuity (Equation 7).

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

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
N	3
%i	9
PV	n/a (= 0)
FV **compute**	X
PMT	$20,000

iv. Use the formula for the future value of a lump sum (Equation 2), $\text{FV}_N = \text{PV}(1 + r)^N$, 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
N	2
%i	9
PV	$65,562.00
FV **compute**	X
PMT	n/a (= 0)
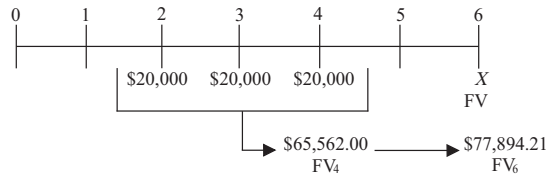
In summary, your client will have $77,894.21 in six years if she receives three yearly payments of $20,000 starting in Year 2 and can earn 9 percent annually on her investments.
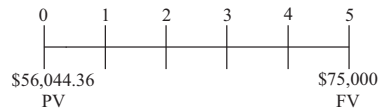
4   **i.** Draw a time line.
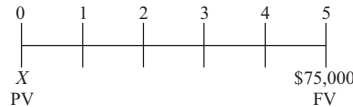
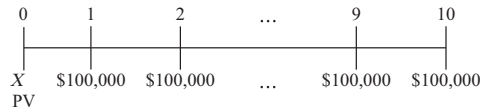**ii.** Identify the problem as the present value of a lump sum.

iii. Use the formula for the present value of a lump sum.

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

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.

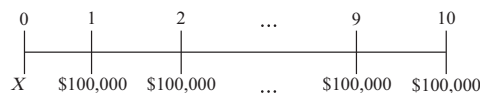**5**   **i.** Draw a time line for the 10 annual payments.

ii. Identify the problem as the present value of an annuity.

iii. Use the formula for the present value of an annuity.

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

$$= \$100,000 \left[\frac{1 - \dfrac{1}{(1 + 0.05)^{10}}}{0.05} \right]$$

$$= \$772,173.49$$

PV = $772,173.49

iv. Alternatively, use a financial calculator.

Notation Used on Most Calculators	Numerical Value for This Problem
N	10
$\%i$	5
PV **compute**	X
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.

```
0     1     2     3     4     5     6     7
|     |     |     |     |     |     |     |
                     $20,000 $20,000 $20,000 $20,000
```

ii.

$$PV_3 = A\left[\frac{1 - \dfrac{1}{(1+r)^N}}{r}\right]$$

$$= \$20,000\left[\frac{1 - \dfrac{1}{(1+0.08)^4}}{0.08}\right]$$

$$= \$66,242.54$$

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.

```
0       1        2        3        4
|       |        |        |        |
     $20,000  $20,000  $20,000  $20,000
                                 +10,000
                                 $30,000
```

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.

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

$$= \$20,000\left[\frac{1 - \dfrac{1}{(1+0.08)^4}}{0.08}\right]$$

$$= \$66,242.54$$

iii.

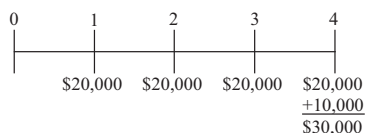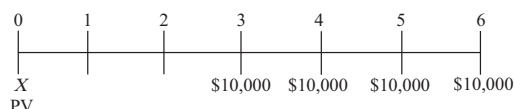$$PV = \frac{FV_4}{(1+r)^N} = \frac{\$10,000}{(1+0.08)^4} = \$7,350.30$$

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).

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

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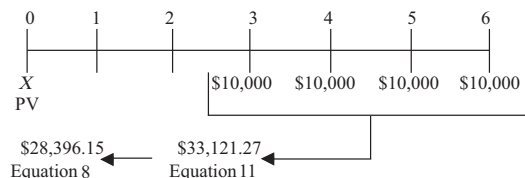
In summary, you should set aside $28,396.15 today to cover four payments of $10,000 starting in three years if your investments earn a rate of 8 percent annually.

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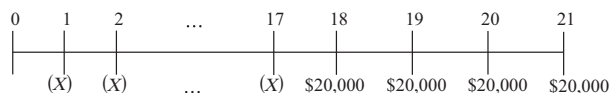
$$PV = \$20,000 \left[\frac{1 - \dfrac{1}{(1.05)^4}}{0.05} \right] = \$70,919$$

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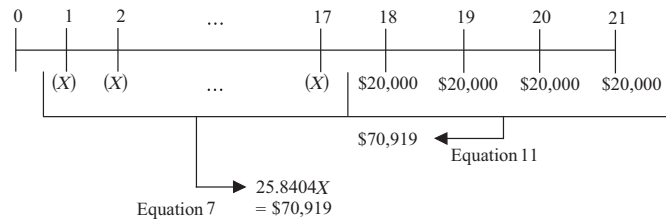
In summary, your client will have to save $2,744.50 each year if she starts next year and makes 17 payments into a savings account paying 5 percent annually.

9   **i.** Draw a time line.
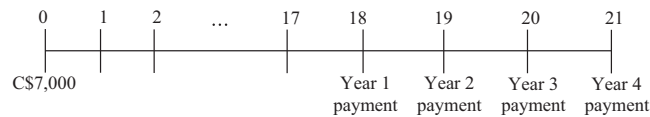
  ii. Recognize that the payments in Years 18, 19, 20, and 21 are the future values of a lump sum of C$7,000 in Year 0.

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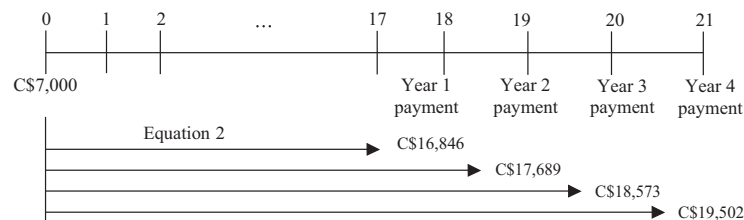
  iv. Using the formula for the present value of a lump sum ($r = 6\%$), equate the four college payments to single payments as of $t = 17$ and add them together. C$16,846$(1.06)^{-1}$ + C$17,689$(1.06)^{-2}$ + C$18,573$(1.06)^{-3}$ + C$19,502$(1.06)^{-4}$ = C$62,677

  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.

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

$$X = \text{C\$2,221.58}$$

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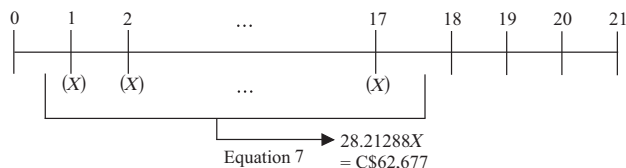
In summary, the couple will need to put aside C$2,221.58 each year if they start next year and make 17 equal payments.

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%.

EAR = (1 + Periodic interest rate)^m − 1

EAR = $(1 + 0.04/365)^{365}$ − 1

EAR = (1.0408) − 1 = 0.04081 ≈ 4.08%.

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

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

$$FV_6 = \$75,000\left(1 + \frac{0.07}{4}\right)^{(4\times6)}$$

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

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):

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

$$PV = \pounds100,000\left(1 + \frac{0.025}{52}\right)^{-52}$$

$$PV = \pounds97,531.58.$$

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

EAR = (1 + Periodic interest rate)^m − 1

EAR = $(1 + 0.03/365)^{365}$ − 1

EAR= (1.03045) − 1 = 0.030453 ≈ 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

€127,496.85 − €127,491.29 = €5.56, or ≈ €6, as shown in the following calculations.

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

$\text{PV}e^{r_s N} - \text{PV}$ = €1,000,000$e^{0.03(4)}$ − €1,000,000

        = €1,127,496.85 − €1,000,000
        = €127,496.85

With daily compounding, the investment earns:

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

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

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

where A = €300, r = 0.04, and N = 5.

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

PV = €1,388.97, or ≈ €1,389.

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

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.

PV = $2.00/(0.06/4)

PV = $133.33.

The value today is (where FV is future value)

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

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

PV = $125.62 ≈ $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 (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 offers.

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:

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

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

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 × 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:

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

= $50,000 × 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 × (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):

$$A = \left(\text{PV of annuity}\right) \Bigg/ \left[\frac{1 - \dfrac{1}{\left(1 + r_s/m\right)^{mN}}}{r_s/m}\right]$$

$$= \left(\pounds200{,}000\right) \Bigg/ \left[\frac{1 - \dfrac{1}{\left(1 + r_s/m\right)^{mN}}}{r_s/m}\right]$$

$$\left(\pounds200{,}000\right) \Bigg/ \left[\frac{1 - \dfrac{1}{\left(1 + 0.06/12\right)^{12(5)}}}{0.06/12}\right]$$

$$= \left(\pounds200{,}000\right)/51.72556$$

$$= \pounds3{,}866.56$$

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:

$$FV = A\left[\frac{\left(1 + \dfrac{r_s}{m}\right)^{mN} - 1}{\dfrac{r}{m}}\right]$$

$$\pounds25{,}000 = A\left[\frac{\left(1 + \dfrac{0.06}{4}\right)^{4\times10} - 1}{\dfrac{0.06}{4}}\right]$$

$$A = \pounds460.68$$

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:

€20,000 initial deposit

€700 €700 €700 €700

annual interest payments (which earn 2.0%/year) + €20,000 (return of principal)
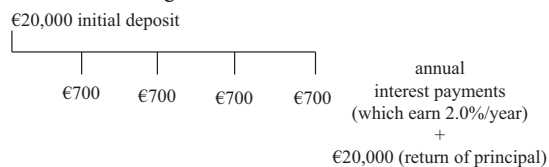
The four annual interest payments are based on the CD's 3.5% annual rate.

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 *FV*
€728.54	Second payment's *FV*
€714.13	Third payment's *FV*
€700.00	Fourth payment's *FV*
€22,885.92	Total *FV*

SUMMARY

In this reading, we have presented descriptive statistics, the set of methods that permit us to convert raw data into useful information for investment analysis.

- A population is defined as all members of a specified group. A sample is a subset of a population.

- A parameter is any descriptive measure of a population. A sample statistic (statistic, for short) is a quantity computed from or used to describe a sample.

- Data measurements are taken using one of four major scales: nominal, ordinal, interval, or ratio. Nominal scales categorize data but do not rank them. Ordinal scales sort data into categories that are ordered with respect to some characteristic. Interval scales provide not only ranking but also assurance that the differences between scale values are equal. Ratio scales have all the characteristics of interval scales as well as a true zero point as the origin. The scale on which data are measured determines the type of analysis that can be performed on the data.

- A frequency distribution is a tabular display of data summarized into a relatively small number of intervals. Frequency distributions permit us to evaluate how data are distributed.

- The relative frequency of observations in an interval is the number of observations in the interval divided by the total number of observations. The cumulative relative frequency cumulates (adds up) the relative frequencies as we move from the first interval to the last, thus giving the fraction of the observations that are less than the upper limit of each interval.

- A histogram is a bar chart of data that have been grouped into a frequency distribution. A frequency polygon is a graph of frequency distributions obtained by drawing straight lines joining successive points representing the class frequencies.

- Sample statistics such as measures of central tendency, measures of dispersion, skewness, and kurtosis help with investment analysis, particularly in making probabilistic statements about returns.

- Measures of central tendency specify where data are centered and include the (arithmetic) mean, median, and mode (most frequently occurring value). The mean is the sum of the observations divided by the number of observations. The median is the value of the middle item (or the mean of the values of the two middle items) when the items in a set are sorted into ascending or descending order. The mean is the most frequently used measure of central tendency. The median is not influenced by extreme values and is most useful in the case of skewed distributions. The mode is the only measure of central tendency that can be used with nominal data.

- A portfolio's return is a weighted mean return computed from the returns on the individual assets, where the weight applied to each asset's return is the fraction of the portfolio invested in that asset.

- The geometric mean, G, of a set of observations X_1, X_2, ..., X_n is $G = \sqrt[n]{X_1 X_2 X_3 \ldots X_n}$ with $X_i \geq 0$ for $i = 1, 2, ..., n$. The geometric mean is especially important in reporting compound growth rates for time series data.

- Quantiles such as the median, quartiles, quintiles, deciles, and percentiles are location parameters that divide a distribution into halves, quarters, fifths, tenths, and hundredths, respectively.

- Dispersion measures such as the variance, standard deviation, and mean absolute deviation (MAD) describe the variability of outcomes around the arithmetic mean.

- Range is defined as the maximum value minus the minimum value. Range has only a limited scope because it uses information from only two observations.

- MAD for a sample is $\dfrac{\sum\limits_{i=1}^{n}\left|X_i - \bar{X}\right|}{n}$ where $\bar{X}$ is the sample mean and n is the number of observations in the sample.

- The variance is the average of the squared deviations around the mean, and the standard deviation is the positive square root of variance. In computing sample variance (s^2) and sample standard deviation, the average squared deviation is computed using a divisor equal to the sample size minus 1.

- The semivariance is the average squared deviation below the mean; semideviation is the positive square root of semivariance. Target semivariance is the average squared deviation below a target level; target semideviation is its positive square root. All these measures quantify downside risk.

- 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 $k > 1$. Chebyshev's inequality permits us to make probabilistic statements about the proportion of observations within various intervals around the mean for any distribution with finite variance. As a result of Chebyshev's inequality, a two-standard-deviation interval around the mean must contain at least 75 percent of the observations, and a three-standard-deviation interval around the mean must contain at least 89 percent of the observations, no matter how the data are distributed.

- The coefficient of variation, CV, is the ratio of the standard deviation of a set of observations to their mean value. A scale-free measure of relative dispersion, by expressing the magnitude of variation among observations relative to their average size, the CV permits direct comparisons of dispersion across different data sets.

- Skew describes the degree to which a distribution is not symmetric about its mean. A return distribution with positive skewness has frequent small losses and a few extreme gains. A return distribution with negative skewness has frequent small gains and a few extreme losses. Zero skewness indicates a symmetric distribution of returns.

- Kurtosis measures combined weight of the tails of a distribution relative to the rest of the distribution. Distributions are characterized as leptokurtic, mesokurtic, or platykurtic according to whether there is relatively more, the same, or less weight in the tails. The calculation for kurtosis involves finding the average of deviations from the mean raised to the fourth power and then standardizing that average by the standard deviation raised to the fourth power. Excess kurtosis is kurtosis minus 3, the value of kurtosis for all normal distributions.

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PRACTICE PROBLEMS

1 Which of the following groups *best* illustrates a sample?

   A The set of all estimates for Exxon Mobil's EPS for next financial year

   B The FTSE Eurotop 100 as a representation of the European stock market

   C UK shares traded on Wednesday of last week that also closed above £120/share on the London Stock Exchange

2 Published ratings on stocks ranging from 1 (strong sell) to 5 (strong buy) are examples of which measurement scale?

   A Ordinal

   B Interval

   C Nominal

3 Which of the following groups *best* illustrates a population?

   A The 500 companies in the S&P 500 Index

   B The NYSE-listed stocks in the Dow Jones Industrial Average

   C The Lehman Aggregate Bond Index as a representation of the US bond market

4 In descriptive statistics, an example of a parameter is the:

   A median of a population.

   B mean of a sample of observations.

   C standard deviation of a sample of observations.

5 A mutual fund has the return frequency distribution shown in the following table.

Return Interval (%)	Absolute Frequency
−10.0 to −7.0	3
−7.0 to −4.0	7
−4.0 to −1.0	10
−1.0 to +2.0	12
+2.0 to +5.0	23
+5.0 to +8.0	5

Which of the following statements is correct?

   A The relative frequency of the interval "−1.0 to +2.0" is 20%.

   B The relative frequency of the interval "+2.0 to +5.0" is 23%.

   C The cumulative relative frequency of the interval "+5.0 to +8.0" is 91.7%.

6 An analyst is using the data in the following table to prepare a statistical report.

Portfolio's Deviations from Benchmark Return, 2003–2014 (%)			
Year 1	2.48	Year 7	−9.19
Year 2	−2.59	Year 8	−5.11
Year 3	9.47	Year 9	1.33

(continued)

(Continued)			
Year 4	−0.55	Year 10	6.84
Year 5	−1.69	Year 11	3.04
Year 6	−0.89	Year 12	4.72

The cumulative relative frequency for the interval −1.71% ≤ x < 2.03% is *closest* to:

A 0.250.

B 0.333.

C 0.583.

7 Frequency distributions summarize data in:

A a tabular display.

B overlapping intervals.

C a relatively large number of intervals.

8 Based on the table below, which of the following statements is correct?

Frequency Distributions of Sample Returns		
Interval	**Range**	**Absolute Frequency**
A	−10% ≤ Observation ⊠ −5%	2
B	−5% ≤ Observation ⊠ 0%	7
C	0% ≤ Observation < 5%	15
D	5% ≤ Observation < 10%	2

A The relative frequency of Interval C is 15.

B The cumulative frequency of Interval D is 100%.

C The cumulative relative frequency of Interval C is 92.3%.

The following information relates to Questions 9–10

The following histogram shows a distribution of the S&P 500 Index annual returns for a 50-year period:

Frequency / Return Intervals histogram
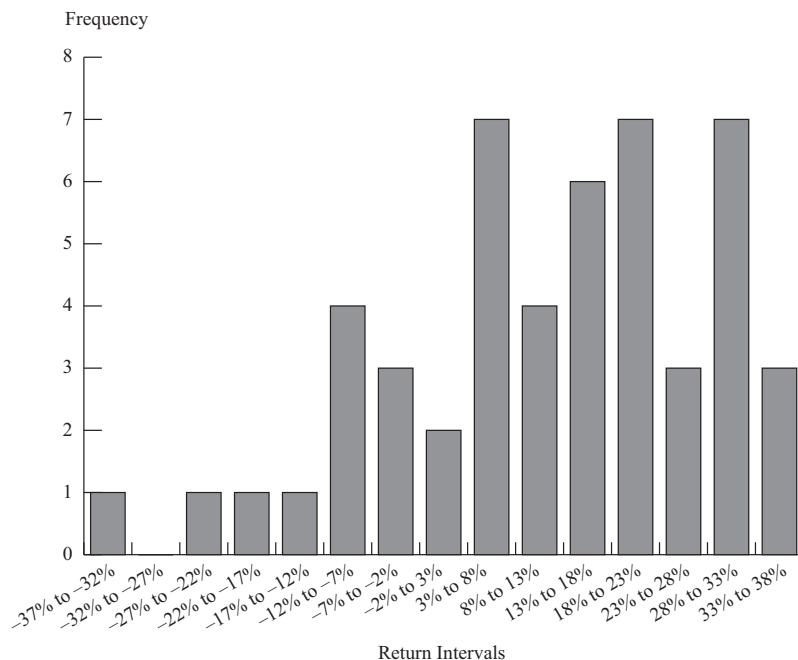
9 The interval containing the median return is:

   A 3% to 8%.

   B 8% to 13%.

   C 13% to 18%.

10 Based on the previous histogram, the distribution is *best* described as having:

   A one mode.

   B two modes.

   C three modes.

---

11 The following is a frequency polygon of monthly exchange rate changes in the US dollar/Japanese yen spot exchange rate for a four-year period. A positive change represents yen appreciation (the yen buys more dollars), and a negative change represents yen depreciation (the yen buys fewer dollars).

Monthly Changes in the US Dollar/Japanese Yen Spot Exchange Rate

Frequency

Return Interval Midpoint
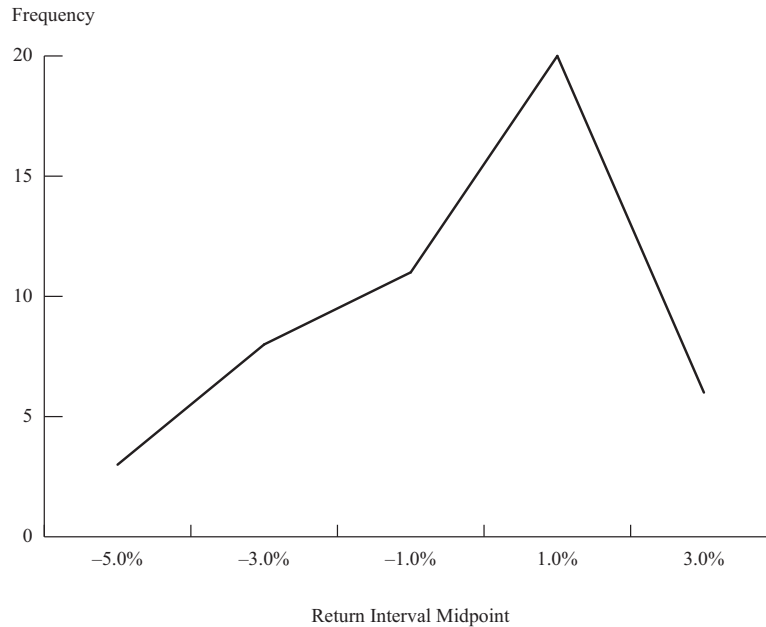
Based on the chart, yen appreciation:

A occurred more than 50% of the time.

B was less frequent than yen depreciation.

C in the 0.0 to 2.0 interval occurred 20% of the time.

12 The height of a bar in a histogram represents the matching data interval's:

A relative frequency.

B absolute frequency.

C cumulative frequency.

The following table relates to Questions 13 and 14

Equity Returns for Six Companies	
Company	**Total Equity Return (%)**
A	−4.53
B	−1.40
C	−1.20
D	−1.20

(Continued)	
Company	**Total Equity Return (%)**
E	0.70
F	8.90

13 Based on the table, the arithmetic mean of the equity returns is *closest* to the return of:

   A Company B.

   B Company C.

   C Company E.

14 Using the data from the table, the difference between the median and the mode is *closest* to:

   A −1.41.

   B 0.00.

   C 1.41.

15 The annual returns for three portfolios are shown in the following table. Portfolios P and R were created in Year 1, Portfolio Q in Year 2.

	Annual Portfolio Returns (%)				
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Portfolio P	−3.0	4.0	5.0	3.0	7.0
Portfolio Q		−3.0	6.0	4.0	8.0
Portfolio R	1.0	−1.0	4.0	4.0	3.0

The median annual return from portfolio creation to 2013 for:

   A Portfolio P is 4.5%.

   B Portfolio Q is 4.0%.

   C Portfolio R is higher than its arithmetic mean annual return.

16 Last year, an investor allocated his retirement savings in the asset classes shown in the following table.

Asset Class	**Asset Allocation (%)**	**Asset Class Return (%)**
Large-cap US equities	20.0	8.0
Small-cap US equities	40.0	12.0
Emerging market equities	25.0	−3.0
High-yield bonds	15.0	4.0

The portfolio return in 2015 is *closest to*:

   A 5.1%.

   B 5.3%.

   C 6.3%.

17 The following table shows the annual returns for Fund Y.

	Fund Y (%)
Year 1	19.5
Year 2	−1.9
Year 3	19.7
Year 4	35.0
Year 5	5.7

The geometric mean for Fund Y is *closest* to:

A   14.9%.

B   15.6%.

C   19.5%.

18 A manager invests €5,000 annually in a security for four years at the prices shown in the following table.

	Purchase Price of Security (€)
Year 1	62.00
Year 2	76.00
Year 3	84.00
Year 4	90.00

The average price paid for the security is *closest* to:

A   €76.48.

B   €77.26.

C   €78.00.

The following information relates to Questions 19–20

The following exhibit shows the annual MSCI World Index total returns for a 10-year period.

Year 1	15.25%	Year 6	30.79%
Year 2	10.02%	Year 7	12.34%
Year 3	20.65%	Year 8	−5.02%
Year 4	9.57%	Year 9	16.54%
Year 5	−40.33%	Year 10	27.37%

19 The fourth quintile return for the MSCI World Index is *closest* to:

A   20.65%.

B   26.03%.

C   27.37%.

20 For Year 6 to Year 10, the mean absolute deviation of the MSCI World Index total returns is *closest* to:

A   10.20%.

B 12.74%.

C 16.40%.

The following table relates to questions 21 and 22

10 Years of S&P 500 Total Returns (in Ascending Order)
Returns
−38.49%
−0.73%
0.00%
9.54%
11.39%
12.78%
13.41%
19.42%
23.45%
29.60%

21 The third quartile percentage of total returns is *closest* to:

A 19.42%.

B 20.43%.

C 23.45%.

22 Complete the missing entries in the table below to answer this question.

Overall Risk Measures, S&P 500 vs. Sample Portfolio		
	S&P 500	**Sample Portfolio**
Mean	8.04%	8.54%
Range	–	67.09%
MAD	–	11.78%

An analyst does a performance measurement to compare the risk of a contemporaneous sample portfolio with that of the S&P 500 by determining the ranges and mean absolute deviations (MAD) of the two investments. The comparison shows that the S&P 500 appears riskier in terms of the:

A range only.

B MAD only.

C MAD and range.

23 Annual returns and summary statistics for three funds are listed in the following table:

Year	Annual Returns (%)		
	Fund ABC	**Fund XYZ**	**Fund PQR**
Year 1	−20.0	−33.0	−14.0
Year 2	23.0	−12.0	−18.0
Year 3	−14.0	−12.0	6.0
Year 4	5.0	−8.0	−2.0
Year 5	−14.0	11.0	3.0
Mean	−4.0	−10.8	−5.0
Standard deviation	17.8	15.6	10.5

The fund that shows the highest dispersion is:

A Fund PQR if the measure of dispersion is the range.

B Fund XYZ if the measure of dispersion is the variance.

C Fund ABC if the measure of dispersion is the mean absolute deviation.

24 Using the information in the following table, the sample standard deviation for VWIGX is *closest* to:

2015–2017 Total Return for VWIGX	
Year	**Vanguard International Growth Fund (VWIGX)**
2015	−0.67%
2016	1.71%
2017	42.96%

A 6.02%.

B 12.04%.

C 24.54%.

25 Over the past 240 months, an investor's portfolio had a mean monthly return of 0.79%, with a standard deviation of monthly returns of 1.16%. According to Chebyshev's inequality, the minimum number of the 240 monthly returns that fall into the range of −0.95% to 2.53% is *closest* to:

A 80.

B 107.

C 133.

26 For a distribution of 2,000 observations with finite variance, sample mean of 10.0%, and standard deviation of 4.0%, what is the minimum number of observations that will lie within 8.0% around the mean according to Chebyshev's Inequality?

A 720

B 1,500

C 1,680

27 The mean monthly return and the standard deviation for three industry sectors are shown in the following exhibit.

Sector	Mean Monthly Return (%)	Standard Deviation of Return (%)
Utilities (UTIL)	2.10	1.23
Materials (MATR)	1.25	1.35
Industrials (INDU)	3.01	1.52

Based on the coefficient of variation, the riskiest sector is:

A utilities.

B materials.

C industrials.

The following information relates to Questions 28–29

The following table shows various statistics for Portfolios 1, 2, and 3.

	Mean Return (%)	Standard Deviation of Returns (%)	Skewness	Excess Kurtosis
Portfolio 1	7.8	15.1	0.0	0.7
Portfolio 2	10.2	20.5	0.9	−1.8
Portfolio 3	12.9	29.3	−1.5	6.2

28 The skewness of Portfolio 1 indicates its mean return is *most likely*:

A less than its median.

B equal to its median.

C greater than its median.

29 Compared with a normal distribution, the distribution of returns for Portfolio 3 *most likely*:

A has less weight in the tails.

B has a greater number of extreme returns.

C has fewer small deviations from its mean.

---

30 Two portfolios have unimodal return distributions. Portfolio 1 has a skewness of 0.77, and Portfolio 2 has a skewness of −1.11.

Which of the following is correct?

A For Portfolio 1, the median is less than the mean.

B For Portfolio 1, the mode is greater than the mean.

C For Portfolio 2, the mean is greater than the median.

31 A return distribution with frequent small gains and a few extreme losses is *most likely* to be called:

A leptokurtic.

    B   positively skewed.

    C   negatively skewed.

32 Which of the following sequences *best* represents the relative sizes of the mean, median, and mode for a positively skewed unimodal distribution?

    A   mode ≤ median ≤ mean

    B   mode < median < mean

    C   mean < median < mode

33 A distribution with excess kurtosis less than zero is termed:

    A   mesokurtic.

    B   platykurtic.

    C   leptokurtic.

34 When analyzing investment returns, which of the following statements is correct?

    A   The geometric mean will exceed the arithmetic mean for a series with non-zero variance.

    B   The geometric mean measures an investment's compound rate of growth over multiple periods.

    C   The arithmetic mean accurately estimates an investment's terminal value over multiple periods.

35 Which of the following statistical means *best* measures a mutual fund's past performance?

    A   Harmonic

    B   Geometric

    C   Arithmetic

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. A population is defined as all members of a specified group. The S&P 500 Index consists of 500 companies, so this group is the population of companies in the index.

B is incorrect because there are several Dow Jones component stocks that are not traded on the NYSE, making the NYSE group a subset of the total population of stocks included in the Dow Jones average.

C is incorrect because although the Lehman Aggregate Bond Index is representative of the US bond market, it is a sampling of bonds in that market and not the entire population of bonds in that market.

4 A is correct. Any descriptive measure of a population characteristic is referred to as a parameter.

5 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) × 100 = 20%. B is incorrect because the relative frequency of this interval is (23/60) × 100 = 38.33%. C is incorrect because the cumulative relative frequency of the last interval must equal 100%.

6 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 exhibit shows the relative frequencies for all the intervals of the data from the previous exhibit:

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

The interval $-1.71\% \le x < 2.03\%$ has a cumulative relative frequency of 0.583.

7 A is correct. A frequency distribution is a tabular display of data summarized into a relatively small number of intervals.

B is incorrect because intervals cannot overlap. Each observation is placed uniquely into one interval.

C is incorrect because a frequency distribution is summarized into a relatively small number of intervals.

8 C is correct because the cumulative relative frequency of an interval tells us the fraction of all observations that are less than the upper limit of an interval. For Interval C, that would be (2 + 7 + 15)/26 = 92.3%.

A is incorrect because the relative frequency of an interval is the absolute frequency of that interval divided by the total number of observations, here 15/26 = 57.7%. The number 15 represents Interval C's absolute frequency (also known as frequency), which is simply the actual number of observations in a given interval.

B is incorrect because the cumulative frequency tells us the number of observations that are less than the upper limit of a return interval, not the percentage of observations meeting that criteria. Because Interval D is the uppermost return interval, its cumulative frequency is the total number of observations for all intervals, yielding 2 + 7 + 15 + 2 = 26 and not 100%, which is the cumulative relative frequency for Interval D.

9 C is correct. Because there are 50 data points in the histogram, the median return would be the mean of the 50/2 = 25th and (50 + 2)/2 = 26th 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.

10 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.

11 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%.

12 B is correct. In a histogram, the height of each bar represents the absolute frequency of its associated data interval.

A is incorrect because the height of each bar in a histogram represents the absolute (not relative) frequency.

C is incorrect because the height of each bar in a histogram represents the absolute (not cumulative) frequency.

13 C is correct. The arithmetic mean equals the sum of the observations divided by the number of observations. In this case, (−4.53 −1.40 −1.20 −1.20 + 0.70 + 8.90)/6 = 1.27/6 = 0.21.

The arithmetic mean is closest to the total equity return of Company E at 0.70 for a difference of (0.70 − 0.21) = 0.49.

A is incorrect because compared with the arithmetic mean, Company B's total equity return has a difference of (−1.40 −0.21) = −1.61, which is a wider distance from the mean than Company E's total equity return.

B is incorrect because compared with the arithmetic mean, Company C's total equity return has a difference of (−1.20 − 0.21) = −1.41, which is a wider distance from the mean than Company E's total equity return.

14 B is correct. The median is the value of the middle item of a set of items sorted into ascending or descending order. In an even-numbered sample, we define the median as the mean of the values of items occupying the $n/2$ and $(n + 2)/2$ positions (the two middle items). Given Table 2 has six observations, the median is the mean of the third and fourth observations. Because both are −1.20, the median is −1.20.

The mode is the most frequently occurring value in a distribution. The only value occurring more than once is −1.20.

Because the median and the mode both equal −1.20, their difference is zero.

A is incorrect because −1.41 is the difference between both the identical mode and median with the arithmetic mean. Both differences are: [−1.20 − (0.21)] = −1.41.

C is incorrect because 1.41 is the difference between the arithmetic mean with both the identical mode and median. Both differences are: [0.21 − (−1.20)] = 1.41.

15 C is correct. The median of Portfolio R is 0.8% higher than the mean for Portfolio R.

16 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 × 8%) + (0.40 × 12%) + (0.25 × −3%) + (0.15 × 4%) = 6.25%, or ≈ 6.3%.

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

Fund Y = $[(1 + 0.195) \times (1 - 0.019) \times (1 + 0.197) \times (1 + 0.350) \times (1 + 0.057)]^{(1/5)} - 1$

= 14.9%.

18 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.

19 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 yth percentile (P_y), we first must determine its location. The formula for the location (L_y) of a yth 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, $P_{80} = X_8 + (L_y - 8) \times (X_9 - X_8)$,

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

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

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

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 exhibit:

Year	Column 1 Return		Column 2 $\lvert X_i - \bar{X} \rvert$
Year 6	30.79%		14.39%
Year 7	12.34%		4.06%
Year 8	−5.02%		21.42%
Year 9	16.54%		0.14%
Year 10	27.37%		10.97%
Sum:	82.02%	Sum:	50.98%
n:	5	n:	5
$\bar{X}$:	16.40%	MAD:	10.20%

21 B is correct. Quartiles divide a distribution into quarters, with the third quartile occurring at the point at which 75% of the observations lie below it. The third quartile is equivalent to the 75th percentile. The formula for the location (L_y) of the yth 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 $y = 75$, so $L_{75} = (11) \times (75/100) = 11 \times 0.75 = 8.25$.

Rearranging the data in ascending order (i.e., with the lowest value at the top), the 8.25th position would be between the eighth and ninth rank order entries, 19.42% and 23.45%, respectively. Using linear interpolation, $P_{75} = X_8 + (L_{75} - 8) \times (X_9 - X_8)$, so $P_{75} = 19.42\% + (8.25 - 8) \times (23.45\% - 19.42\%) = 20.428\%$, or 20.43%.

A is incorrect because it is the non-interpolated value of the eighth observation without the adjustment for placement at the location of the third quartile.

C is incorrect because it is the non-interpolated value of the ninth observation without the adjustment for placement at the location of the third quartile.

22 C is correct. Both the range and MAD of the S&P 500 are greater than the range and MAD of the sample portfolio. Thus both measures indicate the S&P 500 is riskier.

The range for the S&P 500 equals the distance between the lowest and highest values in the dataset. That distance for the S&P 500 is [29.60% − (−38.49%)] = 68.09%. Given that this range is larger than the range of the sample portfolio at 67.09%, the S&P 500 appears riskier than the sample portfolio.

The MAD for the S&P 500 returns equals the sum of the absolute deviations from the mean return divided by the number of observations.

$$\text{MAD} = \frac{\sum_{i=1}^{n} \lvert X_i - \bar{X} \rvert}{n}, \text{ where } \bar{X} \text{ is the sample mean and } n \text{ is the number of}$$

observations in the sample.

Use the 10 observed S&P 500 returns from the table (sample mean = 8.04%) to calculate the MAD for the S&P 500 as follows:

$\text{MAD}_{\text{S\&P500}}$

$= \dfrac{\lvert 19.42 - \bar{x} \rvert + \lvert 9.54 - \bar{x} \rvert + \lvert -0.73 - \bar{x} \rvert + \lvert 11.39 - \bar{x} \rvert + \lvert 29.60 - \bar{x} \rvert + \lvert 13.41 - \bar{x} \rvert + \lvert 0.00 - \bar{x} \rvert + \lvert 12.78 - \bar{x} \rvert + \lvert 23.45 - \bar{x} \rvert + \lvert -38.49 - \bar{x} \rvert}{10}$

$\text{MAD}_{\text{S\&P500}} = 12.67\%$

Given that the MAD for the S&P 500 is greater than the MAD for the sample portfolio (12.67% versus 11.78%), the S&P 500 appears riskier than the sample portfolio.

A is incorrect because although the S&P 500 is correctly identified as having the larger range, the sample portfolio has a smaller MAD.

B is incorrect because although the S&P 500 is correctly identified as having the larger MAD, the Sample Portfolio has a smaller range.

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

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

MAD for Fund ABC =

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

MAD for Fund XYZ =

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

MAD for Fund PQR =

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

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.

24 C is correct. The sample variance is defined as sum of the squared deviations from the sample mean divided by the sample size minus one, and the sample standard deviation equals the square root of the sample variance.

The following figure summarizes the inputs for the calculation of VWGIX sample variance.

Year	VWIGX	$\left(X_i - \bar{X}\right)^2$
2015	−0.67%	2.35
2016	1.71%	1.68
2017	42.96%	8.00

(continued)

Year	VWIGX	$\left(X_i - \bar{X}\right)^2$
Sample mean $\left(\bar{X}\right)$	14.67%	
$\sum\left(X - \bar{X}\right)^2$		12.04
$\left[\sum\left(X - \bar{X}\right)^2\right]\Big/(n-1) = \sigma^2$	[12.04/2]	6.02
$\sqrt{\left[\sum\left(X - \bar{X}\right)^2\right]\Big/(n-1)} = \sigma$	$\sqrt{(12.04/2)}$	24.54%

The sample variance is thus calculated as $\dfrac{\left[\sum\left(X - \bar{X}\right)^2\right]}{(n-1)} = \dfrac{12.04}{2} = 6.02.$

The square root of the sample variance is the sample standard deviation.

That number is $\left(\sqrt{6.02}\right) = 24.54\%$.

A is incorrect because it is the sample variance for VWGIX, not its sample standard deviation.

B is incorrect because it represents the sum of the squared deviations from the mean, not the sample standard deviation.

25 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 × 55.6%, which is ≈ 133.

26 B is correct. Observations within 8% of the sample mean will cover an interval of 8/4 or two standard deviations. Chebyshev's Inequality says the proportion of the observations P within k standard deviations of the arithmetic mean is at least $1 - 1/k^2$ for all $k > 1$. So, solving for $k = 2$: P = 1 − ¼ = 75%. Given 2,000 observations, this implies at least 1,500 will lie within 8.0% of the mean.

A is incorrect because 720 shows P = 720/2,000 = 36.0% of the observations. Using P to solve for k implies 36.0% = $1 - 1/k^2$, where $k = 1.25$. This result would cover an interval only 4% × 1.25 or 5% around the mean (i.e. less than two standard deviations).

C is incorrect because 1,680 shows P = 1,680/2,000 = 84.0% of the observations. Using P to solve for k implies 84.0% = $1 - 1/k^2$, where $k = 2.50$. This result would cover an interval of 4% × 2.5, or 10% around the mean (i.e., more than two standard deviations).

27 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.

$$\text{CV}_{UTIL} = \frac{s}{\bar{X}} = \frac{1.23\%}{2.10\%} = 0.59$$

$$\text{CV}_{MATR} = \frac{s}{\overline{X}} = \frac{1.35\%}{1.25\%} = 1.08$$

$$\text{CV}_{INDU} = \frac{s}{\overline{X}} = \frac{1.52\%}{3.01\%} = 0.51$$

28 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.

29 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.

30 A is correct. Portfolio 1 is positively skewed, so the mean is greater than the median, which is greater than the mode.

31 C is correct. A return distribution with negative skew has frequent small gains and a few extreme losses.

A is incorrect because a leptokurtic distribution is more peaked with fatter tails, which exhibit both extreme gains and losses.

B is incorrect because a return distribution with positive skew has frequent small losses and a few extreme gains.

32 B is correct. For the positively skewed unimodal distribution, the mode is less than the median, which is less than the mean.

A is incorrect because, for the positively skewed unimodal distribution, the mode is less than the median (not less than or equal to), which is less than (not less than or equal to) the mean.

C is incorrect because, for the negatively (not positively) skewed unimodal distribution, the mean is less than the median, which is less than the mode.

33 B is correct. A platykurtic distribution has excess kurtosis less than zero.

A is incorrect because a normal or other mesokurtic distribution has excess kurtosis equal to zero.

C is incorrect because a leptokurtic distribution has excess kurtosis greater than zero.

34 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.

35 B is correct. The geometric mean is an excellent measure of past performance. For reporting historical returns, the geometric mean has considerable appeal because it is the rate of growth or return a fund would have had to earn each year to match the actual, cumulative investment performance. To estimate the average returns over more than one period, the geometric mean captures how the total returns are linked over time.

A is incorrect because the harmonic mean is more appropriate for determining the average price per unit, not evaluating a mutual fund's return history. The average price paid is in fact the harmonic mean of the asset's prices at the purchase dates. The harmonic mean is applicable when ratios are repeatedly applied to a fixed quantity to yield a variable number of units, such as in cost averaging, which involves the periodic investment of a fixed amount of money.

C is incorrect because the arithmetic mean is more appropriate for making investment statements in a forward-looking context, not for historical returns. It can distort the assessment of historical performance, so it is better applied to estimate the average return over a one-period horizon.

SUMMARY

In this reading, we have discussed the essential concepts and tools of probability. We have applied probability, expected value, and variance to a range of investment problems.

- A random variable is a quantity whose outcome is uncertain.
- Probability is a number between 0 and 1 that describes the chance that a stated event will occur.
- An event is a specified set of outcomes of a random variable.
- Mutually exclusive events can occur only one at a time. Exhaustive events cover or contain all possible outcomes.
- The two defining properties of a probability are, first, that $0 \le P(E) \le 1$ (where $P(E)$ denotes the probability of an event E), and second, that the sum of the probabilities of any set of mutually exclusive and exhaustive events equals 1.
- A probability estimated from data as a relative frequency of occurrence is an empirical probability. A probability drawing on personal or subjective judgment is a subjective probability. A probability obtained based on logical analysis is an a priori probability.
- A probability of an event E, $P(E)$, can be stated as odds for $E = P(E)/[1 - P(E)]$ or odds against $E = [1 - P(E)]/P(E)$.
- Probabilities that are inconsistent create profit opportunities, according to the Dutch Book Theorem.
- A probability of an event *not* conditioned on another event is an unconditional probability. The unconditional probability of an event A is denoted $P(A)$. Unconditional probabilities are also called marginal probabilities.
- A probability of an event given (conditioned on) another event is a conditional probability. The probability of an event A given an event B is denoted $P(A \mid B)$.
- The probability of both A and B occurring is the joint probability of A and B, denoted $P(AB)$.
- $P(A \mid B) = P(AB)/P(B)$, $P(B) \ne 0$.
- The multiplication rule for probabilities is $P(AB) = P(A \mid B)P(B)$.
- The probability that A or B occurs, or both occur, is denoted by $P(A \text{ or } B)$.
- The addition rule for probabilities is $P(A \text{ or } B) = P(A) + P(B) - P(AB)$.
- When events are independent, the occurrence of one event does not affect the probability of occurrence of the other event. Otherwise, the events are dependent.
- The multiplication rule for independent events states that if A and B are independent events, $P(AB) = P(A)P(B)$. The rule generalizes in similar fashion to more than two events.
- According to the total probability rule, if S_1, S_2, ..., S_n are mutually exclusive and exhaustive scenarios or events, then $P(A) = P(A \mid S_1)P(S_1) + P(A \mid S_2)P(S_2) + ... + P(A \mid S_n)P(S_n)$.
- The expected value of a random variable is a probability-weighted average of the possible outcomes of the random variable. For a random variable X, the expected value of X is denoted $E(X)$.
- The total probability rule for expected value states that $E(X) = E(X \mid S_1)P(S_1) + E(X \mid S_2)P(S_2) + ... + E(X \mid S_n)P(S_n)$, where S_1, S_2, ..., S_n are mutually exclusive and exhaustive scenarios or events.

- The variance of a random variable is the expected value (the probability-weighted average) of squared deviations from the random variable's expected value $E(X)$: $\sigma^2(X) = E\{[X - E(X)]^2\}$, where $\sigma^2(X)$ stands for the variance of X.

- Variance is a measure of dispersion about the mean. Increasing variance indicates increasing dispersion. Variance is measured in squared units of the original variable.

- Standard deviation is the positive square root of variance. Standard deviation measures dispersion (as does variance), but it is measured in the same units as the variable.

- Covariance is a measure of the co-movement between random variables.

- The covariance between two random variables R_i and R_j in a forward-looking sense is the expected value of the cross-product of the deviations of the two random variables from their respective means: $Cov(R_i, R_j) = E\{[R_i - E(R_i)][R_j - E(R_j)]\}$. The covariance of a random variable with itself is its own variance.

- The historical or sample covariance between two random variables R_i and R_j based on a sample of past data of size n is the average value of the product of the deviations of observations on two random variables from their sample means:

$$Cov\left(R_i, R_j\right) = \sum_{i=1}^{n}\left(R_{i,t} - \bar{R}_i\right)\left(R_{j,t} - \bar{R}_j\right)\big/(n-1)$$

- Correlation is a number between –1 and +1 that measures the co-movement (linear association) between two random variables: $\rho(R_i, R_j) = Cov(R_i, R_j)/[\sigma(R_i)\sigma(R_j)]$.

- If two variables have a very strong linear relation, then the absolute value of their correlation will be close to 1. If two variables have a weak linear relation, then the absolute value of their correlation will be close to 0.

- If the correlation coefficient is positive, the two variables are directly related; if the correlation coefficient is negative, the two variables are inversely related.

- A scatter plot shows graphically the relationship between two variables. If the points on the scatter plot cluster together in a straight line, the two variables have a strong linear relation.

- Even one outlier can greatly affect the correlation between two variables. Analysts should examine a scatter plot for the variables to determine whether outliers might affect a particular correlation.

- Correlations can be spurious in the sense of misleadingly pointing toward associations between variables.

- To calculate the variance of return on a portfolio of n assets, the inputs needed are the n expected returns on the individual assets, n variances of return on the individual assets, and $n(n-1)/2$ distinct covariances.

- Portfolio variance of return is $\sigma^2\left(R_p\right) = \sum_{i=1}^{n}\sum_{j=1}^{n} w_i w_j Cov\left(R_i, R_j\right)$.

- The calculation of covariance in a forward-looking sense requires the specification of a joint probability function, which gives the probability of joint occurrences of values of the two random variables.

- When two random variables are independent, the joint probability function is the product of the individual probability functions of the random variables.

- Bayes' formula is a method for updating probabilities based on new information.

- Bayes' formula is expressed as follows: Updated probability of event given the new information = [(Probability of the new information given event)/(Unconditional probability of the new information)] × Prior probability of event.

- The multiplication rule of counting says, for example, that if the first step in a process can be done in 10 ways, the second step, given the first, can be done in 5 ways, and the third step, given the first two, can be done in 7 ways, then the steps can be carried out in (10)(5)(7) = 350 ways.

- The number of ways to assign every member of a group of size n to n slots is $n!$ = $n (n − 1) (n − 2)(n − 3) … 1$. (By convention, $0! = 1$.)

- The number of ways that n objects can be labeled with k different labels, with n_1 of the first type, n_2 of the second type, and so on, with $n_1 + n_2 + … + n_k = n$, is given by $n!/(n_1!n_2! … n_k!)$. This expression is the multinomial formula.

- A special case of the multinomial formula is the combination formula. The number of ways to choose r objects from a total of n objects, when the order in which the r objects are listed does not matter, is

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

- The number of ways to choose r objects from a total of n objects, when the order in which the r objects are listed does matter, is

$$_nP_r = \frac{n!}{(n − r)!}$$

This expression is the permutation formula.

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PRACTICE PROBLEMS

1   Suppose that 5 percent of the stocks meeting your stock-selection criteria are in the telecommunications (telecom) industry. Also, dividend-paying telecom stocks are 1 percent of the total number of stocks meeting your selection criteria. What is the probability that a stock is dividend paying, given that it is a telecom stock that has met your stock selection criteria?

2   You are using the following three criteria to screen potential acquisition targets from a list of 500 companies:

Criterion	Fraction of the 500 Companies Meeting the Criterion
Product lines compatible	0.20
Company will increase combined sales growth rate	0.45
Balance sheet impact manageable	0.78

   If the criteria are independent, how many companies will pass the screen?

3   You apply both valuation criteria and financial strength criteria in choosing stocks. The probability that a randomly selected stock (from your investment universe) meets your valuation criteria is 0.25. Given that a stock meets your valuation criteria, the probability that the stock meets your financial strength criteria is 0.40. What is the probability that a stock meets both your valuation and financial strength criteria?

4   Suppose the prospects for recovering principal for a defaulted bond issue depend on which of two economic scenarios prevails. Scenario 1 has probability 0.75 and will result in recovery of $0.90 per $1 principal value with probability 0.45, or in recovery of $0.80 per $1 principal value with probability 0.55. Scenario 2 has probability 0.25 and will result in recovery of $0.50 per $1 principal value with probability 0.85, or in recovery of $0.40 per $1 principal value with probability 0.15.

   A   Compute the probability of each of the four possible recovery amounts: $0.90, $0.80, $0.50, and $0.40.

   B   Compute the expected recovery, given the first scenario.

   C   Compute the expected recovery, given the second scenario.

   D   Compute the expected recovery.

   E   Graph the information in a tree diagram.

5   You have developed a set of criteria for evaluating distressed credits. Companies that do not receive a passing score are classed as likely to go bankrupt within 12 months. You gathered the following information when validating the criteria:

   ●   Forty percent of the companies to which the test is administered will go bankrupt within 12 months: $P(nonsurvivor) = 0.40$.

   ●   Fifty-five percent of the companies to which the test is administered pass it: $P(pass\ test) = 0.55$.

   ●   The probability that a company will pass the test given that it will subsequently survive 12 months, is 0.85: $P(pass\ test\ |\ survivor) = 0.85$.

   A   What is $P(pass\ test\ |\ nonsurvivor)$?

    B Using Bayes' formula, calculate the probability that a company is a survivor, given that it passes the test; that is, calculate *P*(survivor | pass test).

    C What is the probability that a company is a *nonsurvivor*, given that it fails the test?

    D Is the test effective?

6 In probability theory, exhaustive events are *best* described as events:

    A with a probability of zero.

    B that are mutually exclusive.

    C that include all potential outcomes.

7 Which probability estimate *most likely* varies greatly between people?

    A An *a priori* probability

    B An empirical probability

    C A subjective probability

8 If the probability that Zolaf Company sales exceed last year's sales is 0.167, the odds for exceeding sales are *closest* to:

    A 1 to 5.

    B 1 to 6.

    C 5 to 1.

9 The probability of an event given that another event has occurred is a:

    A joint probability.

    B marginal probability.

    C conditional probability.

10 After estimating the probability that an investment manager will exceed his benchmark return in each of the next two quarters, an analyst wants to forecast the probability that the investment manager will exceed his benchmark return over the two-quarter period in total. Assuming that each quarter's performance is independent of the other, which probability rule should the analyst select?

    A Addition rule

    B Multiplication rule

    C Total probability rule

11 Which of the following is a property of two dependent events?

    A The two events must occur simultaneously.

    B The probability of one event influences the probability of the other event.

    C The probability of the two events occurring is the product of each event's probability.

12 Which of the following *best* describes how an analyst would estimate the expected value of a firm under the scenarios of bankruptcy and survivorship? The analyst would use:

    A the addition rule.

    B conditional expected values.

    C the total probability rule for expected value.

13 An analyst developed two scenarios with respect to the recovery of $100,000 principal from defaulted loans:

Scenario	Probability of Scenario (%)	Amount Recovered ($)	Probability of Amount (%)
1	40	50,000	60
		30,000	40
2	60	80,000	90
		60,000	10

The amount of the expected recovery is *closest* to:

A $36,400.

B $63,600.

C $81,600.

14 US and Spanish bonds have return standard deviations of 0.64 and 0.56, respectively. If the correlation between the two bonds is 0.24, the covariance of returns is *closest* to:

A 0.086.

B 0.670.

C 0.781.

15 The covariance of returns is positive when the returns on two assets tend to:

A have the same expected values.

B be above their expected value at different times.

C be on the same side of their expected value at the same time.

16 Which of the following correlation coefficients indicates the weakest linear relationship between two variables?

A −0.67

B −0.24

C 0.33

17 An analyst develops the following covariance matrix of returns:

	Hedge Fund	Market Index
Hedge fund	256	110
Market index	110	81

The correlation of returns between the hedge fund and the market index is *closest* to:

A 0.005.

B 0.073.

C 0.764.

18 All else being equal, as the correlation between two assets approaches +1.0, the diversification benefits:

A decrease.

B stay the same.

C increase.

19 Given a portfolio of five stocks, how many unique covariance terms, excluding variances, are required to calculate the portfolio return variance?

A 10

B 20

C 25

20 The probability distribution for a company's sales is:

Probability	Sales ($ millions)
0.05	70
0.70	40
0.25	25

The standard deviation of sales is *closest* to:

A $9.81 million.

B $12.20 million.

C $32.40 million.

21 Which of the following statements is *most* accurate? If the covariance of returns between two assets is 0.0023, then:

A the assets' risk is near zero.

B the asset returns are unrelated.

C the asset returns have a positive relationship.

22 An analyst produces the following joint probability function for a foreign index (FI) and a domestic index (DI).

	$R_{DI} = 30\%$	$R_{DI} = 25\%$	$R_{DI} = 15\%$
$R_{FI} = 25\%$	0.25		
$R_{FI} = 15\%$		0.50	
$R_{FI} = 10\%$			0.25

The covariance of returns on the foreign index and the returns on the domestic index is *closest* to:

A 26.39.

B 26.56.

C 28.12.

23 A manager will select 20 bonds out of his universe of 100 bonds to construct a portfolio. Which formula provides the number of possible portfolios?

A Permutation formula

B Multinomial formula

C Combination formula

24 A firm will select two of four vice presidents to be added to the investment committee. How many different groups of two are possible?

A 6

B 12

C 24

25 From an approved list of 25 funds, a portfolio manager wants to rank 4 mutual funds from most recommended to least recommended. Which formula is *most* appropriate to calculate the number of possible ways the funds could be ranked?

A Permutation formula

B Multinomial formula

C Combination formula

SOLUTIONS

1   Use Equation 1 to find this conditional probability: *P*(*stock is dividend paying | telecom stock that meets criteria*) = *P*(*stock is dividend paying and telecom stock that meets criteria*)/*P*(*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* | *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* | *B*)*P*(*B*) = 0.40 × 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*(*recovery | Scenario 1*) = 0.45($0.90) + 0.55($0.80) = $0.845

    C   *E*(*recovery | Scenario 2*) = 0.85($0.50) + 0.15($0.40) = $0.485

    D   *E*(*recovery*) = 0.75($0.845) + 0.25($0.485) = $0.755

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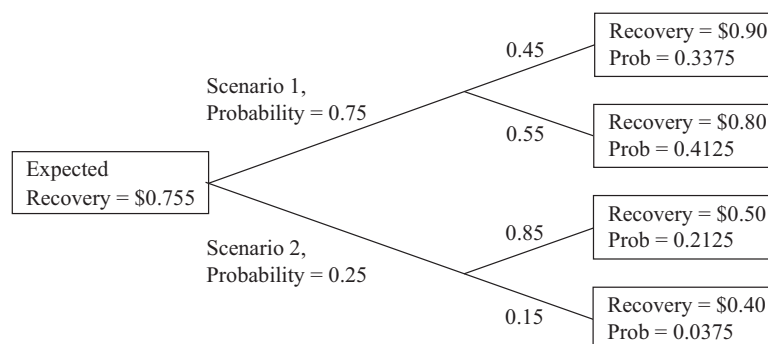
5   **A**   We can set up the equation using the total probability rule:

$$P(pass\ test) = P(pass\ test\ |\ survivor)P(survivor)$$
$$+P(pass\ test\ |\ nonsurvivor)P(nonsurvivor)$$

      We know that *P*(*survivor*) = 1 − *P*(*nonsurvivor*) = 1 − 0.40 = 0.60. Therefore, *P*(*pass test*) = 0.55 = 0.85(0.60) + *P*(*pass test | nonsurvivor*)(0.40). Thus *P*(*pass test | nonsurvivor*) = [0.55 − 0.85(0.60)]/0.40 = 0.10.

B $P(survivor \mid pass\ test) = \left[P(pass\ test \mid survivor)/P(pass\ test)\right]P(survivor)$

$$= (0.85/0.55)0.60 = 0.927273$$

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, $P(nonsurvivor \mid fail\ test) = [P(fail\ test \mid nonsurvivor)/\ P(fail\ test)]P(nonsurvivor) = [P(fail\ test \mid nonsurvivor)/0.45]0.40$.

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

$$P(fail\ test) = P(fail\ test \mid nonsurvivor)P(nonsurvivor)$$
$$+P(fail\ test \mid survivor)P(survivor)$$
$$0.45 = P(fail\ test \mid nonsurvivor)0.40 + 0.15(0.60)$$

where $P(fail\ test \mid survivor) = 1 - P(pass\ test \mid survivor) = 1 - 0.85 = 0.15$. So $P(fail\ test \mid nonsurvivor) = [0.45 - 0.15(0.60)]/0.40 = 0.90$. Using this result with the formula above, we find $P(nonsurvivor \mid fail\ test) = (0.90/0.45)0.40 = 0.80$. 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 Cov(US bond returns, Spanish bond returns) = σ(US bonds) × σ (Spanish bonds) × ρ(US bond returns, Spanish bond returns) = 0.64 × 0.56 × 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 $0.05 \times \$70 + 0.70 \times \$40 + 0.25 \times \$25 = \$3.50$ million + $\$28.00$ million + $\$6.25$ million = $\$37.75$ million.

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

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

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

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

Covariance is

$$\text{Cov}(R_{FI}, R_{DI}) = \sum_i \sum_j P(R_{FI,i}, R_{DI,j})(R_{FI,i} - ER_{FI})(R_{DI,j} - ER_{DI})$$

$$= 0.25[(25 - 16.25)(30 - 23.75)] + 0.50[(15 - 16.25)$$
$$(25 - 23.75)] + 0.25[(10 - 16.25)(15 - 23.75)]$$
$$= 13.67 + (-0.78) + 13.67 = 26.56.$$

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.

of daily stock returns over the last five years. In one type of historical simulation, we randomly draw K returns from that record to generate one simulation trial. We put back the observations into the sample, and in the next trial we again randomly sample with replacement. The simulation results directly reflect frequencies in the data. A drawback of this approach is that any risk not represented in the time period selected (for example, a stock market crash) will not be reflected in the simulation. Compared with Monte Carlo simulation, historical simulation does not lend itself to "what if" analyses. Nevertheless, historic simulation is an established alternative simulation methodology.

Monte Carlo simulation is a complement to analytical methods. It provides only statistical estimates, not exact results. Analytical methods, where available, provide more insight into cause-and-effect relationships. For example, the Black–Scholes–Merton option pricing model for the value of a European call option is an analytical method, expressed as a formula. It is a much more efficient method for valuing such a call than is Monte Carlo simulation. As an analytical expression, the Black–Scholes–Merton model permits the analyst to quickly gauge the sensitivity of call value to changes in current stock price and the other variables that determine call value. In contrast, Monte Carlo simulations do not directly provide such precise insights. However, only some types of options can be priced with analytical expressions. As financial product innovations proceed, the field of applications for Monte Carlo simulation continues to grow.

SUMMARY

In this reading, we have presented the most frequently used probability distributions in investment analysis and the Monte Carlo simulation.

- A probability distribution specifies the probabilities of the possible outcomes of a random variable.

- The two basic types of random variables are discrete random variables and continuous random variables. Discrete random variables take on at most a countable number of possible outcomes that we can list as x_1, x_2, … In contrast, we cannot describe the possible outcomes of a continuous random variable Z with a list z_1, z_2, … because the outcome $(z_1 + z_2)/2$, not in the list, would always be possible.

- The probability function specifies the probability that the random variable will take on a specific value. The probability function is denoted $p(x)$ for a discrete random variable and $f(x)$ for a continuous random variable. For any probability function $p(x)$, $0 \leq p(x) \leq 1$, and the sum of $p(x)$ over all values of X equals 1.

- The cumulative distribution function, denoted $F(x)$ for both continuous and discrete random variables, gives the probability that the random variable is less than or equal to x.

- The discrete uniform and the continuous uniform distributions are the distributions of equally likely outcomes.

- The binomial random variable is defined as the number of successes in n Bernoulli trials, where the probability of success, p, is constant for all trials and the trials are independent. A Bernoulli trial is an experiment with two outcomes, which can represent success or failure, an up move or a down move, or another binary (two-fold) outcome.

- A binomial random variable has an expected value or mean equal to np and variance equal to $np(1 - p)$.

- A binomial tree is the graphical representation of a model of asset price dynamics in which, at each period, the asset moves up with probability p or down with probability $(1 - p)$. The binomial tree is a flexible method for modeling asset price movement and is widely used in pricing options.

- The normal distribution is a continuous symmetric probability distribution that is completely described by two parameters: its mean, μ, and its variance, σ^2.

- A univariate distribution specifies the probabilities for a single random variable. A multivariate distribution specifies the probabilities for a group of related random variables.

- To specify the normal distribution for a portfolio when its component securities are normally distributed, we need the means, standard deviations, and all the distinct pairwise correlations of the securities. When we have those statistics, we have also specified a multivariate normal distribution for the securities.

- For a normal random variable, approximately 68 percent of all possible outcomes are within a one standard deviation interval about the mean, approximately 95 percent are within a two standard deviation interval about the mean, and approximately 99 percent are within a three standard deviation interval about the mean.

- A normal random variable, X, is standardized using the expression $Z = (X - \mu)/\sigma$, where μ and σ are the mean and standard deviation of X. Generally, we use the sample mean $\overline{X}$ as an estimate of μ and the sample standard deviation s as an estimate of σ in this expression.

- The standard normal random variable, denoted Z, has a mean equal to 0 and variance equal to 1. All questions about any normal random variable can be answered by referring to the cumulative distribution function of a standard normal random variable, denoted $N(x)$ or $N(z)$.

- Shortfall risk is the risk that portfolio value will fall below some minimum acceptable level over some time horizon.

- Roy's safety-first criterion, addressing shortfall risk, asserts that the optimal portfolio is the one that minimizes the probability that portfolio return falls below a threshold level. According to Roy's safety-first criterion, if returns are normally distributed, the safety-first optimal portfolio P is the one that maximizes the quantity $[E(R_P) - R_L]/\sigma_P$, where R_L is the minimum acceptable level of return.

- A random variable follows a lognormal distribution if the natural logarithm of the random variable is normally distributed. The lognormal distribution is defined in terms of the mean and variance of its associated normal distribution. The lognormal distribution is bounded below by 0 and skewed to the right (it has a long right tail).

- The lognormal distribution is frequently used to model the probability distribution of asset prices because it is bounded below by zero.

- Continuous compounding views time as essentially continuous or unbroken; discrete compounding views time as advancing in discrete finite intervals.

- The continuously compounded return associated with a holding period is the natural log of 1 plus the holding period return, or equivalently, the natural log of ending price over beginning price.

- If continuously compounded returns are normally distributed, asset prices are lognormally distributed. This relationship is used to move back and forth between the distributions for return and price. Because of the central limit theorem, continuously compounded returns need not be normally distributed for asset prices to be reasonably well described by a lognormal distribution.

- Monte Carlo simulation involves the use of a computer to represent the operation of a complex financial system. A characteristic feature of Monte Carlo simulation is the generation of a large number of random samples from specified probability distribution(s) to represent the operation of risk in the system. Monte Carlo simulation is used in planning, in financial risk management, and in valuing complex securities. Monte Carlo simulation is a complement to analytical methods but provides only statistical estimates, not exact results.

- Historical simulation is an established alternative to Monte Carlo simulation that in one implementation involves repeated sampling from a historical data series. Historical simulation is grounded in actual data but can reflect only risks represented in the sample historical data. Compared with Monte Carlo simulation, historical simulation does not lend itself to "what if" analyses.

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PRACTICE PROBLEMS

1 A European put option on stock conveys the right to sell the stock at a pre-specified price, called the exercise price, at the maturity date of the option. The value of this put at maturity is (exercise price – stock price) or $0, whichever is greater. Suppose the exercise price is $100 and the underlying stock trades in ticks of $0.01. At any time before maturity, the terminal value of the put is a random variable.

    A Describe the distinct possible outcomes for terminal put value. (Think of the put's maximum and minimum values and its minimum price increments.)

    B Is terminal put value, at a time before maturity, a discrete or continuous random variable?

    C Letting Y stand for terminal put value, express in standard notation the probability that terminal put value is less than or equal to $24. No calculations or formulas are necessary.

2 Define the term "binomial random variable." Describe the types of problems for which the binomial distribution is used.

3 The value of the cumulative distribution function $F(x)$, where x is a particular outcome, for a discrete uniform distribution:

    A sums to 1.

    B lies between 0 and 1.

    C decreases as x increases.

4 For a binomial random variable with five trials, and a probability of success on each trial of 0.50, the distribution will be:

    A skewed.

    B uniform.

    C symmetric.

5 In a discrete uniform distribution with 20 potential outcomes of integers 1 to 20, the probability that X is greater than or equal to 3 but less than 6, $P(3 \leq X < 6)$, is:

    A 0.10.

    B 0.15.

    C 0.20.

6 Over the last 10 years, a company's annual earnings increased year over year seven times and decreased year over year three times. You decide to model the number of earnings increases for the next decade as a binomial random variable.

    A What is your estimate of the probability of success, defined as an increase in annual earnings?

    For Parts B, C, and D of this problem, assume the estimated probability is the actual probability for the next decade.

    B What is the probability that earnings will increase in exactly 5 of the next 10 years?

    C Calculate the expected number of yearly earnings increases during the next 10 years.

D Calculate the variance and standard deviation of the number of yearly earnings increases during the next 10 years.

E The expression for the probability function of a binomial random variable depends on two major assumptions. In the context of this problem, what must you assume about annual earnings increases to apply the binomial distribution in Part B? What reservations might you have about the validity of these assumptions?

7 A portfolio manager annually outperforms her benchmark 60% of the time. Assuming independent annual trials, what is the probability that she will outperform her benchmark four or more times over the next five years?

A 0.26

B 0.34

C 0.48

8 You are examining the record of an investment newsletter writer who claims a 70 percent success rate in making investment recommendations that are profitable over a one-year time horizon. You have the one-year record of the newsletter's seven most recent recommendations. Four of those recommendations were profitable. If all the recommendations are independent and the newsletter writer's skill is as claimed, what is the probability of observing four or fewer profitable recommendations out of seven in total?

9 You are forecasting sales for a company in the fourth quarter of its fiscal year. Your low-end estimate of sales is €14 million, and your high-end estimate is €15 million. You decide to treat all outcomes for sales between these two values as equally likely, using a continuous uniform distribution.

A What is the expected value of sales for the fourth quarter?

B What is the probability that fourth-quarter sales will be less than or equal to €14,125,000?

10 State the approximate probability that a normal random variable will fall within the following intervals:

A Mean plus or minus one standard deviation.

B Mean plus or minus two standard deviations.

C Mean plus or minus three standard deviations.

11 Find the area under the normal curve up to $z = 0.36$; that is, find $P(Z \leq 0.36)$. Interpret this value.

12 If the probability that a portfolio outperforms its benchmark in any quarter is 0.75, the probability that the portfolio outperforms its benchmark in three or fewer quarters over the course of a year is *closest* to:

A 0.26

B 0.42

C 0.68

13 In futures markets, profits or losses on contracts are settled at the end of each trading day. This procedure is called marking to market or daily resettlement. By preventing a trader's losses from accumulating over many days, marking to market reduces the risk that traders will default on their obligations. A futures markets trader needs a liquidity pool to meet the daily mark to market. If liquidity is exhausted, the trader may be forced to unwind his position at an unfavorable time.

Suppose you are using financial futures contracts to hedge a risk in your portfolio. You have a liquidity pool (cash and cash equivalents) of λ dollars per contract and a time horizon of T trading days. For a given size liquidity pool, λ, Kolb, Gay, and Hunter (1985) developed an expression for the probability stating that you will exhaust your liquidity pool within a T-day horizon as a result of the daily mark to market. Kolb et al. assumed that the expected change in futures price is 0 and that futures price changes are normally distributed. With σ representing the standard deviation of daily futures price changes, the standard deviation of price changes over a time horizon to day T is $\sigma\sqrt{T}$, given continuous compounding. With that background, the Kolb et al. expression is

Probability of exhausting liquidity pool = $2[1 - N(x)]$

where $x = \lambda/(\sigma\sqrt{T})$. Here x is a standardized value of λ. $N(x)$ is the standard normal cumulative distribution function. For some intuition about $1 - N(x)$ in the expression, note that the liquidity pool is exhausted if losses exceed the size of the liquidity pool at any time up to and including T; the probability of that event happening can be shown to be proportional to an area in the right tail of a standard normal distribution, $1 - N(x)$.

Using the Kolb et al. expression, answer the following questions:

A Your hedging horizon is five days, and your liquidity pool is $2,000 per contract. You estimate that the standard deviation of daily price changes for the contract is $450. What is the probability that you will exhaust your liquidity pool in the five-day period?

B Suppose your hedging horizon is 20 days, but all the other facts given in Part A remain the same. What is the probability that you will exhaust your liquidity pool in the 20-day period?

14 Which of the following is characteristic of the normal distribution?

A Asymmetry

B Kurtosis of 3

C Definitive limits or boundaries

15 Which of the following assets *most likely* requires the use of a multivariate distribution for modeling returns?

A A call option on a bond

B A portfolio of technology stocks

C A stock in a market index

16 The total number of parameters that fully characterizes a multivariate normal distribution for the returns on two stocks is:

A 3.

B 4.

C 5.

17 A client has a portfolio of common stocks and fixed-income instruments with a current value of £1,350,000. She intends to liquidate £50,000 from the portfolio at the end of the year to purchase a partnership share in a business. Furthermore, the client would like to be able to withdraw the £50,000 without reducing the initial capital of £1,350,000. The following table shows four alternative asset allocations.

Mean and Standard Deviation for Four Allocations (in Percent)				
	A	**B**	**C**	**D**
Expected annual return	16	12	10	9
Standard deviation of return	24	17	12	11

Address the following questions (assume normality for Parts B and C):

A Given the client's desire not to invade the £1,350,000 principal, what is the shortfall level, R_L? Use this shortfall level to answer Part B.

B According to the safety-first criterion, which of the allocations is the best?

C What is the probability that the return on the safety-first optimal portfolio will be less than the shortfall level, R_L?

Please refer to Exhibit 1 for Questions 18 and 19

Exhibit 1	Z-Table Values, $P(Z \le z) = N(z)$ for $z \ge 0$									
Z	**0.00**	**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
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224

18 A portfolio has an expected mean return of 8 percent and standard deviation of 14 percent. The probability that its return falls between 8 and 11 percent is *closest* to:

A 8.3%

B 14.8%.

C 58.3%.

19 A portfolio has an expected return of 7% with a standard deviation of 13%. For an investor with a minimum annual return target of 4%, the probability that the portfolio return will fail to meet the target is *closest* to:

A 33%.

B 41%.

C 59%.

20 A Define Monte Carlo simulation and explain its use in finance.

    B Compared with analytical methods, what are the strengths and weaknesses of Monte Carlo simulation for use in valuing securities?

21 A standard lookback call option on stock has a value at maturity equal to (Value of the stock at maturity – Minimum value of stock during the life of the option prior to maturity) or $0, whichever is greater. If the minimum value reached prior to maturity was $20.11 and the value of the stock at maturity is $23, for example, the call is worth $23 – $20.11 = $2.89. Briefly discuss how you might use Monte Carlo simulation in valuing a lookback call option.

22 Which of the following is a continuous random variable?

    A The value of a futures contract quoted in increments of $0.05

    B The total number of heads recorded in 1 million tosses of a coin

    C The rate of return on a diversified portfolio of stocks over a three-month period

23 X is a discrete random variable with possible outcomes $X = \{1,2,3,4\}$. Three functions $f(x)$, $g(x)$, and $h(x)$ are proposed to describe the probabilities of the outcomes in X.

	Probability Function		
$X = x$	$f(x) = P(X = x)$	$g(x) = P(X = x)$	$h(x) = P(X = x)$
1	−0.25	0.20	0.20
2	0.25	0.25	0.25
3	0.50	0.50	0.30
4	0.25	0.05	0.35

The conditions for a probability function are satisfied by:

    A $f(x)$.

    B $g(x)$.

    C $h(x)$.

24 The cumulative distribution function for a discrete random variable is shown in the following table.

	Cumulative Distribution Function
$X = x$	$F(x) = P(X \leq x)$
1	0.15
2	0.25
3	0.50
4	0.60
5	0.95
6	1.00

The probability that X will take on a value of either 2 or 4 is *closest* to:

    A 0.20.

    B 0.35.

    C 0.85.

25 Which of the following events can be represented as a Bernoulli trial?

    A The flip of a coin

    B The closing price of a stock

    C The picking of a random integer between 1 and 10

26 The weekly closing prices of Mordice Corporation shares are as follows:

Date	Closing Price (€)
1 August	112
8 August	160
15 August	120

The continuously compounded return of Mordice Corporation shares for the period August 1 to August 15 is *closest to*:

A 6.90%

B 7.14%

C 8.95%

27 A stock is priced at $100.00 and follows a one-period binomial process with an up move that equals 1.05 and a down move that equals 0.97. If 1 million Bernoulli trials are conducted, and the average terminal stock price is $102.00, the probability of an up move (p) is *closest* to:

A 0.375.

B 0.500.

C 0.625.

28 A call option on a stock index is valued using a three-step binomial tree with an up move that equals 1.05 and a down move that equals 0.95. The current level of the index is $190, and the option exercise price is $200. If the option value is positive when the stock price exceeds the exercise price at expiration and $0 otherwise, the number of terminal nodes with a positive payoff is:

A one.

B two.

C three.

29 A random number between zero and one is generated according to a continuous uniform distribution. What is the probability that the first number generated will have a value of exactly 0.30?

A 0%

B 30%

C 70%

30 A Monte Carlo simulation can be used to:

A directly provide precise valuations of call options.

B simulate a process from historical records of returns.

C test the sensitivity of a model to changes in assumptions.

31 A limitation of Monte Carlo simulation is:

A its failure to do "what if" analysis.

B that it requires historical records of returns

C its inability to independently specify cause-and-effect relationships.

32 Which parameter equals zero in a normal distribution?

A Kurtosis

B Skewness

C Standard deviation

33 An analyst develops the following capital market projections.

	Stocks	Bonds
Mean Return	10%	2%
Standard Deviation	15%	5%

Assuming the returns of the asset classes are described by normal distributions, which of the following statements is correct?

A Bonds have a higher probability of a negative return than stocks.

B On average, 99% of stock returns will fall within two standard deviations of the mean.

C The probability of a bond return less than or equal to 3% is determined using a *Z*-score of 0.25.

34 A client holding a £2,000,000 portfolio wants to withdraw £90,000 in one year without invading the principal. According to Roy's safety-first criterion, which of the following portfolio allocations is optimal?

	Allocation A	Allocation B	Allocation C
Expected annual return	6.5%	7.5%	8.5%
Standard deviation of returns	8.35%	10.21%	14.34%

A Allocation A

B Allocation B

C Allocation C

35 In contrast to normal distributions, lognormal distributions:

A are skewed to the left.

B have outcomes that cannot be negative.

C are more suitable for describing asset returns than asset prices.

36 The lognormal distribution is a more accurate model for the distribution of stock prices than the normal distribution because stock prices are:

A symmetrical.

B unbounded.

C non-negative.

37 The price of a stock at $t = 0$ is $208.25 and at $t = 1$ is $186.75. The continuously compounded rate of return for the stock from $t = 0$ to $t = 1$ is *closest* to:

A −10.90%.

B −10.32%.

C 11.51%.

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 (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 $P(Y \le 24)$ 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: $0 \le F(x) \le 1$.

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 $P(3 \le X < 6) = P(3) + P(4) + P(5) = 0.05 + 0.05 + 0.05 = 0.15$

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,

$$\binom{10}{5} 0.7^5 0.3^{10-5} = \frac{10!}{(10-5)! 5!} 0.7^5 0.3^{10-5}$$

$$= 252 \times 0.16807 \times 0.00243 = 0.102919$$

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 σ^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:

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

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

Therefore,

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

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

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,

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

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

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

$$p(0) = \frac{4!}{(4 - 0)! 0!} 0.75^0 (1 - 0.75)^{4-0} = [24/24](1)(0.004) = 0.004$$

Therefore,

$F(3) = p(3) + p(2) + p(1) + p(0) = 0.42 + 0.20 + 0.06 + 0.004 = 0.684$ or approximately 68 percent

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 $[E(R_P) - R_L]/\sigma_P$:

         Allocation A: $0.5125 = (16 - 3.7)/24$

         Allocation B: $0.488235 = (12 - 3.7)/17$

         Allocation C: $0.525 = (10 - 3.7)/12$

         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% ≤ (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.
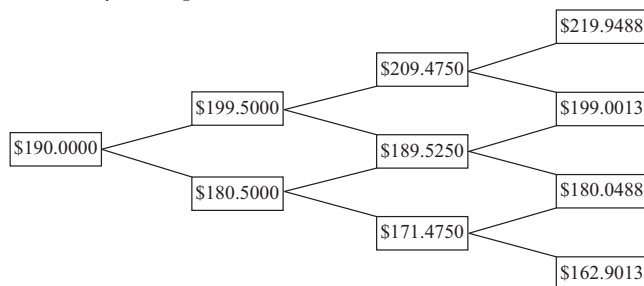
29 A is correct. The probability of generating a random number equal to any fixed point under a continuous uniform distribution is zero.

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:

$$\frac{\left[E(R_P − R_L)\right]}{\sigma_P}$$

   Allocation A $= \dfrac{6.5 − 4.5}{8.35} = 0.240$

   Allocation B $= \dfrac{7.5 − 4.5}{10.21} = 0.294$

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

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 $r_{0,1} = \ln(S_1/S_0) = \ln(186.75/208.25) = -0.10897 = -10.90\%$.

> ### *Time-Period Bias.*
>
> A test design is subject to time-period bias if it is based on a time period that may make the results time-period specific. Although the test covered a period extending more than 10 years, that period may be too short for testing an anomaly. Ideally, an analyst should test market anomalies over several business cycles to ensure that results are not period specific. This bias can favor a proposed strategy if the time period chosen was favorable to the strategy.

SUMMARY

In this reading, we have presented basic concepts and results in sampling and estimation. We have also emphasized the challenges faced by analysts in appropriately using and interpreting financial data. As analysts, we should always use a critical eye when evaluating the results from any study. The quality of the sample is of the utmost importance: If the sample is biased, the conclusions drawn from the sample will be in error.

- To draw valid inferences from a sample, the sample should be random.

- In simple random sampling, each observation has an equal chance of being selected. In stratified random sampling, the population is divided into subpopulations, called strata or cells, based on one or more classification criteria; simple random samples are then drawn from each stratum.

- Stratified random sampling ensures that population subdivisions of interest are represented in the sample. Stratified random sampling also produces more-precise parameter estimates than simple random sampling.

- Time-series data are a collection of observations at equally spaced intervals of time. Cross-sectional data are observations that represent individuals, groups, geographical regions, or companies at a single point in time.

- The central limit theorem states that for large sample sizes, for any underlying distribution for a random variable, the sampling distribution of the sample mean for that variable will be approximately normal, with mean equal to the population mean for that random variable and variance equal to the population variance of the variable divided by sample size.

- Based on the central limit theorem, when the sample size is large, we can compute confidence intervals for the population mean based on the normal distribution regardless of the distribution of the underlying population. In general, a sample size of 30 or larger can be considered large.

- An estimator is a formula for estimating a parameter. An estimate is a particular value that we calculate from a sample by using an estimator.

- Because an estimator or statistic is a random variable, it is described by some probability distribution. We refer to the distribution of an estimator as its sampling distribution. The standard deviation of the sampling distribution of the sample mean is called the standard error of the sample mean.

- The desirable properties of an estimator are *unbiasedness* (the expected value of the estimator equals the population parameter), *efficiency* (the estimator has the smallest variance), and *consistency* (the probability of accurate estimates increases as sample size increases).

- The two types of estimates of a parameter are point estimates and interval estimates. A point estimate is a single number that we use to estimate a parameter. An interval estimate is a range of values that brackets the population parameter with some probability.

- A confidence interval is an interval for which we can assert with a given probability $1 - \alpha$, called the degree of confidence, that it will contain the parameter it is intended to estimate. This measure is often referred to as the $100(1 - \alpha)\%$ confidence interval for the parameter.

- A $100(1 - \alpha)\%$ confidence interval for a parameter has the following structure: Point estimate ± Reliability factor × Standard error, where the reliability factor is a number based on the assumed distribution of the point estimate and the degree of confidence $(1 - \alpha)$ for the confidence interval and where standard error is the standard error of the sample statistic providing the point estimate.

- A $100(1 - \alpha)\%$ confidence interval for population mean μ when sampling from a normal distribution with known variance σ^2 is given by $\bar{X} \pm z_{\alpha/2} \dfrac{\sigma}{\sqrt{n}}$, where $z_{\alpha/2}$ is the point of the standard normal distribution such that $\alpha/2$ remains in the right tail.

- Student's t-distribution is a family of symmetrical distributions defined by a single parameter, degrees of freedom.

- A random sample of size n is said to have $n - 1$ degrees of freedom for estimating the population variance, in the sense that there are only $n - 1$ independent deviations from the mean on which to base the estimate.

- The degrees of freedom number for use with the t-distribution is also $n - 1$.

- The t-distribution has fatter tails than the standard normal distribution but converges to the standard normal distribution as degrees of freedom go to infinity.

- A $100(1 - \alpha)\%$ confidence interval for the population mean μ when sampling from a normal distribution with unknown variance (a t-distribution confidence interval) is given by $\bar{X} \pm t_{\alpha/2}\left(s/\sqrt{n}\right)$, where $t_{\alpha/2}$ is the point of the t-distribution such that $\alpha/2$ remains in the right tail and s is the sample standard deviation. This confidence interval can also be used, because of the central limit theorem, when dealing with a large sample from a population with unknown variance that may not be normal.

- We may use the confidence interval $\bar{X} \pm z_{\alpha/2}\left(s/\sqrt{n}\right)$ as an alternative to the t-distribution confidence interval for the population mean when using a large sample from a population with unknown variance. The confidence interval based on the z-statistic is less conservative (narrower) than the corresponding confidence interval based on a t-distribution.

- Three issues in the selection of sample size are the need for precision, the risk of sampling from more than one population, and the expenses of different sample sizes.

- Sample data in investments can have a variety of problems. *Survivorship bias* occurs if companies are excluded from the analysis because they have gone out of business or because of reasons related to poor performance. *Data-mining bias* comes from finding models by repeatedly searching through databases for patterns. *Look-ahead bias* exists if the model uses data not available to market participants at the time the market participants act in the model. Finally, time-period bias is present if the time period used makes the results time-period specific or if the time period used includes a point of structural change.

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PRACTICE PROBLEMS

1   Peter Biggs wants to know how growth managers performed last year. Biggs
    assumes that the population cross-sectional standard deviation of growth man-
    ager returns is 6 percent and that the returns are independent across managers.

    A   How large a random sample does Biggs need if he wants the standard devia-
        tion of the sample means to be 1 percent?

    B   How large a random sample does Biggs need if he wants the standard devia-
        tion of the sample means to be 0.25 percent?

2   Petra Munzi wants to know how value managers performed last year. Munzi
    estimates that the population cross-sectional standard deviation of value man-
    ager returns is 4 percent and assumes that the returns are independent across
    managers.

    A   Munzi wants to build a 95 percent confidence interval for the mean return.
        How large a random sample does Munzi need if she wants the 95 percent
        confidence interval to have a total width of 1 percent?

    B   Munzi expects a cost of about $10 to collect each observation. If she has
        a $1,000 budget, will she be able to construct the confidence interval she
        wants?

3   Assume that the equity risk premium is normally distributed with a population
    mean of 6 percent and a population standard deviation of 18 percent. Over
    the last four years, equity returns (relative to the risk-free rate) have averaged
    −2.0 percent. You have a large client who is very upset and claims that results
    this poor should *never* occur. Evaluate your client's concerns.

    A   Construct a 95 percent confidence interval around the population mean for
        a sample of four-year returns.

    B   What is the probability of a −2.0 percent or lower average return over a
        four-year period?

4   Compare the standard normal distribution and Student's *t*-distribution.

5   Find the reliability factors based on the *t*-distribution for the following confi-
    dence intervals for the population mean (df = degrees of freedom, *n* = sample
    size):

    A   A 99 percent confidence interval, df = 20.

    B   A 90 percent confidence interval, df = 20.

    C   A 95 percent confidence interval, *n* = 25.

    D   A 95 percent confidence interval, *n* = 16.

6   Assume that monthly returns are normally distributed with a mean of 1 percent
    and a sample standard deviation of 4 percent. The population standard devi-
    ation is unknown. Construct a 95 percent confidence interval for the sample
    mean of monthly returns if the sample size is 24.

7   Ten analysts have given the following fiscal year earnings forecasts for a stock:

Forecast (X_i)	Number of Analysts (n_i)
1.40	1
1.43	1
1.44	3

Forecast (X_i)	Number of Analysts (n_i)
1.45	2
1.47	1
1.48	1
1.50	1

Because the sample is a small fraction of the number of analysts who follow this stock, assume that we can ignore the finite population correction factor. Assume that the analyst forecasts are normally distributed.

A What are the mean forecast and standard deviation of forecasts?

B Provide a 95 percent confidence interval for the population mean of the forecasts.

8 Thirteen analysts have given the following fiscal-year earnings forecasts for a stock:

Forecast (X_i)	Number of Analysts (n_i)
0.70	2
0.72	4
0.74	1
0.75	3
0.76	1
0.77	1
0.82	1

Because the sample is a small fraction of the number of analysts who follow this stock, assume that we can ignore the finite population correction factor.

A What are the mean forecast and standard deviation of forecasts?

B What aspect of the data makes us uncomfortable about using t-tables to construct confidence intervals for the population mean forecast?

9 Explain the differences between constructing a confidence interval when sampling from a normal population with a known population variance and sampling from a normal population with an unknown variance.

10 An exchange rate has a given expected future value and standard deviation.

A Assuming that the exchange rate is normally distributed, what are the probabilities that the exchange rate will be at least 2 or 3 standard deviations away from its mean?

B Assume that you do not know the distribution of exchange rates. Use Chebyshev's inequality (that at least $1 - 1/k^2$ proportion of the observations will be within k standard deviations of the mean for any positive integer k greater than 1) to calculate the maximum probabilities that the exchange rate will be at least 2 or 3 standard deviations away from its mean.

11 Although he knows security returns are not independent, a colleague makes the claim that because of the central limit theorem, if we diversify across a large number of investments, the portfolio standard deviation will eventually approach zero as n becomes large. Is he correct?

12 Why is the central limit theorem important?

13 What is wrong with the following statement of the central limit theorem?

Central Limit Theorem. "If the random variables $X_1, X_2, X_3, \ldots, X_n$ are a random sample of size n from any distribution with finite mean μ and variance σ^2, then the distribution of $\bar{X}$ will be approximately normal, with a standard deviation of $\sigma/\sqrt{n}$."

14 Suppose we take a random sample of 30 companies in an industry with 200 companies. We calculate the sample mean of the ratio of cash flow to total debt for the prior year. We find that this ratio is 23 percent. Subsequently, we learn that the population cash flow to total debt ratio (taking account of all 200 companies) is 26 percent. What is the explanation for the discrepancy between the sample mean of 23 percent and the population mean of 26 percent?

   A Sampling error.

   B Bias.

   C A lack of consistency.

15 Alcorn Mutual Funds is placing large advertisements in several financial publications. The advertisements prominently display the returns of 5 of Alcorn's 30 funds for the past 1-, 3-, 5-, and 10-year periods. The results are indeed impressive, with all of the funds beating the major market indexes and a few beating them by a large margin. Is the Alcorn family of funds superior to its competitors?

16 Julius Spence has tested several predictive models in order to identify undervalued stocks. Spence used about 30 company-specific variables and 10 market-related variables to predict returns for about 5,000 North American and European stocks. He found that a final model using eight variables applied to telecommunications and computer stocks yields spectacular results. Spence wants you to use the model to select investments. Should you? What steps would you take to evaluate the model?

17 The *best* approach for creating a stratified random sample of a population involves:

   A drawing an equal number of simple random samples from each subpopulation.

   B selecting every kth member of the population until the desired sample size is reached.

   C drawing simple random samples from each subpopulation in sizes proportional to the relative size of each subpopulation.

18 A population has a non-normal distribution with mean μ and variance σ^2. The sampling distribution of the sample mean computed from samples of large size from that population will have:

   A the same distribution as the population distribution.

   B its mean approximately equal to the population mean.

   C its variance approximately equal to the population variance.

19 A sample mean is computed from a population with a variance of 2.45. The sample size is 40. The standard error of the sample mean is *closest* to:

   A 0.039.

   B 0.247.

   C 0.387.

20 An estimator with an expected value equal to the parameter that it is intended to estimate is described as:

    A   efficient.

    B   unbiased.

    C   consistent.

21 If an estimator is consistent, an increase in sample size will increase the:

    A   accuracy of estimates.

    B   efficiency of the estimator.

    C   unbiasedness of the estimator.

22 For a two-sided confidence interval, an increase in the degree of confidence will result in:

    A   a wider confidence interval.

    B   a narrower confidence interval.

    C   no change in the width of the confidence interval.

23 As the *t*-distribution's degrees of freedom decrease, the *t*-distribution *most likely*:

    A   exhibits tails that become fatter.

    B   approaches a standard normal distribution.

    C   becomes asymmetrically distributed around its mean value.

24 For a sample size of 17, with a mean of 116.23 and a variance of 245.55, the width of a 90% confidence interval using the appropriate *t*-distribution is *closest to*:

    A   13.23.

    B   13.27.

    C   13.68.

25 For a sample size of 65 with a mean of 31 taken from a normally distributed population with a variance of 529, a 99% confidence interval for the population mean will have a lower limit *closest* to:

    A   23.64.

    B   25.41.

    C   30.09.

26 An increase in sample size is *most likely* to result in a:

    A   wider confidence interval.

    B   decrease in the standard error of the sample mean.

    C   lower likelihood of sampling from more than one population.

27 A report on long-term stock returns focused exclusively on all currently publicly traded firms in an industry is *most likely* susceptible to:

    A   look-ahead bias.

    B   survivorship bias.

    C   intergenerational data mining.

28 Which sampling bias is *most likely* investigated with an out-of-sample test?

    A   Look-ahead bias

    B   Data-mining bias

    C   Sample selection bias

29 Which of the following characteristics of an investment study *most likely* indicates time-period bias?

    A   The study is based on a short time-series.

B Information not available on the test date is used.

C A structural change occurred prior to the start of the study's time series.

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 $\bar{X} \pm 1.96 s_{\bar{X}}$, 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

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

Simplifying this equation, we get $2\left(1.96 s_{\bar{X}}\right)$ = 1%. Finally, we have $3.92 s_{\bar{X}}$ = 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 $X_1 = \mu - 1.96\frac{\sigma}{\sqrt{n}} = 6\% - 1.96\frac{18\%}{\sqrt{4}} = 6\% - 1.96(9\%) = -11.64\%$.

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)	$X_i n_i$	$(X_i - \overline{X})$	$(X_i - \overline{X})^2$	$(X_i - \overline{X})^2 n_i$
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

$$P\big(|X - \mu| \geq 2\sigma\big) = 0.0456$$
$$P\big(|X - \mu| \geq 3\sigma\big) = 0.0026$$

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

$$P\big(|X - \mu| \geq 2\sigma\big) \leq (1/2)^2 = 0.2500$$
$$P\big(|X - \mu| \geq 3\sigma\big) \leq (1/3)^2 = 0.1111$$

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* ≥ 30).

13 The statement makes the following mistakes:

- Given the conditions in the statement, the distribution of $\overline{X}$ will be approximately normal only for large sample sizes.

- The statement omits the important element of the central limit theorem that the distribution of $\overline{X}$ 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 ± Reliability factor × 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, σ = $\sqrt{529}$ = 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.

sharper conclusions.[37] For complete coverage of all the nonparametric procedures that may be encountered in the finance and investment literature, it is best to consult a specialist textbook.[38]

SUMMARY

In this reading, we have presented the concepts and methods of statistical inference and hypothesis testing.

- A hypothesis is a statement about one or more populations.
- The steps in testing a hypothesis are as follows:
    1 Stating the hypotheses.
    2 Identifying the appropriate test statistic and its probability distribution.
    3 Specifying the significance level.
    4 Stating the decision rule.
    5 Collecting the data and calculating the test statistic.
    6 Making the statistical decision.
    7 Making the economic or investment decision.
- We state two hypotheses: The null hypothesis is the hypothesis to be tested; the alternative hypothesis is the hypothesis accepted when the null hypothesis is rejected.
- There are three ways to formulate hypotheses:
    1 $H_0: \theta = \theta_0$ versus $H_a: \theta \neq \theta_0$
    2 $H_0: \theta \leq \theta_0$ versus $H_a: \theta > \theta_0$
    3 $H_0: \theta \geq \theta_0$ versus $H_a: \theta < \theta_0$

    where θ_0 is a hypothesized value of the population parameter and θ is the true value of the population parameter. In the above, Formulation 1 is a two-sided test and Formulations 2 and 3 are one-sided tests.
- When we have a "suspected" or "hoped for" condition for which we want to find supportive evidence, we frequently set up that condition as the alternative hypothesis and use a one-sided test. To emphasize a neutral attitude, however, the researcher may select a "not equal to" alternative hypothesis and conduct a two-sided test.
- A test statistic is a quantity, calculated on the basis of a sample, whose value is the basis for deciding whether to reject or not reject the null hypothesis. To decide whether to reject, or not to reject, the null hypothesis, we compare the computed value of the test statistic to a critical value (rejection point) for the same test statistic.
- In reaching a statistical decision, we can make two possible errors: We may reject a true null hypothesis (a Type I error), or we may fail to reject a false null hypothesis (a Type II error).

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37 To use a concept introduced in an earlier section, the parametric test is often more powerful.
38 See, for example, Hettmansperger and McKean (2010) or Siegel and Castellan (1988).

- The level of significance of a test is the probability of a Type I error that we accept in conducting a hypothesis test. The probability of a Type I error is denoted by the Greek letter alpha, α. The standard approach to hypothesis testing involves specifying a level of significance (probability of Type I error) only.

- The power of a test is the probability of correctly rejecting the null (rejecting the null when it is false).

- A decision rule consists of determining the rejection points (critical values) with which to compare the test statistic to decide whether to reject or not to reject the null hypothesis. When we reject the null hypothesis, the result is said to be statistically significant.

- The (1 – α) confidence interval represents the range of values of the test statistic for which the null hypothesis will not be rejected at an α significance level.

- The statistical decision consists of rejecting or not rejecting the null hypothesis. The economic decision takes into consideration all economic issues pertinent to the decision.

- The *p*-value is the smallest level of significance at which the null hypothesis can be rejected. The smaller the *p*-value, the stronger the evidence against the null hypothesis and in favor of the alternative hypothesis. The *p*-value approach to hypothesis testing does not involve setting a significance level; rather it involves computing a *p*-value for the test statistic and allowing the consumer of the research to interpret its significance.

- For hypothesis tests concerning the population mean of a normally distributed population with unknown (known) variance, the theoretically correct test statistic is the *t*-statistic (*z*-statistic). In the unknown variance case, given large samples (generally, samples of 30 or more observations), the *z*-statistic may be used in place of the *t*-statistic because of the force of the central limit theorem.

- The *t*-distribution is a symmetrical distribution defined by a single parameter: degrees of freedom. Compared to the standard normal distribution, the *t*-distribution has fatter tails.

- When we want to test whether the observed difference between two means is statistically significant, we must first decide whether the samples are independent or dependent (related). If the samples are independent, we conduct tests concerning differences between means. If the samples are dependent, we conduct tests of mean differences (paired comparisons tests).

- When we conduct a test of the difference between two population means from normally distributed populations with unknown variances, if we can assume the variances are equal, we use a *t*-test based on pooling the observations of the two samples to estimate the common (but unknown) variance. This test is based on an assumption of independent samples.

- When we conduct a test of the difference between two population means from normally distributed populations with unknown variances, if we cannot assume that the variances are equal, we use an approximate *t*-test using modified degrees of freedom given by a formula. This test is based on an assumption of independent samples.

- In tests concerning two means based on two samples that are not independent, we often can arrange the data in paired observations and conduct a test of mean differences (a paired comparisons test). When the samples are from normally distributed populations with unknown variances, the appropriate test statistic is a *t*-statistic. The denominator of the *t*-statistic, the standard error of the mean differences, takes account of correlation between the samples.

- In tests concerning the variance of a single, normally distributed population, the test statistic is chi-square (χ^2) with $n - 1$ degrees of freedom, where n is sample size.

- For tests concerning differences between the variances of two normally distributed populations based on two random, independent samples, the appropriate test statistic is based on an *F*-test (the ratio of the sample variances).

- The *F*-statistic is defined by the numerator and denominator degrees of freedom. The numerator degrees of freedom (number of observations in the sample minus 1) is the divisor used in calculating the sample variance in the numerator. The denominator degrees of freedom (number of observations in the sample minus 1) is the divisor used in calculating the sample variance in the denominator. In forming an *F*-test, a convention is to use the larger of the two ratios, $s_1^2 \big/ s_2^2$ or $s_2^2 \big/ s_1^2$, as the actual test statistic.

- In tests concerning correlation, we use a *t*-statistic to test whether a population correlation coefficient is significantly different from 0. If we have n observations for two variables, this test statistic has a *t*-distribution with $n - 2$ degrees of freedom.

- A parametric test is a hypothesis test concerning a parameter or a hypothesis test based on specific distributional assumptions. In contrast, a nonparametric test either is not concerned with a parameter or makes minimal assumptions about the population from which the sample comes.

- A nonparametric test is primarily used in three situations: when data do not meet distributional assumptions, when data are given in ranks, or when the hypothesis we are addressing does not concern a parameter.

- The Spearman rank correlation coefficient is calculated on the ranks of two variables within their respective samples.

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PRACTICE PROBLEMS

1 Which of the following statements about hypothesis testing is correct?

   A The null hypothesis is the condition a researcher hopes to support.

   B The alternative hypothesis is the proposition considered true without conclusive evidence to the contrary.

   C The alternative hypothesis exhausts all potential parameter values not accounted for by the null hypothesis.

2 Identify the appropriate test statistic or statistics for conducting the following hypothesis tests. (Clearly identify the test statistic and, if applicable, the number of degrees of freedom. For example, "We conduct the test using an x-statistic with y degrees of freedom.")

   A H_0: $\mu = 0$ versus H_a: $\mu \neq 0$, where μ is the mean of a normally distributed population with unknown variance. The test is based on a sample of 15 observations.

   B H_0: $\mu = 0$ versus H_a: $\mu \neq 0$, where μ is the mean of a normally distributed population with unknown variance. The test is based on a sample of 40 observations.

   C H_0: $\mu \leq 0$ versus H_a: $\mu > 0$, where μ is the mean of a normally distributed population with known variance σ^2. The sample size is 45.

   D H_0: $\sigma^2 = 200$ versus H_a: $\sigma^2 \neq 200$, where σ^2 is the variance of a normally distributed population. The sample size is 50.

   E H_0: $\sigma_1^2 = \sigma_2^2$ versus H_a: $\sigma_1^2 \neq \sigma_2^2$, where σ_1^2 is the variance of one normally distributed population and σ_2^2 is the variance of a second normally distributed population. The test is based on two independent random samples.

   F H_0: (Population mean 1) – (Population mean 2) = 0 versus H_a: (Population mean 1) – (Population mean 2) ≠ 0, where the samples are drawn from normally distributed populations with unknown variances. The observations in the two samples are correlated.

   G H_0: (Population mean 1) – (Population mean 2) = 0 versus H_a: (Population mean 1) – (Population mean 2) ≠ 0, where the samples are drawn from normally distributed populations with unknown but assumed equal variances. The observations in the two samples (of size 25 and 30, respectively) are independent.

3 For each of the following hypothesis tests concerning the population mean, μ, state the rejection point condition or conditions for the test statistic (e.g., $t > 1.25$); n denotes sample size.

   A H_0: $\mu = 10$ versus H_a: $\mu \neq 10$, using a t-test with $n = 26$ and $\alpha = 0.05$

   B H_0: $\mu = 10$ versus H_a: $\mu \neq 10$, using a t-test with $n = 40$ and $\alpha = 0.01$

   C H_0: $\mu \leq 10$ versus H_a: $\mu > 10$, using a t-test with $n = 40$ and $\alpha = 0.01$

   D H_0: $\mu \leq 10$ versus H_a: $\mu > 10$, using a t-test with $n = 21$ and $\alpha = 0.05$

   E H_0: $\mu \geq 10$ versus H_a: $\mu < 10$, using a t-test with $n = 19$ and $\alpha = 0.10$

   F H_0: $\mu \geq 10$ versus H_a: $\mu < 10$, using a t-test with $n = 50$ and $\alpha = 0.05$

4 For each of the following hypothesis tests concerning the population mean, μ, state the rejection point condition or conditions for the test statistic (e.g., $z > 1.25$); n denotes sample size.

   A H_0: $\mu = 10$ versus H_a: $\mu \neq 10$, using a z-test with $n = 50$ and $\alpha = 0.01$

   B H_0: $\mu = 10$ versus H_a: $\mu \neq 10$, using a z-test with $n = 50$ and $\alpha = 0.05$

   C H_0: $\mu = 10$ versus H_a: $\mu \neq 10$, using a z-test with $n = 50$ and $\alpha = 0.10$

   D H_0: $\mu \leq 10$ versus H_a: $\mu > 10$, using a z-test with $n = 50$ and $\alpha = 0.05$

5 Willco is a manufacturer in a mature cyclical industry. During the most recent industry cycle, its net income averaged $30 million per year with a standard deviation of $10 million ($n = 6$ observations). Management claims that Willco's performance during the most recent cycle results from new approaches and that we can dismiss profitability expectations based on its average or normalized earnings of $24 million per year in prior cycles.

   A With μ as the population value of mean annual net income, formulate null and alternative hypotheses consistent with testing Willco management's claim.

   B Assuming that Willco's net income is at least approximately normally distributed, identify the appropriate test statistic.

   C Identify the rejection point or points at the 0.05 level of significance for the hypothesis tested in Part A.

   D Determine whether or not to reject the null hypothesis at the 0.05 significance level.

The following information relates to Questions 6–7

Performance in Forecasting Quarterly Earnings per Share

	Number of Forecasts	Mean Forecast Error (Predicted – Actual)	Standard Deviations of Forecast Errors
Analyst A	101	0.05	0.10
Analyst B	121	0.02	0.09

6 Investment analysts often use earnings per share (EPS) forecasts. One test of forecasting quality is the zero-mean test, which states that optimal forecasts should have a mean forecasting error of 0. (Forecasting error = Predicted value of variable – Actual value of variable.)

   You have collected data (shown in the table above) for two analysts who cover two different industries: Analyst A covers the telecom industry; Analyst B covers automotive parts and suppliers.

   A With μ as the population mean forecasting error, formulate null and alternative hypotheses for a zero-mean test of forecasting quality.

   B For Analyst A, using both a t-test and a z-test, determine whether to reject the null at the 0.05 and 0.01 levels of significance.

   C For Analyst B, using both a t-test and a z-test, determine whether to reject the null at the 0.05 and 0.01 levels of significance.

7 Reviewing the EPS forecasting performance data for Analysts A and B, you want to investigate whether the larger average forecast errors of Analyst A are due to chance or to a higher underlying mean value for Analyst A. Assume that the forecast errors of both analysts are normally distributed and that the samples are independent.

A Formulate null and alternative hypotheses consistent with determining whether the population mean value of Analyst A's forecast errors (μ_1) are larger than Analyst B's (μ_2).

B Identify the test statistic for conducting a test of the null hypothesis formulated in Part A.

C Identify the rejection point or points for the hypothesis tested in Part A, at the 0.05 level of significance.

D Determine whether or not to reject the null hypothesis at the 0.05 level of significance.

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8 The table below gives data on the monthly returns on the S&P 500 and small-cap stocks for a forty-year period and provides statistics relating to their mean differences. Furthermore, the entire sample period is split into two subperiods of 20 years each and the returns data for these subperiods is also given in the table.

Measure	S&P 500 Return (%)	Small-Cap Stock Return (%)	Differences (S&P 500– Small-Cap Stock)
Entire sample period, 480 months			
Mean	1.0542	1.3117	−0.258
Standard deviation	4.2185	5.9570	3.752
First subperiod, 240 months			
Mean	0.6345	1.2741	−0.640
Standard deviation	4.0807	6.5829	4.096
Second subperiod, 240 months			
Mean	1.4739	1.3492	0.125
Standard deviation	4.3197	5.2709	3.339

Let μ_d stand for the population mean value of difference between S&P 500 returns and small-cap stock returns. Use a significance level of 0.05 and suppose that mean differences are approximately normally distributed.

A Formulate null and alternative hypotheses consistent with testing whether any difference exists between the mean returns on the S&P 500 and small-cap stocks.

B Determine whether or not to reject the null hypothesis at the 0.05 significance level for the entire sample period.

C Determine whether or not to reject the null hypothesis at the 0.05 significance level for the first subperiod.

D Determine whether or not to reject the null hypothesis at the 0.05 significance level for the second subperiod.

9 During a 10-year period, the standard deviation of annual returns on a portfolio you are analyzing was 15 percent a year. You want to see whether this record is sufficient evidence to support the conclusion that the portfolio's underlying variance of return was less than 400, the return variance of the portfolio's benchmark.

   A Formulate null and alternative hypotheses consistent with the verbal description of your objective.

   B Identify the test statistic for conducting a test of the hypotheses in Part A.

   C Identify the rejection point or points at the 0.05 significance level for the hypothesis tested in Part A.

   D Determine whether the null hypothesis is rejected or not rejected at the 0.05 level of significance.

10 You are investigating whether the population variance of returns on the S&P 500/BARRA Growth Index changed subsequent to the October 1987 market crash. You gather the following data for 120 months of returns before October 1987 and for 120 months of returns after October 1987. You have specified a 0.05 level of significance.

Time Period	n	Mean Monthly Return (%)	Variance of Returns
Before October 1987	120	1.416	22.367
After October 1987	120	1.436	15.795

   A Formulate null and alternative hypotheses consistent with the verbal description of the research goal.

   B Identify the test statistic for conducting a test of the hypotheses in Part A.

   C Determine whether or not to reject the null hypothesis at the 0.05 level of significance. (Use the *F*-tables in the back of this volume.)

11 The following table shows the sample correlations between the monthly returns for four different mutual funds and the S&P 500. The correlations are based on 36 monthly observations. The funds are as follows:

Fund 1	Large-cap fund
Fund 2	Mid-cap fund
Fund 3	Large-cap value fund
Fund 4	Emerging markets fund
S&P 500	US domestic stock index

	Fund 1	Fund 2	Fund 3	Fund 4	S&P 500
Fund 1	1				
Fund 2	0.9231	1			
Fund 3	0.4771	0.4156	1		
Fund 4	0.7111	0.7238	0.3102	1	
S&P 500	0.8277	0.8223	0.5791	0.7515	1

Test the null hypothesis that each of these correlations, individually, is equal to zero against the alternative hypothesis that it is not equal to zero. Use a 5 percent significance level.

12 In the step "stating a decision rule" in testing a hypothesis, which of the following elements must be specified?

    A   Critical value

    B   Power of a test

    C   Value of a test statistic

13 Which of the following statements is correct with respect to the null hypothesis?

    A   It is considered to be true unless the sample provides evidence showing it is false.

    B   It can be stated as "not equal to" provided the alternative hypothesis is stated as "equal to."

    C   In a two-tailed test, it is rejected when evidence supports equality between the hypothesized value and population parameter.

14 An analyst is examining a large sample with an unknown population variance. To test the hypothesis that the historical average return on an index is less than or equal to 6%, which of the following is the *most* appropriate test?

    A   One-tailed *z*-test

    B   Two-tailed *z*-test

    C   One-tailed *F*-test

15 A hypothesis test for a normally-distributed population at a 0.05 significance level implies a:

    A   95% probability of rejecting a true null hypothesis.

    B   95% probability of a Type I error for a two-tailed test.

    C   5% critical value rejection region in a tail of the distribution for a one-tailed test.

16 Which of the following statements regarding a one-tailed hypothesis test is correct?

    A   The rejection region increases in size as the level of significance becomes smaller.

    B   A one-tailed test more strongly reflects the beliefs of the researcher than a two-tailed test.

    C   The absolute value of the rejection point is larger than that of a two-tailed test at the same level of significance.

17 The value of a test statistic is *best* described as the basis for deciding whether to:

    A   reject the null hypothesis.

    B   accept the null hypothesis.

    C   reject the alternative hypothesis.

18 Which of the following is a Type I error?

    A   Rejecting a true null hypothesis

    B   Rejecting a false null hypothesis

    C   Failing to reject a false null hypothesis

19 A Type II error is *best* described as:

    A   rejecting a true null hypothesis.

    B   failing to reject a false null hypothesis.

    C   failing to reject a false alternative hypothesis.

20 The level of significance of a hypothesis test is *best* used to:

    A   calculate the test statistic.

    B   define the test's rejection points.

C specify the probability of a Type II error.

21 You are interested in whether excess risk-adjusted return (alpha) is correlated with mutual fund expense ratios for US large-cap growth funds. The following table presents the sample.

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

A Formulate null and alternative hypotheses consistent with the verbal description of the research goal.

B Identify the test statistic for conducting a test of the hypotheses in Part A.

C Justify your selection in Part B.

D Determine whether or not to reject the null hypothesis at the 0.05 level of significance.

22 All else equal, is specifying a smaller significance level in a hypothesis test likely to increase the probability of a:

	Type I error?	Type II error?
A	No	No
B	No	Yes
C	Yes	No

23 The probability of correctly rejecting the null hypothesis is the:

A p-value.

B power of a test.

C level of significance.

24 The power of a hypothesis test is:

A equivalent to the level of significance.

B the probability of not making a Type II error.

C unchanged by increasing a small sample size.

25 When making a decision in investments involving a statistically significant result, the:

A economic result should be presumed meaningful.

B statistical result should take priority over economic considerations.

C economic logic for the future relevance of the result should be further explored.

26 An analyst tests the profitability of a trading strategy with the null hypothesis being that the average abnormal return before trading costs equals zero. The calculated t-statistic is 2.802, with critical values of ± 2.756 at significance level $\alpha = 0.01$. After considering trading costs, the strategy's return is near zero. The results are *most likely*:

A statistically but not economically significant.

B economically but not statistically significant.

C neither statistically nor economically significant.

27 Which of the following statements is correct with respect to the p-value?

A It is a less precise measure of test evidence than rejection points.

B It is the largest level of significance at which the null hypothesis is rejected.

    C It can be compared directly with the level of significance in reaching test conclusions.

28 Which of the following represents a correct statement about the *p*-value?

    A The *p*-value offers less precise information than does the rejection points approach.

    B A larger *p*-value provides stronger evidence in support of the alternative hypothesis.

    C A *p*-value less than the specified level of significance leads to rejection of the null hypothesis.

29 Which of the following statements on *p*-value is correct?

    A The *p*-value is the smallest level of significance at which H_0 can be rejected.

    B The *p*-value indicates the probability of making a Type II error.

    C The lower the p-value, the weaker the evidence for rejecting the H_0.

30 The following table shows the significance level (α) and the *p*-value for three hypothesis tests.

	α	*p*-value
Test 1	0.05	0.10
Test 2	0.10	0.08
Test 3	0.10	0.05

The evidence for rejecting H_0 is strongest for:

    A Test 1.

    B Test 2.

    C Test 3.

31 Which of the following tests of a hypothesis concerning the population mean is *most* appropriate?

    A A *z*-test if the population variance is unknown and the sample is small

    B A *z*-test if the population is normally distributed with a known variance

    C A *t*-test if the population is non-normally distributed with unknown variance and a small sample

32 For a small sample with unknown variance, which of the following tests of a hypothesis concerning the population mean is most appropriate?

    A A *t*-test if the population is normally distributed

    B A *t*-test if the population is non-normally distributed

    C A *z*-test regardless of the normality of the population distribution

33 For a small sample from a normally distributed population with unknown variance, the *most* appropriate test statistic for the mean is the:

    A *z*-statistic.

    B *t*-statistic.

    C χ^2 statistic.

34 An investment consultant conducts two independent random samples of 5-year performance data for US and European absolute return hedge funds. Noting a 50 basis point return advantage for US managers, the consultant decides to test whether the two means are statistically different from one another at a 0.05 level of significance. The two populations are assumed to be normally distributed with unknown but equal variances. Results of the hypothesis test are contained in the tables below.

	Sample Size	Mean Return %	Standard Deviation
US Managers	50	4.7	5.4
European Managers	50	4.2	4.8

Null and Alternative Hypotheses	$H_0: \mu_{US} - \mu_E = 0; H_a: \mu_{US} - \mu_E \neq 0$
Test Statistic	0.4893
Critical Value Rejection Points	±1.984

μ_{US} is the mean return for US funds and μ_E is the mean return for European funds.

The results of the hypothesis test indicate that the:

A   null hypothesis is not rejected.

B   alternative hypothesis is statistically confirmed.

C   difference in mean returns is statistically different from zero.

35 A pooled estimator is used when testing a hypothesis concerning the:

A   equality of the variances of two normally distributed populations.

B   difference between the means of two at least approximately normally distributed populations with unknown but assumed equal variances.

C   difference between the means of two at least approximately normally distributed populations with unknown and assumed unequal variances.

36 When evaluating mean differences between two dependent samples, the *most* appropriate test is a:

A   chi-square test.

B   paired comparisons test.

C   *z*-test.

37 A fund manager reported a 2% mean quarterly return over the past ten years for its entire base of 250 client accounts that all follow the same investment strategy. A consultant employing the manager for 45 client accounts notes that their mean quarterly returns were 0.25% less over the same period. The consultant tests the hypothesis that the return disparity between the returns of his clients and the reported returns of the fund manager's 250 client accounts are significantly different from zero.

Assuming normally distributed populations with unknown population variances, the *most* appropriate test statistic is:

A   a paired comparisons *t*-test.

B   a *t*-test of the difference between the two population means.

C   an approximate *t*-test of mean differences between the two populations.

38 A chi-square test is *most* appropriate for tests concerning:

A   a single variance.

B   differences between two population means with variances assumed to be equal.

C   differences between two population means with variances assumed to not be equal.

39 Which of the following should be used to test the difference between the variances of two normally distributed populations?

    A *t*-test

    B *F*-test

    C Paired comparisons test

40 Jill Batten is analyzing how the returns on the stock of Stellar Energy Corp. are related with the previous month's percent change in the US Consumer Price Index for Energy (CPIENG). Based on 248 observations, she has computed the sample correlation between the Stellar and CPIENG variables to be −0.1452. She also wants to determine whether the sample correlation is statistically significant. The critical value for the test statistic at the 0.05 level of significance is approximately 1.96. Batten should conclude that the statistical relationship between Stellar and CPIENG is:

    A significant, because the calculated test statistic has a lower absolute value than the critical value for the test statistic.

    B significant, because the calculated test statistic has a higher absolute value than the critical value for the test statistic.

    C not significant, because the calculated test statistic has a higher absolute value than the critical value for the test statistic.

41 In which of the following situations would a non-parametric test of a hypothesis *most likely* be used?

    A The sample data are ranked according to magnitude.

    B The sample data come from a normally distributed population.

    C The test validity depends on many assumptions about the nature of the population.

42 An analyst is examining the monthly returns for two funds over one year. Both funds' returns are non-normally distributed. To test whether the mean return of one fund is greater than the mean return of the other fund, the analyst can use:

    A a parametric test only.

    B a nonparametric test only.

    C both parametric and nonparametric tests.

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 α = 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 α = 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 α = 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 Willco'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 α = 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 $t = (0.05 - 0)\big/\big(0.10\big/\sqrt{101}\big) = 0.05/0.00995 =$ 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 $t = (0.02 - 0)\big/\big(0.09\big/\sqrt{121}\big) = 0.02/0.008182 = 2.444444$ 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:

$$s_p^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2} = \frac{(101 - 1)(0.10)^2 + (121 - 1)(0.09)^2}{101 + 121 - 2}$$

$$= \frac{1.972}{220} = 0.008964$$

Then

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

$$= \frac{0.03}{0.01276} = 2.351018$$

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 = ∞ in the t-distribution table under $\alpha = 0.025$ because we have a very large sample and a two-sided test.

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

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.

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

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.

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

At the 0.05 significance level, because neither rejection point condition is met, we do not reject the null hypothesis that for the second subperiod, 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 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   The critical *t*-value for *n* − 2 = 34 df, using a 5 percent significance level and a two-tailed test, is 2.032. First, take the smallest correlation in the table, the correlation between Fund 3 and Fund 4, and see if it is significantly different from zero. Its calculated *t*-value is

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} = \frac{0.3102\sqrt{36-2}}{\sqrt{1-0.3102^2}} = 1.903$$

This correlation is not significantly different from zero. If we take the next lowest correlation, between Fund 2 and Fund 3, this correlation of 0.4156 has a calculated *t*-value of 2.664. So this correlation is significantly different from zero at the 5 percent level of significance. All of the other correlations in the table (besides the 0.3102) are greater than 0.4156, so they too are significantly different from zero.

12   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.

13   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.

14   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.

15   C is correct. For a one-tailed hypothesis test, there is a 5% critical value rejection region in one tail of the distribution.

16 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.

17 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.

18 A is correct. The definition of a Type I error is when a true null hypothesis is rejected.

19 B is correct. A Type II error occurs when a false null hypothesis is not rejected.

20 B is correct. The level of significance is used to establish the rejection points of the hypothesis test.

21 A We have a "not equal to" alternative hypothesis:

H_0: $\rho = 0$ 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.

22 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.

23 B is correct. The power of a test is the probability of rejecting the null hypothesis when it is false.

24   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.

25   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.

26   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

27   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.

28   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.

29   A is correct. The p-value is the smallest level of significance (α) at which the null hypothesis can be rejected.

30   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.

31   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.

32   A is correct. A t-test is used if the sample is small and drawn from a normally or approximately normally distributed population.

33   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.

34   A is correct. The t-statistic value of 0.4893 does not fall into the critical value rejection regions ($\leq$ −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.

35   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.

36   B is correct. A paired comparisons test is appropriate to test the mean differences of two samples believed to be dependent.

37   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.

38 A is correct. A chi-square test is used for tests concerning the variance of a single normally distributed population.

39 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.

40 B is correct. The calculated test statistic is

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$$

$$= \frac{-0.1452\sqrt{248-2}}{\sqrt{1-(-0.1452)^2}} = -2.30177$$

Because the absolute value of $t = -2.30177$ is greater than 1.96, the correlation coefficient is statistically significant.

41 A is correct. A non-parametric test is used when the data are given in ranks.

42 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.

down the LRAC$_{US}$ curve to a smaller, yet lower-cost production volume. In Contrast, Starr has to grow in size to become more efficient and competitive by lowering per-unit costs.

From a long-term investment prospective and given its cost advantage, Rocket has the potential to create more investment value relative to GenAuto and Starr. Over the long run, if GenAuto and Starr can lower their ATC, they will become more attractive to investors. But if any of the three US auto companies cannot match the cost competitiveness of the foreign firms, they may be driven from the market. In the long run, the lower-cost foreign automakers pose a severe competitive challenge to the survival of the US manufacturers and their ability to maintain and grow shareholders' wealth.

SUMMARY

This reading addressed several important concepts that extend the basic market model of demand and supply to assist the analyst in assessing a firm's breakeven and shutdown points of production. Demand concepts covered include own-price elasticity of demand, cross-price elasticity of demand, and income elasticity of demand. Supply concepts covered include total, average, and marginal product of labor; total, variable, and marginal cost of labor; and total and marginal revenue. These concepts are used to calculate the breakeven and shutdown points of production.

- Elasticity of demand is a measure of how sensitive quantity demanded is to changes in various variables.
- Own-price elasticity of demand is the ratio of percentage change in quantity demanded to percentage change in a good or service's own price.
- If own-price elasticity of demand is greater than one in absolute terms, demand is elastic and a decline in price will result in higher total expenditure on that good.
- If own-price elasticity of demand is less than one in absolute terms, demand is inelastic and a decline in price will result in a lower total expenditure on that good.
- If own-price elasticity of demand is equal to negative one, demand is unit, or unitary, elastic and total expenditure on that good is independent of price.
- Own-price elasticity of demand will almost always be negative.
- Income elasticity of demand is the ratio of the percentage change in quantity demanded to the percentage change in consumer income.
- Demand is negatively sloped because of either the substitution effect or the income effect.
- The substitution effect is the phenomenon in which, as a good's price falls, more of this good is substituted for other, more expensive goods.
- The income effect is the phenomenon in which, as a good's price falls, real income rises and, if this good is normal, more of it will be purchased.
- If the good is inferior, the income effect will partially or fully offset the substitution effect.
- There are two exceptions to the law of demand: Giffen goods and Veblen goods.

- Giffen goods are highly inferior and make up a large portion of the consumer budget. As price falls, the substitution effect tends to cause more of the good to be consumed, but the highly negative income effect overwhelms the substitution effect. Demand curves for Giffen goods are positively sloped.

- Veblen goods are highly valued high-priced "status" goods; consumers may tend to buy more of a good if its price rises.

- If income elasticity of demand is positive, the good is a normal good. If income elasticity of demand is negative, the good is an inferior good.

- Cross-price elasticity of demand is the ratio of the percentage change in quantity demanded of one good to the percentage change in the price of a related good.

- If cross-price elasticity between two goods is positive, they are substitutes, and if cross-price elasticity between two goods is negative, they are complements.

- The law of demand states that a decrease in price will cause an increase in quantity demanded.

- Total product of labor is a short-run concept that is the total quantity that is able to be produced for each level of labor input, holding all other inputs constant.

- Average product of labor (APL) is the total product of labor divided by number of labor hours.

- Marginal product of labor (MP_L) is the change in total product divided by the change in labor hours. MP_L might rise as more labor is added to a fixed amount of capital.

- The law of diminishing returns dictates that additional output must fall as more and more labor is added to a fixed amount of capital.

- Production costs increase as input prices rise and fall as inputs become more productive.

- Short-run total cost (STC) is the total expenditure on fixed capital plus the total expenditure on labor.

- Short-run marginal cost (SMC) equals the ratio of wage to marginal product of labor (MP_L).

- Average variable cost (AVC) is the ratio of wage to average product of labor (APL).

- Average total cost (ATC) is total cost (TC) divided by the number of units produced.

- Revenue is price times quantity sold.

- Marginal revenue (MR) is the ratio of change in revenue to change in output.

- Firms under conditions of perfect competition have no pricing power and, therefore, face a perfectly horizontal demand curve at the market price. For firms under conditions of perfect competition, price is identical to marginal revenue (MR).

- Firms under conditions of imperfect competition face a negatively sloped demand curve and have pricing power. For firms under conditions of imperfect competition, marginal revenue (MR) is less than price.

- Economic profit equals total revenue (TR) minus total economic cost, whereas accounting profit equals TR minus total accounting cost.

- Economic cost takes into account the total opportunity cost of all factors of production.

- Opportunity cost is the next best alternative forgone in making a decision.

- Maximum economic profit requires that (1) marginal revenue (MR) equals marginal cost (MC) and (2) MC not be falling with output.

- The breakeven point occurs when total revenue (TR) equals total cost (TC), otherwise stated as the output quantity at which average total cost (ATC) equals price.

- Shutdown occurs when a firm is better off not operating than continuing to operate.

- If all fixed costs are sunk costs, then shutdown occurs when the market price falls below minimum average variable cost. After shutdown, the firm incurs only fixed costs and loses less money than it would operating at a price that does not cover variable costs.

- In the short run, it may be rational for a firm to continue to operate while earning negative economic profit if some unavoidable fixed costs are covered.

- Economies of scale is defined as decreasing long-run cost per unit as output increases. Diseconomies of scale is defined as increasing long-run cost per unit as output increases.

- Long-run average total cost is the cost of production per unit of output under conditions in which all inputs are variable.

- Specialization efficiencies and bargaining power in input price can lead to economies of scale.

- Bureaucratic and communication breakdowns and bottlenecks that raise input prices can lead to diseconomies of scale.

- The minimum point on the long-run average total cost curve defines the minimum efficient scale for the firm.

PRACTICE PROBLEMS

1 If the price elasticity coefficient of the demand curve for paper clips is equal to −1, demand is:

   A elastic.

   B inelastic.

   C unit elastic.

2 The demand for membership at a local health club is determined by the following equation:

$$Q_{hm}^d = 400 - 5P_{hm}$$

   where Q_{hm}^d is the number of health club members and P_{hm} is the price of membership. If the price of health club membership is $35, the price elasticity of demand is *closest* to:

   A −0.778.

   B −0.500.

   C −0.438.

3 Price elasticity of demand for a good will *most likely* be greater if:

   A there are no substitutes for the good.

   B consumers consider the good as discretionary.

   C consumers spend a small portion of their budget on the good.

4 If the income elasticity of demand for a product is −0.6, a:

   A 1% increase in income will result in a 0.6% increase in demand.

   B 1% increase in income will result in a 0.6% decrease in demand.

   C 0.6% increase in income will result in a 1% decrease in demand.

5 An individual's demand for onions is given by the following equation:

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

   where Q_o^d is the number of onions demanded, P_o is the price per pound of onions, I is the household income, and P_t is the price per pound of tomatoes.

   If the price of onions is $1.25, household income is $2,500, and the price of tomatoes is $3.75, the cross-price elasticity of demand for onions with respect to the price of tomatoes is *closest* to:

   A −1.0597.

   B −0.0242.

   C −0.0081.

6 Movement along the demand curve for good X occurs due to a change in:

   A income.

   B the price of good X.

   C the price of a substitute for good X.

7   A wireless phone manufacturer introduced a next-generation phone that received a high level of positive publicity. Despite running several high-speed production assembly lines, the manufacturer is still falling short in meeting demand for the phone nine months after introduction. Which of the following statements is the *most* plausible explanation for the demand/supply imbalance?

   A   The phone price is low relative to the equilibrium price.

   B   Competitors introduced next-generation phones at a similar price.

   C   Consumer incomes grew faster than the manufacturer anticipated.

The following information relates to Questions 8–11

The market demand function for four-year private universities is given by the equation

$$Q_{pr}^d = 84 - 3.1P_{pr} + 0.8I + 0.9P_{pu}$$

where Q_{pr}^d is the number of applicants to private universities per year in thousands, P_{pr} is the average price of private universities (in thousands of USD), I is the household monthly income (in thousands of USD), and P_{pu} is the average price of public (government-supported) universities (in thousands of USD). Assume that P_{pr} is equal to 38, I is equal to 100, and P_{pu} is equal to 18.

8   The price elasticity of demand for private universities is *closest* to:

   A   −3.1.

   B   −1.9.

   C   0.6.

9   The income elasticity of demand for private universities is *closest* to:

   A   0.5.

   B   0.8.

   C   1.3.

10   The cross-price elasticity of demand for private universities with respect to the price of public universities is *closest* to:

   A   0.3.

   B   3.1.

   C   3.9.

11   If the cross-price elasticity between two goods is negative, the two goods are classified as:

   A   normal.

   B   substitutes.

   C   complements.

---

12   In the case of a normal good with a decrease in own price, which of the following statements is *most likely* true?

   A   Both the substitution and income effects lead to an increase in the quantity purchased.

    B   The substitution effect leads to an increase in the quantity purchased, while the income effect has no impact.

    C   The substitution effect leads to an increase in the quantity purchased, while the income effect leads to a decrease.

13   For a Giffen good, the:

    A   demand curve is positively sloped.

    B   substitution effect overwhelms the income effect.

    C   income and substitution effects are in the same direction.

14   Normal profit is best described as:

    A   zero economic profit.

    B   total revenue minus all explicit costs.

    C   the sum of accounting profit plus economic profit.

15   A company plans to hire additional factory employees. In the short run, marginal returns are most likely to decrease if:

    A   the factory is operating at full capacity.

    B   the factory is experiencing a labor shortage.

    C   workers are required to multitask and share duties.

16   The production relationship between the number of machine hours and total product for a company is presented below.

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

Diminishing marginal returns first occur beyond machine hour:

    A   3.

    B   4.

    C   5.

17   The marketing director for a Swiss specialty equipment manufacturer estimates the firm can sell 200 units and earn total revenue of CHF500,000. However, if 250 units are sold, revenue will total CHF600,000. The marginal revenue per unit associated with marketing 250 units instead of 200 units is *closest* to:

    A   CHF 2,000.

    B   CHF 2,400.

    C   CHF 2,500.

18   An agricultural firm operating in a perfectly competitive market supplies wheat to manufacturers of consumer food products and animal feeds. If the firm were able to expand its production and unit sales by 10% the *most likely* result would be:

    A   a 10% increase in total revenue.

    B   a 10% increase in average revenue.

    C   an increase in total revenue of less than 10%.

19 An operator of a ski resort is considering offering price reductions on weekday ski passes. At the normal price of €50 per day, 300 customers are expected to buy passes each weekday. At a discounted price of €40 per day 450 customers are expected to buy passes each weekday. The marginal revenue per customer earned from offering the discounted price is *closest* to:

A €20.

B €40.

C €50.

20 The marginal revenue per unit sold for a firm doing business under conditions of perfect competition will *most likely* be:

A equal to average revenue.

B less than average revenue.

C greater than average revenue.

The following information relates to Questions 21–23

A firm's director of operations gathers the following information about the firm's cost structure at different levels of output:

Exhibit 1		
Quantity (Q)	**Total Fixed Cost (TFC)**	**Total Variable Cost (TVC)**
0	200	0
1	200	100
2	200	150
3	200	200
4	200	240
5	200	320

21 Refer to the data in Exhibit 1. When quantity produced is equal to 4 units, the average fixed cost (*AFC*) is *closest* to:

A 50.

B 60.

C 110.

22 Refer to the data in Exhibit 1. When the firm increases production from 4 to 5 units, the marginal cost (*MC*) is *closest* to:

A 40.

B 64.

C 80.

23 Refer to the data in Exhibit 1. The level of unit production resulting in the lowest average total cost (*ATC*) is *closest* to:

A 3.

B   4.

C   5.

---

24 The short-term breakeven point of production for a firm operating under perfect competition will *most likely* occur when:

A   price is equal to average total cost.

B   marginal revenue is equal to marginal cost.

C   marginal revenue is equal to average variable costs.

25 The short-term shutdown point of production for a firm operating under perfect competition will *most likely* occur when:

A   price is equal to average total cost.

B   marginal revenue is equal to marginal cost.

C   marginal revenue is equal to average variable costs.

26 Under conditions of perfect competition, a company will break even when market price is equal to the minimum point of the:

A   average total cost curve.

B   average variable cost curve.

C   short-run marginal cost curve.

27 A company will shut down production in the short run if total revenue is less than total:

A   fixed costs.

B   variable costs.

C   opportunity costs.

28 A company has total variable costs of $4 million and fixed costs of $3 million. Based on this information, the company will stay in the market in the long term if total revenue is at least:

A $3.0 million.

B $4.5 million.

C $7.0 million.

29 When total revenue is greater than total variable costs but less than total costs, in the short term a firm will *most likely*:

A   exit the market.

B   stay in the market.

C   shut down production.

30 A profit maximum is *least likely* to occur when:

A   average total cost is minimized.

B   marginal revenue equals marginal cost.

C   the difference between total revenue and total cost is maximized.

31 A firm that increases its quantity produced without any change in per-unit cost is experiencing:

A   economies of scale.

B   diseconomies of scale.

C   constant returns to scale.

32 A company is experiencing economies of scale when:

A cost per unit increases as output increases.

B it is operating at a point on the LRAC curve where the slope is negative.

C It is operating beyond the minimum point on the long-run average total cost curve.

33 Diseconomies of scale *most likely* result from:

A specialization in the labor force.

B overlap of business functions and product lines.

C discounted prices on resources when buying in larger quantities.

34 A firm is operating beyond minimum efficient scale in a perfectly competitive industry. To maintain long-term viability the *most likely* course of action for the firm is to:

A operate at the current level of production.

B increase its level of production to gain economies of scale.

C decrease its level of production to the minimum point on the long-run average total cost curve.

35 Under conditions of perfect competition, in the long run firms will *most likely* earn:

A normal profits.

B positive economic profits.

C negative economic profits.

The following information relates to Questions 36 and 37

The manager of a small manufacturing firm gathers the following information about the firm's labor utilization and production:

Exhibit 2	
Labor (L)	**Total Product (TP)**
0	0
1	150
2	320
3	510
4	660
5	800

36 Refer to the data in Exhibit 2. The number of workers resulting in the highest level of average product of labor is *closest* to:

A 3.

B 4.

C 5.

37 Refer to the data in Exhibit 2. The marginal product of labor demonstrates increasing returns for the firm if the number of workers is *closest* to but not more than:

A 2.

B 3.

C 4.

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

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

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:

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

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:

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

$$Q_{pr}^d = 84 - 3.1P_{pr} + 0.8I + 0.9P_{pu}$$

$$= 84 - 3.1(38) + 0.8(100) + 0.9(18)$$

$$= 62.4$$

At P_{pr} = 38,

price elasticity of demand = $\left(\Delta Q^d_{pr}\big/\Delta P_{pr}\right)\left(P_{pr}\big/Q^d_{pr}\right)$

$$= (-3.1)(38/62.4)$$
$$= -1.9$$

9   C is correct. From the demand function:

Solve for Q^d_{pr}:

$\Delta Q^d_{pr}\big/\Delta I$ = 0.8 (coefficient in front of the income variable)

$$Q^d_{pr} = 84 - 3.1P_{pr} + 0.8I + 0.9P_{pu}$$
$$= 84 - 3.1(38) + 0.8(100) + 0.9(18)$$
$$= 62.4$$

At I = 100,

the income elasticity of demand = $\left(\Delta Q^d_{pr}\big/\Delta I\right)\left(I\big/Q^d_{pr}\right)$

$$= (0.8)(100/62.4)$$
$$= 1.3$$

10 A is correct. From the demand function:

Solve for Q^d_{pr}:

$\Delta Q^d_{pr}\big/\Delta P_{pu}$ = 0.9 (the coefficient in front of P_{pu})

$$Q^d_{pr} = 84 - 3.1P_{pr} + 0.8I + 0.9P_{pu}$$
$$= 84 - 3.1(38) + 0.8(100) + 0.9(18)$$
$$= 62.4$$

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

the cross-price elasticity of demand = $\left(\Delta Q^d_{pr}\big/\Delta P_{pu}\right)\left(P_{pu}\big/Q^d_{pr}\right)$

$$= (0.9)(18/62.4)$$
$$= 0.3$$

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. $MR = \Delta TR \div \Delta Q$. 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. $MR = \Delta TR \div \Delta Q$. In this case, change in total revenue per day equals €3,000 [(450 × €40) − (300 × €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 = 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 = ΔTP/ΔL = (510 − 320)/(3 − 2) = 190/1 = 190.

EXAMPLE 5

The Herfindahl–Hirschman Index

Suppose a market has 10 suppliers, each of them with 10 percent of the market. What are the concentration ratio and the HHI of the top four firms?

A   Concentration ratio 4 percent and HHI 40

B   Concentration ratio 40 percent and HHI 0.4

C   Concentration ratio 40 percent and HHI 0.04

Solution:

C is correct. The concentration ratio for the top four firms is 10 + 10 + 10 + 10 = 40 percent, and the HHI is $0.10^2 \times 4 = 0.01 \times 4 = 0.04$.

SUMMARY

In this reading, we have surveyed how economists classify market structures. We have analyzed the distinctions between the different structures that are important for understanding demand and supply relations, optimal price and output, and the factors affecting long-run profitability. We also provided guidelines for identifying market structure in practice. Among our conclusions are the following:

■   Economic market structures can be grouped into four categories: perfect competition, monopolistic competition, oligopoly, and monopoly.

■   The categories differ because of the following characteristics: The number of producers is many in perfect and monopolistic competition, few in oligopoly, and one in monopoly. The degree of product differentiation, the pricing power of the producer, the barriers to entry of new producers, and the level of non-price competition (e.g., advertising) are all low in perfect competition, moderate in monopolistic competition, high in oligopoly, and generally highest in monopoly.

■   A financial analyst must understand the characteristics of market structures in order to better forecast a firm's future profit stream.

■   The optimal marginal revenue equals marginal cost. However, only in perfect competition does the marginal revenue equal price. In the remaining structures, price generally exceeds marginal revenue because a firm can sell more units only by reducing the per unit price.

■   The quantity sold is highest in perfect competition. The price in perfect competition is usually lowest, but this depends on factors such as demand elasticity and increasing returns to scale (which may reduce the producer's marginal cost). Monopolists, oligopolists, and producers in monopolistic competition attempt to differentiate their products so that they can charge higher prices.

■   Typically, monopolists sell a smaller quantity at a higher price. Investors may benefit from being shareholders of monopolistic firms that have large margins and substantial positive cash flows.

■   Competitive firms do not earn economic profit. There will be a market compensation for the rental of capital and of management services, but the lack of pricing power implies that there will be no extra margins.

- While in the short run firms in any market structure can have economic profits, the more competitive a market is and the lower the barriers to entry, the faster the extra profits will fade. In the long run, new entrants shrink margins and push the least efficient firms out of the market.

- Oligopoly is characterized by the importance of strategic behavior. Firms can change the price, quantity, quality, and advertisement of the product to gain an advantage over their competitors. Several types of equilibrium (e.g., Nash, Cournot, kinked demand curve) may occur that affect the likelihood of each of the incumbents (and potential entrants in the long run) having economic profits. Price wars may be started to force weaker competitors to abandon the market.

- Measuring market power is complicated. Ideally, econometric estimates of the elasticity of demand and supply should be computed. However, because of the lack of reliable data and the fact that elasticity changes over time (so that past data may not apply to the current situation), regulators and economists often use simpler measures. The concentration ratio is simple, but the HHI, with little more computation required, often produces a better figure for decision making.

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PRACTICE PROBLEMS

1 A market structure characterized by many sellers with each having some pricing power and product differentiation is *best* described as:

   A oligopoly.

   B perfect competition.

   C monopolistic competition.

2 A market structure with relatively few sellers of a homogeneous or standardized product is *best* described as:

   A oligopoly.

   B monopoly.

   C perfect competition.

3 Market competitors are *least likely* to use advertising as a tool of differentiation in an industry structure identified as:

   A monopoly.

   B perfect competition.

   C monopolistic competition.

4 Upsilon Natural Gas, Inc. is a monopoly enjoying very high barriers to entry. Its marginal cost is $40 and its average cost is $70. A recent market study has determined the price elasticity of demand is 1.5. The company will *most likely* set its price at:

   A $40.

   B $70.

   C $120.

5 The demand schedule in a perfectly competitive market is given by P = 93 − 1.5Q (for Q ≤ 62) and the long-run cost structure of each company is:

Total cost:	$256 + 2Q + 4Q^2$
Average cost:	$256/Q + 2 + 4Q$
Marginal cost:	$2 + 8Q$

   New companies will enter the market at any price greater than:

   A 8.

   B 66.

   C 81.

6 Companies *most likely* have a well-defined supply function when the market structure is:

   A oligopoly.

   B perfect competition.

   C monopolistic competition.

7 Aquarius, Inc. is the dominant company and the price leader in its market. One of the other companies in the market attempts to gain market share by undercutting the price set by Aquarius. The market share of Aquarius will *most likely*:

   A increase.

   B decrease.

    C   stay the same.

8 SigmaSoft and ThetaTech are the dominant makers of computer system software. The market has two components: a large mass-market component in which demand is price sensitive, and a smaller performance-oriented component in which demand is much less price sensitive. SigmaSoft's product is considered to be technically superior. Each company can choose one of two strategies:

- *Open architecture (Open):* Mass market focus allowing other software venders to develop products for its platform.

- *Proprietary (Prop):* Allow only its own software applications to run on its platform.

Depending upon the strategy each company selects, their profits would be:

SigmaSoft – Open		SigmaSoft – Prop	
400	**600**	**650**	**700**
	ThetaTech – Open		ThetaTech – Open
SigmaSoft – Open		**SigmaSoft – Prop**	
800	**300**	**600**	**400**
	ThetaTech – Prop		ThetaTech – Prop

The Nash equilibrium for these companies is:

    A   proprietary for SigmaSoft and proprietary for ThetaTech.

    B   open architecture for SigmaSoft and proprietary for ThetaTech.

    C   proprietary for SigmaSoft and open architecture for ThetaTech.

9 A company doing business in a monopolistically competitive market will *most likely* maximize profits when its output quantity is set such that:

    A   average cost is minimized.

    B   marginal revenue equals average cost.

    C   marginal revenue equals marginal cost.

10 Oligopolistic pricing strategy *most likely* results in a demand curve that is:

    A   kinked.

    B   vertical.

    C   horizontal.

11 Collusion is *less likely* in a market when:

    A   the product is homogeneous.

    B   companies have similar market shares.

    C   the cost structures of companies are similar.

12 If companies earn economic profits in a perfectly competitive market, over the long run the supply curve will *most likely*:

    A   shift to the left.

    B   shift to the right.

    C   remain unchanged.

13 Over time, the market share of the dominant company in an oligopolistic market will *most likely*:

  A increase.

  B decrease.

  C remain the same.

14 A government entity that regulates an authorized monopoly will *most likely* base regulated prices on:

  A marginal cost.

  B long run average cost.

  C first degree price discrimination.

15 An analyst gathers the following market share data for an industry:

Company	Sales (in millions of €)
ABC	300
Brown	250
Coral	200
Delta	150
Erie	100
All others	50

The industry's four-company concentration ratio is *closest* to:

  A 71%.

  B 86%.

  C 95%.

16 An analyst gathered the following market share data for an industry comprised of five companies:

Company	Market Share (%)
Zeta	35
Yusef	25
Xenon	20
Waters	10
Vlastos	10

The industry's three-firm Herfindahl–Hirschmann Index is *closest* to:

  A 0.185.

  B 0.225.

  C 0.235.

17 One disadvantage of the Herfindahl–Hirschmann Index is that the index:

  A is difficult to compute.

  B fails to reflect low barriers to entry.

  C fails to reflect the effect of mergers in the industry.

18 In an industry comprised of three companies, which are small-scale manufacturers of an easily replicable product unprotected by brand recognition or patents, the *most* representative model of company behavior is:

  A oligopoly.

    B perfect competition.

    C monopolistic competition.

19 Deep River Manufacturing is one of many companies in an industry that make a food product. Deep River units are identical up to the point they are labeled. Deep River produces its labeled brand, which sells for $2.20 per unit, and "house brands" for seven different grocery chains which sell for $2.00 per unit. Each grocery chain sells both the Deep River brand and its house brand. The *best* characterization of Deep River's market is:

    A oligopoly.

    B perfect competition.

    C monopolistic competition.

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:

$40 = P[1 − (1/1.5)] = P × 0.333$
   $P = 120

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.

Solution:

In comparing the OECD forecast for GDP growth with the estimated growth rate in potential GDP, there are two cases to consider:

1   If actual GDP is growing at a faster rate than potential GDP, it signals growing inflationary pressures and an increased likelihood that the central bank will raise interest rates.

2   If actual GDP is growing at a slower rate than potential GDP, it signals growing resource slack, less inflationary pressures, and an increased likelihood that the central bank will reduce rates or leave them unchanged.

Exhibit 31 provides a comparison of actual and potential GDP for the above countries.

Exhibit 31	Actual vs. Potential GDP	
	Projected Average Annual GDP Growth (2018–2020)	**Potential GDP Growth (Example 16)**
Canada	4.0%	2.4%
Germany	1.5	1.6
Japan	0.5	1.5
United States	3.8	2.7

The data suggest that inflationary pressure will grow in the United States and Canada and that both the Federal Reserve and the Bank of Canada will eventually raise interest rates. Thus, the environment for bond investing is not favorable in the United States and Canada, because bond prices are likely to decline.

With Germany growing at its potential rate of GDP growth, the rate of inflation should neither rise nor fall. Monetary policy is set by the European Central Bank (ECB), but data on the German economy play a big role in the ECB's decision. Based on the above data, no change in ECB policy is likely. For bond investors, little change in bond prices is likely in Germany, so investors need to focus on the interest (coupon) income received from the bond.

Finally, growing resource slack in Japan will put downward pressure on inflation and may force the Bank of Japan to keep rates low. Bond prices should rise in this environment.

SUMMARY

This reading introduces important macroeconomic concepts and principles for macroeconomic forecasting and related investment decision making. Macroeconomics examines the economy as a whole by focusing on a country's aggregate output of final goods and services, total income, aggregate expenditures, and the general price level. The first step in macroeconomic analysis is to measure the size of an economy. Gross domestic product enables us to assign a monetary value to an economy's level of output or aggregate expenditures. The interaction of aggregate demand and aggregate supply determines the level of GDP as well as the general price level. The business cycle

reflects shifts in aggregate demand and short-run aggregate supply. The long-term sustainable growth rate of the economy depends on growth in the supply and quality of inputs (labor, capital, and natural resources) and advances in technology. From an investment perspective, macroeconomic analysis and forecasting are important because business profits, asset valuations, interest rates, and inflation rates depend on the business cycle in the short to intermediate term and on the drivers of sustainable economic growth in the long term. In addition, it is important to understand fiscal and monetary policies' economic impact on and implications for inflation, household consumption and saving, capital investment, and exports.

- GDP is the market value of all final goods and services produced within a country in a given time period.

- GDP can be valued by looking at either the total amount spent on goods and services produced in the economy or the income generated in producing those goods and services.

- GDP counts only final purchases of newly produced goods and services during the current time period. Transfer payments and capital gains are excluded from GDP.

- With the exception of owner-occupied housing and government services, which are estimated at imputed values, GDP includes only goods and services that are valued by being sold in the market.

- Intermediate goods are excluded from GDP in order to avoid double counting.

- GDP can be measured either from the value of final output or by summing the value added at each stage of the production and distribution process. The sum of the value added by each stage is equal to the final selling price of the good.

- Nominal GDP is the value of production using the prices of the current year. Real GDP measures production using the constant prices of a base year. The GDP deflator equals the ratio of nominal GDP to real GDP.

- Households earn income in exchange for providing—directly or indirectly through ownership of businesses—the factors of production (labor, capital, natural resources including land). From this income, they consume, save, and pay net taxes.

- Businesses produce most of the economy's output/income and invest to maintain and expand productive capacity. Companies retain some earnings but pay out most of their revenue as income to the household sector and as taxes to the government.

- The government sector collects taxes from households and businesses and purchases goods and services, for both consumption and investment, from the private business sector.

- Foreign trade consists of exports and imports. The difference between the two is net exports. If net exports are positive (negative), then the country spends less (more) than it earns. Net exports are balanced by accumulation of either claims on the rest of the world (net exports > 0) or obligations to the rest of the world (net exports < 0).

- Capital markets provide a link between saving and investment in the economy.

- From the expenditure side, GDP includes personal consumption (C), gross private domestic investment (I), government spending (G), and net exports ($X - M$).

- The major categories of expenditure are often broken down into subcategories. Gross private domestic investment includes both investment in fixed assets (plant and equipment) and the change in inventories. In some countries, government spending on investment is separated from other government spending.

- National income is the income received by all factors of production used in the generation of final output. It equals GDP minus the **capital consumption allowance** (depreciation) and a statistical discrepancy.

- Personal income reflects pre-tax income received by households. It equals national income plus transfers minus undistributed corporate profits, corporate income taxes, and indirect business taxes.

- Personal disposable income equals personal income minus personal taxes.

- Private saving must equal investment plus the fiscal and trade deficits. That is, $S = I + (G - T) + (X - M)$.

- Consumption spending is a function of disposable income. The marginal propensity to consume represents the fraction of an additional unit of disposable income that is spent.

- Investment spending depends on the average interest rate and the level of aggregate income. Government purchases and tax policy are often considered to be exogenous variables determined outside the macroeconomic model. Actual taxes collected depend on income and are, therefore, endogenous—that is, determined within the model.

- The IS curve reflects combinations of GDP and the real interest rate such that aggregate income/output equals planned expenditures. The LM curve reflects combinations of GDP and the interest rate such that demand and supply of real money balances are equal.

- Combining the IS and LM relationships yields the aggregate demand curve.

- Aggregate demand and aggregate supply determine the level of real GDP and the price level.

- The aggregate demand curve is the relationship between real output (GDP) demanded and the price level, holding underlying factors constant. Movements along the aggregate demand curve reflect the impact of price on demand.

- The aggregate demand curve is downward sloping because a rise in the price level reduces wealth, raises real interest rates, and raises the price of domestically produced goods versus foreign goods. The aggregate demand curve is drawn assuming a constant money supply.

- The aggregate demand curve will shift if there is a change in a factor, other than price, that affects aggregate demand. These factors include household wealth, consumer and business expectations, capacity utilization, monetary policy, fiscal policy, exchange rates, and foreign GDP.

- The aggregate supply curve is the relationship between the quantity of real GDP supplied and the price level, keeping all other factors constant. Movements along the supply curve reflect the impact of price on supply.

- The short-run aggregate supply curve is upward sloping because higher prices result in higher profits and induce businesses to produce more and laborers to work more. In the short run, some prices are sticky, implying that some prices do not adjust to changes in demand.

- In the long run, all prices are assumed to be flexible. The long-run aggregate supply curve is vertical because input costs adjust to changes in output prices, leaving the optimal level of output unchanged. The position of the curve is determined by the economy's level of potential GDP.

- The level of potential output, also called the full employment or natural level of output, is unobservable and difficult to measure precisely. This concept represents an efficient and unconstrained level of production at which companies have enough spare capacity to avoid bottlenecks and there is a balance between the pool of unemployed workers and the pool of job openings.

- The long-run aggregate supply curve will shift because of changes in labor supply, supply of physical and human capital, and productivity/technology.

- The short-run supply curve will shift because of changes in potential GDP, nominal wages, input prices, expectations about future prices, business taxes and subsidies, and the exchange rate.

- The business cycle and short-term fluctuations in GDP are caused by shifts in aggregate demand and aggregate supply.

- When the level of GDP in the economy is below potential GDP, such a recessionary situation exerts downward pressure on the aggregate price level.

- When the level of GDP is above potential GDP, such an overheated situation puts upward pressure on the aggregate price level.

- Stagflation, a combination of high inflation and weak economic growth, is caused by a decline in short-run aggregate supply.

- The sustainable rate of economic growth is measured by the rate of increase in the economy's productive capacity or potential GDP.

- Growth in real GDP measures how rapidly the total economy is expanding. Per capita GDP, defined as real GDP divided by population, reflects the standard of living in a country. Real GDP growth rates and levels of per capita GDP vary widely among countries.

- The sources of economic growth include the supply of labor, the supply of physical and human capital, raw materials, and technological knowledge.

- Output can be described in terms of a production function. For example, $Y = A\boldsymbol{F}(L,K)$ where L is the quantity of labor, K is the capital stock, and A represents technological knowledge or total factor productivity. The function $\boldsymbol{F}(\cdot)$ is assumed to exhibit constant returns to scale but diminishing marginal productivity for each input individually.

- Total factor productivity is a scale factor that reflects the portion of output growth that is not accounted for by changes in the capital and labor inputs. TFP is mainly a reflection of technological change.

- Based on a two-factor production function, Potential GDP growth = Growth in TFP + W_L (Growth in labor) + W_C (Growth in capital), where W_L and W_C (= 1 − W_L) are the shares of labor and capital in GDP.

- Diminishing marginal productivity implies that
  - increasing the supply of some input(s) relative to other inputs will lead to diminishing returns and cannot be the basis for sustainable growth. In particular, long-term sustainable growth cannot rely solely on capital deepening, that is, increasing the stock of capital relative to labor.
  - given the relative scarcity and hence high productivity of capital in developing countries, the growth rate of developing countries should exceed that of developed countries.

- The labor supply is determined by population growth, the labor force participation rate, and net immigration. The capital stock in a country increases with investment. Correlation between long-run economic growth and the rate of investment is high.

- In addition to labor, capital, and technology, human capital—essentially, the quality of the labor force—and natural resources are important determinants of output and growth.

- Technological advances are discoveries that make it possible to produce more and/or higher-quality goods and services with the same resources or inputs. Technology is the main factor affecting economic growth in developed countries.

- The sustainable rate of growth in an economy is determined by the growth rate of the labor supply plus the growth rate of labor productivity.

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PRACTICE PROBLEMS

1 Which of the following statements is the *most* appropriate description of gross domestic product (GDP)?

  A The total income earned by all households, firms, and the government whose value can be verified.

  B The total amount spent on all final goods and services produced within the economy over a given time period.

  C The total market value of resalable and final goods and services produced within the economy over a given time period.

2 The component *least likely* to be included in a measurement of gross domestic product (GDP) is:

  A the value of owner occupied rent.

  B the annual salary of a local police officer.

  C environmental damage caused by production.

3 Which of the following conditions is *least likely* to increase a country's GDP?

  A An increase in net exports.

  B Increased investment in capital goods.

  C Increased government transfer payments.

4 Which of the following would be included in Canadian GDP for a given year? The market value of:

  A wine grown in Canada by US citizens.

  B electronics made in Japan and sold in Canada.

  C movies produced outside Canada by Canadian film makers.

5 Suppose a painting is produced and sold in 2018 for £5,000. The expenses involved in producing the painting amounted to £2,000. According to the sum-of-value-added method of calculating GDP, the value added by the final step of creating the painting was:

  A £2,000.

  B £3,000.

  C £5,000.

6 A GDP deflator less than 1 indicates that an economy has experienced:

  A inflation.

  B deflation.

  C stagflation.

7 The *most* accurate description of nominal GDP is:

  A a measure of total expenditures at current prices.

  B the value of goods and services at constant prices.

  C a measure to compare one nation's economy to another.

8 From the beginning to the ending years of a decade, the annual value of final goods and services for country *X* increased from €100 billion to €300 billion. Over that time period, the GDP deflator increased from 111 to 200. Over the decade, real GDP for country *X* increased by approximately:

  A 50%.

    B 67%.

    C 200%.

9 If the GDP deflator values for year 1 and year 2 were 190 and 212.8, respectively, which of the following *best* describes the annual growth rate of the overall price level?

    A 5.8%.

    B 6%.

    C 12%.

10 The numerator of the GDP price deflator reflects:

    A the value of base year output at current prices.

    B the value of current year output at current prices.

    C the value of current year output at base year prices.

11 Consider the following data for a hypothetical country:

Account name	Amount ($ trillions)
Consumption	15.0
Capital consumption allowance	1.5
Government spending	3.8
Imports	1.7
Gross private domestic investment	4.0
Exports	1.5

Based only on the data given, the gross domestic product and national income are respectively *closest* to:

    A 21.1 and 20.6.

    B 22.6 and 21.1.

    C 22.8 and 20.8.

12 In calculating personal income for a given year, which of the following would *not* be subtracted from national income?

    A Indirect business taxes.

    B Undistributed corporate profits.

    C Unincorporated business net income.

13 Equality between aggregate expenditure and aggregate output implies that the government's fiscal deficit must equal:

    A Private saving – Investment – Net exports.

    B Private saving – Investment + Net exports.

    C Investment – Private saving + Net exports.

14 Because of a sharp decline in real estate values, the household sector has increased the fraction of disposable income that it saves. If output and investment spending remain unchanged, which of the following is *most likely*?

    A A decrease in the government deficit.

    B A decrease in net exports and increased capital inflow.

    C An increase in net exports and increased capital outflow.

15 Which curve represents combinations of income and the real interest rate at which planned expenditure equals income?

    A The IS curve.

B   The LM curve.

C   The aggregate demand curve.

16   An increase in government spending would shift the:

A   IS curve and the LM curve.

B   IS curve and the aggregate demand curve.

C   LM curve and the aggregate demand curve.

17   An increase in the nominal money supply would shift the:

A   IS curve and the LM curve.

B   IS curve and the aggregate demand curve.

C   LM curve and the aggregate demand curve.

18   An increase in the price level would shift the:

A   IS curve.

B   LM curve.

C   aggregate demand curve.

19   As the price level declines along the aggregate demand curve, the interest rate is *most likely* to:

A   decline.

B   increase.

C   remain unchanged.

20   The full employment, or natural, level of output is *best* described as:

A   the maximum level obtainable with existing resources.

B   the level at which all available workers have jobs consistent with their skills.

C   a level with a modest, stable pool of unemployed workers transitioning to new jobs.

21   Which of the following *best* describes the aggregate supply curve in the short-run (e.g., 1 to 2 years)? The short run aggregate supply curve is:

A   flat because output is more flexible than prices in the short run.

B   vertical because wages and other input prices fully adjust to the price level.

C   upward sloping because input prices do not fully adjust to the price level in the short run.

22   If wages were automatically adjusted for changes in the price level, the short-run aggregate supply curve would *most likely* be:

A   flatter.

B   steeper.

C   unchanged.

23   The *least likely* cause of a decrease in aggregate demand is:

A   higher taxes.

B   a weak domestic currency.

C   a fall in capacity utilization.

24   Which of the following is *most likely* to cause the long-run aggregate supply curve to shift to the left?

A   Higher nominal wages.

B   A decline in productivity.

C   An increase in corporate taxes.

25   Increased household wealth will *most likely* cause an increase in:

    A household saving.

    B investment expenditures.

    C consumption expenditures.

26 The *most likely* outcome when both aggregate supply and aggregate demand increase is:

    A a rise in inflation.

    B higher employment.

    C an increase in nominal GDP.

27 Which of the following is *least likely* to be caused by a shift in aggregate demand?

    A Stagflation.

    B A recessionary gap.

    C An inflationary gap.

28 Following a sharp increase in the price of energy, the overall price level is *most likely* to rise in the short run:

    A and remain elevated indefinitely unless the central bank tightens.

    B but be unchanged in the long run unless the money supply is increased.

    C and continue to rise until all prices have increased by the same proportion.

29 Among developed economies, which of the following sources of economic growth is *most likely* to explain superior growth performance?

    A Technology.

    B Capital stock.

    C Labor supply.

30 Which of the following can be measured directly?

    A Potential GDP.

    B Labor productivity.

    C Total factor productivity.

31 The sustainable growth rate is *best* estimated as:

    A the weighted average of capital and labor growth rates.

    B growth in the labor force plus growth of labor productivity.

    C growth in total factor productivity plus growth in the capital-to-labor ratio.

32 In the neoclassical or Solow growth model, an increase in total factor productivity reflects an increase in:

    A returns to scale.

    B output for given inputs.

    C the sustainable growth rate.

The following information relates to Questions 33–34

An economic forecasting firm has estimated the following equation from historical data based on the neoclassical growth model:

Potential output growth = 1.5 + 0.72 × Growth of labor + 0.28 × Growth of capital

33 The intercept (1.5) in this equation is *best* interpreted as:

A the long-run sustainable growth rate.

B the growth rate of total factor productivity.

C above trend historical growth that is unlikely to be sustained.

34 The coefficient on the growth rate of labor (0.72) in this equation is *best* interpreted as:

A the labor force participation rate.

B the marginal productivity of labor.

C the share of income earned by labor.

---

35 Convergence of incomes over time between emerging market countries and developed countries is *most likely* due to:

A total factor productivity.

B diminishing marginal productivity of capital.

C the exhaustion of non-renewable resources.

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. GDP = Consumption + Gross private domestic investment + Government Spending + Exports − Imports = 15 + 4 + 3.8 + 1.5 − 1.7 = 22.6. National income = GDP − 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 in 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.

SUMMARY

This reading has summarized business cycle analysis. Among the points made are the following:

- Business cycles are a fundamental feature of market economies but their amplitude and/or length vary considerably.

- Business cycles have four phases: trough, expansion, peak, and contraction.

- Keynesian theories focus on fluctuations of aggregate demand (AD). If AD shifts left, Keynesians advocate government intervention to restore full employment and avoid a deflationary spiral. Monetarists argue that the timing of the impact from government policies is uncertain and it is generally better to let the economy find its new equilibrium unassisted, but ensure that the money supply is kept growing at an even pace.

- New Classical and Real Business Cycle (RBC) theories also consider fluctuations of aggregate supply (AS). If AS shifts left because of an input price increase or right because of a price decrease or technical progress, the economy will gradually converge to its new equilibrium. Government intervention is generally not necessary because it may exacerbate the fluctuation or delay the convergence to equilibrium. New Keynesians argue that frictions in the economy may prevent convergence and government policies may be needed.

- The demand for factors of production may change in the short run as a result of changes in all components of GDP: consumption (e.g., households worry about the future, save more, and thus shift AD left), investment (e.g., companies expect customers to increase demand and buy new equipment, thus shifting AD right; another example is that companies introduce new technologies, thus shifting long-term AS right), government (e.g., fiscal and monetary policies shift AD), and net exports (e.g., faster growth in other countries generates higher demand for the home country's products, thus shifting AD, or higher prices of imported inputs shift AS left). Any shifts in AD and AS will affect the demand for the factors of production (capital and labor) that are used to produce the new level of GDP.

- Unemployment has different subcategories. Frictional (people that are not working because they are in between jobs); structural (people that are unemployed because they do not have the skills required by the openings or reside far away from the jobs); discouraged workers are unemployed people who have given up looking for jobs because they do not believe they can find one (they are considered outside the labor force in unemployment statistics); and voluntarily unemployed are people who do not wish to work, for example because they are in school, retired early, or very rich (they are also considered outside the labor force in unemployment statistics).

- There are different types of inflation. Hyperinflation indicates a high (e.g., 100% annual) and increasing rate of inflation; deflation indicates a negative inflation rate (prices decrease); imported inflation is associated with increasing cost of inputs that come from abroad; demand inflation is caused by constraints in production that prevent companies from making as many goods as the market demands (it is sometimes called wartime inflation because in times of war, goods tend to be rationed).

- Economic indicators are statistics on macroeconomic variables that help in understanding which stage of the business cycle an economy is at. Of particular importance are the leading indicators, which suggest where the economy is likely to be in the near future. No economic indicator is perfect, and many of these statistics are subject to periodic revisions.

- Price levels are affected by real factors and monetary factors. Real factors include aggregate supply (an increase in supply leads to lower prices) and aggregate demand (an increase in demand leads to higher prices). Monetary factors include the supply of money (more money circulating, if the economy is in equilibrium, will lead to higher prices) and the velocity of money (higher velocity, if the economy is in equilibrium, will lead to higher prices).

- Inflation is measured by many indexes. Consumer price indexes reflect the prices of a basket of goods and services that is typically purchased by a normal household. Producer price indexes measure the cost of a basket of raw materials, intermediate inputs, and finished products. GDP deflators measure the price of the basket of goods and services produced within an economy in a given year. Core indexes exclude volatile items, such as agricultural products and energy, whose prices tend to vary more than other goods.

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PRACTICE PROBLEMS

1 The characteristic business cycle patterns of trough, expansion, peak, and con-
   traction are:
   A periodic.
   B recurrent.
   C of similar duration.

2 During the contraction phase of a business cycle, it is *most likely* that:
   A inflation indicators are stable.
   B aggregate economic activity is decreasing.
   C investor preference for government securities declines.

3 An economic peak is *most* closely associated with:
   A accelerating inflation.
   B stable unemployment.
   C declining capital spending.

4 Based on typical labor utilization patterns across the business cycle, productiv-
   ity (output per hours worked) is *most likely* to be highest:
   A at the peak of a boom.
   B into a maturing expansion
   C at the bottom of a recession.

5 As the expansion phase of the business cycle advances from early stage to late
   stage, businesses *most likely* experience a decrease in:
   A labor costs.
   B capital investment.
   C availability of qualified workers.

6 An analyst writes in an economic report that the current phase of the business
   cycle is characterized by accelerating inflationary pressures and borrowing by
   companies. The analyst is *most likely* referring to the:
   A peak of the business cycle.
   B contraction phase of the business cycle.
   C early expansion phase of the business cycle.

7 In a recession, companies are *most likely* to adjust their stock of physical capital
   by:
   A selling it at fire sale prices.
   B not maintaining equipment.
   C quickly canceling orders for new construction equipment.

8 The inventory/sales ratio is *most likely* to be rising:
   A as a contraction unfolds.
   B partially into a recovery.
   C near the top of an economic cycle.

9 The Austrian economic school attributes the primary cause of the business
   cycle to:
   A misguided government intervention.

    B the creative destruction of technological progress.

    C sticky price and wage expectations that exaggerate trends.

10 A decrease in a country's total imports is *most likely* caused by:

    A an increase in the pace of domestic GDP growth.

    B a cyclical downturn in the economies of primary trading partners.

    C persistent currency depreciation relative to primary trading partners.

11 Monetarists favor a limited role for the government because they argue:

    A government policy responses may lag.

    B firms take time to adjust to systemic shocks to the economy.

    C resource use is efficient with marginal revenue and cost equal.

12 The discouraged worker category is defined to include people who:

    A are overqualified for their job.

    B could look for a job but choose not to.

    C currently look for work without finding it.

13 According to the Austrian school, the *most appropriate* government response to an economic recession is to:

    A allow the market to adjust naturally.

    B maintain steady growth in the money supply.

    C decrease the market rate of interest below its natural value.

14 A national government responds to a severe recession by funding numerous infrastructure projects using deficit spending. Which school of economic thought is *most* consistent with such action.

    A Keynesian

    B Monetarist

    C Neoclassical

15 According to Real Business Cycle models, an economic contraction is *most likely* caused by:

    A sticky wages.

    B rising energy prices.

    C a contraction in the money supply.

16 The unemployment rate is considered a lagging indicator because:

    A new job types must be defined to count their workers.

    B multi-worker households change jobs at a slower pace.

    C businesses are slow to hire and fire due to related costs.

17 The category of persons who would be *most likely* to be harmed by an increase in the rate of inflation is:

    A homeowners with fixed 30-year mortgages.

    B retirees relying on a fixed annuity payment.

    C workers employed under contracts with escalator clauses.

18 A decrease in both the labor force participation ratio and the unemployment rate is *most likely* caused by:

    A an increase in discouraged workers.

    B an increase in underemployed workers.

    C a decrease in voluntarily unemployed persons.

19 The term that describes when inflation declines but nonetheless remains at a positive level is:

A deflation.

B stagflation.

C disinflation.

20 During an economic recovery, a lagging unemployment rate is *most likely* attributable to:

A businesses quickly rehiring workers.

B new job seekers entering the labor force.

C underemployed workers transitioning to higher-paying jobs.

21 The treasury manager of a large company has recently left his position to accept a promotion with a competitor six months from now. A statistical employment survey conducted now should categorize the status of the former treasury manager as:

A underemployed.

B voluntarily unemployed.

C frictionally unemployed.

22 Deflation is *most likely* to be associated with:

A a shortage of government revenue.

B substantial macroeconomic contraction.

C explicit monetary policy to combat inflation.

23 The *least likely* consequence of a period of hyperinflation is the:

A reduced velocity of money.

B increased supply of money.

C possibility of social unrest.

The following information relates to Questions 24–25

Exhibit 1	Consumption Baskets and Prices Over Two Months			
Date	**November 2010**		**December 2010**	
Goods	**Quantity**	**Price**	**Quantity**	**Price**
Sugar	70 kg	€ 0.90 / kg	120 kg	€ 1.00 / kg
Cotton	60 kg	€ 0.60 / kg	50 kg	€ 0.80 / kg

24 Assuming the base period for 2010 consumption is November and the initial price index is set at 100, then the inflation rate after calculating the December price index as a Laspeyres index is *closest* to:

A 19.2%.

B 36.4%.

C 61.6%.

25 For the December consumption basket in Exhibit 1, the value of the Paasche index is *closest* to:

A 116.

B 148.

C 160.

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26 A central bank will *most likely* allow the economy to self-correct in periods of:

A high inflation, fast economic growth, and low unemployment.

B low inflation, slow economic growth, and high unemployment.

C high inflation, slow economic growth, and high unemployment.

27 Disinflation is *best* described as a:

A decline in price levels.

B negative inflation rate.

C decline in the inflation rate.

28 The characteristic of national consumer price indexes which is *most* typically shared across major economies worldwide is:

A the geographic areas covered in their surveys.

B the weights they place on covered goods and services.

C their use in the determination of macroeconomic policy.

29 Of the following statements regarding the Producer Price Index (PPI), which is the *least likely*? The PPI:

A can influence the future CPI.

B category weights can vary more widely than analogous CPI terms.

C is used more frequently than CPI as a benchmark for adjusting labor contract payments.

30 The following presents selected commodity price data for July–August 2015:

	July 2015		August 2015	
Goods	**Quantity**	**Price**	**Quantity**	**Price**
Milk	18	€1.00/L	17	€1.00/L
Orange juice	6	€2.00/L	4	€2.50/L

Given the consumption basket and prices presented, which type of price index will result in the highest calculated inflation rate over a two-month time period?

A One that uses a current consumption basket

B One that uses a constant consumption basket

C One reflecting substitutions made by consumers over time

31 The inflation rate *most likely* relied on to determine public economic policy is:

A core inflation.

B headline inflation.

C index of food and energy prices.

32 What is the *most* important effect of labor productivity in a cost-push inflation scenario?

A Rising productivity indicates a strong economy and a bias towards inflation.

 B The productivity level determines the economy's status relative to its "natural rate of unemployment."

 C As productivity growth proportionately exceeds wage increases, product price increases are less likely.

33 Which of the following statements is the *best* description of the characteristics of economic indicators?

 A Leading indicators are important because they track the entire economy.

 B Lagging indicators in measuring past conditions do not require revisions.

 C A combination of leading and coincident indicators can offer effective forecasts.

34 A product is part of a price index based on a fixed consumption basket. If, over time, the product's quality improves while its price stays constant, the measured inflation rate is *most likely*:

 A unaffected.

 B biased upward.

 C biased downward.

35 A price index of goods and services that excludes food and energy is *most likely* used to calculate:

 A core inflation.

 B the GDP deflator.

 C headline inflation.

36 When the spread between 10-year US Treasury yields and the federal funds rate narrows and at the same time the prime rate stays unchanged, this mix of indicators *most likely* forecasts future economic:

 A growth.

 B decline.

 C stability.

37 Which of the following economic developments is *most likely* to cause cost-push inflation?

 A Industrial capacity utilization rises to a very high level.

 B Labor productivity increases faster than hourly labor costs.

 C A shortage of trained workers emerges throughout the economy.

38 An economist expects the following:

- The decline in the unemployment rate will result in higher revenues for home retailers.
- A tighter labor market will put upward pressure on wages, compelling home retailers to raise prices.

Which type of inflation *best* corresponds to the economist's expectations?

 A Stagflation

 B Cost-push inflation

 C Demand-pull inflation

39 If relative to prior values of their respective indicators, the inventory–sales ratio has risen, unit labor cost is stable, and real personal income has decreased, it is *most likely* that a peak in the business cycle:

 A has occurred.

 B is just about to occur.

    C   will occur sometime into the future.

40 Current economic statistics indicating little change in services inflation, rising residential building permits, and increasing average duration of unemployment are *best* interpreted as:

    A   conflicting evidence about the direction of economy.

    B   evidence that a cyclical upturn is expected to occur in the future.

    C   evidence that a cyclical downturn is expected to occur in the future.

41 When aggregate real personal income, industrial output, and the S&P 500 Index all increase in a given period, it is *most accurate* to conclude that a cyclical upturn is:

    A   occurring.

    B   about to end.

    C   about to begin.

42 Which of the following is *most likely* to increase after an increase in aggregate real personal income?

    A   Equity prices

    B   Building permits for new private housing units

    C   The ratio of consumer installment debt to income

43 Which of the following indicators is *most* appropriate in predicting a turning point in the economy?

    A   The Industrial Production Index

    B   The average bank prime lending rate

    C   Average weekly hours, manufacturing

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:

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

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

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

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

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

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

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.

SUMMARY

In this reading, we have sought to explain the practices of both monetary and fiscal policy. Both can have a significant impact on economic activity, and it is for this reason that financial analysts need to be aware of the tools of both monetary and fiscal policy, the goals of the monetary and fiscal authorities, and most important the monetary and fiscal policy transmission mechanisms.

- Governments can influence the performance of their economies by using combinations of monetary and fiscal policy. Monetary policy refers to central bank activities that are directed toward influencing the quantity of money and credit in an economy. By contrast, fiscal policy refers to the government's decisions about taxation and spending. The two sets of policies affect the economy via different mechanisms.

- Money fulfills three important functions: It acts as a medium of exchange, provides individuals with a way of storing wealth, and provides society with a convenient unit of account. Via the process of fractional reserve banking, the banking system can create money.

- The amount of wealth that the citizens of an economy choose to hold in the form of money—as opposed to, for example, bonds or equities—is known as the demand for money. There are three basic motives for holding money: transactions-related, precautionary, and speculative.

- The addition of 1 unit of additional reserves to a fractional reserve banking system can support an expansion of the money supply by an amount equal to the money multiplier, defined as 1/reserve requirement (stated as a decimal).

- The nominal rate of interest is comprised of three components: a real required rate of return, a component to compensate lenders for future inflation, and a risk premium to compensate lenders for uncertainty (e.g., about the future rate of inflation).

- Central banks take on multiple roles in modern economies. They are usually the monopoly supplier of their currency, the lender of last resort to the banking sector, the government's bank and bank of the banks, and they often supervise banks. Although they may express their objectives in different ways, the overarching objective of most central banks is price stability.

- For a central bank to be able to implement monetary policy objectively, it should have a degree of independence from government, be credible, and be transparent in its goals and objectives.

- The ultimate challenge for central banks as they try to manipulate the supply of money to influence the economy is that they cannot control the amount of money that households and corporations put in banks on deposit, nor can they easily control the willingness of banks to create money by expanding credit. Taken together, this also means that they cannot always control the money supply. Therefore, there are definite limits to the power of monetary policy.

- The concept of money neutrality is usually interpreted as meaning that money cannot influence the real economy in the long run. However, by the setting of its policy rate, a central bank hopes to influence the real economy via the policy rate's impact on other market interest rates, asset prices, the exchange rate, and the expectations of economic agents.

- Inflation targeting is the most common monetary policy—although exchange rate targeting is also used, particularly in developing economies. Quantitative easing attempts to spur aggregate demand by drastically increasing the money supply.

- Fiscal policy involves the use of government spending and revenue raising (taxation) to impact a number of aspects of the economy: the overall level of aggregate demand in an economy and hence the level of economic activity; the distribution of income and wealth among different segments of the population; and hence ultimately the allocation of resources between different sectors and economic agents.

- The tools that governments use in implementing fiscal policy are related to the way in which they raise revenue and the different forms of expenditure. Governments usually raise money via a combination of direct and indirect taxes. Government expenditure can be current on goods and services or can take the form of capital expenditure, for example, on infrastructure projects.

- As economic growth weakens, or when it is in recession, a government can enact an expansionary fiscal policy—for example, by raising expenditure without an offsetting increase in taxation. Conversely, by reducing expenditure and maintaining tax revenues, a contractionary policy might reduce economic activity. Fiscal policy can therefore play an important role in stabilizing an economy.

- Although both fiscal and monetary policy can alter aggregate demand, they work through different channels, the policies are therefore not interchangeable, and they conceivably can work against one another unless the government and central bank coordinate their objectives.

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PRACTICE PROBLEMS

1 As the reserve requirement increases, the money multiplier:

   A increases.

   B decreases.

   C remains the same.

2 Which is the *most* accurate statement regarding the demand for money?

   A Precautionary money demand is directly related to GDP.

   B Transactions money demand is inversely related to returns on bonds.

   C Speculative demand is inversely related to the perceived risk of other assets.

3 The following exhibit shows the supply and demand for money:
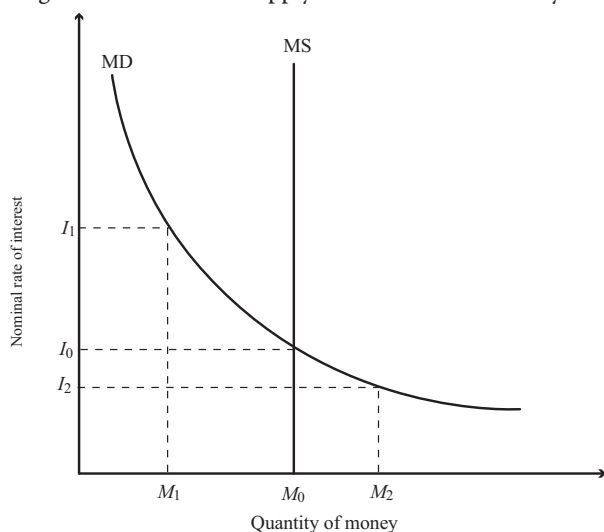
There is an excess supply of money when the nominal rate of interest is:

   A I_0.

   B I_1.

   C I_2.

4 According to the theory of money neutrality, money supply growth does *not* affect variables such as real output and employment in:

   A the long run.

   B the short run.

   C the long and short run.

5 Which of the following *best* describes a fundamental assumption when monetary policy is used to influence the economy?

   A Financial markets are efficient.

   B Money is not neutral in the short run.

   C Official rates do not affect exchange rates.

6 Monetarists are *most likely* to believe:

   A there is a causal relationship running from inflation to money.

   B inflation can be affected by changing the money supply growth rate.

    C   rapid financial innovation in the market increases the effectiveness of monetary policy.

7   The proposition that the real interest rate is relatively stable is *most* closely associated with:

    A   the Fisher effect.

    B   money neutrality.

    C   the quantity theory of money.

8   Which of the following equations is a consequence of the Fisher effect?

    A   Nominal interest rate = Real interest rate + Expected rate of inflation.

    B   Real interest rate = Nominal interest rate + Expected rate of inflation.

    C   Nominal interest rate = Real interest rate + Market risk premium.

9   Central banks would typically be *most* concerned with costs of:

    A   low levels of inflation that are anticipated.

    B   moderate levels of inflation that are anticipated.

    C   moderate levels of inflation that are not anticipated.

10   Monetary policy is *least likely* to include:

    A   setting an inflation rate target.

    B   changing an official interest rate.

    C   enacting a transfer payment program.

11   Which role is a central bank *least likely* to assume?

    A   Lender of last resort.

    B   Sole supervisor of banks.

    C   Supplier of the currency.

12   Which is the *most* accurate statement regarding central banks and monetary policy?

    A   Central bank activities are typically intended to maintain price stability.

    B   Monetary policies work through the economy via four independent channels.

    C   Commercial and interbank interest rates move inversely to official interest rates.

13   When a central bank announces a decrease in its official policy rate, the desired impact is an increase in:

    A   investment.

    B   interbank borrowing rates.

    C   the national currency's value in exchange for other currencies.

14   Which action is a central bank *least likely* to take if it wants to encourage businesses and households to borrow for investment and consumption purposes?

    A   Sell long-dated government securities.

    B   Purchase long-dated government treasuries.

    C   Purchase mortgage bonds or other securities.

15   A central bank that decides the desired levels of interest rates and inflation and the horizon over which the inflation objective is to be achieved is *most* accurately described as being:

    A   target independent and operationally independent.

    B   target independent but not operationally independent.

C operationally independent but not target independent.

16 A country that maintains a target exchange rate is *most likely* to have which outcome when its inflation rate rises above the level of the inflation rate in the target country?

A An increase in short-term interest rates.

B An increase in the domestic money supply.

C An increase in its foreign currency reserves.

17 A central bank's repeated open market purchases of government bonds:

A decreases the money supply.

B is prohibited in most countries.

C is consistent with an expansionary monetary policy.

18 In theory, setting the policy rate equal to the neutral interest rate should promote:

A stable inflation.

B balanced budgets.

C greater employment.

19 A prolonged period of an official interest rate very close to zero without an increase in economic growth *most likely* suggests:

A quantitative easing must be limited to be successful.

B there may be limits to the effectiveness of monetary policy.

C targeting reserve levels is more important than targeting interest rates.

20 Raising the reserve requirement is *most likely* an example of which type of monetary policy?

A Neutral.

B Expansionary.

C Contractionary.

21 Which of the following is a limitation on the ability of central banks to stimulate growth in periods of deflation?

A Ricardian equivalence.

B The interaction of monetary and fiscal policy.

C The fact that interest rates cannot fall significantly below zero.

22 The *least likely* limitation to the effectiveness of monetary policy is that central banks cannot:

A accurately determine the neutral rate of interest.

B regulate the willingness of financial institutions to lend.

C control amounts that economic agents deposit into banks.

23 Which of the following is the *most likely* example of a tool of fiscal policy?

A Public financing of a power plant.

B Regulation of the payment system.

C Central bank's purchase of government bonds.

24 The *least likely* goal of a government's fiscal policy is to:

A redistribute income and wealth.

B influence aggregate national output.

C ensure the stability of the purchasing power of its currency.

25 Given an independent central bank, monetary policy actions are *more likely* than fiscal policy actions to be:

   A implementable quickly.

   B effective when a specific group is targeted.

   C effective when combating a deflationary economy.

26 Which statement regarding fiscal policy is *most* accurate?

   A To raise business capital spending, personal income taxes should be reduced.

   B Cyclically adjusted budget deficits are appropriate indicators of fiscal policy.

   C An increase in the budget surplus is associated with expansionary fiscal policy.

27 The *least likely* explanation for why fiscal policy cannot stabilize aggregate demand completely is that:

   A private sector behavior changes over time.

   B policy changes are implemented very quickly.

   C fiscal policy focuses more on inflation than on unemployment.

28 Which of the following *best* represents a contractionary fiscal policy?

   A Public spending on a high-speed railway.

   B A temporary suspension of payroll taxes.

   C A freeze in discretionary government spending.

29 A "pay-as-you-go" rule, which requires that any tax cut or increase in entitlement spending be offset by an increase in other taxes or reduction in other entitlement spending, is an example of which fiscal policy stance?

   A Neutral.

   B Expansionary.

   C Contractionary.

30 Quantitative easing, the purchase of government or private securities by the central banks from individuals and/or institutions, is an example of which monetary policy stance?

   A Neutral.

   B Expansionary.

   C Contractionary.

31 The *most likely* argument against high national debt levels is that:

   A the debt is owed internally to fellow citizens.

   B they create disincentives for economic activity.

   C they may finance investment in physical and human capital.

32 Which statement regarding fiscal deficits is *most* accurate?

   A Higher government spending may lead to higher interest rates and lower private sector investing.

   B Central bank actions that grow the money supply to address deflationary conditions decrease fiscal deficits.

   C According to the Ricardian equivalence, deficits have a multiplicative effect on consumer spending.

33 Which policy alternative is *most likely* to be effective for growing both the public and private sectors?

   A Easy fiscal/easy monetary policy.

B Easy fiscal/tight monetary policy.

C Tight fiscal/tight monetary policy.

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.

calendar quarter of 2013, to assess progress in implementing the program and reach understandings on any additional measures that may be needed to achieve its objectives. (....) The Greek authorities believe that the policies set forth in the attached memorandum are adequate to achieve the objectives of the economic program, and stand ready to take any further measures that may become appropriate for this purpose. The authorities will consult with the Fund in accordance with its policies on such consultations, (....) and in advance of revisions to the policies contained in the MEFP. All information requested by the Fund (....) to assess implementation of the program will be provided.

(....)

Sincerely,

George Papaconstantinou   George Provopoulos

Minister of Finance   Governor of the Bank of Greece

1   What is the objective of the IMF's emergency lending facilities?

2   What are the macroeconomic policy conditions under which the IMF provides emergency lending to Greece?

3   What is the amount Greece requests from the IMF as emergency funds?

Solution to 1:

The program seeks to safeguard the stability of the Greek financial system and to implement structural reforms to boost competitiveness and the economy's capacity to produce, save and export.

Solution to 2:

The Greek government has to reduce the country's fiscal deficit by achieving higher and more equitable tax collections as well as constrain spending in the government wage bill and entitlement outlays.

Solution to 3:

Greece applied for a standby arrangement in an amount equivalent to SDR26.4 billion (approximately USD39.5 billion, based on the 10 May 2010 exchange rate).

SUMMARY

This reading provides a framework for analyzing a country's trade and capital flows and their economic implications. It examines basic models that explain trade based on comparative advantage and provides a basis for understanding how international trade can affect the rate and composition of economic growth as well as the attractiveness of investment in various sectors.

■ The benefits of trade include

● gains from exchange and specialization;

● gains from economies of scale as companies add new markets for their products;

● greater variety of products available to households and firms; and

- increased competition and more efficient allocation of resources.

- A country has an absolute advantage in producing a good (or service) if it is able to produce that good at a lower absolute cost or use fewer resources in its production than its trading partner. A country has a comparative advantage in producing a good if its *opportunity cost* of producing that good is less than that of its trading partner.

- Even if a country does not have an absolute advantage in the production of any good, it can gain from trade by producing and exporting the good(s) in which it has a comparative advantage and importing good(s) in which it has a comparative disadvantage.

- In the Ricardian model of trade, comparative advantage and the pattern of trade are determined by differences in technology between countries. In the Heckscher–Ohlin model of trade, comparative advantage and the pattern of trade are determined by differences in factor endowments between countries. In reality, technology and factor endowments are complementary, not mutually exclusive, determinants of trade patterns.

- Trade barriers prevent the free flow of goods and services among countries. Governments impose trade barriers for various reasons including: to promote specific developmental objectives, to counteract certain imperfections in the functioning of markets, or to respond to problems facing their economies.

- For purposes of international trade policy and analysis, a small country is defined as one that cannot affect the world price of traded goods. A large country's production and/or consumption decisions do alter the relative prices of trade goods.

- In a small country, trade barriers generate a net welfare loss arising from distortion of production and consumption decisions and the associated inefficient allocation of resources.

- Trade barriers can generate a net welfare gain in a large country if the gain from improving its terms of trade (higher export prices and lower import prices) more than offsets the loss from the distortion of resource allocations. However, the large country can only gain if it imposes an even larger welfare loss on its trading partner(s).

- An import tariff and an import quota have the same effect on price, production, and trade. With a quota, however, some or all of the revenue that would be raised by the equivalent tariff is instead captured by foreign producers (or the foreign government) as quota rents. Thus, the welfare loss suffered by the importing country is generally greater with a quota.

- A voluntary export restraint is imposed by the exporting country. It has the same impact on the importing country as an import quota from which foreigners capture all of the quota rents.

- An export subsidy encourages firms to export their product rather than sell it in the domestic market. The distortion of production, consumption, and trade decisions generates a welfare loss. The welfare loss is greater for a large country because increased production and export of the subsidized product reduces its global price—that is, worsens the country's terms of trade.

- Capital restrictions are defined as controls placed on foreigners' ability to own domestic assets and/or domestic residents' ability to own foreign assets. In contrast to trade restrictions, which limit the openness of goods markets, capital restrictions limit the openness of financial markets.

- A regional trading bloc is a group of countries who have signed an agreement to reduce and progressively eliminate barriers to trade and movement of factors of production among the members of the bloc.
  - They may or may not have common trade barriers against those countries that are not members of the bloc. In a free trade area all barriers to the flow of goods and services among members are eliminated, but each country maintains its own polices against non-members.
  - A customs union extends the FTA by not only allowing free movement of goods and services among members but also creating a common trade policy against non-members.
  - A common market incorporates all aspects of a customs union and extends it by allowing free movement of factors of production among members.
  - An economic union incorporates all aspects of a common market and requires common economic institutions and coordination of economic policies among members.
  - Members of a monetary union adopt a common currency.
- From an investment perspective, it is important to understand the complex and dynamic nature of trading relationships because they can help identify potential profitable investment opportunities as well as provide some advance warning signals regarding when to disinvest in a market or industry.
- The major components of the balance of payments are the
  - current account balance, which largely reflects trade in goods and services.
  - capital account balance, which mainly consists of capital transfers and net sales of non-produced, non-financial assets.
  - financial account, which measures net capital flows based on sales and purchases of domestic and foreign financial assets.
- Decisions by consumers, firms, and governments influence the balance of payments.
  - Low private savings and/or high investment tend to produce a current account deficit that must be financed by net capital imports; high private savings and/or low investment, however, produce a current account surplus, balanced by net capital exports.
  - All else the same, a government deficit produces a current account deficit and a government surplus leads to a current account surplus.
  - All else the same, a sustained current account deficit contributes to a rise in the risk premium for financial assets of the deficit country. Current account surplus countries tend to enjoy lower risk premiums than current account deficit countries.
- Created after WWII, the International Monetary Fund, the World Bank, and the World Trade Organization are the three major international organizations that provide necessary stability to the international monetary system and facilitate international trade and development.
  - The IMF's mission is to ensure the stability of the international monetary system, the system of exchange rates and international payments that enables countries to buy goods and services from each other. The IMF helps to keep country-specific market risk and global systemic risk under control.

- 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.

- The World Trade Organization's mission is to foster free trade by providing a major institutional and regulatory framework of global trade rules without which today's global multinational corporations would be hard to conceive.

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PRACTICE PROBLEMS

1 Which of the following statements *best* describes the benefits of international trade?

 A Countries gain from exchange and specialization.

 B Countries receive lower prices for their exports and pay higher prices for imports.

 C Absolute advantage is required for a country to benefit from trade in the long term.

2 Which of the following statements *best* describes the costs of international trade?

 A Countries without an absolute advantage in producing a good cannot benefit significantly from international trade.

 B Resources may need to be allocated into or out of an industry and less-efficient companies may be forced to exit an industry, which in turn may lead to higher unemployment.

 C Loss of manufacturing jobs in developed countries as a result of import competition means that developed countries benefit far less than developing countries from trade.

3 Suppose the cost of producing tea relative to copper is lower in Tealand than in Copperland. With trade, the copper industry in Copperland would *most likely*:

 A expand.

 B contract.

 C remain stable.

4 A country has a comparative advantage in producing a good if:

 A it is able to produce the good at a lower cost than its trading partner.

 B its opportunity cost of producing the good is less than that of its trading partner.

 C its opportunity cost of producing the good is more than that of its trading partner.

5 Suppose Mexico exports vegetables to Brazil and imports flashlights used for mining from Brazil. The output per worker per day in each country is as follows:

	Flashlights	Vegetables
Mexico	20	60
Brazil	40	80

 Which country has a comparative advantage in the production of vegetables and what is the *most* relevant opportunity cost?

 A Brazil: 2 vegetables per flashlight.

 B Mexico: 1.5 vegetables per flashlight.

 C Mexico: ⅓ flashlight per vegetable.

6 Suppose three countries produce bananas and pencils with output per worker per day in each country as follows:

	Bananas	Pencils
Mexico	20	40
Brazil	30	90
Canada	40	160

Which country has the greatest comparative advantage in the production of bananas?

A Canada.

B Brazil.

C Mexico.

7 In the Ricardian trade model, a country captures more of the gains from trade if:

A it produces all products while its trade partner specializes in one good.

B the terms of trade are closer to its autarkic prices than to its partner's autarkic prices.

C the terms of trade are closer to its partner's autarkic prices than to its autarkic prices.

8 Germany has much more capital per worker than Portugal. In autarky each country produces and consumes both machine tools and wine. Production of machine tools is relatively capital intensive whereas winemaking is labor intensive. According to the Heckscher–Ohlin model, when trade opens:

A Germany should export machine tools and Portugal should export wine.

B Germany should export wine and Portugal should export machine tools.

C Germany should produce only machine tools and Portugal should produce only wine.

9 According to the Heckscher–Ohlin model, when trade opens:

A the scarce factor gains relative to the abundant factor in each country.

B the abundant factor gains relative to the scarce factor in each country.

C income is redistributed between countries but not within each country.

10 Which type of trade restriction would *most likely* increase domestic government revenue?

A Tariff.

B Import quota.

C Export subsidy.

11 Which of the following trade restrictions is likely to result in the greatest welfare loss for the importing country?

A A tariff.

B An import quota.

C A voluntary export restraint.

12 A large country can:

A benefit by imposing a tariff.

B benefit with an export subsidy.

C not benefit from any trade restriction.

13 If Brazil and South Africa have free trade with each other, a common trade policy against all other countries, but no free movement of factors of production between them, then Brazil and South Africa are part of a:

    A customs union.

    B common market.

    C free trade area (FTA).

14 Which of the following factors *best* explains why regional trading agreements are more popular than larger multilateral trade agreements?

    A Minimal displacement costs.

    B Trade diversions benefit members.

    C Quicker and easier policy coordination.

15 The sale of mineral rights would be captured in which of the following balance of payments components?

    A Capital account.

    B Current account.

    C Financial account.

16 Patent fees and legal services are recorded in which of the following balance of payments components?

    A Capital account.

    B Current account.

    C Financial account.

17 During the most recent quarter, a steel company in South Korea had the following transactions

- Bought iron ore from Australia for AUD50 million.
- Sold finished steel to the United States for USD65 million.
- Borrowed AUD50 million from a bank in Sydney, Australia.
- Received a USD10 million dividend from US subsidiary.
- Paid KRW550 million to a Korean shipping company.

Which of the following would be reflected in South Korea's current account balance for the quarter?

    A The loan.

    B The shipping.

    C The dividend.

18 Which of the following *most likely* contributes to a current account deficit?

    A High taxes.

    B Low private savings.

    C Low private investment.

19 Which of the following chronic deficit conditions is *least* alarming to the deficit country's creditors?

    A High consumption.

    B High private investment.

    C High government spending.

20 Which of the following international trade organizations regulates cross-border exchange among nations on a global scale?

    A World Bank Group (World Bank).

    B World Trade Organization (WTO).

    C International Monetary Fund (IMF).

21 Which of the following international trade organizations has a mission to help developing countries fight poverty and enhance environmentally sound economic growth?

   A World Bank Group (World Bank).

   B World Trade Organization (WTO).

   C International Monetary Fund (IMF).

22 Which of the following organizations helps to keep global systemic risk under control by preventing contagion in scenarios such as the 2010 Greek sovereign debt crisis?

   A World Bank Group (World Bank).

   B World Trade Organization (WTO).

   C International Monetary Fund (IMF).

23 Which of the following international trade bodies was the only multilateral body governing international trade from 1948 to 1995?

   A World Trade Organization (WTO).

   B International Trade Organization (ITO).

   C General Agreement on Tariffs and Trade (GATT).

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 ⅓ per flashlight, while the opportunity cost of vegetables in Brazil is ½ per flashlight.

6 C is correct. Mexico has the lowest opportunity cost to produce an extra banana. The opportunity cost is 2 pencils per banana in Mexico, 3 pencils per banana in Brazil, and 4 pencils per banana in Canada.

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 on 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.

SUMMARY

Foreign exchange markets are crucial for understanding both the functioning of the global economy as well as the performance of investment portfolios. In this reading, we have described the diverse array of FX market participants and have introduced some of the basic concepts necessary to understand the structure and functions of these markets. The reader should be able to understand how exchange rates—both spot and forward—are quoted and be able to calculate cross exchange rates and forward rates. We also have described the array of exchange rate regimes that characterize foreign exchange markets globally and how these regimes determine the flexibility of exchange rates, and hence, the degree of foreign exchange rate risk that international investments are exposed to. Finally, we have discussed how movements in exchange rates affect international trade flows (imports and exports) and capital flows.

The following points, among others, are made in this reading:

- Measured by average daily turnover, the foreign exchange market is by far the largest financial market in the world. It has important effects, either directly or indirectly, on the pricing and flows in all other financial markets.

- There is a wide diversity of global FX market participants that have a wide variety of motives for entering into foreign exchange transactions.

- Individual currencies are usually referred to by standardized three-character codes. These currency codes can also be used to define exchange rates (the price of one currency in terms of another). There are a variety of exchange rate quoting conventions commonly used.

- A direct currency quote takes the domestic currency as the price currency and the foreign currency as the base currency (i.e., $S_{d/f}$). An indirect quote uses the domestic currency as the base currency (i.e., $S_{f/d}$). To convert between direct and indirect quotes, the inverse (reciprocal) is used. Professional FX markets use standardized conventions for how the exchange rate for specific currency pairs will be quoted.

- Currencies trade in foreign exchange markets based on nominal exchange rates. An increase (decrease) in the exchange rate, quoted in indirect terms, means that the domestic currency is appreciating (depreciating) versus the foreign currency.

- The real exchange rate, defined as the nominal exchange rate multiplied by the ratio of price levels, measures the relative purchasing power of the currencies. An increase in the real exchange rate ($R_{d/f}$) implies a reduction in the relative purchasing power of the domestic currency.

- Given exchange rates for two currency pairs—A/B and A/C—we can compute the cross-rate (B/C) between currencies B and C. Depending on how the rates are quoted, this may require inversion of one of the quoted rates.

- Spot exchange rates are for immediate settlement (typically, T + 2), while forward exchange rates are for settlement at agreed-upon future dates. Forward rates can be used to manage foreign exchange risk exposures or can be combined with spot transactions to create FX swaps.

- The spot exchange rate, the forward exchange rate, and the domestic and foreign interest rates must jointly satisfy an arbitrage relationship that equates the investment return on two alternative but equivalent investments. Given the spot exchange rate and the foreign and domestic interest rates, the forward exchange rate must take the value that prevents riskless arbitrage.

- Forward rates are typically quoted in terms of forward (or swap) points. The swap points are added to the spot exchange rate in order to calculate the forward rate. Occasionally, forward rates are presented in terms of percentages relative to the spot rate.

- The base currency is said to be trading at a forward premium if the forward rate is above the spot rate (forward points are positive). Conversely, the base currency is said to be trading at a forward discount if the forward rate is below the spot rate (forward points are negative).

- The currency with the higher (lower) interest rate will trade at a forward discount (premium).

- Swap points are proportional to the spot exchange rate and to the interest rate differential and approximately proportional to the term of the forward contract.

- Empirical studies suggest that forward exchange rates may be unbiased predictors of future spot rates, but the margin of error on such forecasts is too large for them to be used in practice as a guide to managing exchange rate exposures. FX markets are too complex and too intertwined with other global financial markets to be adequately characterized by a single variable, such as the interest rate differential.

- Virtually every exchange rate is managed to some degree by central banks. The policy framework that each central bank adopts is called an exchange rate regime. These regimes range from using another country's currency (dollarization), to letting the market determine the exchange rate (independent float). In practice, most regimes fall in between these extremes. The type of exchange rate regime used varies widely among countries and over time.

- An ideal currency regime would have three properties: (1) the exchange rate between any two currencies would be credibly fixed; (2) all currencies would be fully convertible; and (3) each country would be able to undertake fully independent monetary policy in pursuit of domestic objectives, such as growth and inflation targets. However, these conditions are inconsistent. In particular, a fixed exchange rate and unfettered capital flows severely limit a country's ability to undertake independent monetary policy. Hence, there cannot be an ideal currency regime.

- The IMF identifies the following types of regimes: arrangements with no separate legal tender (dollarization, monetary union), currency board, fixed parity, target zone, crawling peg, crawling band, managed float, and independent float. Most major currencies traded in FX markets are freely floating, albeit subject to occasional central bank intervention.

- A trade surplus (deficit) must be matched by a corresponding deficit (surplus) in the capital account. Any factor that affects the trade balance must have an equal and opposite impact on the capital account, and vice versa.

- A trade surplus reflects an excess of domestic saving (including the government fiscal balance) over investment spending. A trade deficit indicates that the country invests more than it saves and must finance the excess by borrowing from foreigners or selling assets to foreigners.

- The impact of the exchange rate on trade and capital flows can be analyzed from two perspectives. The elasticities approach focuses on the effect of changing the relative price of domestic and foreign goods. This approach highlights changes in the composition of spending. The absorption approach focuses on the impact of exchange rates on aggregate expenditure/saving decisions.

- The elasticities approach leads to the Marshall–Lerner condition, which describes combinations of export and import demand elasticities such that depreciation (appreciation) of the domestic currency will move the trade balance toward surplus (deficit).

- The idea underlying the Marshall–Lerner condition is that demand for imports and exports must be sufficiently price-sensitive so that an increase in the relative price of imports increases the difference between export receipts and import expenditures.

- In order to move the trade balance toward surplus (deficit), a change in the exchange rate must decrease (increase) domestic expenditure (also called absorption) relative to income. Equivalently, it must increase (decrease) domestic saving relative to domestic investment.

- If there is excess capacity in the economy, then currency depreciation can increase output/income by switching demand toward domestically produced goods and services. Because some of the additional income will be saved, income rises relative to expenditure and the trade balance improves.

- If the economy is at full employment, then currency depreciation must reduce domestic expenditure in order to improve the trade balance. The main mechanism is a wealth effect: A weaker currency reduces the purchasing power of domestic-currency-denominated assets (including the present value of current and future earned income), and households respond by reducing expenditure and increasing saving.

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PRACTICE PROBLEMS

1 An exchange rate:

   A is most commonly quoted in real terms.

   B is the price of one currency in terms of another.

   C between two currencies ensures they are fully convertible.

2 A decrease in the real exchange rate (quoted in terms of domestic currency per unit of foreign currency) is *most likely* to be associated with an increase in which of the following?

   A Foreign price level.

   B Domestic price level.

   C Nominal exchange rate.

3 In order to minimize the foreign exchange exposure on a euro-denominated receivable due from a German company in 100 days, a British company would *most likely* initiate a:

   A spot transaction.

   B forward contract.

   C real exchange rate contract.

4 Which of the following counterparties is *most likely* to be considered a sell-side foreign-exchange market participant?

   A A large corporation that borrows in foreign currencies.

   B A sovereign wealth fund that influences cross-border capital flows.

   C A multinational bank that trades foreign exchange with its diverse client base.

5 What will be the effect on a direct exchange rate quote if the domestic currency appreciates?

   A Increase

   B Decrease

   C No change

6 An executive from Switzerland checked into a hotel room in Spain and was told by the hotel manager that 1 EUR will buy 1.2983 CHF. From the executive's perspective, an indirect exchange rate quote would be:

   A 0.7702 EUR per CHF.

   B 0.7702 CHF per EUR.

   C 1.2983 EUR per CHF.

7 Over the past month, the Swiss Franc (CHF) has depreciated 12 percent against pound sterling (GBP). How much has the pound sterling appreciated against the Swiss Franc?

   A 12%

   B Less than 12%

   C More than 12%

8 An exchange rate between two currencies has increased to 1.4500. If the base currency has appreciated by 8% against the price currency, the initial exchange rate between the two currencies was *closest* to:

A 1.3340.

B 1.3426.

C 1.5660.

The following information relates to Questions 9–10

A dealer provides the following quotes:

Ratio	Spot rate
CNY/HKD	0.8422
CNY/ZAR	0.9149
CNY/SEK	1.0218

9 The spot ZAR/HKD cross-rate is *closest* to:

A 0.9205.

B 1.0864.

C 1.2978.

10 Another dealer is quoting the ZAR/SEK cross-rate at 1.1210. The arbitrage profit that can be earned is *closest* to:

A ZAR 3671 per million SEK traded.

B SEK 4200 per million ZAR traded.

C ZAR 4200 per million SEK traded.

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11 A BRL/MXN spot rate is listed by a dealer at 0.1378. The 6-month forward rate is 0.14193. The 6-month forward points are *closest* to:

A −41.3.

B +41.3.

C +299.7.

12 A three-month forward exchange rate in CAD/USD is listed by a dealer at 1.0123. The dealer also quotes 3-month forward points as a percentage at 6.8%. The CAD/USD spot rate is *closest* to:

A 0.9478.

B 1.0550.

C 1.0862.

13 If the base currency in a forward exchange rate quote is trading at a forward discount, which of the following statements is *most* accurate?

A The forward points will be positive.

B The forward percentage will be negative.

C The base currency is expected to appreciate versus the price currency.

14 A forward premium indicates:

A an expected increase in demand for the base currency.

B the interest rate is higher in the base currency than in the price currency.

C the interest rate is higher in the price currency than in the base currency.

15 The JPY/AUD spot exchange rate is 82.42, the JPY interest rate is 0.15%, and the AUD interest rate is 4.95%. If the interest rates are quoted on the basis of a 360-day year, the 90-day forward points in JPY/AUD would be *closest* to:

A −377.0.

B −97.7.

C 98.9.

16 Which of the following is *not* a condition of an ideal currency regime?

A Fully convertible currencies.

B Fully independent monetary policy.

C Independently floating exchange rates.

17 In practice, both a fixed parity regime and a target zone regime allow the exchange rate to float within a band around the parity level. The *most likely* rationale for the band is that the band allows the monetary authority to:

A be less active in the currency market.

B earn a spread on its currency transactions.

C exercise more discretion in monetary policy.

18 A fixed exchange rate regime in which the monetary authority is legally required to hold foreign exchange reserves backing 100% of its domestic currency issuance is best described as:

A dollarization.

B a currency board.

C a monetary union.

19 A country with a trade deficit will *most likely*:

A have an offsetting capital account surplus.

B save enough to fund its investment spending.

C buy assets from foreigners to fund the imbalance.

20 A large industrialized country has recently devalued its currency in an attempt to correct a persistent trade deficit. Which of the following domestic industries is *most likely* to benefit from the devaluation?

A Luxury cars.

B Branded prescription drugs.

C Restaurants and live entertainment venues.

21 A country with a persistent trade surplus is being pressured to let its currency appreciate. Which of the following *best* describes the adjustment that must occur if currency appreciation is to be effective in reducing the trade surplus?

A Domestic investment must decline relative to saving.

B Foreigners must increase investment relative to saving.

C Global capital flows must shift toward the domestic market.

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:

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

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

SEK 1,000,000 × (1.1210 − 1.1168) = 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 × 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:

Spot rate × (1 + Forward points as a percentage) = Forward rate

Spot rate × (1 + 0.068) = 1.0123

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 × ($F − S$) = 100 × (81.443 − 82.42) = 100 × (−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.

- valuation;
- business summary;
- risk, industry, and competitive analysis;
- historical performance; and
- forecasts.

The contents of reports may also be specified by regulatory agencies or professional standards. For example, the CFA Institute *Standards of Practice Handbook* (*Handbook*) dictates standards that must be followed in communicating recommendations. According to the *Handbook*:

> Standard V(B) states that members and candidates should communicate in a recommendation the factors that were instrumental in making the investment recommendation. A critical part of this requirement is to distinguish clearly between opinions and facts. In preparing a research report, the member or candidate must present the basic characteristics of the security(ies) being analyzed, which will allow the reader to evaluate the report and incorporate information the reader deems relevant to his or her investment decision making process.[9]

The *Handbook* requires that limitations to the analysis and any risks inherent to the investment be disclosed. Furthermore, it requires that any report include elements important to the analysis and conclusions so that readers can evaluate the conclusions themselves.

4.6 Follow-Up

The process does not end with the report. If an equity investment is made or a credit rating is assigned, periodic review is required to determine if the original conclusions and recommendations are still valid. In the case of a rejected investment, follow-up may not be necessary but may be useful in determining whether the analytical process is adequate or should be refined (for example, if a rejected investment turns out to be successful in the market, perhaps the rejection was due to inadequate analysis). Follow-up may involve repeating all the previous steps in the process on a periodic basis.

SUMMARY

The information presented in financial and other reports, including the financial statements, notes, and management's commentary, help the financial analyst to assess a company's performance and financial position. An analyst may be called on to perform a financial analysis for a variety of reasons, including the valuation of equity securities, the assessment of credit risk, the performance of due diligence on an acquisition, and the evaluation of a subsidiary's performance relative to other business units. Major considerations in both equity analysis and credit analysis are evaluating a company's financial position, its ability to generate profits and cash flow, and its potential to generate future growth in profits and cash flow.

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9 *Standards of Practice Handbook* (2014, p. 169).

This reading has presented an overview of financial statement analysis. Among the major points covered are the following:

- The primary purpose of financial reports is to provide information and data about a company's financial position and performance, including profitability and cash flows. The information presented in the reports —including the financial statements and notes and management's commentary or management's discussion and analysis—allows the financial analyst to assess a company's financial position and performance and trends in that performance.

- The primary financial statements are the statement of financial position (i.e., the balance sheet), the statement of comprehensive income (or two statements consisting of an income statement and a statement of comprehensive income), the statement of changes in equity, and the statement of cash flows.

- The balance sheet discloses what resources a company controls (assets) and what it owes (liabilities) at a specific point in time. Owners' equity represents the net assets of the company; it is the owners' residual interest in, or residual claim on, the company's assets after deducting its liabilities. The relationship among the three parts of the balance sheet (assets, liabilities, and owners' equity) may be shown in equation form as follows: Assets = Liabilities + Owners' equity.

- The income statement presents information on the financial results of a company's business activities over a period of time. The income statement communicates how much revenue and other income the company generated during a period and what expenses, including losses, it incurred in connection with generating that revenue and other income. The basic equation underlying the income statement is Revenue + Other income – Expenses = Net income.

- The statement of comprehensive income includes all items that change owners' equity except transactions with owners. Some of these items are included as part of net income, and some are reported as other comprehensive income (OCI).

- The statement of changes in equity provides information about increases or decreases in the various components of owners' equity.

- Although the income statement and balance sheet provide measures of a company's success, cash and cash flow are also vital to a company's long-term success. Disclosing the sources and uses of cash helps creditors, investors, and other statement users evaluate the company's liquidity, solvency, and financial flexibility.

- The notes (also referred to as footnotes) that accompany the financial statements are an integral part of those statements and provide information that is essential to understanding the statements. Analysts should evaluate note disclosures regarding the use of alternative accounting methods, estimates, and assumptions.

- In addition to the financial statements, a company provides other sources of information that are useful to the financial analyst. As part of his or her analysis, the financial analyst should read and assess this additional information, particularly that presented in the management commentary (also called management report[ing], operating and financial review, and management's discussion and analysis [MD&A]).

- A publicly traded company must have an independent audit performed on its annual financial statements. The auditor's report expresses an opinion on the financial statements and provides some assurance about whether the financial

statements fairly present a company's financial position, performance, and cash flows. In addition, for US publicly traded companies, auditors must also express an opinion on the company's internal control systems.

■ Information on the economy, industry, and peer companies is useful in putting the company's financial performance and position in perspective and in assessing the company's future. In most cases, information from sources apart from the company are crucial to an analyst's effectiveness.

■ The financial statement analysis framework provides steps that can be followed in any financial statement analysis project. These steps are:

● articulate the purpose and context of the analysis;

● collect input data;

● process data;

● analyze/interpret the processed data;

● develop and communicate conclusions and recommendations; and

● follow up.

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PRACTICE PROBLEMS

1 Providing information about the performance and financial position of companies so that users can make economic decisions *best* describes the role of:

   A auditing.

   B financial reporting.

   C financial statement analysis.

2 Which of the following *best* describes the role of financial statement analysis?

   A To provide information about a company's performance

   B To provide information about a company's changes in financial position

   C To form expectations about a company's future performance and financial position

3 The role of financial statement analysis is *best* described as:

   A providing information useful for making investment decisions.

   B evaluating a company for the purpose of making economic decisions.

   C using financial reports prepared by analysts to make economic decisions.

4 A company's financial position would *best* be evaluated using the:

   A balance sheet.

   B income statement.

   C statement of cash flows.

5 A company's profitability for a period would *best* be evaluated using the:

   A balance sheet.

   B income statement.

   C statement of cash flows.

6 The financial statement that presents a shareholder's residual claim on assets is the:

   A balance sheet.

   B income statement.

   C cash flow statement.

7 A company's profitability over a period of time is *best* evaluated using the:

   A balance sheet.

   B income statement.

   C cash flow statement.

8 The income statement is *best* used to evaluate a company's:

   A financial position.

   B sources of cash flow.

   C financial results from business activities.

9 Accounting policies, methods, and estimates used in preparing financial statements are *most likely* to be found in the:

   A auditor's report.

   B management commentary.

   C notes to the financial statements.

10 Information about management and director compensation are *least likely* to be found in the:

   A auditor's report.

   B proxy statement.

   C notes to the financial statements.

11 Information about a company's objectives, strategies, and significant risks are *most likely* to be found in the:

   A auditor's report.

   B management commentary.

   C notes to the financial statements.

12 Which of the following *best* describes why the notes that accompany the financial statements are required? The notes:

   A permit flexibility in statement preparation.

   B standardize financial reporting across companies.

   C provide information necessary to understand the financial statements.

13 What type of audit opinion is preferred when analyzing financial statements?

   A Qualified.

   B Adverse.

   C Unqualified.

14 An auditor determines that a company's financial statements are prepared in accordance with applicable accounting standards except with respect to inventory reporting. This exception is *most likely* to result in an audit opinion that is:

   A adverse.

   B qualified.

   C unqualified.

15 An independent audit report is *most likely* to provide:

   A absolute assurance about the accuracy of the financial statements.

   B reasonable assurance that the financial statements are fairly presented.

   C a qualified opinion with respect to the transparency of the financial statements.

16 Interim financial reports released by a company are *most likely* to be:

   A monthly.

   B unaudited.

   C unqualified.

17 Which of the following sources of information used by analysts is found outside a company's annual report?

   A Auditor's report

   B Peer company analysis

   C Management's discussion and analysis

18 Ratios are an input into which step in the financial statement analysis framework?

   A Process data.

   B Collect input data.

   C Analyze/interpret the processed data.

19 Which phase in the financial statement analysis framework is *most likely* to involve producing updated reports and recommendations?

   A Follow-up

   B Analyze/interpret the processed data

   C Develop and communicate conclusions and recommendations

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 their past, current, and potential performance and financial position for the purpose of making investment, credit, and other economic decisions.

4 A is correct. The balance sheet portrays the company's financial position on a specified date. The income statement and statement of cash flows present different aspects of performance during the period.

5 B is correct. Profitability is the performance aspect measured by the income statement. The balance sheet portrays the 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 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.

credit decisions. When a new standard is proposed, an exposure draft is made available and users of financial statements can draft comment letters and position papers for submission to the IASB and FASB in order to evaluate the proposal.

CFA Institute is active in supporting improvements to financial reporting. Volunteer members of CFA Institute serve on several liaison committees that meet regularly to make recommendations to the IASB and FASB on proposed standards and to draft comment letters and position papers. The comment letters and position papers of these groups on financial reporting issues are available at www.cfainstitute.org/advocacy.

In 2007, CFA Institute issued a position paper titled *A Comprehensive Business Reporting Model: Financial Reporting for Investors*, which provides a suggested model for significantly improving financial reporting. The position paper remains relevant in stating:

> Corporate financial statements and their related disclosures are fundamental to sound investment decision making. The well-being of the world's financial markets, and of the millions of investors who entrust their financial present and future to those markets, depends directly on the information financial statements and disclosures provide. Consequently, the quality of the information drives global financial markets. The quality, in turn, depends directly on the principles and standards managers apply when recognizing and measuring the economic activities and events affecting their companies' operations….
>
> Investors require timeliness, transparency, comparability, and consistency in financial reporting. Investors have a preference for decision relevance over reliability…"analysts need to know economic reality—what is really going on—to the greatest extent it can be depicted by accounting numbers." Corporate financial statements that fail to reflect this economic reality undermine the investment decision-making process.[16]

Among other principles, the proposed model stresses the importance of information regarding the current fair value of assets and liabilities, of neutrality in financial reporting, and of providing detailed information on cash flows to investors through the choice of the so-called direct format for the cash flow statement.

In summary, analysts can improve their investment decision making by keeping current on financial reporting standards. In addition, analysts can contribute to improving financial reporting by sharing their perspective as users with standard-setting bodies, which typically invite comments concerning proposed changes.

SUMMARY

An awareness of financial reporting and underlying financial reporting standards can assist in security valuation and other financial analysis. This reading describes the conceptual objectives of financial reporting standards, the parties involved in standard-setting processes, and the implication for analysts in monitoring developments in reporting standards.

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16 *A Comprehensive Business Reporting Model: Financial Reporting for Investors*, CFA Institute Centre for Financial Market Integrity, July 2007, p. 1, 2.

Some key points of the reading are summarized below:

- The objective of financial reporting is to provide financial information about the reporting entity that is useful to existing and potential investors, lenders, and other creditors in making decisions about providing resources to the entity.

- Financial reporting requires policy choices and estimates. These choices and estimates require judgment, which can vary from one preparer to the next. Accordingly, standards are needed to ensure increased consistency in these judgments.

- Private sector standard setting bodies and regulatory authorities play significant but different roles in the standard setting process. In general, standard setting bodies make the rules, and regulatory authorities enforce the rules. However, regulators typically retain legal authority to establish financial reporting standards in their jurisdiction.

- The IFRS framework sets forth the concepts that underlie the preparation and presentation of financial statements for external users.

- The objective of fair presentation of useful information is the center of the IASB's *Conceptual Framework.* The qualitative characteristics of useful information include fundamental and enhancing characteristics. Information must exhibit the fundamental characteristics of relevance and faithful representation to be useful. The enhancing characteristics identified are comparability, verifiability, timeliness, and understandability.

- *IFRS Financial Statements*: IAS No. 1 prescribes that a complete set of financial statements includes a statement of financial position (balance sheet), a statement of comprehensive income (either two statements—one for net income and one for comprehensive income—or a single statement combining both net income and comprehensive income), a statement of changes in equity, a cash flow statement, and notes. The notes include a summary of significant accounting policies and other explanatory information.

- Financial statements need to reflect certain basic features: fair presentation, going concern, accrual basis, materiality and aggregation, and no offsetting.

- Financial statements must be prepared at least annually, must include comparative information from the previous period, and must be consistent.

- Financial statements must follow certain presentation requirements including a classified statement of financial position (balance sheet) and minimum information on both the face of the financial statements and in the notes.

- A significant number of the world's listed companies report under either IFRS or US GAAP.

- In many cases, a user of financial statements will lack the information necessary to make specific adjustments required to achieve comparability between companies that use IFRS and companies that use US GAAP. Instead, an analyst must maintain general caution in interpreting comparative financial measures produced under different accounting standards and monitor significant developments in financial reporting standards.

- Analysts can remain aware of ongoing developments in financial reporting by monitoring new products or types of transactions; actions of standard setters, regulators, and other groups; and company disclosures regarding critical accounting policies and estimates.

PRACTICE PROBLEMS

1   Which of the following is *most likely* not an objective of financial statements?

   A   To provide information about the performance of an entity.

   B   To provide information about the financial position of an entity.

   C   To provide information about the users of an entity's financial statements.

2   International financial reporting standards are currently developed by which entity?

   A   The IFRS Foundation.

   B   The International Accounting Standards Board.

   C   The International Organization of Securities Commissions.

3   US generally accepted accounting principles are currently developed by which entity?

   A   The Securities and Exchange Commission.

   B   The Financial Accounting Standards Board.

   C   The Public Company Accounting Oversight Board.

4   A core objective of the International Organization of Securities Commissions is to:

   A   eliminate systemic risk.

   B   protect users of financial statements.

   C   ensure that markets are fair, efficient, and transparent.

5   According to the *Conceptual Framework for Financial Reporting*, which of the following is *not* an enhancing qualitative characteristic of information in financial statements?

   A   Accuracy.

   B   Timeliness.

   C   Comparability.

6   Which of the following is *not* a constraint on the financial statements according to the *Conceptual Framework*?

   A   Understandability.

   B   Benefit versus cost.

   C   Balancing of qualitative characteristics.

7   The assumption that an entity will continue to operate for the foreseeable future is called:

   A   accrual basis.

   B   comparability.

   C   going concern.

8   The assumption that the effects of transactions and other events are recognized when they occur, not when the cash flows occur, is called:

   A   relevance.

   B   accrual basis.

   C   going concern.

9 Neutrality of information in the financial statements most closely contributes to which qualitative characteristic?

  A Relevance.

  B Understandability.

  C Faithful representation.

10 Valuing assets at the amount of cash or equivalents paid or the fair value of the consideration given to acquire them at the time of acquisition most closely describes which measurement of financial statement elements?

  A Current cost.

  B Historical cost.

  C Realizable value.

11 The valuation technique under which assets are recorded at the amount that would be received in an orderly disposal is:

  A current cost.

  B present value.

  C realizable value.

12 Which of the following is *not* a required financial statement according to IAS No. 1?

  A Statement of financial position.

  B Statement of changes in income.

  C Statement of comprehensive income.

13 Which of the following elements of financial statements is *most* closely related to measurement of performance?

  A Assets.

  B Expenses.

  C Liabilities.

14 Which of the following elements of financial statements is *most* closely related to measurement of financial position?

  A Equity.

  B Income.

  C Expenses.

15 Which of the following disclosures regarding new accounting standards provides the *most* meaningful information to an analyst?

  A The impact of adoption is discussed.

  B The standard will have no material impact.

  C Management is still evaluating the impact.

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   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.

5   A is correct. Accuracy is not an enhancing qualitative characteristic. Faithful representation, not accuracy, is a fundamental qualitative characteristic.

6   A is correct. Understandability is an enhancing qualitative characteristic of financial information—not a constraint.

7   C is correct. The *Conceptual Framework* 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.

8   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.

9   C is correct. The fundamental qualitative characteristic of faithful representation is contributed to by completeness, neutrality, and freedom from error.

10   B is correct. Historical cost is the consideration paid to acquire an asset.

11   C is correct. The amount that would be received in an orderly disposal is realizable value.

12   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.

13   B is correct. The elements of financial statements related to the measure of performance are income and expenses.

14   A is correct. The elements of financial statements related to the measurement of financial position are assets, liabilities, and equity.

15   A is correct. A discussion of the impact would be the most meaningful, although B would also be useful.

EXAMPLE 15

Other Comprehensive Income in Analysis

An analyst is looking at two comparable companies. Company A has a lower price/earnings (P/E) ratio than Company B, and the conclusion that has been suggested is that Company A is undervalued. As part of examining this conclusion, the analyst decides to explore the question: What would the company's P/E look like if total comprehensive income per share—rather than net income per share—were used as the relevant metric?

	Company A	Company B
Price	$35	$30
EPS	$1.60	$0.90
P/E ratio	21.9×	33.3×
Other comprehensive income (loss) $ million	($16.272)	$(1.757)
Shares (millions)	22.6	25.1

Solution:

As shown in the following table, part of the explanation for Company A's lower P/E ratio may be that its significant losses—accounted for as other comprehensive income (OCI)—are not included in the P/E ratio.

	Company A	Company B
Price	$35	$30
EPS	$1.60	$0.90
OCI (loss) $ million	($16.272)	$(1.757)
Shares (millions)	22.6	25.1
OCI (loss) per share	$(0.72)	$(0.07)
Comprehensive EPS = EPS + OCI per share	$ 0.88	$0.83
Price/Comprehensive EPS ratio	39.8×	36.1×

Both IFRS and US GAAP allow companies two alternative presentations. One alternative is to present two statements—a separate income statement and a second statement additionally including other comprehensive income. The other alternative is to present a single statement of other comprehensive income. Particularly in comparing financial statements of two companies, it is relevant to examine significant differences in comprehensive income.

SUMMARY

This reading has presented the elements of income statement analysis. The income statement presents information on the financial results of a company's business activities over a period of time; it communicates how much revenue the company generated during a period and what costs it incurred in connection with generating that revenue. A company's net income and its components (e.g., gross margin, operating earnings, and pretax earnings) are critical inputs into both the equity and credit analysis processes. Equity analysts are interested in earnings because equity markets

often reward relatively high- or low-earnings growth companies with above-average or below-average valuations, respectively. Fixed-income analysts examine the components of income statements, past and projected, for information on companies' abilities to make promised payments on their debt over the course of the business cycle. Corporate financial announcements frequently emphasize income statements more than the other financial statements.

Key points to this reading include the following:

■ The income statement presents revenue, expenses, and net income.

■ The components of the income statement include: revenue; cost of sales; sales, general, and administrative expenses; other operating expenses; non-operating income and expenses; gains and losses; non-recurring items; net income; and EPS.

■ An income statement that presents a subtotal for gross profit (revenue minus cost of goods sold) is said to be presented in a multi-step format. One that does not present this subtotal is said to be presented in a single-step format.

■ Revenue is recognized in the period it is earned, which may or may not be in the same period as the related cash collection. Recognition of revenue when earned is a fundamental principal of accrual accounting.

■ An analyst should identify differences in companies' revenue recognition methods and adjust reported revenue where possible to facilitate comparability. Where the available information does not permit adjustment, an analyst can characterize the revenue recognition as more or less conservative and thus qualitatively assess how differences in policies might affect financial ratios and judgments about profitability.

■ As of the beginning of 2018, revenue recognition standards have converged. The core principle of the converged standards is that revenue should be recognized to "depict the transfer of promised goods or services to customers in an amount that reflects the consideration to which the entity expects to be entitled in an exchange for those goods or services."

■ To achieve the core principle, the standard describes the application of five steps in recognizing revenue. The standard also specifies the treatment of some related contract costs and disclosure requirements.

■ The general principles of expense recognition include a process to match expenses either to revenue (such as, cost of goods sold) or to the time period in which the expenditure occurs (period costs such as, administrative salaries) or to the time period of expected benefits of the expenditures (such as, depreciation).

■ In expense recognition, choice of method (i.e., depreciation method and inventory cost method), as well as estimates (i.e., uncollectible accounts, warranty expenses, assets' useful life, and salvage value) affect a company's reported income. An analyst should identify differences in companies' expense recognition methods and adjust reported financial statements where possible to facilitate comparability. Where the available information does not permit adjustment, an analyst can characterize the policies and estimates as more or less conservative and thus qualitatively assess how differences in policies might affect financial ratios and judgments about companies' performance.

■ To assess a company's future earnings, it is helpful to separate those prior years' items of income and expense that are likely to continue in the future from those items that are less likely to continue.

- Under IFRS, a company should present additional line items, headings, and subtotals beyond those specified when such presentation is relevant to an understanding of the entity's financial performance. Some items from prior years clearly are not expected to continue in future periods and are separately disclosed on a company's income statement. Under US GAAP, unusual and/or infrequently occurring items, which are material, are presented separately within income from continuing operations.

- Non-operating items are reported separately from operating items on the income statement. Under both IFRS and US GAAP, the income statement reports separately the effect of the disposal of a component operation as a "discontinued" operation.

- Basic EPS is the amount of income available to common shareholders divided by the weighted average number of common shares outstanding over a period. The amount of income available to common shareholders is the amount of net income remaining after preferred dividends (if any) have been paid.

- If a company has a simple capital structure (i.e., one with no potentially dilutive securities), then its basic EPS is equal to its diluted EPS. If, however, a company has dilutive securities, its diluted EPS is lower than its basic EPS.

- Diluted EPS is calculated using the if-converted method for convertible securities and the treasury stock method for options.

- Common-size analysis of the income statement involves stating each line item on the income statement as a percentage of sales. Common-size statements facilitate comparison across time periods and across companies of different sizes.

- Two income-statement-based indicators of profitability are net profit margin and gross profit margin.

- Comprehensive income includes *both* net income and other revenue and expense items that are excluded from the net income calculation.

PRACTICE PROBLEMS

1 Expenses on the income statement may be grouped by:

   A nature, but not by function.

   B function, but not by nature.

   C either function or nature.

2 An example of an expense classification by function is:

   A tax expense.

   B interest expense.

   C cost of goods sold.

3 Denali Limited, a manufacturing company, had the following income statement information:

Revenue	$4,000,000
Cost of goods sold	$3,000,000
Other operating expenses	$500,000
Interest expense	$100,000
Tax expense	$120,000

   Denali's gross profit is equal to:

   A $280,000.

   B $500,000.

   C $1,000,000.

4 Under IFRS, income includes increases in economic benefits from:

   A increases in liabilities not related to owners' contributions.

   B enhancements of assets not related to owners' contributions.

   C increases in owners' equity related to owners' contributions.

5 Fairplay had the following information related to the sale of its products during 2009, which was its first year of business:

Revenue	$1,000,000
Returns of goods sold	$100,000
Cash collected	$800,000
Cost of goods sold	$700,000

   Under the accrual basis of accounting, how much net revenue would be reported on Fairplay's 2009 income statement?

   A $200,000.

   B $900,000.

   C $1,000,000.

6 Apex Consignment sells items over the internet for individuals on a consignment basis. Apex receives the items from the owner, lists them for sale on the internet, and receives a 25 percent commission for any items sold. Apex collects the full amount from the buyer and pays the net amount after commission to the owner. Unsold items are returned to the owner after 90 days. During 2009, Apex had the following information:

- Total sales price of items sold during 2009 on consignment was €2,000,000.
- Total commissions retained by Apex during 2009 for these items was €500,000.

How much revenue should Apex report on its 2009 income statement?

A   €500,000.

B   €2,000,000.

C   €1,500,000.

7   A company previously expensed the incremental costs of obtaining a contract. All else being equal, adopting the May 2014 IASB and FASB converged accounting standards on revenue recognition makes the company's profitability initially appear:

A   lower.

B   unchanged.

C   higher.

8   During 2009, Accent Toys Plc., which began business in October of that year, purchased 10,000 units of a toy at a cost of £10 per unit in October. The toy sold well in October. In anticipation of heavy December sales, Accent purchased 5,000 additional units in November at a cost of £11 per unit. During 2009, Accent sold 12,000 units at a price of £15 per unit. Under the first in, first out (FIFO) method, what is Accent's cost of goods sold for 2009?

A   £120,000.

B   £122,000.

C   £124,000.

9   Using the same information as in Question 8, what would Accent's cost of goods sold be under the weighted average cost method?

A   £120,000.

B   £122,000.

C   £124,000.

10 Which inventory method is least likely to be used under IFRS?

A   First in, first out (FIFO).

B   Last in, first out (LIFO).

C   Weighted average.

11 At the beginning of 2009, Glass Manufacturing purchased a new machine for its assembly line at a cost of $600,000. The machine has an estimated useful life of 10 years and estimated residual value of $50,000. Under the straight-line method, how much depreciation would Glass take in 2010 for financial reporting purposes?

A $55,000.

B $60,000.

C $65,000.

12 Using the same information as in Question 16, how much depreciation would Glass take in 2009 for financial reporting purposes under the double-declining balance method?

A $60,000.

B $110,000.

C $120,000.

13 Which combination of depreciation methods and useful lives is most conservative in the year a depreciable asset is acquired?

   A Straight-line depreciation with a short useful life.

   B Declining balance depreciation with a long useful life.

   C Declining balance depreciation with a short useful life.

14 Under IFRS, a loss from the destruction of property in a fire would most likely be classified as:

   A continuing operations.

   B discontinued operations.

   C other comprehensive income.

15 A company chooses to change an accounting policy. This change requires that, if practical, the company restate its financial statements for:

   A all prior periods.

   B current and future periods.

   C prior periods shown in a report.

16 For 2009, Flamingo Products had net income of $1,000,000. At 1 January 2009, there were 1,000,000 shares outstanding. On 1 July 2009, the company issued 100,000 new shares for $20 per share. The company paid $200,000 in dividends to common shareholders. What is Flamingo's basic earnings per share for 2009?

   A $0.80.

   B $0.91.

   C $0.95.

17 For its fiscal year-end, Calvan Water Corporation (CWC) reported net income of $12 million and a weighted average of 2,000,000 common shares outstanding. The company paid $800,000 in preferred dividends and had 100,000 options outstanding with an average exercise price of $20. CWC's market price over the year averaged $25 per share. CWC's diluted EPS is *closest* to:

   A $5.33.

   B $5.54.

   C $5.94.

18 A company with no debt or convertible securities issued publicly traded common stock three times during the current fiscal year. Under both IFRS and US GAAP, the company's:

   A basic EPS equals its diluted EPS.

   B capital structure is considered complex at year-end.

   C basic EPS is calculated by using a simple average number of shares outstanding.

19 Laurelli Builders (LB) reported the following financial data for year-end 31 December:

Common shares outstanding, 1 January	2,020,000
Common shares issued as stock dividend, 1 June	380,000
Warrants outstanding, 1 January	500,000
Net income	$3,350,000
Preferred stock dividends paid	$430,000
Common stock dividends paid	$240,000

Which statement about the calculation of LB's EPS is *most* accurate?

    A   LB's basic EPS is $1.12.

    B   LB's diluted EPS is equal to or less than its basic EPS.

    C   The weighted average number of shares outstanding is 2,210,000.

20 Cell Services Inc. (CSI) had 1,000,000 average shares outstanding during all of 2009. During 2009, CSI also had 10,000 options outstanding with exercise prices of $10 each. The average stock price of CSI during 2009 was $15. For purposes of computing diluted earnings per share, how many shares would be used in the denominator?

    A   1,003,333.

    B   1,006,667.

    C   1,010,000.

21 For its fiscal year-end, Sublyme Corporation reported net income of $200 million and a weighted average of 50,000,000 common shares outstanding. There are 2,000,000 convertible preferred shares outstanding that paid an annual dividend of $5. Each preferred share is convertible into two shares of the common stock. The diluted EPS is *closest to*:

    A $3.52.

    B $3.65.

    C $3.70.

22 When calculating diluted EPS, which of the following securities in the capital structure increases the weighted average number of common shares outstanding without affecting net income available to common shareholders?

    A   Stock options

    B   Convertible debt that is dilutive

    C   Convertible preferred stock that is dilutive

23 Which statement is *most* accurate? A common size income statement:

    A   restates each line item of the income statement as a percentage of net income.

    B   allows an analyst to conduct cross-sectional analysis by removing the effect of company size.

    C   standardizes each line item of the income statement but fails to help an analyst identify differences in companies' strategies.

24 Selected year-end financial statement data for Workhard are shown below.

	$ millions
Beginning shareholders' equity	475
Ending shareholders' equity	493
Unrealized gain on available-for-sale securities	5
Unrealized loss on derivatives accounted for as hedges	−3
Foreign currency translation gain on consolidation	2
Dividends paid	1
Net income	15

    Workhard's comprehensive income for the year:

    A   is $18 million.

    B   is increased by the derivatives accounted for as hedges.

    C   includes $4 million in other comprehensive income.

25 When preparing an income statement, which of the following items would *most likely* be classified as other comprehensive income?

    A A foreign currency translation adjustment

    B An unrealized gain on a security held for trading purposes

    C A realized gain on a derivative contract not accounted for as a hedge

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 A is correct. Apex is not the owner of the goods and should only report its net commission as revenue.

7 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.

8 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.

9 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 units = $10.3333 × 12,000 units = $124,000.

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

11 A is correct. Straight-line depreciation would be ($600,000 − $50,000)/10, or $55,000.

12 C is correct. Double-declining balance depreciation would be $600,000 × 20 percent (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.

13 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.

14 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.

15 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.

16 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.

17 B is correct. The formula to calculate diluted EPS is as follows:

Diluted EPS = (Net income – Preferred dividends)/[Weighted average number of shares outstanding + (New shares that would have been issued at option exercise – Shares that could have been purchased with cash received upon exercise) × (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:

Proceeds from option exercise = 100,000 × $20 = $2,000,000

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.

18 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.

19 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.

20 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

21 C is correct.

> Diluted EPS = (Net income)/(Weighted average number of shares out-
> standing + New common shares that would have been issued
> at conversion)
> = $200,000,000/[50,000,000 + (2,000,000 × 2)]
> = $3.70

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

22 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.

23 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.

24 C is correct. Comprehensive income includes both net income and other comprehensive income.

> Other comprehensive income = Unrealized gain on available-for-sale
> securities – Unrealized loss on derivatives
> accounted for as hedges + Foreign currency
> translation gain on consolidation
> = $5 million – $3 million + $2 million
> = $4 million

Alternatively,

> Comprehensive income – Net income = Other comprehensive income

> Comprehensive income = (Ending shareholders equity – Beginning share-
> holders equity) + Dividends
> = ($493 million – $475 million) + $1 million
> = $18 million + $1 million = $19 million

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

25 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.

Solution to 3:

A, B, and C are correct. The ratios are shown in the table below. All three leverage ratios decreased in 2017 relative to 2016.

Solvency Ratios			
Long-term debt-to-equity	Total long-term debt ÷ Total equity	€5,034 ÷ €25,540 =**19.7%**	€6,481 ÷ €26,397 = **24.6%**
Debt-to-equity	Total debt ÷ Total equity	(€1,561 + €5,034) ÷ €25,540 = **25.8%**	(€ 1,813 + €6,481) ÷ €26,397 = **31.4%**
Financial Leverage	Total assets ÷ Total equity	€42,497 ÷ €25,540 = **1.66**	€44,277 ÷ €26,397 = **1.68**

Cross-sectional financial ratio analysis can be limited by differences in accounting methods. In addition, lack of homogeneity of a company's operating activities can limit comparability. For diversified companies operating in different industries, using industry-specific ratios for different lines of business can provide better comparisons. Companies disclose information on operating segments. The financial position and performance of the operating segments can be compared to the relevant industry.

Ratio analysis requires a significant amount of judgment. One key area requiring judgment is understanding the limitations of any ratio. The current ratio, for example, is only a rough measure of liquidity at a specific point in time. The ratio captures only the amount of current assets, but the components of current assets differ significantly in their nearness to cash (e.g., marketable securities versus inventory). Another limitation of the current ratio is its sensitivity to end-of-period financing and operating decisions that can potentially impact current asset and current liability amounts. Another overall area requiring judgment is determining whether a ratio for a company is within a reasonable range for an industry. Yet another area requiring judgment is evaluating whether a ratio signifies a persistent condition or reflects only a temporary condition. Overall, evaluating specific ratios requires an examination of the entire operations of a company, its competitors, and the external economic and industry setting in which it is operating.

SUMMARY

The balance sheet (also referred to as the statement of financial position) discloses what an entity owns (assets) and what it owes (liabilities) at a specific point in time. Equity is the owners' residual interest in the assets of a company, net of its liabilities. The amount of equity is increased by income earned during the year, or by the issuance of new equity. The amount of equity is decreased by losses, by dividend payments, or by share repurchases.

An understanding of the balance sheet enables an analyst to evaluate the liquidity, solvency, and overall financial position of a company.

■ The balance sheet distinguishes between current and non-current assets and between current and non-current liabilities unless a presentation based on liquidity provides more relevant and reliable information.

- The concept of liquidity relates to a company's ability to pay for its near-term operating needs. With respect to a company overall, liquidity refers to the availability of cash to pay those near-term needs. With respect to a particular asset or liability, liquidity refers to its "nearness to cash."

- Some assets and liabilities are measured on the basis of fair value and some are measured at historical cost. Notes to financial statements provide information that is helpful in assessing the comparability of measurement bases across companies.

- Assets expected to be liquidated or used up within one year or one operating cycle of the business, whichever is greater, are classified as current assets. Assets not expected to be liquidated or used up within one year or one operating cycle of the business, whichever is greater, are classified as non-current assets.

- Liabilities expected to be settled or paid within one year or one operating cycle of the business, whichever is greater, are classified as current liabilities. Liabilities not expected to be settled or paid within one year or one operating cycle of the business, whichever is greater, are classified as non-current liabilities.

- Trade receivables, also referred to as accounts receivable, are amounts owed to a company by its customers for products and services already delivered. Receivables are reported net of the allowance for doubtful accounts.

- Inventories are physical products that will eventually be sold to the company's customers, either in their current form (finished goods) or as inputs into a process to manufacture a final product (raw materials and work-in-process). Inventories are reported at the lower of cost or net realizable value. If the net realizable value of a company's inventory falls below its carrying amount, the company must write down the value of the inventory and record an expense.

- Inventory cost is based on specific identification or estimated using the first-in, first-out or weighted average cost methods. Some accounting standards (including US GAAP but not IFRS) also allow last-in, first-out as an additional inventory valuation method.

- Accounts payable, also called trade payables, are amounts that a business owes its vendors for purchases of goods and services.

- Deferred revenue (also known as unearned revenue) arises when a company receives payment in advance of delivery of the goods and services associated with the payment received.

- Property, plant, and equipment (PPE) are tangible assets that are used in company operations and expected to be used over more than one fiscal period. Examples of tangible assets include land, buildings, equipment, machinery, furniture, and natural resources such as mineral and petroleum resources.

- IFRS provide companies with the choice to report PPE using either a historical cost model or a revaluation model. US GAAP permit only the historical cost model for reporting PPE.

- Depreciation is the process of recognizing the cost of a long-lived asset over its useful life. (Land is not depreciated.)

- Under IFRS, property used to earn rental income or capital appreciation is considered to be an investment property. IFRS provide companies with the choice to report an investment property using either a historical cost model or a fair value model.

- Intangible assets refer to identifiable non-monetary assets without physical substance. Examples include patents, licenses, and trademarks. For each intangible asset, a company assesses whether the useful life is finite or indefinite.

- An intangible asset with a finite useful life is amortised on a systematic basis over the best estimate of its useful life, with the amortisation method and useful-life estimate reviewed at least annually. Impairment principles for an intangible asset with a finite useful life are the same as for PPE.

- An intangible asset with an indefinite useful life is not amortised. Instead, it is tested for impairment at least annually.

- For internally generated intangible assets, IFRS require that costs incurred during the research phase must be expensed. Costs incurred in the development stage can be capitalized as intangible assets if certain criteria are met, including technological feasibility, the ability to use or sell the resulting asset, and the ability to complete the project.

- The most common intangible asset that is not a separately identifiable asset is goodwill, which arises in business combinations. Goodwill is not amortised; instead it is tested for impairment at least annually.

- Financial instruments are contracts that give rise to both a financial asset of one entity and a financial liability or equity instrument of another entity. In general, there are two basic alternative ways that financial instruments are measured: fair value or amortised cost. For financial instruments measured at fair value, there are two basic alternatives in how net changes in fair value are recognized: as profit or loss on the income statement, or as other comprehensive income (loss) which bypasses the income statement.

- Typical long-term financial liabilities include loans (i.e., borrowings from banks) and notes or bonds payable (i.e., fixed-income securities issued to investors). Liabilities such as bonds issued by a company are usually reported at amortised cost on the balance sheet.

- Deferred tax liabilities arise from temporary timing differences between a company's income as reported for tax purposes and income as reported for financial statement purposes.

- Six potential components that comprise the owners' equity section of the balance sheet include: contributed capital, preferred shares, treasury shares, retained earnings, accumulated other comprehensive income, and non-controlling interest.

- The statement of changes in equity reflects information about the increases or decreases in each component of a company's equity over a period.

- Vertical common-size analysis of the balance sheet involves stating each balance sheet item as a percentage of total assets.

- Balance sheet ratios include liquidity ratios (measuring the company's ability to meet its short-term obligations) and solvency ratios (measuring the company's ability to meet long-term and other obligations).

PRACTICE PROBLEMS

1   Resources controlled by a company as a result of past events are:

  A   equity.

  B   assets.

  C   liabilities.

2   Equity equals:

  A   Assets – Liabilities.

  B   Liabilities – Assets.

  C   Assets + Liabilities.

3   Distinguishing between current and non-current items on the balance sheet and presenting a subtotal for current assets and liabilities is referred to as:

  A   a classified balance sheet.

  B   an unclassified balance sheet.

  C   a liquidity-based balance sheet.

4   Shareholders' equity reported on the balance sheet is *most likely* to differ from the market value of shareholders' equity because:

  A   historical cost basis is used for all assets and liabilities.

  B   some factors that affect the generation of future cash flows are excluded.

  C   shareholders' equity reported on the balance sheet is updated continuously.

5   The information provided by a balance sheet item is limited because of uncertainty regarding:

  A   measurement of its cost or value with reliability.

  B   the change in current value following the end of the reporting period.

  C   the probability that any future economic benefit will flow to or from the entity.

6   Which of the following is *most likely* classified as a current liability?

  A   Payment received for a product due to be delivered at least one year after the balance sheet date

  B   Payments for merchandise due at least one year after the balance sheet date but still within a normal operating cycle

  C   Payment on debt due in six months for which the company has the unconditional right to defer settlement for at least one year after the balance sheet date

7   The *most likely* company to use a liquidity-based balance sheet presentation is a:

  A   bank.

  B   computer manufacturer holding inventories.

  C   software company with trade receivables and payables.

8   All of the following are current assets *except*:

  A   cash.

  B   goodwill.

  C   inventories.

9 The *most* likely costs included in both the cost of inventory and property, plant, and equipment are:

  A selling costs.

  B storage costs.

  C delivery costs.

10 Debt due within one year is considered:

  A current.

  B preferred.

  C convertible.

11 Money received from customers for products to be delivered in the future is recorded as:

  A revenue and an asset.

  B an asset and a liability.

  C revenue and a liability.

12 An example of a contra asset account is:

  A depreciation expense.

  B sales returns and allowances.

  C allowance for doubtful accounts.

13 The carrying value of inventories reflects:

  A their historical cost.

  B their current value.

  C the lower of historical cost or net realizable value.

14 When a company pays its rent in advance, its balance sheet will reflect a reduction in:

  A assets and liabilities.

  B assets and shareholders' equity.

  C one category of assets and an increase in another.

15 Accrued expenses (accrued liabilities) are:

  A expenses that have been paid.

  B created when another liability is reduced.

  C expenses that have been reported on the income statement but not yet paid.

16 The initial measurement of goodwill is *most likely* affected by:

  A an acquisition's purchase price.

  B the acquired company's book value.

  C the fair value of the acquirer's assets and liabilities.

17 Defining total asset turnover as revenue divided by average total assets, all else equal, impairment write-downs of long-lived assets owned by a company will *most likely* result in an increase for that company in:

  A the debt-to-equity ratio but not the total asset turnover.

  B the total asset turnover but not the debt-to-equity ratio.

  C both the debt-to-equity ratio and the total asset turnover.

18 A company has total liabilities of £35 million and total stockholders' equity of £55 million. Total liabilities are represented on a vertical common-size balance sheet by a percentage *closest* to:

  A 35%.

    B 39%.

    C 64%.

19 For financial assets classified as trading securities, how are unrealized gains and losses reflected in shareholders' equity?

    A They are not recognized.

    B They flow through income into retained earnings.

    C They are a component of accumulated other comprehensive income.

20 For financial assets classified as available for sale, how are unrealized gains and losses reflected in shareholders' equity?

    A They are not recognized.

    B They flow through retained earnings.

    C They are a component of accumulated other comprehensive income.

21 For financial assets classified as held to maturity, how are unrealized gains and losses reflected in shareholders' equity?

    A They are not recognized.

    B They flow through retained earnings.

    C They are a component of accumulated other comprehensive income.

22 The non-controlling (minority) interest in consolidated subsidiaries is presented on the balance sheet:

    A as a long-term liability.

    B separately, but as a part of shareholders' equity.

    C as a mezzanine item between liabilities and shareholders' equity.

23 The item "retained earnings" is a component of:

    A assets.

    B liabilities.

    C shareholders' equity.

24 When a company buys shares of its own stock to be held in treasury, it records a reduction in:

    A both assets and liabilities.

    B both assets and shareholders' equity.

    C assets and an increase in shareholders' equity.

25 Which of the following would an analyst *most likely* be able to determine from a common-size analysis of a company's balance sheet over several periods?

    A An increase or decrease in sales.

    B An increase or decrease in financial leverage.

    C A more efficient or less efficient use of assets.

26 An investor concerned whether a company can meet its near-term obligations is *most likely* to calculate the:

    A current ratio.

    B return on total capital.

    C financial leverage ratio.

27 The most stringent test of a company's liquidity is its:

    A cash ratio.

    B quick ratio.

    C current ratio.

28 An investor worried about a company's long-term solvency would *most likely* examine its:

   A current ratio.

   B return on equity.

   C debt-to-equity ratio.

29 Using the information presented in Exhibit 4, the quick ratio for SAP Group at 31 December 2017 is *closest* to:

   A 1.00.

   B 1.07.

   C 1.17.

30 Using the information presented in Exhibit 14, the financial leverage ratio for SAP Group at 31 December 2017 is *closest* to:

   A 1.50.

   B 1.66.

   C 2.00.

Questions 31 through 34 refer to Exhibit 1.

Exhibit 1	Common-Size Balance Sheets for Company A, Company B, and Sector Average		
	Company A	**Company B**	**Sector Average**
ASSETS			
Current assets			
Cash and cash equivalents	5	5	7
Marketable securities	5	0	2
Accounts receivable, net	5	15	12
Inventories	15	20	16
Prepaid expenses	5	15	11
Total current assets	35	55	48
Property, plant, and equipment, net	40	35	37
Goodwill	25	0	8
Other assets	0	10	7
Total assets	100	100	100
LIABILITIES AND SHAREHOLDERS' EQUITY			
Current liabilities			
Accounts payable	10	10	10
Short-term debt	25	10	15
Accrued expenses	0	5	3
Total current liabilities	35	25	28

(continued)

Exhibit 1	(Continued)			

LIABILITIES AND SHAREHOLDERS' EQUITY

Long-term debt	45	20	28
Other non-current liabilities	0	10	7
Total liabilities	80	55	63
Total shareholders' equity	20	45	37
Total liabilities and shareholders' equity	100	100	100

31 Based on Exhibit 1, which statement is *most likely* correct?

    A Company A has below-average liquidity risk.

    B Company B has above-average solvency risk.

    C Company A has made one or more acquisitions.

32 The quick ratio for Company A is *closest* to:

    A 0.43.

    B 0.57.

    C 1.00.

33 Based on Exhibit 1, the financial leverage ratio for Company B is *closest* to:

    A 0.55.

    B 1.22.

    C 2.22.

34 Based on Exhibit 1, which ratio indicates lower liquidity risk for Company A compared with Company B?

    A Cash ratio

    B Quick ratio

    C Current ratio

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 ([Cash + Marketable securities + Receivables] ÷ Current liabilities) is 1.07 ([= €4,011 + €990 + €5,899] ÷ €10,210). As noted in the text, the largest component of the current financial assets are loans and other financial receivables. Thus, financial assets are included in the quick ratio but not the cash ratio.

30 B is correct. The financial leverage ratio (Total assets ÷ Total equity) is 1.66 (= €42,497 ÷ €25,540).

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 (Cash and cash equivalents + Marketable securities + receivables) ÷ 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 Total assets ÷ 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 (Cash + Marketable securities)/Current liabilities. Company A's cash ratio, (5 + 5)/35 = 0.29, is higher than (5 + 0)/25 = 0.20 for Company B.

as Apple's in 2016 and relatively stable with a slight increase since 2015. Apple started the three years with a much stronger ratio but saw a declining trend such that its ratio is now at the same level as Microsoft. We should note that this ratio is heavily influenced by substantial investments in financial instruments that Apple has made over the years due to its strong historic cash flow.

SUMMARY

The cash flow statement provides important information about a company's cash receipts and cash payments during an accounting period as well as information about a company's operating, investing, and financing activities. Although the income statement provides a measure of a company's success, cash and cash flow are also vital to a company's long-term success. Information on the sources and uses of cash helps creditors, investors, and other statement users evaluate the company's liquidity, solvency, and financial flexibility. Key concepts are as follows:

- Cash flow activities are classified into three categories: operating activities, investing activities, and financing activities. Significant non-cash transaction activities (if present) are reported by using a supplemental disclosure note to the cash flow statement.

- Cash flow statements under IFRS and US GAAP are similar; however, IFRS provide companies with more choices in classifying some cash flow items as operating, investing, or financing activities.

- Companies can use either the direct or the indirect method for reporting their operating cash flow:
  - The direct method discloses operating cash inflows by source (e.g., cash received from customers, cash received from investment income) and operating cash outflows by use (e.g., cash paid to suppliers, cash paid for interest) in the operating activities section of the cash flow statement.
  - The indirect method reconciles net income to operating cash flow by adjusting net income for all non-cash items and the net changes in the operating working capital accounts.

- The cash flow statement is linked to a company's income statement and comparative balance sheets and to data on those statements.

- Although the indirect method is most commonly used by companies, an analyst can generally convert it to an approximation of the direct format by following a simple three-step process.

- An evaluation of a cash flow statement should involve an assessment of the sources and uses of cash and the main drivers of cash flow within each category of activities.

- The analyst can use common-size statement analysis for the cash flow statement. Two approaches to developing the common-size statements are the total cash inflows/total cash outflows method and the percentage of net revenues method.

- The cash flow statement can be used to determine free cash flow to the firm (FCFF) and free cash flow to equity (FCFE).

- The cash flow statement may also be used in financial ratios that measure a company's profitability, performance, and financial strength.

PRACTICE PROBLEMS

1   The three major classifications of activities in a cash flow statement are:

    A   inflows, outflows, and net flows.

    B   operating, investing, and financing.

    C   revenues, expenses, and net income.

2   The sale of a building for cash would be classified as what type of activity on the cash flow statement?

    A   Operating.

    B   Investing.

    C   Financing.

3   Under which section of a manufacturing company's cash flow statement are the following activities reported?

    Item 1: Purchases of securities held for trading

    Item 2: Sales of securities considered cash equivalents

    A   Both items are investing activities.

    B   Both items are operating activities.

    C   Only Item 1 is an investing activity.

4   Which of the following is an example of a financing activity on the cash flow statement under US GAAP?

    A   Payment of interest.

    B   Receipt of dividends.

    C   Payment of dividends.

5   A conversion of a face value $1 million convertible bond for $1 million of common stock would most likely be:

    A   reported as a $1 million investing cash inflow and outflow.

    B   reported as a $1 million financing cash outflow and inflow.

    C   reported as supplementary information to the cash flow statement.

6   A company recently engaged in a non-cash transaction that significantly affected its property, plant, and equipment. The transaction is:

    A   reported under the investing section of the cash flow statement.

    B   reported differently in cash flow from operations under the direct and indirect methods.

    C   disclosed as a separate note or in a supplementary schedule to the cash flow statement.

7   Interest paid is classified as an operating cash flow under:

    A   US GAAP but may be classified as either operating or investing cash flows under IFRS.

    B   IFRS but may be classified as either operating or investing cash flows under US GAAP.

    C   US GAAP but may be classified as either operating or financing cash flows under IFRS.

8   Cash flows from taxes on income must be separately disclosed under:

A IFRS only.

B US GAAP only.

C both IFRS and US GAAP.

9 Which of the following components of the cash flow statement may be prepared under the indirect method under both IFRS and US GAAP?

A Operating.

B Investing.

C Financing.

10 Which of the following is *most likely* to appear in the operating section of a cash flow statement under the indirect method?

A Net income.

B Cash paid to suppliers.

C Cash received from customers.

11 A benefit of using the direct method rather than the indirect method when reporting operating cash flows is that the direct method:

A mirrors a forecasting approach.

B is easier and less costly.

C provides specific information on the sources of operating cash flows.

12 Mabel Corporation (MC) reported accounts receivable of $66 million at the end of its second fiscal quarter. MC had revenues of $72 million for its third fiscal quarter and reported accounts receivable of $55 million at the end of its third fiscal quarter. Based on this information, the amount of cash MC collected from customers during the third fiscal quarter is:

A $61 million.

B $72 million.

C $83 million.

13 When computing net cash flow from operating activities using the indirect method, an addition to net income is *most likely* to occur when there is a:

A gain on the sale of an asset.

B loss on the retirement of debt.

C decrease in a deferred tax liability.

14 Red Road Company, a consulting company, reported total revenues of $100 million, total expenses of $80 million, and net income of $20 million in the most recent year. If accounts receivable increased by $10 million, how much cash did the company receive from customers?

A $90 million.

B $100 million.

C $110 million.

15 In 2018, a company using US GAAP made cash payments of $6 million for salaries, $2 million for interest expense, and $4 million for income taxes. Additional information for the company is provided in the table:

($ millions)	2017	2018
Revenue	42	37
Cost of goods sold	18	16
Inventory	36	40

(continued)

($ millions)	2017	2018
Accounts receivable	22	19
Accounts payable	14	12

Based only on the information given, the company's operating cash flow for 2018 is *closest to*:

A $6 million.

B $10 million.

C $14 million.

16 Green Glory Corp., a garden supply wholesaler, reported cost of goods sold for the year of $80 million. Total assets increased by $55 million, including an increase of $5 million in inventory. Total liabilities increased by $45 million, including an increase of $2 million in accounts payable. The cash paid by the company to its suppliers is most likely *closest* to:

A $73 million.

B $77 million.

C $83 million.

17 Purple Fleur S.A., a retailer of floral products, reported cost of goods sold for the year of $75 million. Total assets increased by $55 million, but inventory declined by $6 million. Total liabilities increased by $45 million, and accounts payable increased by $2 million. The cash paid by the company to its suppliers is most likely *closest* to:

A $67 million.

B $79 million.

C $83 million.

18 White Flag, a women's clothing manufacturer, reported salaries expense of $20 million. The beginning balance of salaries payable was $3 million, and the ending balance of salaries payable was $1 million. How much cash did the company pay in salaries?

A $18 million.

B $21 million.

C $22 million.

19 An analyst gathered the following information from a company's 2018 financial statements (in $ millions):

Year ended 31 December	2017	2018
Net sales	245.8	254.6
Cost of goods sold	168.3	175.9
Accounts receivable	73.2	68.3
Inventory	39.0	47.8
Accounts payable	20.3	22.9

Based only on the information above, the company's 2018 statement of cash flows in the direct format would include amounts (in $ millions) for cash received from customers and cash paid to suppliers, respectively, that are *closest* to:

	cash received from customers	cash paid to suppliers
A	249.7	169.7
B	259.5	174.5
C	259.5	182.1

20 Golden Cumulus Corp., a commodities trading company, reported interest expense of $19 million and taxes of $6 million. Interest payable increased by $3 million, and taxes payable decreased by $4 million over the period. How much cash did the company pay for interest and taxes?

   A $22 million for interest and $10 million for taxes.

   B $16 million for interest and $2 million for taxes.

   C $16 million for interest and $10 million for taxes.

21 An analyst gathered the following information from a company's 2018 financial statements (in $ millions):

Balances as of Year Ended 31 December	2017	2018
Retained earnings	120	145
Accounts receivable	38	43
Inventory	45	48
Accounts payable	36	29

   In 2018, the company declared and paid cash dividends of $10 million and recorded depreciation expense in the amount of $25 million. The company considers dividends paid a financing activity. The company's 2018 cash flow from operations (in $ millions) was *closest* to

   A   25.

   B   45.

   C   75.

22 Silverago Incorporated, an international metals company, reported a loss on the sale of equipment of $2 million in 2018. In addition, the company's income statement shows depreciation expense of $8 million and the cash flow statement shows capital expenditure of $10 million, all of which was for the purchase of new equipment. Using the following information from the comparative balance sheets, how much cash did the company receive from the equipment sale?

Balance Sheet Item	12/31/2017	12/31/2018	Change
Equipment	$100 million	$105 million	$5 million
Accumulated depreciation—equipment	$40 million	$46 million	$6 million

   A $1 million.

   B $2 million.

   C $3 million.

23 Jaderong Plinkett Stores reported net income of $25 million. The company has no outstanding debt. Using the following information from the comparative balance sheets (in millions), what should the company report in the financing section of the statement of cash flows in 2018?

Balance Sheet Item	12/31/2017	12/31/2018	Change
Common stock	$100	$102	$2
Additional paid-in capital common stock	$100	$140	$40
Retained earnings	$100	$115	$15
Total stockholders' equity	$300	$357	$57

- **A**   Issuance of common stock of $42 million; dividends paid of $10 million.
- **B**   Issuance of common stock of $38 million; dividends paid of $10 million.
- **C**   Issuance of common stock of $42 million; dividends paid of $40 million.

24   Based on the following information for Star Inc., what are the total net adjustments that the company would make to net income in order to derive operating cash flow?

Income Statement Item	Year Ended 12/31/2018
Net income	$20 million
Depreciation	$2 million

Balance Sheet Item	12/31/2017	12/31/2018	Change
Accounts receivable	$25 million	$22 million	($3 million)
Inventory	$10 million	$14 million	$4 million
Accounts payable	$8 million	$13 million	$5 million

- **A**   Add $2 million.
- **B**   Add $6 million.
- **C**   Subtract $6 million.

25   The first step in cash flow statement analysis should be to:

- **A**   evaluate consistency of cash flows.
- **B**   determine operating cash flow drivers.
- **C**   identify the major sources and uses of cash.

26   Which of the following would be valid conclusions from an analysis of the cash flow statement for Telefónica Group presented in Exhibit 3?

- **A**   The primary use of cash is financing activities.
- **B**   The primary source of cash is operating activities.
- **C**   Telefónica classifies dividends paid as an operating activity.

27   The following information is extracted from Sweetfall Incorporated's financial statements.

Income Statement		Balance Sheet Changes	
Revenue	$56,800	Decrease in accounts receivable	$1,324
Cost of goods sold	27,264	Decrease in inventory	501
Other operating expense	562	Increase in prepaid expense	6
Depreciation expense	2,500	Increase in accounts payable	1,063

The amount of cash Sweetfall Inc. paid to suppliers is:

  A $25,700.

  B $26,702.

  C $27,826.

28 Which is an appropriate method of preparing a common-size cash flow statement?

  A Show each item of revenue and expense as a percentage of net revenue.

  B Show each line item on the cash flow statement as a percentage of net revenue.

  C Show each line item on the cash flow statement as a percentage of total cash outflows.

29 Which of the following is an appropriate method of computing free cash flow to the firm?

  A Add operating cash flows to capital expenditures and deduct after-tax interest payments.

  B Add operating cash flows to after-tax interest payments and deduct capital expenditures.

  C Deduct both after-tax interest payments and capital expenditures from operating cash flows.

30 An analyst has calculated a ratio using as the numerator the sum of operating cash flow, interest, and taxes and as the denominator the amount of interest. What is this ratio, what does it measure, and what does it indicate?

  A This ratio is an interest coverage ratio, measuring a company's ability to meet its interest obligations and indicating a company's solvency.

  B This ratio is an effective tax ratio, measuring the amount of a company's operating cash flow used for taxes and indicating a company's efficiency in tax management.

  C This ratio is an operating profitability ratio, measuring the operating cash flow generated accounting for taxes and interest and indicating a company's liquidity.

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 million + $72 million – $55 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.

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

$$\text{Cash received from customers} = \text{Revenue} + \text{Decrease in accounts receivable}$$
$$= \$37 + \$3 = \$40 \text{ million}$$

$$\text{Cash paid to suppliers} = \text{Cost of goods sold} + \text{Increase in inventory} + \text{Decrease in accounts payable}$$
$$= \$16 + \$4 + \$2 = \$22 \text{ million}$$

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 2018 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. Cash flow provided by operating activity totaled €13,796 million in the most recent year. The primary use of cash is investing activities (total of €10,245 million). Dividends paid are classified as a financing activity.

27 A is correct. The amount of cash paid to suppliers is calculated as follows:

= Cost of goods sold – Decrease in inventory – Increase in accounts payable
= $27,264 – $501 – $1,063
= $25,700.

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).

- **Scenario analysis**: This type of analysis shows the changes in key financial quantities that result from given (economic) events, such as the loss of customers, the loss of a supply source, or a catastrophic event. If the list of events is mutually exclusive and exhaustive and the events can be assigned probabilities, the analyst can evaluate not only the range of outcomes but also standard statistical measures such as the mean and median value for various quantities of interest.

- **Simulation**: This is computer-generated sensitivity or scenario analysis based on probability models for the factors that drive outcomes. Each event or possible outcome is assigned a probability. Multiple scenarios are then run using the probability factors assigned to the possible values of a variable.

SUMMARY

Financial analysis techniques, including common-size financial statements and ratio analysis, are useful in summarizing financial reporting data and evaluating the performance and financial position of a company. The results of financial analysis techniques provide important inputs into security valuation. Key facets of financial analysis include the following:

- Common-size financial statements and financial ratios remove the effect of size, allowing comparisons of a company with peer companies (cross-sectional analysis) and comparison of a company's results over time (trend or time-series analysis).

- Activity ratios measure the efficiency of a company's operations, such as collection of receivables or management of inventory. Major activity ratios include inventory turnover, days of inventory on hand, receivables turnover, days of sales outstanding, payables turnover, number of days of payables, working capital turnover, fixed asset turnover, and total asset turnover.

- Liquidity ratios measure the ability of a company to meet short-term obligations. Major liquidity ratios include the current ratio, quick ratio, cash ratio, and defensive interval ratio.

- Solvency ratios measure the ability of a company to meet long-term obligations. Major solvency ratios include debt ratios (including the debt-to-assets ratio, debt-to-capital ratio, debt-to-equity ratio, and financial leverage ratio) and coverage ratios (including interest coverage and fixed charge coverage).

- Profitability ratios measure the ability of a company to generate profits from revenue and assets. Major profitability ratios include return on sales ratios (including gross profit margin, operating profit margin, pretax margin, and net profit margin) and return on investment ratios (including operating ROA, ROA, return on total capital, ROE, and return on common equity).

- Ratios can also be combined and evaluated as a group to better understand how they fit together and how efficiency and leverage are tied to profitability.

- ROE can be analyzed as the product of the net profit margin, asset turnover, and financial leverage. This decomposition is sometimes referred to as DuPont analysis.

- Valuation ratios express the relation between the market value of a company or its equity (for example, price per share) and some fundamental financial metric (for example, earnings per share).

- Ratio analysis is useful in the selection and valuation of debt and equity securities and is a part of the credit rating process.

- Ratios can also be computed for business segments to evaluate how units within a business are performing.

- The results of financial analysis provide valuable inputs into forecasts of future earnings and cash flow.

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PRACTICE PROBLEMS

1 Comparison of a company's financial results to other peer companies for the same time period is called:

   A technical analysis.

   B time-series analysis.

   C cross-sectional analysis.

2 In order to assess a company's ability to fulfill its long-term obligations, an analyst would *most likely* examine:

   A activity ratios.

   B liquidity ratios.

   C solvency ratios.

3 Which ratio would a company *most likely* use to measure its ability to meet short-term obligations?

   A Current ratio.

   B Payables turnover.

   C Gross profit margin.

4 Which of the following ratios would be *most* useful in determining a company's ability to cover its lease and interest payments?

   A ROA.

   B Total asset turnover.

   C Fixed charge coverage.

5 An analyst is interested in assessing both the efficiency and liquidity of Spherion PLC. The analyst has collected the following data for Spherion:

	FY3	FY2	FY1
Days of inventory on hand	32	34	40
Days sales outstanding	28	25	23
Number of days of payables	40	35	35

Based on this data, what is the analyst *least likely* to conclude?

   A Inventory management has contributed to improved liquidity.

   B Management of payables has contributed to improved liquidity.

   C Management of receivables has contributed to improved liquidity.

6 An analyst is evaluating the solvency and liquidity of Apex Manufacturing and has collected the following data (in millions of euro):

	FY5 (€)	FY4 (€)	FY3 (€)
Total debt	2,000	1,900	1,750
Total equity	4,000	4,500	5,000

Which of the following would be the analyst's *most likely* conclusion?

   A The company is becoming increasingly less solvent, as evidenced by the increase in its debt-to-equity ratio from 0.35 to 0.50 from FY3 to FY5.

B   The company is becoming less liquid, as evidenced by the increase in its debt-to-equity ratio from 0.35 to 0.50 from FY3 to FY5.

C   The company is becoming increasingly more liquid, as evidenced by the increase in its debt-to-equity ratio from 0.35 to 0.50 from FY3 to FY5.

7   With regard to the data in Problem 6, what would be the *most* reasonable explanation of the financial data?

A   The decline in the company's equity results from a decline in the market value of this company's common shares.

B   The €250 increase in the company's debt from FY3 to FY5 indicates that lenders are viewing the company as increasingly creditworthy.

C   The decline in the company's equity indicates that the company may be incurring losses, paying dividends greater than income, and/or repurchasing shares.

8   An analyst observes a decrease in a company's inventory turnover. Which of the following would *most likely* explain this trend?

A   The company installed a new inventory management system, allowing more efficient inventory management.

B   Due to problems with obsolescent inventory last year, the company wrote off a large amount of its inventory at the beginning of the period.

C   The company installed a new inventory management system but experienced some operational difficulties resulting in duplicate orders being placed with suppliers.

9   Which of the following would *best* explain an increase in receivables turnover?

A   The company adopted new credit policies last year and began offering credit to customers with weak credit histories.

B   Due to problems with an error in its old credit scoring system, the company had accumulated a substantial amount of uncollectible accounts and wrote off a large amount of its receivables.

C   To match the terms offered by its closest competitor, the company adopted new payment terms now requiring net payment within 30 days rather than 15 days, which had been its previous requirement.

10 Brown Corporation had average days of sales outstanding of 19 days in the most recent fiscal year. Brown wants to improve its credit policies and collection practices and decrease its collection period in the next fiscal year to match the industry average of 15 days. Credit sales in the most recent fiscal year were $300 million, and Brown expects credit sales to increase to $390 million in the next fiscal year. To achieve Brown's goal of decreasing the collection period, the change in the average accounts receivable balance that must occur is *closest* to:

A   +$0.41 million.

B   −$0.41 million.

C   −$1.22 million.

11 An analyst observes the following data for two companies:

	Company A ($)	Company B ($)
Revenue	4,500	6,000
Net income	50	1,000
Current assets	40,000	60,000
Total assets	100,000	700,000

	Company A ($)	Company B ($)
Current liabilities	10,000	50,000
Total debt	60,000	150,000
Shareholders' equity	30,000	500,000

Which of the following choices *best* describes reasonable conclusions that the analyst might make about the two companies' ability to pay their current and long-term obligations?

A Company A's current ratio of 4.0 indicates it is more liquid than Company B, whose current ratio is only 1.2, but Company B is more solvent, as indicated by its lower debt-to-equity ratio.

B Company A's current ratio of 0.25 indicates it is less liquid than Company B, whose current ratio is 0.83, and Company A is also less solvent, as indicated by a debt-to-equity ratio of 200 percent compared with Company B's debt-to-equity ratio of only 30 percent.

C Company A's current ratio of 4.0 indicates it is more liquid than Company B, whose current ratio is only 1.2, and Company A is also more solvent, as indicated by a debt-to-equity ratio of 200 percent compared with Company B's debt-to-equity ratio of only 30 percent.

The following information relates to Questions 12–15

The data in Exhibit 1 appear in the five-year summary of a major international company. A business combination with another major manufacturer took place in FY13.

Exhibit 1

	FY10	FY11	FY12	FY13	FY14
Financial statements	GBP m	GBP m	GBP m	GBP m	GBP m
Income statements					
Revenue	4,390	3,624	3,717	8,167	11,366
Profit before interest and taxation (EBIT)	844	700	704	933	1,579
Net interest payable	−80	−54	−98	−163	−188
Taxation	−186	−195	−208	−349	−579
Minorities	−94	−99	−105	−125	−167
Profit for the year	484	352	293	296	645
Balance sheets					
Fixed assets	3,510	3,667	4,758	10,431	11,483
Current asset investments, cash at bank and in hand	316	218	290	561	682
Other current assets	558	514	643	1,258	1,634
Total assets	4,384	4,399	5,691	12,250	13,799
Interest bearing debt (long term)	−602	−1,053	−1,535	−3,523	−3,707

(continued)

Exhibit 1	**(Continued)**				
	FY10	**FY11**	**FY12**	**FY13**	**FY14**
Other creditors and provisions (current)	–1,223	–1,054	–1,102	–2,377	–3,108
Total liabilities	–1,825	–2,107	–2,637	–5,900	–6,815
Net assets	2,559	2,292	3,054	6,350	6,984
Shareholders' funds	2,161	2,006	2,309	5,572	6,165
Equity minority interests	398	286	745	778	819
Capital employed	2,559	2,292	3,054	6,350	6,984
Cash flow					
Working capital movements	–53	5	71	85	107
Net cash inflow from operating activities	864	859	975	1,568	2,292

12 The company's total assets at year-end FY9 were GBP 3,500 million. Which of the following choices *best* describes reasonable conclusions an analyst might make about the company's efficiency?

   A   Comparing FY14 with FY10, the company's efficiency improved, as indicated by a total asset turnover ratio of 0.86 compared with 0.64.

   B   Comparing FY14 with FY10, the company's efficiency deteriorated, as indicated by its current ratio.

   C   Comparing FY14 with FY10, the company's efficiency deteriorated due to asset growth faster than turnover revenue growth.

13 Which of the following choices *best* describes reasonable conclusions an analyst might make about the company's solvency?

   A   Comparing FY14 with FY10, the company's solvency improved, as indicated by an increase in its debt-to-assets ratio from 0.14 to 0.27.

   B   Comparing FY14 with FY10, the company's solvency deteriorated, as indicated by a decrease in interest coverage from 10.6 to 8.4.

   C   Comparing FY14 with FY10, the company's solvency improved, as indicated by the growth in its profits to GBP 645 million.

14 Which of the following choices *best* describes reasonable conclusions an analyst might make about the company's liquidity?

   A   Comparing FY14 with FY10, the company's liquidity improved, as indicated by an increase in its debt-to-assets ratio from 0.14 to 0.27.

   B   Comparing FY14 with FY10, the company's liquidity deteriorated, as indicated by a decrease in interest coverage from 10.6 to 8.4.

   C   Comparing FY14 with FY10, the company's liquidity improved, as indicated by an increase in its current ratio from 0.71 to 0.75.

15 Which of the following choices *best* describes reasonable conclusions an analyst might make about the company's profitability?

   A   Comparing FY14 with FY10, the company's profitability improved, as indicated by an increase in its debt-to-assets ratio from 0.14 to 0.27.

B Comparing FY14 with FY10, the company's profitability deteriorated, as indicated by a decrease in its net profit margin from 11.0 percent to 5.7 percent.

C Comparing FY14 with FY10, the company's profitability improved, as indicated by the growth in its shareholders' equity to GBP 6,165 million.

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16 Assuming no changes in other variables, which of the following would decrease ROA?

A A decrease in the effective tax rate.

B A decrease in interest expense.

C An increase in average assets.

17 An analyst compiles the following data for a company:

	FY13	FY14	FY15
ROE	19.8%	20.0%	22.0%
Return on total assets	8.1%	8.0%	7.9%
Total asset turnover	2.0	2.0	2.1

Based only on the information above, the *most* appropriate conclusion is that, over the period FY13 to FY15, the company's:

A net profit margin and financial leverage have decreased.

B net profit margin and financial leverage have increased.

C net profit margin has decreased but its financial leverage has increased.

18 A decomposition of ROE for Integra SA is as follows:

	FY12	FY11
ROE	18.90%	18.90%
Tax burden	0.70	0.75
Interest burden	0.90	0.90
EBIT margin	10.00%	10.00%
Asset turnover	1.50	1.40
Leverage	2.00	2.00

Which of the following choices *best* describes reasonable conclusions an analyst might make based on this ROE decomposition?

A Profitability and the liquidity position both improved in FY12.

B The higher average tax rate in FY12 offset the improvement in profitability, leaving ROE unchanged.

C The higher average tax rate in FY12 offset the improvement in efficiency, leaving ROE unchanged.

19 A decomposition of ROE for Company A and Company B is as follows:

	Company A		Company B	
	FY15	FY14	FY15	FY14
ROE	26.46%	18.90%	26.33%	18.90%
Tax burden	0.7	0.75	0.75	0.75
Interest burden	0.9	0.9	0.9	0.9

(continued)

	Company A		Company B	
	FY15	**FY14**	**FY15**	**FY14**
EBIT margin	7.00%	10.00%	13.00%	10.00%
Asset turnover	1.5	1.4	1.5	1.4
Leverage	4	2	2	2

An analyst is *most likely* to conclude that:

A Company A's ROE is higher than Company B's in FY15, and one explanation consistent with the data is that Company A may have purchased new, more efficient equipment.

B Company A's ROE is higher than Company B's in FY15, and one explanation consistent with the data is that Company A has made a strategic shift to a product mix with higher profit margins.

C The difference between the two companies' ROE in FY15 is very small and Company A's ROE remains similar to Company B's ROE mainly due to Company A increasing its financial leverage.

20 What does the P/E ratio measure?

A The "multiple" that the stock market places on a company's EPS.

B The relationship between dividends and market prices.

C The earnings for one common share of stock.

21 A creditor *most likely* would consider a decrease in which of the following ratios to be positive news?

A Interest coverage (times interest earned).

B Debt-to-total assets.

C Return on assets.

22 When developing forecasts, analysts should *most likely*:

A develop possibilities relying exclusively on the results of financial analysis.

B use the results of financial analysis, analysis of other information, and judgment.

C aim to develop extremely precise forecasts using the results of financial analysis.

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) × 19]. The desired average accounts receivable balance for the next fiscal year is $16.03 million (= ($390,000,000/365) × 15). This is an increase of $0.41 million (= 16.03 million – 15.62 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 = Net profit margin × Total asset turnover. ROA decreased over the period despite the increase in total asset turnover; therefore, the net profit margin must have decreased.

ROE = Return on assets × 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.

The effects on ratios are as follows:

- The inventory turnover ratios would all be higher under the weighted average cost method because the numerator (cost of sales) would be higher and the denominator (inventory) would be lower than what was reported by Jollof under the FIFO method.

- The number of days of inventory would be lower under the weighted average cost method because the inventory turnover ratios would be higher.

- The gross profit margin ratios would all be lower under the weighted average cost method because cost of sales would be higher under the weighted average cost method than under the FIFO method.

- The current ratios would all be lower under the weighted average cost method because inventory carrying values would be lower than under the FIFO method (current liabilities would be the same under both methods).

- The return-on-assets ratios would all be lower under the weighted average cost method because the incremental profit added to the numerator (net income) has a greater impact than the incremental increase to the denominator (total assets). By way of example, assume that a company has €3 million in net income and €100 million in total assets using the weighted average cost method. If the company reports another €1 million in net income by using FIFO instead of weighted average cost, it would then also report an additional €1 million in total assets (after tax). Based on this example, the return on assets is 3.00 percent (€3/€100) under the weighted average cost method and 3.96 percent (€4/€101) under the FIFO method.

- The debt-to-equity ratios would all be higher under the weighted average cost method because retained earnings would be lower than under the FIFO method (again assuming no inventory write-downs that would otherwise neutralize the differences between the inventory valuation methods).

Conversely, if inventory replacement costs were decreasing during 2015, 2016, and 2017 (and inventory quantity levels were stable or increasing), Jollof's cost of sales would have been lower and its gross profit and inventory would have been higher under the weighted average cost method than were reported under the FIFO method (assuming no inventory write-downs that would otherwise neutralize the differences between the inventory valuation methods). As a result, the ratio assessment that was performed above would result in directly opposite conclusions.

SUMMARY

The choice of inventory valuation method (cost formula or cost flow assumption) can have a potentially significant impact on inventory carrying amounts and cost of sales. These in turn impact other financial statement items, such as current assets, total assets, gross profit, and net income. The financial statements and accompanying

notes provide important information about a company's inventory accounting policies that the analyst needs to correctly assess financial performance and compare it with that of other companies. Key concepts in this reading are as follows:

- Inventories are a major factor in the analysis of merchandising and manufacturing companies. Such companies generate their sales and profits through inventory transactions on a regular basis. An important consideration in determining profits for these companies is measuring the cost of sales when inventories are sold.

- The total cost of inventories comprises all costs of purchase, costs of conversion, and other costs incurred in bringing the inventories to their present location and condition. Storage costs of finished inventory and abnormal costs due to waste are typically treated as expenses in the period in which they occurred.

- The allowable inventory valuation methods implicitly involve different assumptions about cost flows. The choice of inventory valuation method determines how the cost of goods available for sale during the period is allocated between inventory and cost of sales.

- IFRS allow three inventory valuation methods (cost formulas): first-in, first-out (FIFO); weighted average cost; and specific identification. The specific identification method is used for inventories of items that are not ordinarily interchangeable and for goods or services produced and segregated for specific projects. US GAAP allow the three methods above plus the last-in, first-out (LIFO) method. The LIFO method is widely used in the United States for both tax and financial reporting purposes because of potential income tax savings.

- The choice of inventory method affects the financial statements and any financial ratios that are based on them. As a consequence, the analyst must carefully consider inventory valuation method differences when evaluating a company's performance over time or in comparison to industry data or industry competitors.

- A company must use the same cost formula for all inventories having a similar nature and use to the entity.

- The inventory accounting system (perpetual or periodic) may result in different values for cost of sales and ending inventory when the weighted average cost or LIFO inventory valuation method is used.

- Under US GAAP, companies that use the LIFO method must disclose in their financial notes the amount of the LIFO reserve or the amount that would have been reported in inventory if the FIFO method had been used. This information can be used to adjust reported LIFO inventory and cost of goods sold balances to the FIFO method for comparison purposes.

- LIFO liquidation occurs when the number of units in ending inventory declines from the number of units that were present at the beginning of the year. If inventory unit costs have generally risen from year to year, this will produce an inventory-related increase in gross profits.

- Consistency of inventory costing is required under both IFRS and US GAAP. If a company changes an accounting policy, the change must be justifiable and applied retrospectively to the financial statements. An exception to the retrospective restatement is when a company reporting under US GAAP changes to the LIFO method.

- Under IFRS, inventories are measured at the lower of cost and net realisable value. Net realisable value is the estimated selling price in the ordinary course of business less the estimated costs necessary to make the sale. Under US GAAP, inventories are measured at the lower of cost, market value, or net

realisable value depending upon the inventory method used. Market value is defined as current replacement cost subject to an upper limit of net realizable value and a lower limit of net realizable value less a normal profit margin. Reversals of previous write-downs are permissible under IFRS but not under US GAAP.

■ Reversals of inventory write-downs may occur under IFRS but are not allowed under US GAAP.

■ Changes in the carrying amounts within inventory classifications (such as raw materials, work-in-process, and finished goods) may provide signals about a company's future sales and profits. Relevant information with respect to inventory management and future sales may be found in the Management Discussion and Analysis or similar items within the annual or quarterly reports, industry news and publications, and industry economic data.

■ The inventory turnover ratio, number of days of inventory ratio, and gross profit margin ratio are useful in evaluating the management of a company's inventory.

■ Inventory management may have a substantial impact on a company's activity, profitability, liquidity, and solvency ratios. It is critical for the analyst to be aware of industry trends and management's intentions.

■ Financial statement disclosures provide information regarding the accounting policies adopted in measuring inventories, the principal uncertainties regarding the use of estimates related to inventories, and details of the inventory carrying amounts and costs. This information can greatly assist analysts in their evaluation of a company's inventory management.

PRACTICE PROBLEMS

1 Inventory cost is *least likely* to include:

   A production-related storage costs.

   B costs incurred as a result of normal waste of materials.

   C transportation costs of shipping inventory to customers.

2 Mustard Seed PLC adheres to IFRS. It recently purchased inventory for €100 million and spent €5 million for storage prior to selling the goods. The amount it charged to inventory expense (€ millions) was *closest* to:

   A €95.

   B €100.

   C €105.

3 Carrying inventory at a value above its historical cost would *most likely* be permitted if:

   A the inventory was held by a producer of agricultural products.

   B financial statements were prepared using US GAAP.

   C the change resulted from a reversal of a previous write-down.

The following information relates to Questions 4 and 5.

A retail company is comparing different approaches to valuing inventory. The company has one product that it sells for $50.

Table 1 Units Purchased and Sold (first quarter)					
Date	Units Purchased	Purchase Price	Units Sold	Selling Price	Inventory Units on Hand
2 Jan	1,000	$20.00			1,000
17 Jan			500	$50.00	500
16 Feb	1,000	$18.00			1,500
3 Mar			1,200	$50.00	300
13 Mar	1,000	$17.00			1,300
23 Mar			500	$50.00	800
End of quarter totals:	3,000	$55,000	2,200	$110,000	

Table 2   Comparison of Inventory Methods and Models

End of Quarter Valuations 31 March	Perpetual LIFO	Periodic LIFO	Perpetual FIFO
Sales	$110,000	$110,000	$110,000
Ending inventory		$16,000	$13,600
Cost of goods sold		$39,000	$41,400
Gross profit		$71,000	$68,600
Inventory turnover ratio	279%		

Note: LIFO is last in, first out and FIFO is first in, first out.

4   What is the value of ending inventory for the first quarter if the company uses a perpetual LIFO inventory valuation method?

   A $14,500

   B $15,000

   C $16,000

5   Which inventory accounting method results in the lowest inventory turnover ratio for the first quarter?

   A   Periodic LIFO

   B   Perpetual LIFO

   C   Perpetual FIFO

6   During periods of rising inventory unit costs, a company using the FIFO method rather than the LIFO method will report a lower:

   A   current ratio.

   B   inventory turnover.

   C   gross profit margin.

7   LIFO reserve is *most likely* to increase when inventory unit:

   A   costs are increasing.

   B   costs are decreasing.

   C   levels are decreasing.

8   If inventory unit costs are increasing from period-to-period, a LIFO liquidation is *most likely* to result in an increase in:

   A   gross profit.

   B   LIFO reserve.

   C   inventory carrying amounts.

9   A company using the LIFO method reports the following in £:

	2018	2017
Cost of goods sold (COGS)	50,800	48,500
Ending inventories	10,550	10,000
LIFO reserve	4,320	2,600

   Cost of goods sold for 2018 under the FIFO method is *closest* to:

  A £48,530.

  B £49,080.

  C £52,520.

10 Eric's Used Book Store prepares its financial statements in accordance with IFRS. Inventory was purchased for £1 million and later marked down to £550,000. One of the books, however, was later discovered to be a rare collectible item, and the inventory is now worth an estimated £3 million. The inventory is *most likely* reported on the balance sheet at:

  A £550,000.

  B £1,000,000.

  C £3,000,000.

11 Fernando's Pasta purchased inventory and later wrote it down. The current net realisable value is higher than the value when written down. Fernando's inventory balance will *most likely* be:

  A higher if it complies with IFRS.

  B higher if it complies with US GAAP.

  C the same under US GAAP and IFRS.

12 A write down of the value of inventory to its net realizable value will have a positive effect on the:

  A balance sheet.

  B income statement.

  C inventory turnover ratio.

For questions 13–24, assume the companies use a periodic inventory system.

13 Cinnamon Corp. started business in 2017 and uses the weighted average cost method. During 2017, it purchased 45,000 units of inventory at €10 each and sold 40,000 units for €20 each. In 2018, it purchased another 50,000 units at €11 each and sold 45,000 units for €22 each. Its 2018 cost of sales (€ thousands) was *closest* to:

  A €490.

  B €491.

  C €495.

14 Zimt AG started business in 2017 and uses the FIFO method. During 2017, it purchased 45,000 units of inventory at €10 each and sold 40,000 units for €20 each. In 2018, it purchased another 50,000 units at €11 each and sold 45,000 units for €22 each. Its 2018 ending inventory balance (€ thousands) was *closest* to:

  A €105.

  B €109.

  C €110.

15 Zimt AG uses the FIFO method, and Nutmeg Inc. uses the LIFO method. Compared to the cost of replacing the inventory, during periods of rising prices, the cost of sales reported by:

A Zimt is too low.

B Nutmeg is too low.

C Nutmeg is too high.

16 Zimt AG uses the FIFO method, and Nutmeg Inc. uses the LIFO method. Compared to the cost of replacing the inventory, during periods of rising prices the ending inventory balance reported by:

A Zimt is too high.

B Nutmeg is too low.

C Nutmeg is too high.

17 Like many technology companies, TechnoTools operates in an environment of declining prices. Its reported profits will tend to be *highest* if it accounts for inventory using the:

A FIFO method.

B LIFO method.

C weighted average cost method.

18 Compared to using the weighted average cost method to account for inventory, during a period in which prices are generally rising, the current ratio of a company using the FIFO method would *most likely* be:

A lower.

B higher.

C dependent upon the interaction with accounts payable.

19 Zimt AG wrote down the value of its inventory in 2017 and reversed the write-down in 2018. Compared to the ratios that would have been calculated if the write-down had never occurred, Zimt's reported 2017:

A current ratio was too high.

B gross margin was too high.

C inventory turnover was too high.

20 Zimt AG wrote down the value of its inventory in 2017 and reversed the write-down in 2018. Compared to the results the company would have reported if the write-down had never occurred, Zimt's reported 2018:

A profit was overstated.

B cash flow from operations was overstated.

C year-end inventory balance was overstated.

21 Compared to a company that uses the FIFO method, during periods of rising prices a company that uses the LIFO method will *most likely* appear more:

A liquid.

B efficient.

C profitable.

22 Nutmeg, Inc. uses the LIFO method to account for inventory. During years in which inventory unit costs are generally rising and in which the company purchases more inventory than it sells to customers, its reported gross profit margin will *most likely* be:

A lower than it would be if the company used the FIFO method.

B higher than it would be if the company used the FIFO method.

C about the same as it would be if the company used the FIFO method.

23 Compared to using the FIFO method to account for inventory, during periods of rising prices, a company using the LIFO method is *most likely* to report higher:

  A net income.

  B cost of sales.

  C income taxes.

24 Carey Company adheres to US GAAP, whereas Jonathan Company adheres to IFRS. It is *least likely* that:

  A Carey has reversed an inventory write-down.

  B Jonathan has reversed an inventory write-down.

  C Jonathan and Carey both use the FIFO inventory accounting method.

---

25 Company A adheres to US GAAP and Company B adheres to IFRS. Which of the following is *most likely* to be disclosed on the financial statements of both companies?

  A Any material income resulting from the liquidation of LIFO inventory

  B The amount of inventories recognized as an expense during the period

  C The circumstances that led to the reversal of a write down of inventories

26 Which of the following *most likely* signals that a manufacturing company expects demand for its product to increase?

  A Finished goods inventory growth rate higher than the sales growth rate

  B Higher unit volumes of work in progress and raw material inventories

  C Substantially higher finished goods, with lower raw materials and work-in-process

27 Compared with a company that uses the FIFO method, during a period of rising unit inventory costs, a company using the LIFO method will *most likely* appear more:

  A liquid.

  B efficient.

  C profitable.

28 In a period of declining inventory unit costs and constant or increasing inventory quantities, which inventory method is *most likely* to result in a higher debt-to-equity ratio?

  A LIFO

  B FIFO

  C Weighted average cost

The following information relates to Questions 29–36

Hans Annan, CFA, a food and beverage analyst, is reviewing Century Chocolate's inventory policies as part of his evaluation of the company. Century Chocolate, based in Switzerland, manufactures chocolate products and purchases and resells other confectionery products to complement its chocolate line. Annan visited Century Chocolate's manufacturing facility last year. He learned that cacao beans, imported

from Brazil, represent the most significant raw material and that the work-in-progress inventory consists primarily of three items: roasted cacao beans, a thick paste produced from the beans (called chocolate liquor), and a sweetened mixture that needs to be "conched" to produce chocolate. On the tour, Annan learned that the conching process ranges from a few hours for lower-quality products to six days for the highest-quality chocolates. While there, Annan saw the facility's climate-controlled area where manufactured finished products (cocoa and chocolate) and purchased finished goods are stored prior to shipment to customers. After touring the facility, Annan had a discussion with Century Chocolate's CFO regarding the types of costs that were included in each inventory category.

Annan has asked his assistant, Joanna Kern, to gather some preliminary information regarding Century Chocolate's financial statements and inventories. He also asked Kern to calculate the inventory turnover ratios for Century Chocolate and another chocolate manufacturer for the most recent five years. Annan does not know Century Chocolate's most direct competitor, so he asks Kern to do some research and select the most appropriate company for the ratio comparison.

Kern reports back that Century Chocolate prepares its financial statements in accordance with IFRS. She tells Annan that the policy footnote states that raw materials and purchased finished goods are valued at purchase cost whereas work in progress and manufactured finished goods are valued at production cost. Raw material inventories and purchased finished goods are accounted for using the FIFO (first-in, first-out) method, and the weighted average cost method is used for other inventories. An allowance is established when the net realisable value of any inventory item is lower than the value calculated above.

Kern provides Annan with the selected financial statements and inventory data for Century Chocolate shown in Exhibits 1 through 5. The ratio exhibit Kern prepared compares Century Chocolate's inventory turnover ratios to those of Gordon's Goodies, a US-based company. Annan returns the exhibit and tells Kern to select a different competitor that reports using IFRS rather than US GAAP. During this initial review, Annan asks Kern why she has not indicated whether Century Chocolate uses a perpetual or a periodic inventory system. Kern replies that she learned that Century Chocolate uses a perpetual system but did not include this information in her report because inventory values would be the same under either a perpetual or periodic inventory system. Annan tells Kern she is wrong and directs her to research the matter.

While Kern is revising her analysis, Annan reviews the most recent month's Cocoa Market Review from the International Cocoa Organization. He is drawn to the statement that "the ICCO daily price, averaging prices in both futures markets, reached a 29-year high in US$ terms and a 23-year high in SDRs terms (the SDR unit comprises a basket of major currencies used in international trade: US$, euro, pound sterling and yen)." Annan makes a note that he will need to factor the potential continuation of this trend into his analysis.

Exhibit 1 Century Chocolate Income Statements (CHF Millions)		
For Years Ended 31 December	**2018**	**2017**
Sales	95,290	93,248
Cost of sales	−41,043	−39,047
Marketing, administration, and other expenses	−35,318	−42,481
Profit before taxes	**18,929**	**11,720**
Taxes	−3,283	−2,962
Profit for the period	**15,646**	**8,758**

Exhibit 2 Century Chocolate Balance Sheets (CHF Millions)

31 December	2018	2017
Cash, cash equivalents, and short-term investments	6,190	8,252
Trade receivables and related accounts, net	11,654	12,910
Inventories, net	8,100	7,039
Other current assets	2,709	2,812
Total current assets	**28,653**	**31,013**
Property, plant, and equipment, net	18,291	19,130
Other non-current assets	45,144	49,875
Total assets	**92,088**	**100,018**
Trade and other payables	10,931	12,299
Other current liabilities	17,873	25,265
Total current liabilities	**28,804**	**37,564**
Non-current liabilities	15,672	14,963
Total liabilities	**44,476**	**52,527**
Equity		
Share capital	332	341
Retained earnings and other reserves	47,280	47,150
Total equity	**47,612**	**47,491**
Total liabilities and shareholders' equity	**92,088**	**100,018**

Exhibit 3 Century Chocolate Supplementary Footnote Disclosures: Inventories (CHF Millions)

31 December	2018	2017
Raw Materials	2,154	1,585
Work in Progress	1,061	1,027
Finished Goods	5,116	4,665
Total inventories before allowance	8,331	7,277
Allowance for write-downs to net realisable value	−231	−238
Total inventories net of allowance	8,100	7,039

Exhibit 4 Century Chocolate Inventory Record for Purchased Lemon Drops

Date		Cartons	Per Unit Amount (CHF)
	Beginning inventory	100	22
4 Feb 09	Purchase	40	25

(continued)

Exhibit 4   (Continued)

Date		Cartons	Per Unit Amount (CHF)
3 Apr 09	Sale	50	32
23 Jul 09	Purchase	70	30
16 Aug 09	Sale	100	32
9 Sep 09	Sale	35	32
15 Nov 09	Purchase	100	28

Exhibit 5   Century Chocolate Net Realisable Value Information for Black Licorice Jelly Beans

	2018	2017
FIFO cost of inventory at 31 December (CHF)	314,890	374,870
Ending inventory at 31 December (Kilograms)	77,750	92,560
Cost per unit (CHF)	4.05	4.05
Net Realisable Value (CHF per Kilograms)	4.20	3.95

29 The costs *least likely* to be included by the CFO as inventory are:
   A storage costs for the chocolate liquor.
   B excise taxes paid to the government of Brazil for the cacao beans.
   C storage costs for chocolate and purchased finished goods awaiting shipment to customers.

30 What is the *most likely* justification for Century Chocolate's choice of inventory valuation method for its purchased finished goods?
   A It is the preferred method under IFRS.
   B It allocates the same per unit cost to both cost of sales and inventory.
   C Ending inventory reflects the cost of goods purchased most recently.

31 In Kern's comparative ratio analysis, the 2018 inventory turnover ratio for Century Chocolate is *closest* to:
   A 5.07.
   B 5.42.
   C 5.55.

32 The *most accurate* statement regarding Annan's reasoning for requiring Kern to select a competitor that reports under IFRS for comparative purposes is that under US GAAP:
   A fair values are used to value inventory.
   B the LIFO method is permitted to value inventory.
   C the specific identification method is permitted to value inventory.

33 Annan's statement regarding the perpetual and periodic inventory systems is most significant when which of the following costing systems is used?
   A LIFO.

  B FIFO.

  C Specific identification.

34 Using the inventory record for purchased lemon drops shown in Exhibit 4, the cost of sales for 2018 will be *closest* to:

  A CHF 3,550.

  B CHF 4,550.

  C CHF 4,850.

35 Ignoring any tax effect, the 2018 net realisable value reassessment for the black licorice jelly beans will *most likely* result in:

  A an increase in gross profit of CHF 7,775.

  B an increase in gross profit of CHF 11,670.

  C no impact on cost of sales because under IFRS, write-downs cannot be reversed.

36 If the trend noted in the ICCO report continues and Century Chocolate plans to maintain constant or increasing inventory quantities, the *most likely* impact on Century Chocolate's financial statements related to its raw materials inventory will be:

  A a cost of sales that more closely reflects current replacement values.

  B a higher allocation of the total cost of goods available for sale to cost of sales.

  C a higher allocation of the total cost of goods available for sale to ending inventory.

The following information relates to Questions 37–42

John Martinson, CFA, is an equity analyst with a large pension fund. His supervisor, Linda Packard, asks him to write a report on Karp Inc. Karp prepares its financial statements in accordance with US GAAP. Packard is particularly interested in the effects of the company's use of the LIFO method to account for its inventory. For this purpose, Martinson collects the financial data presented in Exhibits 1 and 2.

Exhibit 1 Balance Sheet Information (US$ Millions)		
As of 31 December	**2018**	**2017**
Cash and cash equivalents	172	157
Accounts receivable	626	458
Inventories	620	539
Other current assets	125	65
Total current assets	1,543	1,219
Property and equipment, net	3,035	2,972
Total assets	4,578	4,191
Total current liabilities	1,495	1,395
Long-term debt	644	604
	(continued)	

Exhibit 1	(Continued)	
As of 31 December	**2018**	**2017**
Total liabilities	2,139	1,999
Common stock and paid in capital	1,652	1,652
Retained earnings	787	540
Total shareholders' equity	2,439	2,192
Total liabilities and shareholders' equity	**4,578**	**4,191**

Exhibit 2	Income Statement Information (US$ Millions)	
For the Year Ended 31 December	**2018**	**2017**
Sales	4,346	4,161
Cost of goods sold	2,211	2,147
Depreciation and amortisation expense	139	119
Selling, general, and administrative expense	1,656	1,637
Interest expense	31	18
Income tax expense	62	48
Net income	247	192

Martinson finds the following information in the notes to the financial statements:

■   The LIFO reserves as of 31 December 2018 and 2017 are $155 million and $117 million respectively, and

■   The effective income tax rate applicable to Karp for 2018 and earlier periods is 20 percent.

37 If Karp had used FIFO instead of LIFO, the amount of inventory reported as of 31 December 2018 would have been *closest* to:

   A $465 million.

   B $658 million.

   C $775 million.

38 If Karp had used FIFO instead of LIFO, the amount of cost of goods sold reported by Karp for the year ended 31 December 2018 would have been *closest* to:

   A $2,056 million.

   B $2,173 million.

   C $2,249 million.

39 If Karp had used FIFO instead of LIFO, its reported net income for the year ended 31 December 2018 would have been higher by an amount *closest to*:

   A $30 million.

   B $38 million.

   C $155 million.

40 If Karp had used FIFO instead of LIFO, Karp's retained earnings as of 31 December 2018 would have been higher by an amount *closest to*:

   A $117 million.

   B $124 million.

   C $155 million.

41 If Karp had used FIFO instead of LIFO, which of the following ratios computed as of 31 December 2018 would *most likely* have been lower?

   A Cash ratio.

   B Current ratio.

   C Gross profit margin.

42 If Karp had used FIFO instead of LIFO, its debt to equity ratio computed as of 31 December 2018 would have:

   A increased.

   B decreased.

   C remained unchanged.

The following information relates to Questions 43–48

Robert Groff, an equity analyst, is preparing a report on Crux Corp. As part of his report, Groff makes a comparative financial analysis between Crux and its two main competitors, Rolby Corp. and Mikko Inc. Crux and Mikko report under US GAAP and Rolby reports under IFRS.

Groff gathers information on Crux, Rolby, and Mikko. The relevant financial information he compiles is in Exhibit 1. Some information on the industry is in Exhibit 2.

Exhibit 1 Selected Financial Information (US$ Millions)			
	Crux	**Rolby**	**Mikko**
Inventory valuation method	LIFO	FIFO	LIFO
From the Balance Sheets			
As of 31 December 2018			
Inventory, gross	480	620	510
Valuation allowance	20	25	14
Inventory, net	460	595	496
Total debt	1,122	850	732
Total shareholders' equity	2,543	2,403	2,091
As of 31 December 2017			
Inventory, gross	465	602	401
Valuation allowance	23	15	12
Inventory, net	442	587	389
From the Income Statements			
Year Ended 31 December 2018			

(continued)

Exhibit 1   (Continued)

	Crux	Rolby	Mikko
Revenues	4,609	5,442	3,503
Cost of goods sold[a]	3,120	3,782	2,550
Net income	229	327	205
[a]Charges included in cost of goods sold for inventory write-downs*	13	15	15

* This does not match the change in the inventory valuation allowance because the valuation allowance is reduced to reflect the valuation allowance attached to items sold and increased for additional necessary write-downs.

LIFO Reserve			
As of 31 December 2018	55	0	77
As of 31 December 2017	72	0	50
As of 31 December 2016	96	0	43
Tax Rate			
Effective tax rate	30%	30%	30%

Exhibit 2   Industry Information

	2018	2017	2016
Raw materials price index	112	105	100
Finished goods price index	114	106	100

To compare the financial performance of the three companies, Groff decides to convert LIFO figures into FIFO figures, and adjust figures to assume no valuation allowance is recognized by any company.

After reading Groff's draft report, his supervisor, Rachel Borghi, asks him the following questions:

Question 1   Which company's gross profit margin would best reflect current costs of the industry?

Question 2   Would Rolby's valuation method show a higher gross profit margin than Crux's under an inflationary, a deflationary, or a stable price scenario?

Question 3   Which group of ratios usually appears more favorable with an inventory write-down?

43 Crux's inventory turnover ratio computed as of 31 December 2018, after the adjustments suggested by Groff, is *closest* to:

   A   5.67.

   B   5.83.

   C   6.13.

44 Rolby's net profit margin for the year ended 31 December 2018, after the adjustments suggested by Groff, is *closest* to:

A 6.01%.

B 6.20%.

C 6.28%.

45 Compared with its unadjusted debt-to-equity ratio, Mikko's debt-to-equity ratio as of 31 December 2018, after the adjustments suggested by Groff, is:

A lower.

B higher.

C the same.

46 The *best* answer to Borghi's Question 1 is:

A Crux's.

B Rolby's.

C Mikko's.

47 The *best* answer to Borghi's Question 2 is:

A Stable.

B Inflationary.

C Deflationary.

48 The *best* answer to Borghi's Question 3 is:

A Activity ratios.

B Solvency ratios.

C Profitability ratios.

The following information relates to Questions 49–55

ZP Corporation is a (hypothetical) multinational corporation headquartered in Japan that trades on numerous stock exchanges. ZP prepares its consolidated financial statements in accordance with US GAAP. Excerpts from ZP's 2018 annual report are shown in Exhibits 1–3.

Exhibit 1 Consolidated Balance Sheets (¥ Millions)		
31 December	**2017**	**2018**
Current Assets		
Cash and cash equivalents	¥542,849	¥814,760
⋮	⋮	⋮
Inventories	608,572	486,465
⋮	⋮	⋮
Total current assets	4,028,742	3,766,309
⋮	⋮	⋮
Total assets	**¥10,819,440**	**¥9,687,346**

(continued)

Exhibit 1   (Continued)

31 December	2017	2018
⋮	⋮	⋮
Total current liabilities	¥3,980,247	¥3,529,765
⋮	⋮	⋮
Total long-term liabilities	2,663,795	2,624,002
Minority interest in consolidated subsidiaries	218,889	179,843
Total shareholders' equity	3,956,509	3,353,736
Total liabilities and shareholders' equity	**¥10,819,440**	**¥9,687,346**

Exhibit 2   Consolidated Statements of Income (¥ Millions)

For the years ended 31 December	2016	2017	2018
Net revenues			
Sales of products	¥7,556,699	¥8,273,503	¥6,391,240
Financing operations	425,998	489,577	451,950
	7,982,697	8,763,080	6,843,190
Cost and expenses			
Cost of products sold	6,118,742	6,817,446	5,822,805
Cost of financing operations	290,713	356,005	329,128
Selling, general and administrative	827,005	832,837	844,927
⋮	⋮	⋮	⋮
Operating income (loss)	746,237	756,792	−153,670
⋮	⋮	⋮	⋮
Net income	**¥548,011**	**¥572,626**	**−¥145,646**

Exhibit 3   Selected Disclosures in the 2018 Annual Report

Management's Discussion and Analysis of Financial Condition and Results of Operations

Cost reduction efforts were offset by increased prices of raw materials, other production materials and parts ... Inventories decreased during fiscal 2009 by ¥122.1 billion, or 20.1%, to ¥486.5 billion. This reflects the impacts of decreased sales volumes and fluctuations in foreign currency translation rates.

Management & Corporate Information
Risk Factors
Industry and Business Risks

Exhibit 3	(Continued)

The worldwide market for our products is highly competitive. ZP faces intense competition from other manufacturers in the respective markets in which it operates. Competition has intensified due to the worldwide deterioration in economic conditions. In addition, competition is likely to further intensify because of continuing globalization, possibly resulting in industry reorganization. Factors affecting competition include product quality and features, the amount of time required for innovation and development, pricing, reliability, safety, economy in use, customer service and financing terms. Increased competition may lead to lower unit sales and excess production capacity and excess inventory. This may result in a further downward price pressure.

ZP's ability to adequately respond to the recent rapid changes in the industry and to maintain its competitiveness will be fundamental to its future success in maintaining and expanding its market share in existing and new markets.

Notes to Consolidated Financial Statements
2. Summary of significant accounting policies:

Inventories. Inventories are valued at cost, not in excess of market. Cost is determined on the "average-cost" basis, except for the cost of finished products carried by certain subsidiary companies which is determined "last-in, first-out" ("LIFO") basis. Inventories valued on the LIFO basis totaled ¥94,578 million and ¥50,037 million at December 31, 2017 and 2018, respectively. Had the "first-in, first-out" basis been used for those companies using the LIFO basis, inventories would have been ¥10,120 million and ¥19,660 million higher than reported at December 31, 2017 and 2018, respectively.

9. Inventories:

Inventories consist of the following:

31 December (¥ Millions)	2017	2018
Finished goods	¥ 403,856	¥ 291,977
Raw materials	99,869	85,966
Work in process	79,979	83,890
Supplies and other	24,868	24,632
	¥ 608,572	¥ 486,465

49 The MD&A indicated that the prices of raw material, other production materials, and parts increased. Based on the inventory valuation methods described in Note 2, which inventory classification would *least accurately* reflect current prices?

  A   Raw materials.

  B   Finished goods.

  C   Work in process.

50 The 2017 inventory value as reported on the 2018 Annual Report if the company had used the FIFO inventory valuation method instead of the LIFO inventory valuation method for a portion of its inventory would be *closest* to:

    A ¥104,698 million.

    B ¥506,125 million.

    C ¥618,692 million.

51 If ZP had prepared its financial statement in accordance with IFRS, the inventory turnover ratio (using average inventory) for 2018 would be:

    A lower.

    B higher.

    C the same.

52 Inventory levels decreased from 2017 to 2018 for all of the following reasons *except*:

    A LIFO liquidation.

    B decreased sales volume.

    C fluctuations in foreign currency translation rates.

53 Which observation is *most likely* a result of looking only at the information reported in Note 9?

    A Increased competition has led to lower unit sales.

    B There have been significant price increases in supplies.

    C Management expects a further downturn in sales during 2010.

54 Note 2 indicates that, "Inventories valued on the LIFO basis totaled ¥94,578 million and ¥50,037 million at December 31, 2017 and 2018, respectively." Based on this, the LIFO reserve should *most likely*:

    A increase.

    B decrease.

    C remain the same.

55 The Industry and Business Risk excerpt states that, "Increased competition may lead to lower unit sales and excess production capacity and excess inventory. This may result in a further downward price pressure." The downward price pressure could lead to inventory that is valued above current market prices or net realisable value. Any write-downs of inventory are *least likely* to have a significant effect on the inventory valued using:

    A weighted average cost.

    B first-in, first-out (FIFO).

    C last-in, first-out (LIFO).

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:

Inventory turnover ratio = Cost of goods sold/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:

    COGS (FIFO) = COGS (LIFO) − Increase in LIFO reserve
    COGS (FIFO) = £50,800 − (£4,320 − £2,600)
    COGS (FIFO) = £49,080

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 2018, 5,000 units of inventory were 2017 units at €10 each and 50,000 were 2008 purchases at €11. The weighted average cost of inventory during 2008 was thus (5,000 × 10) + (50,000 × 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 × 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 2018 depleted the 2017 inventory. Of the inventory purchased in 2018, 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 2017. 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 2018 to 2017. The 2017 cost of sales was higher because of the write-down, and the 2018 cost of sales was lower because of the reversal of the write-down. As a result, the reported 2018 profits were overstated. Inventory balance in 2018 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 2018 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 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:

     100 (beginning inventory) × 22 = 2,200

     40 (4 February 2009) × 25 = 1,000

     45 (23 July 2009) × 30 = 1,350

     Cost of sales = 2,200 + 1,000 + 1,350 = CHF 4,550

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 2017 can be reversed. The write-down in 2017 was 9,256 [92,560 × (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 × (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 2018, Karp's inventory under FIFO equals:

Inventory (FIFO method) = Inventory (LIFO method) + LIFO reserve
= $620 million + 155 million
= $775 million

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 2018, Karp's cost of goods sold under FIFO equals:

COGS (FIFO method) = COGS (LIFO method) − Increase in LIFO reserve
= $2,211 million − (155 million − 117 million)
= $2,173 million

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 2018, Karp's net income under FIFO equals:

NI (FIFO method) = NI (LIFO method) + Increase in LIFO reserve × (1 − Tax rate)
= $247 million + 38 million × (1 − 20%)
= $277.4 million

Therefore, the increase in net income is:

Increase in NI = NI (FIFO method) − NI (LIFO method)
= $277 million − 247 million
= $30.4 million

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 2018, Karp's retained earnings under FIFO equals:

RE (FIFO method) = RE (LIFO method) + LIFO reserve × (1 − Tax rate)
= $787 million + 155 million × (1 − 20%)
= $911 million

Therefore, the increase in retained earnings is:

Increase in RE = RE (FIFO method) − RE (LIFO method)
= $911 million − 787 million
= $124 million

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.

COGS (adjusted) = COGS (LIFO method) − Charges included in
                        cost of goods sold for inventory write-downs − Change
                        in LIFO reserve
          = \$3,120 million − 13 million − (55 million − 72 million)
          = \$3,124 million

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.

Ending inventory (FIFO) = Ending inventory (LIFO) + LIFO reserve

Ending inventory 2018 (FIFO) = \$480 + 55 = \$535

Ending inventory 2017 (FIFO) = \$465 + 72 = \$537

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

Therefore, adjusted inventory turnover ratio equals:

Inventory turnover ratio = COGS/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.

NI (adjusted) = NI (FIFO method) + Charges, included in cost of goods
                    sold for inventory write-downs, after tax
          = \$327 million + 15 million × (1 − 30%)
          = \$337.5 million

Therefore, adjusted net profit margin equals:

Net profit margin = NI/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 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

2018 inventory turnover ratio as reported = 10.63 = ¥5,822,805/[(608,572 + 486,465)/2].

2018 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].

52 A is correct. No LIFO liquidation occurred during 2018; the LIFO reserve increased from ¥10,120 million in 2008 to ¥19,660 million in 2018. 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.

53 C is correct. Finished goods and raw materials inventories are lower in 2018 when compared to 2017. Reduced levels of inventory typically indicate an anticipated business contraction.

54 B is correct. The decrease in LIFO inventory in 2018 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 2017 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.

55 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.

SUMMARY

Understanding the reporting of long-lived assets at inception requires distinguishing between expenditures that are capitalised (i.e., reported as long-lived assets) and those that are expensed. Once a long-lived asset is recognised, it is reported under the cost model at its historical cost less accumulated depreciation (amortisation) and less any impairment or under the revaluation model at its fair value. IFRS permit the use of either the cost model or the revaluation model, whereas US GAAP require the use of the cost model. Most companies reporting under IFRS use the cost model. The choice of different methods to depreciate (amortise) long-lived assets can create challenges for analysts comparing companies.

Key points include the following:

■ Expenditures related to long-lived assets are capitalised as part of the cost of assets if they are expected to provide future benefits, typically beyond one year. Otherwise, expenditures related to long-lived assets are expensed as incurred.

■ Although capitalising expenditures, rather than expensing them, results in higher reported profitability in the initial year, it results in lower profitability in subsequent years; however, if a company continues to purchase similar or increasing amounts of assets each year, the profitability-enhancing effect of capitalisation continues.

■ Capitalising an expenditure rather than expensing it results in a greater amount reported as cash from operations because capitalised expenditures are classified as an investing cash outflow rather than an operating cash outflow.

■ Companies must capitalise interest costs associated with acquiring or constructing an asset that requires a long period of time to prepare for its intended use.

■ Including capitalised interest in the calculation of interest coverage ratios provides a better assessment of a company's solvency.

■ IFRS require research costs be expensed but allow all development costs (not only software development costs) to be capitalised under certain conditions. Generally, US accounting standards require that research and development costs be expensed; however, certain costs related to software development are required to be capitalised.

■ When one company acquires another company, the transaction is accounted for using the acquisition method of accounting in which the company identified as the acquirer allocates the purchase price to each asset acquired (and each liability assumed) on the basis of its fair value. Under acquisition accounting, if the purchase price of an acquisition exceeds the sum of the amounts that can be allocated to individual identifiable assets and liabilities, the excess is recorded as goodwill.

■ The capitalised costs of long-lived tangible assets and of intangible assets with finite useful lives are allocated to expense in subsequent periods over their useful lives. For tangible assets, this process is referred to as depreciation, and for intangible assets, it is referred to as amortisation.

■ Long-lived tangible assets and intangible assets with finite useful lives are reviewed for impairment whenever changes in events or circumstances indicate that the carrying amount of an asset may not be recoverable.

■ Intangible assets with an indefinite useful life are not amortised but are reviewed for impairment annually.

- Impairment disclosures can provide useful information about a company's expected cash flows.

- Methods of calculating depreciation or amortisation expense include the straight-line method, in which the cost of an asset is allocated to expense in equal amounts each year over its useful life; accelerated methods, in which the allocation of cost is greater in earlier years; and the units-of-production method, in which the allocation of cost corresponds to the actual use of an asset in a particular period.

- Estimates required for depreciation and amortisation calculations include the useful life of the equipment (or its total lifetime productive capacity) and its expected residual value at the end of that useful life. A longer useful life and higher expected residual value result in a smaller amount of annual depreciation relative to a shorter useful life and lower expected residual value.

- IFRS permit the use of either the cost model or the revaluation model for the valuation and reporting of long-lived assets, but the revaluation model is not allowed under US GAAP.

- Under the revaluation model, carrying amounts are the fair values at the date of revaluation less any subsequent accumulated depreciation or amortisation.

- In contrast with depreciation and amortisation charges, which serve to allocate the cost of a long-lived asset over its useful life, impairment charges reflect an unexpected decline in the fair value of an asset to an amount lower than its carrying amount.

- IFRS permit impairment losses to be reversed, with the reversal reported in profit. US GAAP do not permit the reversal of impairment losses.

- 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.

- Estimates of average age and remaining useful life of a company's assets reflect the relationship between assets accounted for on a historical cost basis and depreciation amounts.

- The average remaining useful life of a company's assets can be estimated as net PPE divided by depreciation expense, although the accounting useful life may not necessarily correspond to the economic useful life.

- Long-lived assets reclassified as held for sale cease to be depreciated or amortised. Long-lived assets to be disposed of other than by a sale (e.g., by abandonment, exchange for another asset, or distribution to owners in a spin-off) are classified as held for use until disposal. Thus, they continue to be depreciated and tested for impairment.

- Investment property is defined as property that is owned (or, in some cases, leased under a finance lease) for the purpose of earning rentals, capital appreciation, or both.

- Under IFRS, companies are allowed to value investment properties using either a cost model or a fair value model. The cost model is identical to the cost model used for property, plant, and equipment, but the fair value model differs from the revaluation model used for property, plant, and equipment. Unlike the revaluation model, under the fair value model, all changes in the fair value of investment property affect net income.

- Under US GAAP, investment properties are generally measured using the cost model.

PRACTICE PROBLEMS

1 JOOVI Inc. has recently purchased and installed a new machine for its manufacturing plant. The company incurred the following costs:

Purchase price	$12,980
Freight and insurance	$1,200
Installation	$700
Testing	$100
Maintenance staff training costs	$500

The total cost of the machine to be shown on JOOVI's balance sheet is *closest* to:

A $14,180.

B $14,980.

C $15,480.

2 Which costs incurred with the purchase of property and equipment are expensed?

A Delivery charges

B Installation and testing

C Training required to use the property and equipment

3 When constructing an asset for sale, directly related borrowing costs are *most likely*:

A expensed as incurred.

B capitalized as part of inventory.

C capitalized as part of property, plant, and equipment.

4 BAURU, S.A., a Brazilian corporation, borrows capital from a local bank to finance the construction of its manufacturing plant. The loan has the following conditions:

Borrowing date	1 January 2009
Amount borrowed	500 million Brazilian real (BRL)
Annual interest rate	14 percent
Term of the loan	3 years
Payment method	Annual payment of interest only. Principal amortization is due at the end of the loan term.

The construction of the plant takes two years, during which time BAURU earned BRL 10 million by temporarily investing the loan proceeds. Which of the following is the amount of interest related to the plant construction (in BRL million) that can be capitalized in BAURU's balance sheet?

A 130.

B 140.

C 210.

5 After reading the financial statements and footnotes of a company that follows IFRS, an analyst identified the following intangible assets:

● product patent expiring in 40 years;

- copyright with no expiration date; and
- goodwill acquired 2 years ago in a business combination.

Which of these assets is an intangible asset with a finite useful life?

	Product Patent	Copyright	Goodwill
A	Yes	Yes	No
B	Yes	No	No
C	No	Yes	Yes

6 Intangible assets with finite useful lives *mostly* differ from intangible assets with infinite useful lives with respect to accounting treatment of:

   A revaluation.

   B impairment.

   C amortization.

7 Costs incurred for intangible assets are generally expensed when they are:

   A internally developed.

   B individually acquired.

   C acquired in a business combination.

8 Under US GAAP, when assets are acquired in a business combination, goodwill *most likely* arises from:

   A contractual or legal rights.

   B assets that can be separated from the acquired company.

   C assets that are neither tangible nor identifiable intangible assets.

9 All else equal, in the fiscal year when long-lived equipment is purchased:

   A depreciation expense increases.

   B cash from operations decreases.

   C net income is reduced by the amount of the purchase.

10 Companies X and Z have the same beginning-of-the-year book value of equity and the same tax rate. The companies have identical transactions throughout the year and report all transactions similarly except for one. Both companies acquire a £300,000 printer with a three-year useful life and a salvage value of £0 on 1 January of the new year. Company X capitalizes the printer and depreciates it on a straight-line basis, and Company Z expenses the printer. The following year-end information is gathered for Company X.

	Company X As of 31 December
Ending shareholders' equity	£10,000,000
Tax rate	25%
Dividends	£0.00
Net income	£750,000

Based on the information given, Company Z's return on equity using year-end equity will be *closest* to:

   A 5.4%.

   B 6.1%.

   C 7.5%.

11   A financial analyst is studying the income statement effect of two alternative depreciation methods for a recently acquired piece of equipment. She gathers the following information about the equipment's expected production life and use:

	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Units of production	2,000	2,000	2,000	2,000	2,500	10,500

Compared with the units-of-production method of depreciation, if the company uses the straight-line method to depreciate the equipment, its net income in Year 1 will *most likely* be:

    A   lower.

    B   higher.

    C   the same.

12   A company purchases a piece of equipment for €1,500. The equipment is expected to have a useful life of five years and no residual value. In the first year of use, the units of production are expected to be 15% of the equipment's lifetime production capacity and the equipment is expected to generate €1,500 of revenue and incur €500 of cash expenses.

The depreciation method yielding the lowest operating profit on the equipment in the first year of use is:

    A   straight line.

    B   units of production.

    C   double-declining balance.

13   Juan Martinez, CFO of VIRMIN, S.A., is selecting the depreciation method to use for a new machine. The machine has an expected useful life of six years. Production is expected to be relatively low initially but to increase over time. The method chosen for tax reporting must be the same as the method used for financial reporting. If Martinez wants to minimize tax payments in the first year of the machine's life, which of the following depreciation methods is Martinez *most likely* to use?

    A   Straight-line method.

    B   Units-of-production method.

    C   Double-declining balance method.

The following information relates to Questions 14–15

Miguel Rodriguez of MARIO S.A., an Uruguayan corporation, is computing the depreciation expense of a piece of manufacturing equipment for the fiscal year ended 31 December 2009. The equipment was acquired on 1 January 2009. Rodriguez gathers the following information (currency in Uruguayan pesos, UYP):

Cost of the equipment	UYP 1,200,000
Estimated residual value	UYP 200,000
Expected useful life	8 years
Total productive capacity	800,000 units

Production in FY 2009	135,000 units
Expected production for the next 7 years	95,000 units each year

14 If MARIO uses the straight-line method, the amount of depreciation expense on MARIO's income statement related to the manufacturing equipment is *closest* to:

A 125,000.

B 150,000.

C 168,750.

15 If MARIO uses the units-of-production method, the amount of depreciation expense (in UYP) on MARIO's income statement related to the manufacturing equipment is *closest* to:

A 118,750.

B 168,750.

C 202,500.

16 Which of the following amortization methods is *most likely* to evenly distribute the cost of an intangible asset over its useful life?

A Straight-line method.

B Units-of-production method.

C Double-declining balance method.

17 Which of the following will cause a company to show a lower amount of amortization of intangible assets in the first year after acquisition?

A A higher residual value.

B A higher amortization rate.

C A shorter useful life.

18 A company purchases equipment for $200,000 with a five-year useful life and salvage value of zero. It uses the double-declining balance method of depreciation for two years, then shifts to straight-line depreciation at the beginning of Year 3. Compared with annual depreciation expense under the double-declining balance method, the resulting annual depreciation expense in Year 4 is:

A smaller.

B the same.

C greater.

19 An analyst in the finance department of BOOLDO S.A., a French corporation, is computing the amortization of a customer list, an intangible asset, for the fiscal year ended 31 December 2009. She gathers the following information about the asset:

Acquisition cost	€2,300,000
Acquisition date	1 January 2008
Expected residual value at time of acquisition	€500,000

The customer list is expected to result in extra sales for three years after acquisition. The present value of these expected extra sales exceeds the cost of the list.

If the analyst uses the straight-line method, the amount of accumulated amortization related to the customer list as of 31 December 2009 is *closest* to:

A   €600,000.

B   €1,200,000.

C   €1,533,333.

20   A financial analyst is analyzing the amortization of a product patent acquired by MAKETTI S.p.A., an Italian corporation. He gathers the following information about the patent:

Acquisition cost	€5,800,000
Acquisition date	1 January 2009
Patent expiration date	31 December 2015
Total plant capacity of patented product	40,000 units per year
Production of patented product in fiscal year ended 31 December 2009	20,000 units
Expected production of patented product during life of the patent	175,000 units

If the analyst uses the units-of-production method, the amortization expense on the patent for fiscal year 2009 is *closest* to:

A   €414,286.

B   €662,857.

C   €828,571.

21   A company acquires a patent with an expiration date in six years for ¥100 million. The company assumes that the patent will generate economic benefits that will decline over time and decides to amortize the patent using the double-declining balance method. The annual amortization expense in Year 4 is closest to:

A   ¥6.6 million.

B   ¥9.9 million.

C   ¥19.8 million.

22   A company is comparing straight-line and double-declining balance amortization methods for a non-renewable six-year license, acquired for €600,000. The difference between the Year 4 ending net book values using the two methods is *closest to*:

A   €81,400.

B   €118,600.

C   €200,000.

23   MARU S.A. de C.V., a Mexican corporation that follows IFRS, has elected to use the revaluation model for its property, plant, and equipment. One of MARU's machines was purchased for 2,500,000 Mexican pesos (MXN) at the beginning of the fiscal year ended 31 March 2010. As of 31 March 2010, the machine has a fair value of MXN 3,000,000. Should MARU show a profit for the revaluation of the machine?

A   Yes.

B   No, because this revaluation is recorded directly in equity.

C   No, because value increases resulting from revaluation can never be recognized as a profit.

24   An analyst is studying the impairment of the manufacturing equipment of WLP Corp., a UK-based corporation that follows IFRS. He gathers the following information about the equipment:

Fair value	£16,800,000
Costs to sell	£800,000
Value in use	£14,500,000
Net carrying amount	£19,100,000

The amount of the impairment loss on WLP Corp.'s income statement related to its manufacturing equipment is *closest* to:

A   £2,300,000.

B   £3,100,000.

C   £4,600,000.

25 Under IFRS, an impairment loss on a property, plant, and equipment asset is measured as the excess of the carrying amount over the asset's:

A   fair value.

B   recoverable amount.

C   undiscounted expected future cash flows.

26 A financial analyst at BETTO S.A. is analyzing the result of the sale of a vehicle for 85,000 Argentine pesos (ARP) on 31 December 2009. The analyst compiles the following information about the vehicle:

Acquisition cost of the vehicle	ARP 100,000
Acquisition date	1 January 2007
Estimated residual value at acquisition date	ARP 10,000
Expected useful life	9 years
Depreciation method	Straight-line

The result of the sale of the vehicle is *most likely*:

A   a loss of ARP 15,000.

B   a gain of ARP 15,000.

C   a gain of ARP 18,333.

27 CROCO S.p.A sells an intangible asset with a historical acquisition cost of €12 million and an accumulated depreciation of €2 million and reports a loss on the sale of €3.2 million. Which of the following amounts is *most likely* the sale price of the asset?

A   €6.8 million

B   €8.8 million

C   €13.2 million

28 The impairment of intangible assets with finite lives affects:

A   the balance sheet but not the income statement.

B   the income statement but not the balance sheet.

C   both the balance sheet and the income statement.

29 The gain or loss on a sale of a long-lived asset to which the revaluation model has been applied is *most likely* calculated using sales proceeds less:

A   carrying amount.

B   carrying amount adjusted for impairment.

C   historical cost net of accumulated depreciation.

30 According to IFRS, all of the following pieces of information about property, plant, and equipment must be disclosed in a company's financial statements and footnotes *except for*:

   A useful lives.

   B acquisition dates.

   C amount of disposals.

31 According to IFRS, all of the following pieces of information about intangible assets must be disclosed in a company's financial statements and footnotes *except for*:

   A fair value.

   B impairment loss.

   C amortization rate.

32 Which of the following is a required financial statement disclosure for long-lived intangible assets under US GAAP?

   A The useful lives of assets

   B The reversal of impairment losses

   C Estimated amortization expense for the next five fiscal years

33 Which of the following characteristics is *most likely* to differentiate investment property from property, plant, and equipment?

   A It is tangible.

   B It earns rent.

   C It is long-lived.

34 If a company uses the fair value model to value investment property, changes in the fair value of the asset are *least likely* to affect:

   A net income.

   B net operating income.

   C other comprehensive income.

35 Investment property is *most likely* to:

   A earn rent.

   B be held for resale.

   C be used in the production of goods and services.

36 A company is *most likely* to:

   A use a fair value model for some investment property and a cost model for other investment property.

   B change from the fair value model when transactions on comparable properties become less frequent.

   C change from the fair value model when the company transfers investment property to property, plant, and equipment.

37 Under the revaluation model for property, plant, and equipment and the fair model for investment property:

   A fair value of the asset must be able to be measured reliably.

   B net income is affected by all changes in the fair value of the asset.

   C net income is never affected if the asset increases in value from its carrying amount.

38 Under IFRS, what must be disclosed under the cost model of valuation for investment properties?

    A   Useful lives

    B   The method for determining fair value

    C   Reconciliation between beginning and ending carrying amounts of investment property

The following information relates to Questions 39–42

Melanie Hart, CFA, is a transportation analyst. Hart has been asked to write a research report on Altai Mountain Rail Company (AMRC). Like other companies in the railroad industry, AMRC's operations are capital intensive, with significant investments in such long-lived tangible assets as property, plant, and equipment. In November of 2008, AMRC's board of directors hired a new team to manage the company. In reviewing the company's 2009 annual report, Hart is concerned about some of the accounting choices that the new management has made. These choices differ from those of the previous management and from common industry practice. Hart has highlighted the following statements from the company's annual report:

    Statement 1   "In 2009, AMRC spent significant amounts on track replacement and similar improvements. AMRC expensed rather than capitalised a significant proportion of these expenditures."

    Statement 2   "AMRC uses the straight-line method of depreciation for both financial and tax reporting purposes to account for plant and equipment."

    Statement 3   "In 2009, AMRC recognized an impairment loss of €50 million on a fleet of locomotives. The impairment loss was reported as 'other income' in the income statement and reduced the carrying amount of the assets on the balance sheet."

    Exhibits 1 and 2 contain AMRC's 2009 consolidated income statement and balance sheet. AMRC prepares its financial statements in accordance with International Financial Reporting Standards.

Exhibit 1 Consolidated Statement of Income				
	2009		**2008**	
For the Years Ended 31 December	**€ Millions**	**% Revenues**	**€ Millions**	**% Revenues**
Operating revenues	2,600	100.0	2,300	100.0
Operating expenses				
Depreciation	(200)	(7.7)	(190)	(8.3)
Other operating expense	(1,590)	(61.1)	(1,515)	(65.9)
Total operating expenses	(1,790)	(68.8)	(1,705)	(74.2)
Operating income	810	31.2	595	25.8
Other income	(50)	(1.9)	—	0.0
Interest expense	(73)	(2.8)	(69)	(3.0)
Income before taxes	687	26.5	526	22.8

(continued)

Exhibit 1	(Continued)			

	2009		2008	
For the Years Ended 31 December	**€ Millions**	**% Revenues**	**€ Millions**	**% Revenues**
Income taxes	(272)	(10.5)	(198)	(8.6)
Net income	415	16	328	14.2

Exhibit 2	Consolidated Balance Sheet			

As of 31 December	2009		2008	
Assets	**€ Millions**	**% Assets**	**€ Millions**	**% Assets**
Current assets	500	9.4	450	8.5
Property & equipment:				
Land	700	13.1	700	13.2
Plant & equipment	6,000	112.1	5,800	109.4
Total property & equipment	6,700	125.2	6,500	122.6
Accumulated depreciation	(1,850)	(34.6)	(1,650)	(31.1)
Net property & equipment	4,850	90.6	4,850	91.5
Total assets	5,350	100.0	5,300	100.0
Liabilities and Shareholders' Equity				
Current liabilities	480	9.0	430	8.1
Long-term debt	1,030	19.3	1,080	20.4
Other long-term provisions and liabilities	1,240	23.1	1,440	27.2
Total liabilities	2,750	51.4	2,950	55.7
Shareholders' equity				
Common stock and paid-in-surplus	760	14.2	760	14.3
Retained earnings	1,888	35.5	1,600	30.2
Other comprehensive losses	(48)	(0.9)	(10)	(0.2)
Total shareholders' equity	2,600	48.6	2,350	44.3
Total liabilities & shareholders' equity	5,350	100.0	5,300	100.0

39 With respect to Statement 1, which of the following is the *most likely* effect of management's decision to expense rather than capitalise these expenditures?

  A 2009 net profit margin is higher than if the expenditures had been capitalised.

  B 2009 total asset turnover is lower than if the expenditures had been capitalised.

  C Future profit growth will be higher than if the expenditures had been capitalised.

40 With respect to Statement 2, what would be the *most likely* effect in 2010 if AMRC were to switch to an accelerated depreciation method for both financial and tax reporting?

    A Net profit margin would increase.

    B Total asset turnover would decrease.

    C Cash flow from operating activities would increase.

41 With respect to Statement 3, what is the *most likely* effect of the impairment loss?

    A Net income in years prior to 2009 was likely understated.

    B Net profit margins in years after 2009 will likely exceed the 2009 net profit margin.

    C Cash flow from operating activities in 2009 was likely lower due to the impairment loss.

42 Based on Exhibits 1 and 2, the *best estimate* of the average remaining useful life of the company's plant and equipment at the end of 2009 is:

    A 20.75 years.

    B 24.25 years.

    C 30.00 years.

The following information relates to Questions 43–48

Brian Jordan is interviewing for a junior equity analyst position at Orion Investment Advisors. As part of the interview process, Mary Benn, Orion's Director of Research, provides Jordan with information about two hypothetical companies, Alpha and Beta, and asks him to comment on the information on their financial statements and ratios. Both companies prepare their financial statements in accordance with International Financial Reporting Standards (IFRS) and are identical in all respects except for their accounting choices.

Jordan is told that at the beginning of the current fiscal year, both companies purchased a major new computer system and began building new manufacturing plants for their own use. Alpha capitalised and Beta expensed the cost of the computer system; Alpha capitalised and Beta expensed the interest costs associated with the construction of the manufacturing plants.

Benn asks Jordan, "What was the impact of these decisions on each company's current fiscal year financial statements and ratios?"

Jordan responds, "Alpha's decision to capitalise the cost of its new computer system instead of expensing it results in lower net income, lower total assets, and higher cash flow from operating activities in the current fiscal year. Alpha's decision to capitalise its interest costs instead of expensing them results in a lower fixed asset turnover ratio and a higher interest coverage ratio."

Jordan is told that Alpha uses the straight-line depreciation method and Beta uses an accelerated depreciation method; both companies estimate the same useful lives for long-lived assets. Many companies in their industry use the units-of-production method.

Benn asks Jordan, "What are the financial statement implications of each depreciation method, and how do you determine a company's need to reinvest in its productive capacity?"

Jordan replies, "All other things being equal, the straight-line depreciation method results in the least variability of net profit margin over time, while an accelerated depreciation method results in a declining trend in net profit margin over time. The units-of-production can result in a net profit margin trend that is quite variable. I use a three-step approach to estimate a company's need to reinvest in its productive capacity. First, I estimate the average age of the assets by dividing net property, plant, and equipment by annual depreciation expense. Second, I estimate the average remaining useful life of the assets by dividing accumulated depreciation by depreciation expense. Third, I add the estimates of the average remaining useful life and the average age of the assets in order to determine the total useful life."

Jordan is told that at the end of the current fiscal year, Alpha revalued a manufacturing plant; this increased its reported carrying amount by 15 percent. There was no previous downward revaluation of the plant. Beta recorded an impairment loss on a manufacturing plant; this reduced its carrying by 10 percent.

Benn asks Jordan "What was the impact of these decisions on each company's current fiscal year financial ratios?"

Jordan responds, "Beta's impairment loss increases its debt to total assets and fixed asset turnover ratios, and lowers its cash flow from operating activities. Alpha's revaluation increases its debt to capital and return on assets ratios, and reduces its return on equity."

At the end of the interview, Benn thanks Jordan for his time and states that a hiring decision will be made shortly.

43 Jordan's response about the financial statement impact of Alpha's decision to capitalise the cost of its new computer system is most likely *correct* with respect to:

   A   lower net income.

   B   lower total assets.

   C   higher cash flow from operating activities.

44 Jordan's response about the ratio impact of Alpha's decision to capitalise interest costs is most likely *correct* with respect to the:

   A   interest coverage ratio.

   B   fixed asset turnover ratio.

   C   interest coverage and fixed asset turnover ratios.

45 Jordan's response about the impact of the different depreciation methods on net profit margin is most likely *incorrect* with respect to:

   A   accelerated depreciation.

   B   straight-line depreciation.

   C   units-of-production depreciation.

46 Jordan's response about his approach to estimating a company's need to reinvest in its productive capacity is most likely *correct* regarding:

   A   estimating the average age of the asset base.

   B   estimating the total useful life of the asset base.

   C   estimating the average remaining useful life of the asset base.

47 Jordan's response about the effect of Beta's impairment loss is most likely *incorrect* with respect to the impact on its:

   A   debt to total assets.

   B   fixed asset turnover.

   C   cash flow from operating activities.

48 Jordan's response about the effect of Alpha's revaluation is most likely *correct* with respect to the impact on its:

   A return on equity.

   B return on assets.

   C debt to capital ratio.

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 million × 14% × 2 years) − 10 million = 130 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 × 0.75) than that of Company X.

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

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:

Straight line = €1,500/5 = €300.

Double-declining balance = €1,500 × 0.40 = €600.

Units of production = €1,500 × 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

Depreciation expense = (1,200,000 − 200,000)/8 years = 125,000.

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

Depreciation expense = (1,200,000 − 200,000) × (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)

= 2 × Annual depreciation % using straight-line method × Carrying amount at end of Year 3
= 40% × $43,200

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

= ⅓ × Remaining depreciable cost at start of Year 3
= ⅓ × $72,000
= $24,000

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

Accumulated amortization = [(2,300,000 − 500,000)/3 years] × 2 years
= 1,200,000

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

Depreciation expense = 5,800,000 × (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 × Straight-line amortization rate × Net book value.

Amortization expense Year 4 = 33.3% × ¥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 × (€600,000/6)] = €200,000.

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

Impairment = max(Fair value less costs to sell; Value in use) − Net carrying amount
= max(16,800,000 − 800,000; 14,500,000) − 19,100,000
= −3,100,000.

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

Gain or loss on the sale = Sale proceeds − Carrying amount
= Sale proceeds − (Acquisition cost − Accumulated depreciation)
= 85,000 − {100,000 − [((100,000 − 10,000)/9 years) × 3 years]}
= 15,000.

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. 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.

40 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.

41 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.

42 A is correct. The estimated average remaining useful life is 20.75 years.

$$\text{Estimate of remaining useful life} = \text{Net plant and equipment} \div \text{Annual depreciation expense}$$
$$\text{Net plant and equipment} = \text{Gross P \& E} - \text{Accumulated depreciation}$$
$$= €6000 - €1850 = €4150$$
$$\text{Estimate of remaining useful life} = \text{Net P \& E} \div \text{Depreciation expense}$$
$$= €4150 \div €200 = 20.75$$

43 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.

44 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.

45 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.

46 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.

47 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.

48 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.

Exhibit 5 (Continued)	
IFRS	**US GAAP**
Deferred tax assets and liabilities are offset if the entity has a legally enforceable right to offset current tax assets against current tax liabilities and the deferred tax assets and deferred tax liabilities relate to income taxes levied by the same taxing authority on either the same taxable entity, or different taxable entities that intend either to settle current tax assets and liabilities on a net basis or to simultaneously realize/settle the asset/liability.	All deferred taxes are offset and presented as a single amount.
Deferred tax assets and liabilities are presented as separate line items in the statement of financial position. If a classified statement of financial position is used, deferred taxes are classified as noncurrent.	Deferred tax assets and deferred tax liabilities are presented as noncurrent in a classified statement of financial position, which aligns with IFRS.
All entities must disclose an explanation of the relationship between tax expense and accounting profit using either or both of the following formats: ■ A numerical reconciliation between tax expense (income) and the product of accounting profit multiplied by the applicable tax rate(s) including disclosure of the basis on which the applicable rate is computed. ■ A numerical reconciliation between the average effective tax rate and the applicable tax rate, including disclosure of the basis on which the applicable tax rate is computed.	Public companies must disclose a reconciliation using percentages or dollar amounts of the reported amount of income tax expense attributable to continuing operations for the year to that amount of income tax expense that would result from applying domestic federal statutory tax rates to pretax income from continuing operations. Nonpublic enterprises must disclose the nature of significant reconciling items but may omit a numerical reconciliation.

Sources: IFRS: IAS 12 and 32. US GAAP: ASC 740. "Comparison between US GAAP and IFRS Standards," Section 5.3 Taxation, Grant Thornton, April 2017. "IFRS and US GAAP: similarities and differences", PricewaterhouseCoopers LLC, 2018.

SUMMARY

Income taxes are a significant category of expense for profitable companies. Analyzing income tax expenses is often difficult for the analyst because there are many permanent and temporary timing differences between the accounting that is used for income tax reporting and the accounting that is used for financial reporting on company financial statements. The financial statements and notes to the financial statements of a company provide important information that the analyst needs to assess financial performance and to compare a company's financial performance with other companies. Key concepts in this reading are as follows:

■ Differences between the recognition of revenue and expenses for tax and accounting purposes may result in taxable income differing from accounting profit. The discrepancy is a result of different treatments of certain income and expenditure items.

■ The tax base of an asset is the amount that will be deductible for tax purposes as an expense in the calculation of taxable income as the company expenses the tax basis of the asset. If the economic benefit will not be taxable, the tax base of the asset will be equal to the carrying amount of the asset.

- The tax base of a liability is the carrying amount of the liability less any amounts that will be deductible for tax purposes in the future. With respect to revenue received in advance, the tax base of such a liability is the carrying amount less any amount of the revenue that will not be taxable in the future.

- Temporary differences arise from recognition of differences in the tax base and carrying amount of assets and liabilities. The creation of a deferred tax asset or liability as a result of a temporary difference will only be allowed if the difference reverses itself at some future date and to the extent that it is expected that the balance sheet item will create future economic benefits for the company.

- Permanent differences result in a difference in tax and financial reporting of revenue (expenses) that will not be reversed at some future date. Because it will not be reversed at a future date, these differences do not constitute temporary differences and do not give rise to a deferred tax asset or liability.

- Current taxes payable or recoverable are based on the applicable tax rates on the balance sheet date of an entity; in contrast, deferred taxes should be measured at the tax rate that is expected to apply when the asset is realized or the liability settled.

- All unrecognized deferred tax assets and liabilities must be reassessed on the appropriate balance sheet date and measured against their probable future economic benefit.

- Deferred tax assets must be assessed for their prospective recoverability. If it is probable that they will not be recovered at all or partly, the carrying amount should be reduced. Under US GAAP, this is done through the use of a valuation allowance.

PRACTICE PROBLEMS

1 Using the straight-line method of depreciation for reporting purposes and accelerated depreciation for tax purposes would *most likely* result in a:

   A valuation allowance.

   B deferred tax asset.

   C temporary difference.

2 In early 2018 Sanborn Company must pay the tax authority €37,000 on the income it earned in 2017. This amount was recorded on the company's 31 December 2017 financial statements as:

   A taxes payable.

   B income tax expense.

   C a deferred tax liability.

3 Income tax expense reported on a company's income statement equals taxes payable, plus the net increase in:

   A deferred tax assets and deferred tax liabilities.

   B deferred tax assets, less the net increase in deferred tax liabilities.

   C deferred tax liabilities, less the net increase in deferred tax assets.

4 Analysts should treat deferred tax liabilities that are expected to reverse as:

   A equity.

   B liabilities.

   C neither liabilities nor equity.

5 Deferred tax liabilities should be treated as equity when:

   A they are not expected to reverse.

   B the timing of tax payments is uncertain.

   C the amount of tax payments is uncertain.

6 When both the timing and amount of tax payments are uncertain, analysts should treat deferred tax liabilities as:

   A equity.

   B liabilities.

   C neither liabilities nor equity.

7 When accounting standards require recognition of an expense that is not permitted under tax laws, the result is a:

   A deferred tax liability.

   B temporary difference.

   C permanent difference.

8 When certain expenditures result in tax credits that directly reduce taxes, the company will *most likely* record:

   A a deferred tax asset.

   B a deferred tax liability.

   C no deferred tax asset or liability.

9   When accounting standards require an asset to be expensed immediately but tax rules require the item to be capitalized and amortized, the company will *most likely* record:

   A   a deferred tax asset.

   B   a deferred tax liability.

   C   no deferred tax asset or liability.

10   A company incurs a capital expenditure that may be amortized over five years for accounting purposes, but over four years for tax purposes. The company will *most likely* record:

   A   a deferred tax asset.

   B   a deferred tax liability.

   C   no deferred tax asset or liability.

11   A company receives advance payments from customers that are immediately taxable but will not be recognized for accounting purposes until the company fulfills its obligation. The company will *most likely* record:

   A   a deferred tax asset.

   B   a deferred tax liability.

   C   no deferred tax asset or liability.

The following information relates to Questions 12–14

Note I
Income Taxes

The components of earnings before income taxes are as follows ($ thousands):

	Year 3	Year 2	Year 1
Earnings before income taxes:			
United States	$88,157	$75,658	$59,973
Foreign	116,704	113,509	94,760
Total	$204,861	$189,167	$154,733

The components of the provision for income taxes are as follows ($ thousands):

	Year 3	Year 2	Year 1
Income taxes			
Current:			
Federal	$30,632	$22,031	$18,959
Foreign	28,140	27,961	22,263
	$58,772	$49,992	$41,222
Deferred:			
Federal	($4,752)	$5,138	$2,336
Foreign	124	1,730	621

	Year 3	Year 2	Year 1
	(4,628)	6,868	2,957
Total	$54,144	$56,860	$44,179

12 In Year 3, the company's US GAAP income statement recorded a provision for income taxes *closest* to:

A $30,632.

B $54,144.

C $58,772.

13 The company's effective tax rate was *highest* in:

A Year 1.

B Year 2.

C Year 3.

14 Compared to the company's effective tax rate on US income, its effective tax rate on foreign income was:

A lower in each year presented.

B higher in each year presented.

C higher in some periods and lower in others.

15 Zimt AG presents its financial statements in accordance with US GAAP. In Year 3, Zimt discloses a valuation allowance of $1,101 against total deferred tax assets of $19,201. In Year 2, Zimt disclosed a valuation allowance of $1,325 against total deferred tax assets of $17,325. The change in the valuation allowance *most likely* indicates that Zimt's:

A deferred tax liabilities were reduced in Year 3.

B expectations of future earning power has increased.

C expectations of future earning power has decreased.

16 Cinnamon, Inc. recorded a total deferred tax asset in Year 3 of $12,301, offset by a $12,301 valuation allowance. Cinnamon *most likely*:

A fully utilized the deferred tax asset in Year 3.

B has an equal amount of deferred tax assets and deferred tax liabilities.

C expects not to earn any taxable income before the deferred tax asset expires.

The following information relates to Questions 17–19

The tax effects of temporary differences that give rise to deferred tax assets and liabilities are as follows ($ thousands):

	Year 3	Year 2
Deferred tax assets:		
Accrued expenses	$8,613	$7,927
Tax credit and net operating loss carryforwards	2,288	2,554

(continued)

	Year 3	Year 2
LIFO and inventory reserves	5,286	4,327
Other	2,664	2,109
Deferred tax assets	18,851	16,917
Valuation allowance	(1,245)	(1,360)
Net deferred tax assets	$17,606	$15,557
Deferred tax liabilities:		
Depreciation and amortization	$(27,338)	$(29,313)
Compensation and retirement plans	(3,831)	(8,963)
Other	(1,470)	(764)
Deferred tax liabilities	(32,639)	(39,040)
Net deferred tax liability	($15,033)	($23,483)

17 A reduction in the statutory tax rate would *most likely* benefit the company's:

   A income statement and balance sheet.

   B income statement but not the balance sheet.

   C balance sheet but not the income statement.

18 If the valuation allowance had been the same in Year 3 as it was in Year 2, the company would have reported $115 *higher*:

   A net income.

   B deferred tax assets.

   C income tax expense.

19 Compared to the provision for income taxes in Year 3, the company's cash tax payments were:

   A lower.

   B higher.

   C the same.

The following information relates to Questions 20–22

A company's provision for income taxes resulted in effective tax rates attributable to loss from continuing operations before cumulative effect of change in accounting principles that varied from the statutory federal income tax rate of 34 percent, as summarized in the table below.

Year Ended 30 June	Year 3	Year 2	Year 1
Expected federal income tax expense (benefit) from continuing operations at 34 percent	($112,000)	$768,000	$685,000
Expenses not deductible for income tax purposes	357,000	32,000	51,000
State income taxes, net of federal benefit	132,000	22,000	100,000

Year Ended 30 June	Year 3	Year 2	Year 1
Change in valuation allowance for deferred tax assets	(150,000)	(766,000)	(754,000)
Income tax expense	$227,000	$56,000	$82,000

20 In Year 3, the company's net income (loss) was *closest* to:

   A   ($217,000).

   B   ($329,000).

   C   ($556,000).

21 The $357,000 adjustment in Year 3 *most likely* resulted in:

   A   an increase in deferred tax assets.

   B   an increase in deferred tax liabilities.

   C   no change to deferred tax assets and liabilities.

22 Over the three years presented, changes in the valuation allowance for deferred tax assets were *most likely* indicative of:

   A   decreased prospect for future profitability.

   B   increased prospects for future profitability.

   C   assets being carried at a higher value than their tax base.

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 Year 3 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 Year 2 and Year 3.

14   A is correct. In Year 3 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 Year 2 the effective tax rate on foreign operations was 26.2 percent and the US rate was 35.9 percent. In Year 1 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 Year 3 than it was in Year 2, indicating that in addition to meeting the tax payments provided for in Year 3 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.

	BT Group plc	Telefonica S A
	31-Mar-18	*31-Dec-17*
Interest coverage ratio	*4.36 = 3,381/776*	*2.02 = 6,791/3,363*

B Both companies' interest coverage ratios increased from 2017 to 2018, indicating an improvement in solvency, consistent with the conclusions drawn from the companies' ratios in question 1. Both companies have sufficient operating earnings to cover interest payments.

C BT's ability to cover interest payments is greater than Telefonica's, although both companies have sufficient operating earnings to service its interest payments. This comparison indicates that BT has greater financial strength than Telefonica, which is also consistent with the conclusions drawn from a comparison of the companies' ratios in question 1.

SUMMARY

Non-current liabilities arise from different sources of financing and different types of creditors. Bonds are a common source of financing from debt markets. Key points in accounting and reporting of non-current liabilities include the following:

- The sales proceeds of a bond issue are determined by discounting future cash payments using the market rate of interest at the time of issuance (effective interest rate). The reported interest expense on bonds is based on the effective interest rate.

- Future cash payments on bonds usually include periodic interest payments (made at the stated interest rate or coupon rate) and the principal amount at maturity.

- When the market rate of interest equals the coupon rate for the bonds, the bonds will sell at par (i.e., at a price equal to the face value). When the market rate of interest is higher than the bonds' coupon rate, the bonds will sell at a discount. When the market rate of interest is lower than the bonds' coupon rate, the bonds will sell at a premium.

- An issuer amortises any issuance discount or premium on bonds over the life of the bonds.

- If a company redeems bonds before maturity, it reports a gain or loss on debt extinguishment computed as the net carrying amount of the bonds (including bond issuance costs under IFRS) less the amount required to redeem the bonds.

- Debt covenants impose restrictions on borrowers, such as limitations on future borrowing or requirements to maintain a minimum debt-to-equity ratio.

- The carrying amount of bonds is typically the amortised historical cost, which can differ from their fair value.

- Companies are required to disclose the fair value of financial liabilities, including debt. Although permitted to do so, few companies opt to report debt at fair values on the balance sheet.

- Beginning with fiscal year 2019, lessees report a right-of-use asset and a lease liability for all leases longer than one year. An exception under IFRS exists for leases when the underlying asset is of low value.

  - Subsequent to lease inception, the lessee's income statement will include both a depreciation expense on the right-of-use asset and an interest expense on the lease liability for all leases under IFRS and, under US GAAP for finance leases.

  - For lessee accounting, the distinction between finance leases and operating leases exists in US GAAP but not in IFRS. For operating leases under US GAAP, the lessee's income statement will show a single lease expense.

  - Under IFRS, a lessor classifies each lease as either a finance lease or an operating lease. A lease is classified as a finance lease if it "transfers substantially all the risks and rewards incidental to ownership of an underlying asset" and otherwise as an operating lease. For finance leases, but not for operating leases, the lessor derecognizes the underlying leased asset, and recognizes a lease receivable, and recognizes selling profit where applicable. For operating leases, the lessor does not derecognize the underlying asset and recognizes lease receipts as income.

  - Under US GAAP, a lessor classifies a lease in one of three categories: sales-type, direct financing, or operating. The lessor's classification and accounting for operating leases under US GAAP is similar to that under IFRS. For both sales-type and direct financing leases, the lessor derecognizes the underlying asset and recognizes a lease receivable; however, the lessor recognizes selling profit only if the lease is considered a sales-type lease.

- Two types of pension plans are defined contribution plans and defined benefits plans. In a defined contribution plan, the amount of contribution into the plan is specified (i.e., defined) and the amount of pension that is ultimately paid by the plan (received by the retiree) depends on the performance of the plan's assets. In a defined benefit plan, the amount of pension that is ultimately paid by the plan (received by the retiree) is defined, usually according to a benefit formula.

- Under a defined contribution pension plan, the cash payment made into the plan is recognised as pension expense.

- Under both IFRS and US GAAP, companies must report the difference between the defined benefit pension obligation and the pension assets as an asset or liability on the balance sheet. An underfunded defined benefit pension plan is shown as a non-current liability.

- Under IFRS, the change in the defined benefit plan net asset or liability is recognised as a cost of the period, with two components of the change (service cost and net interest expense or income) recognised in profit and loss and one component (remeasurements) of the change recognised in other comprehensive income.

- Under US GAAP, the change in the defined benefit plan net asset or liability is also recognised as a cost of the period with three components of the change (current service costs, interest expense on the beginning pension obligation, and expected return on plan assets) recognised in profit and loss and two components (past service costs and actuarial gains and losses) typically recognised in other comprehensive income.

- Solvency refers to a company's ability to meet its long-term debt obligations.

- In evaluating solvency, leverage ratios focus on the balance sheet and measure the amount of debt financing relative to equity financing.

- In evaluating solvency, coverage ratios focus on the income statement and cash flows and measure the ability of a company to cover its interest payments.

PRACTICE PROBLEMS

1 A company issues €1 million of bonds at face value. When the bonds are issued, the company will record a:

   A cash inflow from investing activities.

   B cash inflow from financing activities.

   C cash inflow from operating activities.

2 At the time of issue of 4.50% coupon bonds, the effective interest rate was 5.00%. The bonds were *most likely* issued at:

   A par.

   B a discount.

   C a premium.

3 Oil Exploration LLC paid $45,000 in printing, legal fees, commissions, and other costs associated with its recent bond issue. It is *most likely* to record these costs on its financial statements as:

   A an asset under US GAAP and reduction of the carrying value of the debt under IFRS.

   B a liability under US GAAP and reduction of the carrying value of the debt under IFRS.

   C a cash outflow from investing activities under both US GAAP and IFRS.

4 A company issues $1,000,000 face value of 10-year bonds on 1 January 2015 when the market interest rate on bonds of comparable risk and terms is 5%. The bonds pay 6% interest annually on 31 December. At the time of issue, the bonds payable reflected on the balance sheet is *closest* to:

   A $926,399.

   B $1,000,000.

   C $1,077,217.

5 Midland Brands issues three-year bonds dated 1 January 2015 with a face value of $5,000,000. The market interest rate on bonds of comparable risk and term is 3%. If the bonds pay 2.5% annually on 31 December, bonds payable when issued are most likely reported as *closest* to:

   A $4,929,285.

   B $5,000,000.

   C $5,071,401.

6 A firm issues a bond with a coupon rate of 5.00% when the market interest rate is 5.50% on bonds of comparable risk and terms. One year later, the market interest rate increases to 6.00%. Based on this information, the effective interest rate is:

   A 5.00%.

   B 5.50%.

   C 6.00%.

7 On 1 January 2010, Elegant Fragrances Company issues £1,000,000 face value, five-year bonds with annual interest payments of £55,000 to be paid each 31 December. The market interest rate is 6.0 percent. Using the effective interest rate method of amortisation, Elegant Fragrances is *most likely* to record:

  A an interest expense of £55,000 on its 2010 income statement.

  B a liability of £982,674 on the 31 December 2010 balance sheet.

  C a £58,736 cash outflow from operating activity on the 2010 statement of cash flows.

8 Consolidated Enterprises issues €10 million face value, five-year bonds with a coupon rate of 6.5 percent. At the time of issuance, the market interest rate is 6.0 percent. Using the effective interest rate method of amortisation, the carrying value after one year will be *closest* to:

  A €10.17 million.

  B €10.21 million.

  C €10.28 million.

9 A company issues €10,000,000 face value of 10-year bonds dated 1 January 2015 when the market interest rate on bonds of comparable risk and terms is 6%. The bonds pay 7% interest annually on 31 December. Based on the effective interest rate method, the interest expense on 31 December 2015 is *closest* to:

  A €644,161.

  B €700,000.

  C €751,521.

10 A company issues $30,000,000 face value of five-year bonds dated 1 January 2015 when the market interest rate on bonds of comparable risk and terms is 5%. The bonds pay 4% interest annually on 31 December. Based on the effective interest rate method, the carrying amount of the bonds on 31 December 2015 is *closest* to:

  A $28,466,099.

  B $28,800,000.

  C $28,936,215.

11 Lesp Industries issues five-year bonds dated 1 January 2015 with a face value of $2,000, 000 and 3% coupon rate paid annually on 31 December. The market interest rate on bonds of comparable risk and term is 4%. The sales proceeds of the bonds are $1,910,964. Under the effective interest rate method, the interest expense in 2017 is *closest* to:

  A $77,096.

  B $77,780.

  C $77,807.

12 For a bond issued at a premium, using the effective interest rate method, the:

  A carrying amount increases each year.

  B amortization of the premium increases each year.

  C premium is evenly amortized over the life of the bond.

13 Comte Industries issues $3,000,000 worth of three-year bonds dated 1 January 2015. The bonds pay interest of 5.5% annually on 31 December. The market interest rate on bonds of comparable risk and term is 5%. The sales proceeds of the bonds are $3,040,849. Under the straight-line method, the interest expense in the first year is *closest* to:

  A $150,000.

  B $151,384.

  C $152,042.

14 The management of Bank EZ repurchases its own bonds in the open market. They pay €6.5 million for bonds with a face value of €10.0 million and a carrying value of €9.8 million. The bank will *most likely* report:

A other comprehensive income of €3.3 million.

B other comprehensive income of €3.5 million.

C a gain of €3.3 million on the income statement.

15 A company redeems $1,000,000 face value bonds with a carrying value of $990,000. If the call price is 104 the company will:

A reduce bonds payable by $1,000,000.

B recognize a loss on the extinguishment of debt of $50,000.

C recognize a gain on the extinguishment of debt of $10,000.

16 Innovative Inventions, Inc. needs to raise €10 million. If the company chooses to issue zero-coupon bonds, its debt-to-equity ratio will *most likely*:

A rise as the maturity date approaches.

B decline as the maturity date approaches.

C remain constant throughout the life of the bond.

17 Fairmont Golf issued fixed rate debt when interest rates were 6 percent. Rates have since risen to 7 percent. Using only the carrying amount (based on historical cost) reported on the balance sheet to analyze the company's financial position would *most likely* cause an analyst to:

A overestimate Fairmont's economic liabilities.

B underestimate Fairmont's economic liabilities.

C underestimate Fairmont's interest coverage ratio.

18 Which of the following is an example of an affirmative debt covenant? The borrower is:

A prohibited from entering into mergers.

B prevented from issuing excessive additional debt.

C required to perform regular maintenance on equipment pledged as collateral.

19 Debt covenants are *least likely* to place restrictions on the issuer's ability to:

A pay dividends.

B issue additional debt.

C issue additional equity.

20 Regarding a company's debt obligations, which of the following is *most likely* presented on the balance sheet?

A Effective interest rate

B Maturity dates for debt obligations

C The portion of long-term debt due in the next 12 months

21 Compared to using a finance lease, a lessee that makes use of an operating lease will *most likely* report higher:

A debt.

B rent expense.

C cash flow from operating activity.

22 Which of the following is *most likely* a lessee's disclosure about operating leases?

A Lease liabilities.

B   Future obligations by maturity.

C   Net carrying amounts of leased assets.

23 For a lessor, the leased asset appears on the balance sheet and continues to be depreciated when the lease is classified as:

    A   a sales-type lease.

    B   an operating lease.

    C   a financing lease.

24 Under US GAAP, a lessor's reported revenues at lease inception will be *highest* if the lease is classified as:

    A   a sales-type lease.

    B   an operating lease.

    C   a direct financing lease.

25 A lessor will record interest income if a lease is classified as:

    A   a capital lease.

    B   an operating lease.

    C   either a capital or an operating lease.

26 Compared with a finance lease, an operating lease:

    A   is similar to renting an asset.

    B   is equivalent to the purchase of an asset.

    C   term is for the majority of the economic life of the asset.

27 Under US GAAP, which of the following would require the lessee to classify a lease as a capital lease?

    A   The term is 60% of the useful life of the asset.

    B   The lease contains an option to purchase the asset at fair value.

    C   The present value of the lease payments is 95% of the fair value.

28 A lessee that enters into a finance lease will report the:

    A   lease payable on its balance sheet.

    B   full lease payment on its income statement.

    C   full lease payment as an operating cash flow.

29 A company enters into a finance lease agreement to acquire the use of an asset for three years with lease payments of €19,000,000 starting next year. The leased asset has a fair market value of €49,000,000 and the present value of the lease payments is €47,250,188. Based on this information, the value of the lease payable reported on the company's balance sheet is *closest* to:

    A   €47,250,188.

    B   €49,000,000.

    C   €57,000,000.

30 Which of the following *best* describes reporting and disclosure requirements for a company that enters into an operating lease as the lessee? The operating lease obligation is:

    A   reported as a receivable on the balance sheet.

    B   disclosed in notes to the financial statements.

    C   reported as a component of debt on the balance sheet.

31 Cavalier Copper Mines has $840 million in total liabilities and $520 million in shareholders' equity. It discloses operating lease commitments over the next five years with a present value of $100 million. If the lease commitments are treated as debt, the debt-to-total-capital ratio is *closest* to:

A 0.58.

B 0.62.

C 0.64.

32 The following presents selected financial information for a company:

	$ Millions
Short-term borrowing	4,231
Current portion of long-term interest-bearing debt	29
Long-term interest-bearing debt	925
Average shareholders' equity	18,752
Average total assets	45,981

The financial leverage ratio is *closest* to:

A 0.113

B 0.277

C 2.452

33 An analyst evaluating three industrial companies calculates the following ratios:

	Company A	Company B	Company C
Debt-to-Equity	23.5%	22.5%	52.5%
Interest Coverage	15.6	49.5	45.5

The company with both the lowest financial leverage and the greatest ability to meet interest payments is:

A Company A.

B Company B.

C Company C.

34 An analyst evaluating a company's solvency gathers the following information:

	$ Millions
Short-term interest-bearing debt	1,258
Long-term interest-bearing debt	321
Total shareholder's equity	4,285
Total assets	8,750
EBIT	2,504
Interest payments	52

The company's debt-to-assets ratio is *closest* to:

A 0.18.

B 0.27.

C 0.37.

35 Penben Corporation has a defined benefit pension plan. At 31 December, its pension obligation is €10 million and pension assets are €9 million. Under either IFRS or US GAAP, the reporting on the balance sheet would be *closest* to which of the following?

 A €10 million is shown as a liability, and €9 million appears as an asset.

 B €1 million is shown as a net pension obligation.

 C Pension assets and obligations are not required to be shown on the balance sheet but only disclosed in footnotes.

36 The following information is associated with a company that offers its employees a defined benefit plan:

Fair value of fund's assets	$1,500,000,000
Estimated pension obligations	$2,600,000,000
Present value of estimated pension obligations	$1,200,000,000

Based on this information, the company's balance sheet will present a net pension:

 A asset of $300,000,000.

 B asset of $1,400,000,000.

 C liability of $1,100,000,000.

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	
		463,304.10		613,913.25	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 $4,929,284.72:

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 (€10,736,008.71 × 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 × 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.

It appears that the corporate governance apparatus fostered a GE culture that extended the concept of teamwork to the point of "sharing" profits to win one for the team as a whole, which is incompatible with the concept of neutral financial reporting. Although research is not conclusive on this question, it may also be worth considering that predisposition to earnings manipulation is more likely to be present when the CEO and board chair are one and the same, or when the audit committee of the board essentially serves at the pleasure of the CEO and lacks financial reporting sophistication. Finally, one could discuss whether the financial reporting environment today would reward or penalize a CEO who openly endorsed a view that he could legitimately exercise financial reporting discretion—albeit within limits—for the purpose of artificially smoothing earnings.

Restructuring and/or impairment charges.   At times, a company's stock price has been observed to rise after it recognized a "big bath" charge to reported earnings. The conventional wisdom explaining the stock price rise is that accounting recognition signals something positive: that management is now ready to part with the lagging portion of a company, so as to redirect its attention and talents to more-profitable activities. Consequently, the earnings charge should be disregarded for being solely related to past events.

The analyst should also consider, however, that the events leading ultimately to the big bath on the financial statements did not happen overnight, even though the accounting for those events occurs at a subsequent point. Management may want to communicate that the accounting adjustments reflect the company's new path, but the restructuring charge also indicates that the old path of reported earnings was not real. In particular, expenses reported in prior years were very likely understated—even assuming that no improper financial statement manipulation had occurred. To extrapolate historical earnings trends, an analyst should consider making pro forma analytical adjustments to prior years' earnings to reflect a reasonable division of the latest period's restructuring and impairment charges.

Management has a merger and acquisition orientation.   Tyco International Ltd. acquired more than 700 companies from 1996 to 2002. Even assuming the best of intentions regarding financial reporting, a growth-at-any-cost corporate culture poses a severe challenge to operational and financial reporting controls. In Tyco's case, the SEC found that it consistently and fraudulently understated assets acquired (lowering future depreciation and amortization charges) and overstated liabilities assumed (avoiding expense recognition and potentially increasing earnings in future periods).[30]

SUMMARY

Financial reporting quality varies across companies. The ability to assess the quality of a company's financial reporting is an important skill for analysts. Indications of low-quality financial reporting can prompt an analyst to maintain heightened skepticism

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[30] Accounting and Auditing Enforcement Release No. 2414, "SEC Brings Settled Charges Against Tyco International Ltd. Alleging Billion Dollar Accounting Fraud," SEC (17 April 2006): www.sec.gov/litigation/litreleases/2006/lr19657.htm.

when reading a company's reports, to review disclosures critically when undertaking financial statement analysis, and to incorporate appropriate adjustments in assessments of past performance and forecasts of future performance.

■ Financial reporting quality can be thought of as spanning a continuum from the highest (containing information that is relevant, correct, complete, and unbiased) to the lowest (containing information that is not just biased or incomplete but possibly pure fabrication).

■ *Reporting quality*, the focus of this reading, pertains to the information disclosed. High-quality reporting represents the economic reality of the company's activities during the reporting period and the company's financial condition at the end of the period.

■ *Results quality* (commonly referred to as earnings quality) pertains to the earnings and cash generated by the company's actual economic activities and the resulting financial condition, relative to expectations of current and future financial performance. Quality earnings are regarded as being sustainable, providing a sound platform for forecasts.

■ An aspect of financial reporting quality is the degree to which accounting choices are conservative or aggressive. "Aggressive" typically refers to choices that aim to enhance the company's reported performance and financial position by inflating the amount of revenues, earnings, and/or operating cash flow reported in the period; or by decreasing expenses for the period and/or the amount of debt reported on the balance sheet.

■ Conservatism in financial reports can result from either (1) accounting standards that specifically require a conservative treatment of a transaction or an event or (2) judgments made by managers when applying accounting standards that result in conservative results.

■ Managers may be motivated to issue less-than-high-quality financial reports in order to mask poor performance, to boost the stock price, to increase personal compensation, and/or to avoid violation of debt covenants.

■ Conditions that are conducive to the issuance of low-quality financial reports include a cultural environment that result in fewer or less transparent financial disclosures, book/tax conformity that shifts emphasis toward legal compliance and away from fair presentation, and limited capital markets regulation.

■ Mechanisms that discipline financial reporting quality include the free market and incentives for companies to minimize cost of capital, auditors, contract provisions specifically tailored to penalize misreporting, and enforcement by regulatory entities.

■ Pro forma earnings (also commonly referred to as non-GAAP or non-IFRS earnings) adjust earnings as reported on the income statement. Pro forma earnings that exclude negative items are a hallmark of aggressive presentation choices.

■ Companies are required to make additional disclosures when presenting any non-GAAP or non-IFRS metric.

■ Managers' considerable flexibility in choosing their companies' accounting policies and in formulating estimates provides opportunities for aggressive accounting.

- Examples of accounting choices that affect earnings and balance sheets include inventory cost flow assumptions, estimates of uncollectible accounts receivable, estimated realizability of deferred tax assets, depreciation method, estimated salvage value of depreciable assets, and estimated useful life of depreciable assets.

- Cash from operations is a metric of interest to investors that can be enhanced by operating choices, such as stretching accounts payable, and potentially by classification choices.

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PRACTICE PROBLEMS

1   In contrast to earnings quality, financial reporting quality *most likely* pertains to:

    A   sustainable earnings.

    B   relevant information.

    C   adequate return on investment.

2   The information provided by a low-quality financial report will *most likely*:

    A   decrease company value.

    B   indicate earnings are not sustainable.

    C   impede the assessment of earnings quality.

3   To properly assess a company's past performance, an analyst requires:

    A   high earnings quality.

    B   high financial reporting quality.

    C   both high earnings quality and high financial reporting quality.

4   Low quality earnings *most likely* reflect:

    A   low-quality financial reporting.

    B   company activities which are unsustainable.

    C   information that does not faithfully represent company activities.

5   Earnings that result from non-recurring activities *most likely* indicate:

    A   lower-quality earnings.

    B   biased accounting choices.

    C   lower-quality financial reporting.

6   Which attribute of financial reports would *most likely* be evaluated as optimal in the financial reporting spectrum?

    A   Conservative accounting choices

    B   Sustainable and adequate returns

    C   Emphasized pro forma earnings measures

7   Financial reports of the lowest level of quality reflect:

    A   fictitious events.

    B   biased accounting choices.

    C   accounting that is non-compliant with GAAP.

8   When earnings are increased by deferring research and development (R&D) investments until the next reporting period, this choice is considered:

    A   non-compliant accounting.

    B   earnings management as a result of a real action.

    C   earnings management as a result of an accounting choice.

9   A high-quality financial report may reflect:

    A   earnings smoothing.

    B   low earnings quality.

    C   understatement of asset impairment.

10 If a particular accounting choice is considered aggressive in nature, then the financial performance for the reporting period would *most likely*:

    A be neutral.

    B exhibit an upward bias.

    C exhibit a downward bias.

11 Which of the following is *most likely* to reflect conservative accounting choices?

    A Decreased reported earnings in later periods

    B Increased reported earnings in the period under review

    C Increased debt reported on the balance sheet at the end of the current period

12 Which of the following is *most likely* to be considered a potential benefit of accounting conservatism?

    A A reduction in litigation costs

    B Less biased financial reporting

    C An increase in current period reported performance

13 Which of the following statements *most likely* describes a situation that would motivate a manager to issue low-quality financial reports?

    A The manager's compensation is tied to stock price performance.

    B The manager has increased the market share of products significantly.

    C The manager has brought the company's profitability to a level higher than competitors.

14 Which of the following concerns would *most likely* motivate a manager to make conservative accounting choices?

    A Attention to future career opportunities

    B Expected weakening in the business environment

    C Debt covenant violation risk in the current period

15 Which of the following conditions *best* explains why a company's manager would obtain legal, accounting, and board level approval prior to issuing low-quality financial reports?

    A Motivation

    B Opportunity

    C Rationalization

16 A company is experiencing a period of strong financial performance. In order to increase the likelihood of exceeding analysts' earnings forecasts in the next reporting period, the company would *most likely* undertake accounting choices for the period under review that:

    A inflate reported revenue.

    B delay expense recognition.

    C accelerate expense recognition.

17 Which of the following situations represents a motivation, rather than an opportunity, to issue low-quality financial reports?

    A Poor internal controls

    B Search for a personal bonus

    C Inattentive board of directors

18 Which of the following situations will *most likely* motivate managers to inflate reported earnings?

    A Possibility of bond covenant violation

    B Earnings in excess of analysts' forecasts

    C Earnings that are greater than the previous year

19 Which of the following *best* describes an opportunity for management to issue low-quality financial reports?

    A Ineffective board of directors

    B Pressure to achieve some performance level

    C Corporate concerns about financing in the future

20 An audit opinion of a company's financial reports is *most likely* intended to:

    A detect fraud.

    B reveal misstatements.

    C assure that financial information is presented fairly.

21 If a company uses a non-GAAP financial measure in an SEC filing, then the company must:

    A give more prominence to the non-GAAP measure if it is used in earnings releases.

    B provide a reconciliation of the non-GAAP measure and equivalent GAAP measure.

    C exclude charges requiring cash settlement from any non-GAAP liquidity measures.

22 A company wishing to increase earnings in the reporting period may choose to:

    A decrease the useful life of depreciable assets.

    B lower estimates of uncollectible accounts receivables.

    C classify a purchase as an expense rather than a capital expenditure.

23 Bias in revenue recognition would *least likely* be suspected if:

    A the firm engages in barter transactions.

    B reported revenue is higher than the previous quarter.

    C revenue is recognized before goods are shipped to customers.

24 Which technique *most likely* increases the cash flow provided by operations?

    A Stretching the accounts payable credit period

    B Applying all non-cash discount amortization against interest capitalized

    C Shifting classification of interest paid from financing to operating cash flows

25 Which of the following is an indication that a company may be recognizing revenue prematurely? Relative to its competitors, the company's:

    A asset turnover is decreasing.

    B receivables turnover is increasing.

    C days sales outstanding is increasing.

26 Which of the following would *most likely* signal that a company may be using aggressive accrual accounting policies to shift current expenses to later periods? Over the last five-year period, the ratio of cash flow to net income has:

    A increased each year.

    B decreased each year.

    C fluctuated from year to year.

27 An analyst reviewing a firm with a large reported restructuring charge to earnings should:

    A view expenses reported in prior years as overstated.

    B disregard it because it is solely related to past events.

    C consider making pro forma adjustments to prior years' earnings.

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 of little use in assessing 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. 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 nor 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, meaning 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 that 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 period under review. Conservative choices may increase the amount of debt reported on the balance sheet. They may decrease the revenues, earnings, and/or operating cash flow reported for the 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. 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 reporting 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 occurs 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 report, 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 earnings forecasts for the next period. By accelerating expense recognition or delaying revenue recognition, managers may inflate earnings in the next period and increase the likelihood of exceeding 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 future financing. 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 reporting period. In so doing, 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 a certain level of performance and corporate concerns about future financing 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 the related expense reported for the period. Decreasing the useful life of depreciable assets would increase depreciation expense and decrease earnings in the reporting period. Classifying a purchase as an expense, rather than capital expenditure, would decrease earnings in the reporting period. The use of accrual accounting may result in estimates 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 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 identify 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 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.

	($ millions)	
	SCHW	**AMTD**
Total stockholders' equity	$20,097	$7,936
Less: Goodwill	$1,227	$4,198
Less: Other intangible assets	$93	$1,363
Tangible book value	$18,777	$2,375
MV/tangible book value	**3.7**	**14.0**

Solution to 2:

After adjusting for goodwill, SCHW appears to be selling for a much lower price relative to book value than does AMTD (3.6 versus 8.9) after adjusting for goodwill. The difference is more extreme after adjusting for other intangibles.

SUMMARY

This reading described selected applications of financial statement analysis, including the evaluation of past financial performance, the projection of future financial performance, the assessment of credit risk, and the screening of potential equity investments. In addition, the reading introduced analyst adjustments to reported financials. In all cases, the analyst needs to have a good understanding of the financial reporting standards under which the financial statements were prepared. Because standards evolve over time, analysts must stay current in order to make good investment decisions.

The main points in the reading are as follows:

- Evaluating a company's historical performance addresses not only what happened but also the causes behind the company's performance and how the performance reflects the company's strategy.

- The projection of a company's future net income and cash flow often begins with a top-down sales forecast in which the analyst forecasts industry sales and the company's market share. By projecting profit margins or expenses and the level of investment in working and fixed capital needed to support projected sales, the analyst can forecast net income and cash flow.

- Projections of future performance are needed for discounted cash flow valuation of equity and are often needed in credit analysis to assess a borrower's ability to repay interest and principal of a debt obligation.

- Credit analysis uses financial statement analysis to evaluate credit-relevant factors, including tolerance for leverage, operational stability, and margin stability.

- When ratios constructed from financial statement data and market data are used to screen for potential equity investments, fundamental decisions include which metrics to use as screens, how many metrics to include, what values of those metrics to use as cutoff points, and what weighting to give each metric.

- Analyst adjustments to a company's reported financial statements are sometimes necessary (e.g., when comparing companies that use different accounting methods or assumptions). Adjustments can include those related to investments; inventory; property, plant, and equipment; and goodwill.

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PRACTICE PROBLEMS

1 Projecting profit margins into the future on the basis of past results would be *most* reliable when the company:

   A is in the commodities business.

   B operates in a single business segment.

   C is a large, diversified company operating in mature industries.

2 Galambos Corporation had an average receivables collection period of 19 days in 2003. Galambos has stated that it wants to decrease its collection period in 2004 to match the industry average of 15 days. Credit sales in 2003 were $300 million, and analysts expect credit sales to increase to $400 million in 2004. To achieve the company's goal of decreasing the collection period, the change in the average accounts receivable balance from 2003 to 2004 that must occur is *closest* to:

   A −$420,000.

   B $420,000.

   C $836,000.

3 Credit analysts are likely to consider which of the following in making a rating recommendation?

   A Business risk but not financial risk

   B Financial risk but not business risk

   C Both business risk and financial risk

4 When screening for potential equity investments based on return on equity, to control risk, an analyst would be *most likely* to include a criterion that requires:

   A positive net income.

   B negative net income.

   C negative shareholders' equity.

5 One concern when screening for stocks with low price-to-earnings ratios is that companies with low P/Es may be financially weak. What criterion might an analyst include to avoid inadvertently selecting weak companies?

   A Net income less than zero

   B Debt-to-total assets ratio below a certain cutoff point

   C Current-year sales growth lower than prior-year sales growth

6 When a database eliminates companies that cease to exist because of a merger or bankruptcy, this can result in:

   A look-ahead bias.

   B back-testing bias.

   C survivorship bias.

7 In a comprehensive financial analysis, financial statements should be:

   A used as reported without adjustment.

   B adjusted after completing ratio analysis.

   C adjusted for differences in accounting standards, such as international financial reporting standards and US generally accepted accounting principles.

8 When comparing a US company that uses the last in, first out (LIFO) method of inventory with companies that prepare their financial statements under international financial reporting standards (IFRS), analysts should be aware that according to IFRS, the LIFO method of inventory:

A is never acceptable.

B is always acceptable.

C is acceptable when applied to finished goods inventory only.

9 An analyst is evaluating the balance sheet of a US company that uses last in, first out (LIFO) accounting for inventory. The analyst collects the following data:

	31 Dec 05	31 Dec 06
Inventory reported on balance sheet	$500,000	$600,000
LIFO reserve	$ 50,000	$70,000
Average tax rate	30%	30%

After adjusting the amounts to convert to the first in, first out (FIFO) method, inventory at 31 December 2006 would be closest to:

A $600,000.

B $620,000.

C $670,000.

10 An analyst gathered the following data for a company ($ millions):

	31 Dec 2000	31 Dec 2001
Gross investment in fixed assets	$2.8	$2.8
Accumulated depreciation	$1.2	$1.6

The average age and average depreciable life of the company's fixed assets at the end of 2001 are *closest* to:

	Average Age	**Average Depreciable Life**
A	1.75 years	7 years
B	1.75 years	14 years
C	4.00 years	7 years

11 To compute tangible book value, an analyst would:

A add goodwill to stockholders' equity.

B add all intangible assets to stockholders' equity.

C subtract all intangible assets from stockholders' equity.

12 Which of the following is an off-balance-sheet financing technique? The use of:

A capital leases.

B operating leases.

C the last in, first out inventory method.

13 To better evaluate the solvency of a company, an analyst would most likely add to total liabilities:

A the present value of future capital lease payments.

B the total amount of future operating lease payments.

C the present value of future operating lease payments.

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.

As mentioned earlier, governance factors have long been recognized in investment analysis. Many performance indicators can help evaluate risks arising from governance issues such as ownership structure, board independence and composition, and compensation. Although several governance factors may apply across industries and geographic regions, other factors are unique (such as systemic risk management for financial services companies).

One area of debate has been whether the consideration of ESG factors is consistent with fiduciary duty—particularly when overseeing and managing pension fund assets. Pension fund regulation regarding ESG considerations varies globally. In the United States, the Employee Retirement Income Security Act of 1974 (ERISA) sets the standards for the protection of private pension plan beneficiaries. A fiduciary must act solely in the interest of pension plan participants and beneficiaries. Accepting lower returns or assuming greater risk in a private pension plan to promote environmental, social, or public policy causes would violate fiduciary duty and is prohibited by ERISA. In a series of bulletins issued in October 2015, December 2016, and May 2018, the US Department of Labor (DOL) determined that certain ESG-related investment practices do not violate ERISA or fiduciary duty. These practices include the addition of the consideration of ESG factors in investment policy statements; the integration of ESG factors in the evaluation of an investment's risk or return; and the use of ESG considerations as determining factors, or "tie-breakers," when choosing among investments that have equivalent economic benefits for a pension plan.

EXAMPLE 11

ESG Implementation Methods

The ESG implementation method that is *most* associated with excluding certain sectors or companies is:

A   thematic investing.

B   negative screening.

C   relative/best-in-class.

Solution:

B is correct. Negative screening entails excluding certain companies or sectors, such as fossil fuel extraction, from a portfolio. A is incorrect because thematic investing typically focuses on investing in companies within a specific sector or following a specific theme, such as energy efficiency or climate change, as opposed to merely excluding a set of companies or industries from a portfolio. Likewise, C is incorrect because relative/best-in-class focuses on companies that rank (or score) most favorably compared to their peers with regard to ESG factors.

SUMMARY

The investment community has increasingly recognized the importance of corporate governance, as well as environmental and social considerations. Although practices concerning corporate governance (and ESG overall) will undoubtedly continue to

evolve, investment analysts who have a good understanding of these concepts can better appreciate the implications of ESG considerations in investment decision making. The core concepts covered in this reading are as follows:

- Corporate governance can be defined as a system of controls and procedures by which individual companies are managed.

- There are many systems of corporate governance, most reflecting the influences of either shareholder theory or stakeholder theory, or both. Current trends, however, point to increasing convergence.

- A corporation's governance system is influenced by several stakeholder groups, and the interests of the groups often diverge or conflict.

- The primary stakeholder groups of a corporation consist of shareholders, creditors, managers and employees, the board of directors, customers, suppliers, and government/regulators.

- A principal–agent relationship (or agency relationship) entails a principal hiring an agent to perform a particular task or service. In a corporate structure, such relationships often lead to conflicts among various stakeholders.

- Stakeholder management involves identifying, prioritizing, and understanding the interests of stakeholder groups and on that basis managing the company's relationships with stakeholders. The framework of corporate governance and stakeholder management reflects a legal, contractual, organizational, and governmental infrastructure.

- Mechanisms of stakeholder management may include general meetings, a board of directors, the audit function, company reporting and transparency, related-party transactions, remuneration policies (including say on pay), and other mechanisms to manage the company's relationship with its creditors, employees, customers, suppliers, and regulators.

- A board of directors is the central pillar of the governance structure, serves as the link between shareholders and managers, and acts as the shareholders' internal monitoring tool within the company.

- The structure and composition of a board of directors vary across countries and companies. The number of directors may vary, and the board typically includes a mix of expertise levels, backgrounds, and competencies.

- Executive (internal) directors are employed by the company and are typically members of senior management. Non-executive (external) directors have limited involvement in daily operations but serve an important oversight role.

- Two primary duties of a board of directors are duty of care and duty of loyalty.

- A company's board of directors typically has several committees that are responsible for specific functions and report to the board. Although the types of committees may vary across organization, the most common are the audit committee, governance committee, remuneration (compensation) committee, nomination committee, risk committee, and investment committee.

- Stakeholder relationships and corporate governance are continually shaped and influenced by a variety of market and non-market factors.

- Shareholder engagement by a company can provide benefits that include building support against short-term activist investors, countering negative recommendations from proxy advisory firms, and receiving greater support for management's position.

- Shareholder activism encompasses a range of strategies that may be used by shareholders when seeking to compel a company to act in a desired manner.

- From a corporation's perspective, risks of poor governance include weak control systems; ineffective decision making; and legal, regulatory, reputational, and default risk. Benefits include better operational efficiency, control, and operating and financial performance, as well as lower default risk (or cost of debt).
- Key analyst considerations in corporate governance and stakeholder management include economic ownership and voting control, board of directors representation, remuneration and company performance, investor composition, strength of shareholders' rights, and the management of long-term risks.
- Several terms—sometimes interchangeable—and investment approaches have evolved in relation to ESG: sustainable investing; responsible investing; ESG investing; and socially responsible investing.
- Specific ESG investment styles include:

ESG Investment Style	Description
Negative Screening	Excluding companies or sectors based on business activities or environmental or social concerns
Positive Screening	Including sectors or companies based on specific ESG criteria
Relative/best-in-class screening	Investing in sectors, companies, or projects based on ESG performance relative to industry peers
Full integration	Including ESG factors into the traditional financial analysis of individual stocks
Overlay/portfolio tilt	Using strategies or products to achieve certain ESG characteristics for a fund or portfolio
Risk factor/risk premium investing	Including ESG information in the analysis of systematic risks such as smart beta or factor investing
Thematic investment	Investing in themes or assets related to ESG factors
Engagement/active ownership	Using shareholder power to influence corporate behavior to achieve targeted ESG objectives along with financial returns

PRACTICE PROBLEMS

1 Corporate governance:

   A complies with a set of global standards.

   B is independent of both shareholder theory and stakeholder theory.

   C seeks to minimize and manage conflicting interests between insiders and external shareholders.

2 Which group of company stakeholders would be *least* affected if the firm's financial position weakens?

   A Suppliers

   B Customers

   C Managers and employees

3 Which of the following represents a principal–agent conflict between shareholders and management?

   A Risk tolerance

   B Multiple share classes

   C Accounting and reporting practices

4 Which of the following issues discussed at a shareholders' general meeting would *most likely* require only a simple majority vote for approval?

   A Voting on a merger

   B Election of directors

   C Amendments to bylaws

5 Which of the following statements regarding stakeholder management is *most* accurate?

   A Company management ensures compliance with all applicable laws and regulations.

   B Directors are excluded from voting on transactions in which they hold material interest.

   C The use of variable incentive plans in executive remuneration is decreasing.

6 Which of the following represents a responsibility of a company's board of directors?

   A Implementation of strategy

   B Enterprise risk management

   C Considering the interests of shareholders only

7 Which of the following statements about non-market factors in corporate governance is *most* accurate?

   A Stakeholders can spread information quickly and shape public opinion.

   B A civil law system offers better protection of shareholder interests than does a common law system.

   C Vendors providing corporate governance services have limited influence on corporate governance practices.

8 Which of the following statements regarding corporate shareholders is *most* accurate?

   A Cross-shareholdings help promote corporate mergers.

B Dual-class structures are used to align economic ownership with control.

C Affiliated shareholders can protect a company against hostile takeover bids.

9 Which of the following statements about environmental, social, and governance (ESG) in investment analysis is correct?

   A ESG factors are strictly intangible in nature.

   B ESG terminology is easily distinguishable among investors.

   C Environmental and social factors have been adopted in investment analysis more slowly than governance factors.

10 Which of the following statements regarding ESG implementation methods is *most accurate*?

   A Negative screening is the most commonly applied method.

   B Thematic investing considers multiple factors.

   C Relative/best-in-class screening excludes industries with unfavorable ESG aspects.

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, companies, or practices that violate accepted standards in such areas as human rights or environmental concerns, is the most common ESG investment style.

NPVs and Stock Prices

Freitag Corporation is investing €600 million in distribution facilities. The present value of the future after-tax cash flows is estimated to be €850 million. Freitag has 200 million outstanding shares with a current market price of €32.00 per share. This investment is new information, and it is independent of other expectations about the company. What should be the effect of the project on the value of the company and the stock price?

Solution:

The NPV of the project is €850 million – €600 million = €250 million. The total market value of the company prior to the investment is €32.00 × 200 million shares = €6,400 million. The value of the company should increase by €250 million to €6,650 million. The price per share should increase by the NPV per share, or €250 million/200 million shares = €1.25 per share. The share price should increase from €32.00 to €33.25.

The effect of a capital budgeting project's positive or negative NPV on share price is more complicated than Example 6 above, in which the value of the stock increased by the project's NPV. The value of a company is the value of its existing investments plus the net present values of all of its future investments. If an analyst learns of an investment, the impact of that investment on the stock price will depend on whether the investment's profitability is more or less than expected. For example, an analyst could learn of a positive NPV project, but if the project's profitability is less than expectations, this stock might drop in price on the news. Alternatively, news of a particular capital project might be considered as a signal about other capital projects underway or in the future. A project that by itself might add, say, €0.25 to the value of the stock might signal the existence of other profitable projects. News of this project might increase the stock price by far more than €0.25.

The integrity of a corporation's capital budgeting processes is important to analysts. Management's capital budgeting processes can demonstrate two things about the quality of management: the degree to which management embraces the goal of shareholder wealth maximization, and its effectiveness in pursuing that goal. Both of these factors are important to shareholders.

SUMMARY

Capital budgeting is the process that companies use for decision making on capital projects—those projects with a life of a year or more. This reading developed the principles behind the basic capital budgeting model, the cash flows that go into the model, and several extensions of the basic model.

■ Capital budgeting supports the most critical investments for many corporations—their investments in long-term assets. The principles of capital budgeting have been applied to other corporate investing and financing decisions and to security analysis and portfolio management.

■ The typical steps in the capital budgeting process are: 1) generating ideas, 2) analyzing individual proposals, 3) planning the capital budget, and 4) monitoring and post-auditing.

- Types of projects appropriate for the capital budgeting process can be categorized as: 1) replacement, 2) expansion, 3) new products and services, and 4) regulatory, safety and environmental.

- Capital budgeting decisions are based on incremental after-tax cash flows discounted at the opportunity cost of funds. Financing costs are ignored because both the cost of debt and the cost of other capital are captured in the discount rate.

- The net present value (NPV) is the present value of all after-tax cash flows, or

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

  where the investment outlays are negative cash flows included in the CF_ts and where r is the required rate of return for the investment.

- The IRR is the discount rate that makes the present value of all future cash flows sum to zero. This equation can be solved for the IRR:

$$\sum_{t=0}^{n} \frac{CF_t}{(1 + IRR)^t} = 0$$

- The payback period is the number of years required to recover the original investment in a project. The payback is based on cash flows.

- The discounted payback period is the number of years it takes for the cumulative discounted cash flows from a project to equal the original investment.

- The average accounting rate of return (AAR) can be defined as follows:

$$AAR = \frac{Average\ net\ income}{Average\ book\ value}$$

- The profitability index (PI) is the present value of a project's future cash flows divided by the initial investment:

$$PI = \frac{PV\ of\ future\ cash\ flows}{Initial\ investment} = 1 + \frac{NPV}{Initial\ investment}$$

- The capital budgeting decision rules are to invest if the NPV > 0, if the IRR > r, or if the PI > 1.0 There are no decision rules for the payback period, discounted payback period, and AAR because they are not always sound measures.

- The NPV profile is a graph that shows a project's NPV graphed as a function of various discount rates.

- For mutually exclusive projects that are ranked differently by the NPV and IRR, it is economically sound to choose the project with the higher NPV.

- The "multiple IRR problem" and the "no IRR problem" can arise for a project with nonconventional cash flows—cash flows that change signs more than once during the project's life.

- The fact that projects with positive NPVs theoretically increase the value of the company and the value of its stock could explain the popularity of NPV as an evaluation method.

PRACTICE PROBLEMS

1 The net present value (NPV) of an investment is equal to the sum of the expected cash flows discounted at the:

 A internal rate of return.

 B risk-free rate.

 C opportunity cost of capital.

2 A $2.2 million investment will result in the cash flows shown below:

Year	Year-End Cash Flow (millions)
1	$1.3
2	$1.6
3	$1.9
4	$0.8

 Using an 8% opportunity cost of capital, the project's net present value (NPV) is *closest* to:

 A $2.47 million.

 B $3.40 million.

 C $4.67 million.

3 The internal rate of return (IRR) is *best* described as the:

 A opportunity cost of capital.

 B time-weighted rate of return.

 C discount rate that makes the net present value equal to zero.

4 A three-year investment requires an initial outlay of £1,000. It is expected to provide three year-end cash flows of £200 plus a net salvage value of £700 at the end of three years. Its internal rate of return (IRR) is *closest* to:

 A 10%.

 B 11%.

 C 20%.

5 Given the following cash flows for a capital project, calculate the NPV and IRR. The required rate of return is 8 percent.

Year	0	1	2	3	4	5
Cash flow	−50,000	15,000	15,000	20,000	10,000	5,000

	NPV	IRR
A	$1,905	10.9%
B	$1,905	26.0%
C	$3,379	10.9%

6 Given the following cash flows for a capital project, calculate its payback period and discounted payback period. The required rate of return is 8 percent.

Year	0	1	2	3	4	5
Cash flow	−50,000	15,000	15,000	20,000	10,000	5,000

The discounted payback period is:

A 0.16 years longer than the payback period.

B 0.51 years longer than the payback period.

C 1.01 years longer than the payback period.

7 An investment of $100 generates after-tax cash flows of $40 in Year 1, $80 in Year 2, and $120 in Year 3. The required rate of return is 20 percent. The net present value is *closest* to:

A $42.22.

B $58.33.

C $68.52.

8 An investment of $150,000 is expected to generate an after-tax cash flow of $100,000 in one year and another $120,000 in two years. The cost of capital is 10 percent. What is the internal rate of return?

A 28.39 percent.

B 28.59 percent.

C 28.79 percent.

9 Kim Corporation is considering an investment of 750 million won with expected after-tax cash inflows of 175 million won per year for seven years. The required rate of return is 10 percent. What is the project's:

	NPV?	IRR?
A	102 million won	14.0%
B	157 million won	23.3%
C	193 million won	10.0%

10 Kim Corporation is considering an investment of 750 million won with expected after-tax cash inflows of 175 million won per year for seven years. The required rate of return is 10 percent. Expressed in years, the project's payback period and discounted payback period, respectively, are *closest* to:

A 4.3 years and 5.4 years.

B 4.3 years and 5.9 years.

C 4.8 years and 6.3 years.

11 An investment of $20,000 will create a perpetual after-tax cash flow of $2,000. The required rate of return is 8 percent. What is the investment's profitability index?

A 1.08.

B 1.16.

C 1.25.

12 Hermann Corporation is considering an investment of €375 million with expected after-tax cash inflows of €115 million per year for seven years and an additional after-tax salvage value of €50 million in Year 7. The required rate of return is 10 percent. What is the investment's PI?

A 1.19.

B 1.33.

   C   1.56.

13 Erin Chou is reviewing a profitable investment project that has a conventional cash flow pattern. If the cash flows for the project, initial outlay, and future after-tax cash flows all double, Chou would predict that the IRR would:

   A   increase and the NPV would increase.

   B   stay the same and the NPV would increase.

   C   stay the same and the NPV would stay the same.

14 Shirley Shea has evaluated an investment proposal and found that its payback period is one year, it has a negative NPV, and it has a positive IRR. Is this combination of results possible?

   A   Yes.

   B   No, because a project with a positive IRR has a positive NPV.

   C   No, because a project with such a rapid payback period has a positive NPV.

15 An investment has an outlay of 100 and after-tax cash flows of 40 annually for four years. A project enhancement increases the outlay by 15 and the annual after-tax cash flows by 5. As a result, the vertical intercept of the NPV profile of the enhanced project shifts:

   A   up and the horizontal intercept shifts left.

   B   up and the horizontal intercept shifts right.

   C   down and the horizontal intercept shifts left.

16 Projects 1 and 2 have similar outlays, although the patterns of future cash flows are different. The cash flows as well as the NPV and IRR for the two projects are shown below. For both projects, the required rate of return is 10 percent.

	Cash Flows						
Year	0	1	2	3	4	NPV	IRR (%)
Project 1	−50	20	20	20	20	13.40	21.86
Project 2	−50	0	0	0	100	18.30	18.92

The two projects are mutually exclusive. What is the appropriate investment decision?

   A   Invest in both projects.

   B   Invest in Project 1 because it has the higher IRR.

   C   Invest in Project 2 because it has the higher NPV.

17 Consider the two projects below. The cash flows as well as the NPV and IRR for the two projects are given. For both projects, the required rate of return is 10 percent.

	Cash Flows						
Year	0	1	2	3	4	NPV	IRR (%)
Project 1	−100	36	36	36	36	14.12	16.37
Project 2	−100	0	0	0	175	19.53	15.02

What discount rate would result in the same NPV for both projects?

   A   A rate between 0.00 percent and 10.00 percent.

   B   A rate between 10.00 percent and 15.02 percent.

   C   A rate between 15.02 percent and 16.37 percent.

18 Wilson Flannery is concerned that this project has multiple IRRs.

Year	0	1	2	3
Cash flows	−50	100	0	−50

How many discount rates produce a zero NPV for this project?

A One, a discount rate of 0 percent.

B Two, discount rates of 0 percent and 32 percent.

C Two, discount rates of 0 percent and 62 percent.

19 With regard to the net present value (NPV) profiles of two projects, the cross-over rate is *best* described as the discount rate at which:

A two projects have the same NPV.

B two projects have the same internal rate of return.

C a project's NPV changes from positive to negative.

20 With regard to net present value (NPV) profiles, the point at which a profile crosses the vertical axis is *best* described as:

A the point at which two projects have the same NPV.

B the sum of the undiscounted cash flows from a project.

C a project's internal rate of return when the project's NPV is equal to zero.

21 With regard to net present value (NPV) profiles, the point at which a profile crosses the horizontal axis is *best* described as:

A the point at which two projects have the same NPV.

B the sum of the undiscounted cash flows from a project.

C a project's internal rate of return when the project's NPV is equal to zero.

22 With regard to capital budgeting, an appropriate estimate of the incremental cash flows from a project is *least likely* to include:

A externalities.

B interest costs.

C opportunity costs.

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.

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

3 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.

4 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

5 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.

6 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 exhibit 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.

7   B is correct.

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

8   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.

9   A is correct.

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

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

10   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.

11   C is correct.

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

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

12 C is correct.

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

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

13 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.

14 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.

15 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.

16 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).

17 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).

18 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

19 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.

20 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.

21 C is correct. The horizontal axis represents an NPV of zero. By definition, the project's IRR equals an NPV of zero.

22 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.

In a survey of publicly traded multinational European companies, Franck Bancel and Usha Mittoo provide evidence consistent with the Graham and Harvey survey.[41] They find that over 70 percent of companies use the CAPM to determine the cost of equity; this compares with the 73.5 percent of US companies that use the CAPM. In a survey of both publicly traded and private European companies, Dirk Brounen, Abe de Jong, and Kees Koedijk confirm the result of Graham and Harvey that larger companies are more likely to use the more sophisticated methods, such as CAPM, in estimating the cost of equity.[42] Brounen, Jong, and Koedijk find that the popularity of the use of CAPM is less for their sample (ranging from 34 percent to 55.6 percent, depending on the country) than for the other two surveys, which may reflect the inclusion of smaller, private companies in the latter sample.

We learn from the survey evidence that the CAPM is a popular method for estimating the cost of equity capital and that it is used less by smaller, private companies. This latter result is not surprising because of the difficulty in estimating systematic risk in cases in which the company's equity is not publicly traded.

SUMMARY

In this reading, we provided an overview of the techniques used to calculate the cost of capital for companies and projects. We examined the weighted average cost of capital, discussing the methods commonly used to estimate the component costs of capital and the weights applied to these components. The international dimension of the cost of capital, as well as key factors influencing the cost of capital, were also analyzed.

- The weighted average cost of capital is a weighted average of the after-tax marginal costs of each source of capital: WACC $= w_d r_d (1 - t) + w_p r_p + w_e r_e$

- An analyst uses the WACC in valuation. For example, the WACC is used to value a project using the net present value method:

  NPV = Present value of inflows − Present value of the outflows

- The before-tax cost of debt is generally estimated by means of one of the two methods: yield to maturity or bond rating.

- The yield-to-maturity method of estimating the before-tax cost of debt uses the familiar bond valuation equation. Assuming semi-annual coupon payments, the equation is

$$P_0 = \frac{PMT_1}{\left(1 + \frac{r_d}{2}\right)} + \ldots + \frac{PMT_n}{\left(1 + \frac{r_d}{2}\right)^n} + \frac{FV}{\left(1 + \frac{r_d}{2}\right)^n} = \left(\sum_{t=1}^{n} \frac{PMT_t}{\left(1 + \frac{r_d}{2}\right)^t}\right) + \frac{FV}{\left(1 + \frac{r_d}{2}\right)^n}$$

We solve for the six-month yield $(r_d/2)$ and then annualize it to arrive at the before-tax cost of debt, r_d.

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41 Franck Bancel and Usha Mittoo, "The Determinants of Capital Structure Choice: A Survey of European Firms," *Financial Management*, Vol. 44, No. 4 (Winter 2004).
42 Dirk Brounen, Abe de Jong, and Kees Koedijk, "Corporate Finance in Europe: Confronting Theory with Practice," *Financial Management*, Vol. 44, No. 4 (Winter 2004).

- Because interest payments are generally tax-deductible, the after-tax cost is the true, effective cost of debt to the company. If a current yield or bond rating is not available, such as in the case of a private company without rated debt or a project, the estimate of the cost of debt becomes more challenging.

- The cost of preferred stock is the preferred stock dividend divided by the current preferred stock price:

$$r_p = \frac{D_p}{P_p}$$

- The cost of equity is the rate of return required by a company's common stockholders. We estimate this cost using the CAPM (or its variants) or the dividend discount method.

- The CAPM is the approach most commonly used to calculate the cost of common stock. The three components needed to calculate the cost of common stock are the risk-free rate, the equity risk premium, and beta:

$$E(R_i) = R_F + \beta_i \left[E(R_M) - R_F \right]$$

- When estimating the cost of equity capital using the CAPM when we do not have publicly traded equity, we may be able to use the pure-play method in which we estimate the unlevered beta for a company with similar business risk, β_U,

$$\beta_{U,comparable} = \frac{\beta_{L,comparable}}{\left[1 + \left(\left(1 - t_{comparable} \right) \frac{D_{comparable}}{E_{comparable}} \right) \right]}$$

and then lever this beta to reflect the financial risk of the project or company:

$$\beta_{L,project} = \beta_{U,comparable} \left[1 + \left(\left(1 - t_{project} \right) \frac{D_{project}}{E_{project}} \right) \right]$$

- It is often the case that country and foreign exchange risk are diversified so that we can use the estimated β in the CAPM analysis. However, in the case in which these risks cannot be diversified away, we can adjust our measure of systematic risk by a country equity premium to reflect this nondiversified risk:

$$\text{Country equity premium} = \text{Sovereign yield spread} \left[\frac{\text{Annualized standard deviation of equity index}}{\text{Annualized standard deviation of the sovereign bond market in terms of the developed market currency}} \right]$$

- The dividend discount model approach is an alternative approach to calculating the cost of equity, whereby the cost of equity is estimated as follows:

$$r_e = \frac{D_1}{P_0} + g$$

- We can estimate the growth rate in the dividend discount model by using published forecasts of analysts or by estimating the sustainable growth rate:

$$g = \left(1 - D/\text{EPS} \right)\text{ROE}$$

- In estimating the cost of equity, an alternative to the CAPM and dividend discount approaches is the bond yield plus risk premium approach. In this approach, we estimate the before-tax cost of debt and add a risk premium that reflects the additional risk associated with the company's equity.

- The marginal cost of capital schedule is a graph plotting the new funds raised by a company on the *x*-axis and the cost of capital on the *y*-axis. The cost of capital is level to the point at which one of the costs of capital changes, such as when the company bumps up against a debt covenant, requiring it to use another form of capital. We calculate a break point using information on when the different sources' costs change and the proportions that the company uses when it raises additional capital:

$$\text{Break point} = \frac{\text{Amount of capital at which the source's cost of capital changes}}{\text{Proportion of new capital raised from the source}}$$

- Flotation costs are costs incurred in the process of raising additional capital. The preferred method of including these costs in the analysis is as an initial cash flow in the valuation analysis.

- Survey evidence tells us that the CAPM method is the most popular method used by companies in estimating the cost of equity. The CAPM is more popular with larger, publicly traded companies, which is understandable considering the additional analyses and assumptions required in estimating systematic risk for a private company or project.

PRACTICE PROBLEMS

1 The cost of equity is equal to the:

   A expected market return.

   B rate of return required by stockholders.

   C cost of retained earnings plus dividends.

2 Which of the following statements is correct?

   A The appropriate tax rate to use in the adjustment of the before-tax cost of debt to determine the after-tax cost of debt is the average tax rate because interest is deductible against the company's entire taxable income.

   B For a given company, the after-tax cost of debt is generally less than both the cost of preferred equity and the cost of common equity.

   C For a given company, the investment opportunity schedule is upward sloping because as a company invests more in capital projects, the returns from investing increase.

3 Using the dividend discount model, what is the cost of equity capital for Zeller Mining if the company will pay a dividend of C$2.30 next year, has a payout ratio of 30 percent, a return on equity (ROE) of 15 percent, and a stock price of C$45?

   A 9.61 percent.

   B 10.50 percent.

   C 15.61 percent.

4 Dot.Com has determined that it could issue $1,000 face value bonds with an 8 percent coupon paid semi-annually and a five-year maturity at $900 per bond. If Dot.Com's marginal tax rate is 38 percent, its after-tax cost of debt is *closest* to:

   A 6.2 percent.

   B 6.4 percent.

   C 6.6 percent.

5 The cost of debt can be determined using the yield-to-maturity and the bond rating approaches. If the bond rating approach is used, the:

   A coupon is the yield.

   B yield is based on the interest coverage ratio.

   C company is rated and the rating can be used to assess the credit default spread of the company's debt.

6 Morgan Insurance Ltd. issued a fixed-rate perpetual preferred stock three years ago and placed it privately with institutional investors. The stock was issued at $25 per share with a $1.75 dividend. If the company were to issue preferred stock today, the yield would be 6.5 percent. The stock's current value is:

   A $25.00.

   B $26.92.

   C $37.31.

7 A financial analyst at Buckco Ltd. wants to compute the company's weighted average cost of capital (WACC) using the dividend discount model. The analyst has gathered the following data:

Before-tax cost of new debt	8 percent
Tax rate	40 percent
Target debt-to-equity ratio	0.8033
Stock price	$30
Next year's dividend	$1.50
Estimated growth rate	7 percent

Buckco's WACC is *closest* to:

A   8 percent.

B   9 percent.

C   12 percent.

8   The Gearing Company has an after-tax cost of debt capital of 4 percent, a cost of preferred stock of 8 percent, a cost of equity capital of 10 percent, and a weighted average cost of capital of 7 percent. Gearing intends to maintain its current capital structure as it raises additional capital. In making its capital-budgeting decisions for the average-risk project, the relevant cost of capital is:

A   4 percent.

B   7 percent.

C   8 percent.

9   Fran McClure of Alba Advisers is estimating the cost of capital of Frontier Corporation as part of her valuation analysis of Frontier. McClure will be using this estimate, along with projected cash flows from Frontier's new projects, to estimate the effect of these new projects on the value of Frontier. McClure has gathered the following information on Frontier Corporation:

	Current Year ($)	Forecasted for Next Year ($)
Book value of debt	50	50
Market value of debt	62	63
Book value of shareholders' equity	55	58
Market value of shareholders' equity	210	220

The weights that McClure should apply in estimating Frontier's cost of capital for debt and equity are, respectively:

A w_d = 0.200; w_e = 0.800.

B w_d = 0.185; w_e = 0.815.

C w_d = 0.223; w_e = 0.777.

10   Wang Securities had a long-term stable debt-to-equity ratio of 0.65. Recent bank borrowing for expansion into South America raised the ratio to 0.75. The increased leverage has what effect on the asset beta and equity beta of the company?

A   The asset beta and the equity beta will both rise.

B   The asset beta will remain the same and the equity beta will rise.

C   The asset beta will remain the same and the equity beta will decline.

11   Brandon Wiene is a financial analyst covering the beverage industry. He is evaluating the impact of DEF Beverage's new product line of flavored waters. DEF currently has a debt-to-equity ratio of 0.6. The new product line would be financed with $50 million of debt and $100 million of equity. In estimating the valuation impact of this new product line on DEF's value, Wiene has estimated

the equity beta and asset beta of comparable companies. In calculating the equity beta for the product line, Wiene is intending to use DEF's existing capital structure when converting the asset beta into a project beta. Which of the following statements is correct?

A Using DEF's debt-to-equity ratio of 0.6 is appropriate in calculating the new product line's equity beta.

B Using DEF's debt-to-equity ratio of 0.6 is not appropriate, but rather the debt-to-equity ratio of the new product, 0.5, is appropriate to use in calculating the new product line's equity beta.

C Wiene should use the new debt-to-equity ratio of DEF that would result from the additional $50 million debt and $100 million equity in calculating the new product line's equity beta.

12 Happy Resorts Company currently has 1.2 million common shares of stock outstanding and the stock has a beta of 2.2. It also has $10 million face value of bonds that have five years remaining to maturity and 8 percent coupon with semi-annual payments, and are priced to yield 13.65 percent. If Happy issues up to $2.5 million of new bonds, the bonds will be priced at par and have a yield of 13.65 percent; if it issues bonds beyond $2.5 million, the expected yield on the entire issuance will be 16 percent. Happy has learned that it can issue new common stock at $10 a share. The current risk-free rate of interest is 3 percent and the expected market return is 10 percent. Happy's marginal tax rate is 30 percent. If Happy raises $7.5 million of new capital while maintaining the same debt-to-equity ratio, its weighted average cost of capital is *closest* to:

A 14.5 percent.

B 15.5 percent.

C 16.5 percent.

The following information relates to Questions 13–18[1]

Jurgen Knudsen has been hired to provide industry expertise to Henrik Sandell, CFA, an analyst for a pension plan managing a global large-cap fund internally. Sandell is concerned about one of the fund's larger holdings, auto parts manufacturer Kruspa AB. Kruspa currently operates in 80 countries, with the previous year's global revenues at €5.6 billion. Recently, Kruspa's CFO announced plans for expansion into Trutan, a country with a developing economy. Sandell worries that this expansion will change the company's risk profile and wonders if he should recommend a sale of the position.

Sandell provides Knudsen with the basic information. Kruspa's global annual free cash flow to the firm is €500 million and earnings are €400 million. Sandell estimates that cash flow will level off at a 2 percent rate of growth. Sandell also estimates that Kruspa's after-tax free cash flow to the firm on the Trutan project for next three years is, respectively, €48 million, €52 million, and €54.4 million. Kruspa recently announced a dividend of €4.00 per share of stock. For the initial analysis, Sandell requests that Knudsen ignore possible currency fluctuations. He expects the Trutanese plant to sell only to customers within Trutan for the first three years. Knudsen is asked to evaluate Kruspa's planned financing of the required €100 million with a €80 million public offering of 10-year debt in Sweden and the remainder with an equity offering.

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1 The Level I exam uses only independent questions. This minicase is intended as a learning exercise.

Additional information:

Equity risk premium, Sweden	4.82 percent
Risk-free rate of interest, Sweden	4.25 percent
Industry debt-to-equity ratio	0.3
Market value of Kruspa's debt	€900 million
Market value of Kruspa's equity	€2.4 billion
Kruspa's equity beta	1.3
Kruspa's before-tax cost of debt	9.25 percent
Trutan credit A2 country risk premium	1.88 percent
Corporate tax rate	37.5 percent
Interest payments each year	Level

13 Using the capital asset pricing model, Kruspa's cost of equity capital for its typical project is *closest* to:

   A 7.62 percent.

   B 10.52 percent.

   C 12.40 percent.

14 Sandell is interested in the weighted average cost of capital of Kruspa AB prior to its investing in the Trutan project. This weighted average cost of capital (WACC) is *closest* to:

   A 7.65 percent.

   B 9.23 percent.

   C 10.17 percent.

15 In his estimation of the project's cost of capital, Sandell would like to use the asset beta of Kruspa as a base in his calculations. The estimated asset beta of Kruspa prior to the Trutan project is *closest* to:

   A 1.053.

   B 1.110.

   C 1.327.

16 Sandell is performing a sensitivity analysis of the effect of the new project on the company's cost of capital. If the Trutan project has the same asset risk as Kruspa, the estimated project beta for the Trutan project, if it is financed 80 percent with debt, is *closest* to:

   A 1.300.

   B 2.635.

   C 3.686.

17 As part of the sensitivity analysis of the effect of the new project on the company's cost of capital, Sandell is estimating the cost of equity of the Trutan project considering that the Trutan project requires a country equity premium to capture the risk of the project. The cost of equity for the project in this case is *closest* to:

   A 10.52 percent.

   B 19.91 percent.

   C 28.95 percent.

18 In his report, Sandell would like to discuss the sensitivity of the project's net present value to the estimation of the cost of equity. The Trutan project's net present value calculated using the equity beta without and with the country risk premium are, respectively:

   A €26 million and €24 million.

   B €28 million and €25 million.

   C €30 million and €27 million.

The following information relates to Questions 19–22[2]

Boris Duarte, CFA, covers initial public offerings for Zellweger Analytics, an independent research firm specializing in global small-cap equities. He has been asked to evaluate the upcoming new issue of TagOn, a US-based business intelligence software company. The industry has grown at 26 percent per year for the previous three years. Large companies dominate the market, but sizable "pure-play" companies such as Relevant, Ltd., ABJ, Inc., and Opus Software Pvt. Ltd also compete. Each of these competitors is domiciled in a different country, but they all have shares of stock that trade on the US NASDAQ. The debt ratio of the industry has risen slightly in recent years.

Company	Sales in Millions ($)	Market Value Equity in Millions ($)	Market Value Debt in Millions ($)	Equity Beta	Tax Rate	Share Price ($)
Relevant Ltd.	752	3,800	0.0	1.702	23 percent	42
ABJ, Inc.	843	2,150	6.5	2.800	23 percent	24
Opus Software Pvt. Ltd.	211	972	13.0	3.400	23 percent	13

Duarte uses the information from the preliminary prospectus for TagOn's initial offering. The company intends to issue 1 million new shares. In his conversation with the investment bankers for the deal, he concludes the offering price will be between $7 and $12. The current capital structure of TagOn consists of a $2.4 million five-year non-callable bond issue and 1 million common shares. Other information that Duarte has gathered:

Currently outstanding bonds	$2.4 million five-year bonds, coupon of 12.5 percent, with a market value of $2.156 million
Risk-free rate of interest	5.25 percent
Estimated equity risk premium	7 percent
Tax rate	23 percent

19 The asset betas for Relevant, ABJ, and Opus, respectively, are:

   A 1.70, 2.52, and 2.73.

   B 1.70, 2.79, and 3.37.

   C 1.70, 2.81, and 3.44.

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2 The Level I exam uses only independent questions. This minicase is intended as a learning exercise.

20 The average asset beta for the pure players in this industry, Relevant, ABJ, and Opus, weighted by market value of equity is *closest* to:

  A 1.67.

  B 1.97.

  C 2.27.

21 Using the capital asset pricing model, the cost of equity capital for a company in this industry with a debt-to-equity ratio of 0.01, asset beta of 2.27, and a marginal tax rate of 23 percent is *closest* to:

  A 17 percent.

  B 21 percent.

  C 24 percent.

22 The marginal cost of capital for TagOn, based on an average asset beta of 2.27 for the industry and assuming that new stock can be issued at $8 per share, is *closest* to:

  A 20.5 percent.

  B 21.0 percent.

  C 21.5 percent.

---

23 Two years ago, a company issued $20 million in long-term bonds at par value with a coupon rate of 9 percent. The company has decided to issue an additional $20 million in bonds and expects the new issue to be priced at par value with a coupon rate of 7 percent. The company has no other debt outstanding and has a tax rate of 40 percent. To compute the company's weighted average cost of capital, the appropriate after-tax cost of debt is *closest* to:

  A 4.2%.

  B 4.8%.

  C 5.4%.

24 An analyst gathered the following information about a company and the market:

Current market price per share of common stock	$28.00
Most recent dividend per share paid on common stock (D_0)	$2.00
Expected dividend payout rate	40%
Expected return on equity (ROE)	15%
Beta for the common stock	1.3
Expected rate of return on the market portfolio	13%
Risk-free rate of return	4%

Using the discounted cash flow (DCF) approach, the cost of retained earnings for the company is *closest* to:

  A 15.7%.

  B 16.1%.

  C 16.8%.

25 An analyst gathered the following information about a company and the market:

Current market price per share of common stock	$28.00
Most recent dividend per share paid on common stock (D_0)	$2.00
Expected dividend payout rate	40%
Expected return on equity (ROE)	15%
Beta for the common stock	1.3
Expected rate of return on the market portfolio	13%
Risk-free rate of return	4%

Using the Capital Asset Pricing Model (CAPM) approach, the cost of retained earnings for the company is *closest* to:

A   13.6%.

B   15.7%.

C   16.1%.

26 An analyst gathered the following information about a private company and its publicly traded competitor:

Comparable Companies	Tax Rate (%)	Debt/Equity	Equity Beta
Private company	30.0	1.00	N.A.
Public company	35.0	0.90	1.75

Using the pure-play method, the estimated equity beta for the private company is *closest* to:

A   1.029.

B   1.104.

C   1.877.

27 An analyst gathered the following information about the capital markets in the United States and in Paragon, a developing country.

Selected Market Information (%)	
Yield on US 10-year Treasury bond	4.5
Yield on Paragon 10-year government bond	10.5
Annualized standard deviation of Paragon stock index	35.0
Annualized standard deviation of Paragon dollar-denominated government bond	25.0

Based on the analyst's data, the estimated country equity premium for Paragon is *closest* to:

A   4.29%.

B   6.00%.

C   8.40%.

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 − Dividend payout ratio)(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%

    YTM = 5.3149% × 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.

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

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

    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 = 6.825%. 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 million × 40% = $3.0 million in bonds, which results in a before-tax rate of 16 percent.

$r_d(1 - t) = 0.16(1 - 0.3) = 0.112$ or 11.2%

$r_e = 0.03 + 2.2 (0.10 - 0.03) = 0.184$ or 18.4%

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

13 B is correct.

$r_e = 0.0425 + (1.3)(0.0482) = 0.1052$ or 10.52%

14 B is correct.

WACC = $[(€900/€3300) .0925 (1 - 0.375)] + [(€2400/€3300)(0.1052)]$
$= 0.0923$ or 9.23%

15 A is correct.

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

16 C is correct.

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

17 C is correct.

$r_e = 0.0425 + 3.686(0.0482 + 0.0188) = 0.2895$ or 28.95%

18 C is correct.

Cost of equity without the country risk premium:

$r_e = 0.0425 + 3.686 (0.0482) = 0.2202$ or 22.02%

Cost of equity with the country risk premium:

$r_e = 0.0425 + 3.686 (0.0482 + 0.0188) = 0.2895$ or 28.95%

Weighted average cost of capital without the country risk premium:

WACC = $[0.80 (0.0925) (1 - 0.375)] + [0.20 (0.2202)] = 0.04625 + 0.04404$
$= 0.09038$ or 9.03 percent

Weighted average cost of capital with the country risk premium:

WACC = $[0.80 (0.0925) (1 - 0.375)] + [0.20 (0.2895)] = 0.04625 + 0.0579$
$= 0.1042$ or 10.42 percent

NPV without the country risk premium:

$$NPV = \frac{€48 \text{ million}}{(1 + 0.0903)^1} + \frac{€52 \text{ million}}{(1 + 0.0903)^2} + \frac{€54.4 \text{ million}}{(1 + 0.0903)^3} - €100 \text{ million}$$

$= €44.03 \text{ million} + 43.74 \text{ million} + 41.97 \text{ million} - €100 \text{ million}$

$= €29.74 \text{ million}$

NPV with the country risk premium:

$$NPV = \frac{€48\ \text{million}}{(1 + 0.1042)^1} + \frac{€52\ \text{million}}{(1 + 0.1042)^2} + \frac{€54.4\ \text{million}}{(1 + 0.1042)^3} - €100\ \text{million}$$

$$= €43.47\ \text{million} + 42.65\ \text{million} + 40.41\ \text{million} - €100\ \text{million}$$

$$= €26.53\ \text{million}$$

19 B is correct.

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

Relevant = 1.702/[1 + (0.77)(0)] = 1.702

ABJ = 2.8/[1 + (0.77)(0.003)] = 2.7918

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

Weighted average beta (0.5490)(1.702) + (0.3106)(2.7918) + (0.1404)(3.3572) = 2.27.

21 B is correct.

Asset beta = 2.27

Levered beta = 2.27 {1 + [(1 − 0.23)(0.01)]} = 2.2875

Cost of equity capital = 0.0525 + (2.2875)(0.07) = 0.2126 or 21.26%

22 C is correct.

For debt: FV = 2,400,000; PV = 2,156,000; n = 10; PMT = 150,000

Solve for i. i = 0.07748. YTM = 15.5%

Before-tax cost of debt = 15.5%

Market value of equity = 1 million shares outstanding + 1 million newly issued shares = 2 million shares at $8 = $16 million

Total market capitalization = $2.156 million + $16 million = $18.156 million

Levered beta = 2.27 {1 + [(1 − 0.23)(2.156/16)]} = 2.27 (1.1038) = 2.5055

Cost of equity = 0.0525 + 2.5055 (0.07) = 0.2279 or 22.79%

Debt weight = $2.156/$18.156 = 0.1187

Equity weight = $16/$18.156 = 0.8813

TagOn's MCC = [(0.1187)(0.155)(1 − 0.23)] + [(0.8813)(0.2279)]
                        = 0.01417 + 0.20083
                        = 0.2150 or 21.50%

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 $(10.5\% - 4.5\%) \times (35\%/25\%) = 6\% \times 1.4 = 8.40\%$.

Retailers Do Not Deliver

Traditional brick-and-mortar retail stores have been challenged with competition from online retailers. Whereas some retailers successfully added online access, others have struggled to compete effectively. A number of US retail stores filed for bankruptcy protection in 2017 and 2018, including Radio Shack, Nine West, Toys R Us, Brookstone, Payless, and hhgregg. Though some of these retailers were "reborn" online (e.g., hhgregg.com), others liquidated (e.g., Toys R Us), and many are closing stores and working closely with creditors to stave off liquidation.

Whereas the ability to file for bankruptcy is important to the economy, the goal of most investors is to avoid ownership of companies that are heading toward this extreme step, as well as to be able to evaluate opportunities among companies already in bankruptcy. Under both Chapter 7 and Chapter 11, providers of equity capital generally lose all value during the bankruptcy. On the other hand, debtholders typically receive at least a portion of their capital, but the payments of principal and interest are delayed during the period of bankruptcy protection.

SUMMARY

In this reading, we have reviewed the fundamentals of business risk, financial risk, and measures of leverage.

■ Leverage is the use of fixed costs in a company's cost structure. Business risk is the risk associated with operating earnings and reflects both sales risk (uncertainty with respect to the price and quantity of sales) and operating risk (the risk related to the use of fixed costs in operations). Financial risk is the risk associated with how a company finances its operations (i.e., the split between equity and debt financing of the business).

■ The degree of operating leverage (DOL) is the ratio of the percentage change in operating income to the percentage change in units sold. We can use the following formula to measure the degree of operating leverage:

$$\text{DOL} = \frac{Q(P - V)}{Q(P - V) - F}$$

■ The degree of financial leverage (DFL) is the percentage change in net income for a one percent change in operating income. We can use the following formula to measure the degree of financial leverage:

$$\text{DFL} = \frac{\left[Q(P - V) - F\right](1 - t)}{\left[Q(P - V) - F - C\right](1 - t)} = \frac{\left[Q(P - V) - F\right]}{\left[Q(P - V) - F - C\right]}$$

■ The degree of total leverage (DTL) is a measure of the sensitivity of net income to changes in unit sales, which is equivalent to $\text{DTL} = \text{DOL} \times \text{DFL}$.

■ The breakeven point, Q_{BE}, is the number of units produced and sold at which the company's net income is zero, which we calculate as

$$Q_{\text{BE}} = \frac{F + C}{P - V}$$

■ The operating breakeven point, Q_{OBE}, is the number of units produced and sold at which the company's operating income is zero, which we calculate as

$$Q_{OBE} = \frac{F}{P - V}$$

PRACTICE PROBLEMS

1 If two companies have identical unit sales volume and operating risk, they are *most likely* to also have identical:

   A sales risk.

   B business risk.

   C sensitivity of operating earnings to changes in the number of units produced and sold.

2 Degree of operating leverage is *best* described as a measure of the sensitivity of:

   A net earnings to changes in sales.

   B fixed operating costs to changes in variable costs.

   C operating earnings to changes in the number of units produced and sold.

3 The Fulcrum Company produces decorative swivel platforms for home televisions. If Fulcrum produces 40 million units, it estimates that it can sell them for $100 each. Variable production costs are $65 per unit and fixed production costs are $1.05 billion. Which of the following statements is *most accurate*? Holding all else constant, the Fulcrum Company would:

   A generate positive operating income if unit sales were 25 million.

   B have less operating leverage if fixed production costs were 10 percent greater than $1.05 billion.

   C generate 20 percent more operating income if unit sales were 5 percent greater than 40 million.

4 The business risk of a particular company is *most accurately* measured by the company's:

   A debt-to-equity ratio.

   B efficiency in using assets to generate sales.

   C operating leverage and level of uncertainty about demand, output prices, and competition.

5 Consider two companies that operate in the same line of business and have the same degree of operating leverage: the Basic Company and the Grundlegend Company. The Basic Company and the Grundlegend Company have, respectively, no debt and 50 percent debt in their capital structure. Which of the following statements is *most accurate*? Compared to the Basic Company, the Grundlegend Company has:

   A a lower sensitivity of net income to changes in unit sales.

   B the same sensitivity of operating income to changes in unit sales.

   C the same sensitivity of net income to changes in operating income.

6 Myundia Motors now sells 1 million units at ¥3,529 per unit. Fixed operating costs are ¥1,290 million and variable operating costs are ¥1,500 per unit. If the company pays ¥410 million in interest, the levels of sales at the operating breakeven and breakeven points are, respectively:

   A ¥1,500,000,000 and ¥2,257,612,900.

   B ¥2,243,671,760 and ¥2,956,776,737.

   C ¥2,975,148,800 and ¥3,529,000,000.

7   Juan Alavanca is evaluating the risk of two companies in the machinery industry: The Gearing Company and Hebelkraft, Inc. Alavanca used the latest fiscal year's financial statements and interviews with managers of the respective companies to gather the following information:

	The Gearing Company	Hebelkraft, Inc.
Number of units produced and sold	1 million	1.5 million
Sales price per unit	$200	$200
Variable cost per unit	$120	$100
Fixed operating cost	$40 million	$90 million
Fixed financing expense	$20 million	$20 million

Based on this information, the breakeven points for The Gearing Company and Hebelkraft, Inc. are:

A   0.75 million and 1.1 million units, respectively.

B   1 million and 1.5 million units, respectively.

C   1.5 million and 0.75 million units, respectively.

The following information relates to Questions 8–16

Mary Benn, CFA, is a financial analyst for Twin Fields Investments, located in Storrs, Connecticut, USA. She has been asked by her supervisor, Bill Cho, to examine two small Japanese cell phone component manufacturers: 4G, Inc. and Qphone Corp. Cho indicates that his clients are most interested in the use of leverage by 4G and Qphone. Benn states, "I will have to specifically analyze each company's respective business risk, sales risk, operating risk, and financial risk." "Fine, I'll check back with you shortly," Cho, answers.

Benn begins her analysis by examining the sales prospects of the two firms. The results of her sales analysis appear in Exhibit 1. She also expects very little price variability for these cell phones. She next gathers more data on these two companies to assist her analysis of their operating and financial risk.

When Cho inquires as to her progress Benn responds, "I have calculated Qphone's degree of operating leverage (DOL) and degree of financial leverage (DFL) at Qphone's 2009 level of unit sales. I have also calculated Qphone's breakeven level for unit sales. I will have 4G's leverage results shortly."

Cho responds, "Good, I will call a meeting of some potential investors for tomorrow. Please help me explain these concepts to them, and the differences in use of leverage by these two companies. In preparation for the meeting, I have a number of questions":

- ▪ "You mentioned business risk; what is included in that?"
- ▪ "How would you classify the risk due to the varying mix of variable and fixed costs?"
- ▪ "Could you conduct an analysis and tell me how the two companies will fare relative to each other in terms of net income if their unit sales increased by 10 percent above their 2009 unit sales levels?"
- ▪ "Finally, what would be an accurate verbal description of the degree of total leverage?"

The relevant data for analysis of 4G is contained in Exhibit 2, and Benn's analysis of the Qphone data appears in Exhibit 3:

Exhibit 1	Benn's Unit Sales Estimates for 4G, Inc. and Qphone Corp.		
Company	2009 Unit Sales	Standard Deviation of Unit Sales	2010 Expected Unit Sales Growth Rate (%)
4G, Inc.	1,000,000	25,000	15
Qphone Corp.	1,500,000	10,000	15

Exhibit 2	Sales, Cost, and Expense Data for 4G, Inc. (At Unit Sales of 1,000,000)
Number of units produced and sold	1,000,000
Sales price per unit	¥108
Variable cost per unit	¥72
Fixed operating cost	¥22,500,000
Fixed financing expense	¥9,000,000

Exhibit 3	Benn's Analysis of Qphone (At Unit Sales of 1,500,000)
Degree of operating leverage	1.40
Degree of financial leverage	1.15
Breakeven quantity (units)	571,429

8 Based on Benn's analysis, 4G's sales risk relative to Qphone's is *most likely* to be:

   A lower.

   B equal.

   C higher.

9 What is the *most appropriate* response to Cho's question regarding the components of business risk?

   A Sales risk and financial risk.

   B Operating risk and sales risk.

   C Financial risk and operating risk.

10 The *most appropriate* response to Cho's question regarding the classification of risk arising from the mixture of variable and fixed costs is:

   A sales risk.

   B financial risk.

   C operating risk.

11 Based on the information in Exhibit 2, the degree of operating leverage (DOL) of 4G, Inc., at unit sales of 1,000,000, is *closest* to:

   A 1.60.

   B 2.67.

   C 3.20.

12 Based on the information in Exhibit 2, 4G, Inc.'s degree of financial leverage (DFL), at unit sales of 1,000,000, is *closest* to:

   A 1.33.

   B 2.67.

   C 3.00.

13 Based on the information in Exhibit 1 and Exhibit 3, Qphone's expected percentage change in operating income for 2010 is *closest* to:

   A 17.25%.

   B 21.00%.

   C 24.30%.

14 4G's breakeven quantity of unit sales is *closest* to:

   A 437,500 units.

   B 625,000 units.

   C 875,000 units.

15 In response to Cho's question regarding an increase in unit sales above 2009 unit sales levels, it is *most likely* that 4G's net income will increase at:

   A a slower rate than Qphone's.

   B the same rate as Qphone's.

   C a faster rate than Qphone's.

16 The *most appropriate* response to Cho's question regarding a description of the degree of total leverage is that degree of total leverage is:

   A the percentage change in net income divided by the percentage change in units sold.

   B the percentage change in operating income divided by the percentage change in units sold.

   C the percentage change in net income divided by the percentage change in operating income.

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:

$$\text{DOL} = \frac{(40 \text{ million})(\$100 - \$65)}{\left[(40 \text{ million})(\$100 - \$65)\right] - \$1.05 \text{ billion}}$$

$$= \frac{\$1.400 \text{ billion}}{\$1.400 \text{ billion} - \$1.05 \text{ billion}} = \frac{\$1.4}{\$0.35} = 4$$

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.

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

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

or

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

$$\text{Total breakeven} = \frac{¥1,290 \text{ million} + ¥410 \text{ million}}{(¥3,529 - ¥1,500)} = \frac{¥1,700 \text{ million}}{¥2,029}$$

$$= 837,851.1582 \text{ units}$$

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

or

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

7 A is correct. For The Gearing Company,

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

For Hebelkraft, Inc.,

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

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. $\text{DOL} = \dfrac{Q(P-V)}{Q(P-V)-F}$

$$\text{DOL @} \atop \text{1,000,000 units} = \dfrac{1,000,000(¥108 - ¥72)}{1,000,000(¥108 - ¥72) - ¥22,500,000} = 2.67$$

12 C is correct. Degree of financial leverage is

$$\text{DFL} = \dfrac{\left[Q(P-V)-F\right]}{\left[Q(P-V)-F-C\right]}$$

$$= \dfrac{1,000,000(¥108 - ¥72) - ¥22,500,000}{1,000,000(¥108 - ¥72) - ¥22,500,000 - ¥9,000,000} = 3.00$$

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:

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

14 C is correct. The breakeven quantity is computed

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

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 DOL × DFL = 1.4 × 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

$$\text{DTL} = \dfrac{Q(P-V)}{Q(P-V)-F-C}$$

$$= \dfrac{1,000,000(¥108 - ¥72)}{1,000,000(¥108 - ¥72) - ¥22,500,000 - ¥9,000,000} = 8.00$$

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.

Solution:

Line of credit cost:

$$\text{Line cost} = \frac{\text{Interest} + \text{Commitment fee}}{\text{Usable loan amount}} \times 12$$

$$= \frac{(0.025 \times \$5,000,000 \times 1/12) + (0.005 \times \$5,000,000 \times 1/12)}{\$5,000,000} \times 12$$

$$= \frac{\$10,416.67 + 2,083.33}{\$5,000,000} \times 12 = 0.03 \text{ or 3 percent}$$

Banker's acceptance cost:

$$\text{BA cost} = \frac{\text{Interest}}{\text{Net proceeds}} \times 12$$

$$= \frac{0.0255 \times \$5,000,000 \times 1/12}{\$5,000,000 - (0.0255 \times \$5,000,000 \times 1/12)} \times 12$$

$$= \frac{\$10,625}{\$4,989,375} \times 12 = 0.0256 \text{ or 2.56 percent}$$

Commercial paper cost (quoted as nominal rate at a discount):

$$\text{CP cost} = \frac{\text{Interest} + \text{Dealer's commissions} + \text{Backup costs}}{\text{Net proceeds}} \times 12$$

$$= \frac{(0.0215 \times \$5,000,000 \times 1/12) + (0.00125 \times \$5,000,000 \times 1/12) + (0.0025 \times \$5,000,000 \times 1/12)}{\$5,000,000 - (0.0215 \times \$5,000,000 \times 1/12)} \times 12$$

$$= \frac{\$8,958.33 + 520.83 + 1,041.67}{\$5,000,000 - 8,958.33} \times 12 = \frac{\$10,520.83}{\$4,991,041.67} \times 12 = 0.0253 \text{ or 2.53 percent}$$

We have simplified this cost analysis by assuming a loan for one month, using a factor of 1/12 to determine the interest and a factor of 12 to annualize. For specific arrangements for which the cost is determined using a 365-day or 360-day year, the appropriate adjustment would be required.

As the results show, the commercial paper alternative comes out with the lowest effective cost, and the line of credit has the highest effective cost. The commitment fee that was payable on the full line added more additional costs than the additional fees and discounting effects added in the other two options.

Line cost	3.00 percent
Banker's acceptance cost	2.56 percent
Commercial paper cost	2.53 percent

SUMMARY

In this reading, we considered a key aspect of financial management: the management of a company's working capital. This aspect of finance is a critical one in that it ensures, if done effectively, that the company will stay solvent and remain in business. If done improperly, the results can be disastrous for the company.

Working capital management covers a wide range of activities, most of which are focused on or involve the company's cash levels. Competing uses for the company's cash, which is often a scarce resource, create the need for an efficient method of handling the short-term financing of company activities.

Major points that were covered in this reading:

- Understanding how to evaluate a company's liquidity position.
- Calculating and interpreting operating and cash conversion cycles.
- Evaluating overall working capital effectiveness of a company and comparing it with other peer companies.
- Identifying the components of a cash forecast to be able to prepare a short-term (i.e., up to one year) cash forecast.
- Understanding the common types of short-term investments, and computing comparable yields on securities.
- Measuring the performance of a company's accounts receivable function.
- Measuring the financial performance of a company's inventory management function.
- Measuring the performance of a company's accounts payable function.
- Evaluating the short-term financing choices available to a company and recommending a financing method.

Working capital management is an integral part of the financial management of a company because many short-term activities have effects on long-term financial decisions. Having an effective short-term financial strategy, for example, allows a company to plan ahead with the confidence that its short-term concerns are being handled properly. Perhaps unlike other areas of finance, short-term finance has more qualitative features, making each company's case somewhat different from another's. This unique nature, combined with the short time frame associated with this aspect of finance, makes short-term finance a dynamic, challenging activity.

PRACTICE PROBLEMS

1   Suppose a company has a current ratio of 2.5 times and a quick ratio of 1.5 times. If the company's current liabilities are €100 million, the amount of inventory is *closest* to:

    A   €50 million.

    B   €100 million.

    C   €150 million.

2   Given the following financial statement data, calculate the operating cycle for this company.

	In Millions ($)
Credit sales	25,000
Cost of goods sold	20,000
Accounts receivable	2,500
Inventory—Beginning balance	2,000
Inventory—Ending balance	2,300
Accounts payable	1,700

The operating cycle for this company is *closest* to:

    A   42.0 days.

    B   47.9 days.

    C   75.7 days.

3   Given the following financial statement data, calculate the net operating cycle for this company.

	In Millions ($)
Credit sales	40,000
Cost of goods sold	30,000
Accounts receivable	3,000
Inventory—Beginning balance	1,500
Inventory—Ending balance	2,000
Accounts payable	4,000

The net operating cycle of this company is *closest* to:

    A   0.80 days.

    B   24.3 days.

    C   51.7 days.

4   The bond equivalent yield for a 182-day US Treasury bill that has a price of $9,725 per $10,000 face value is *closest* to:

    A   5.44%.

    B   5.53%.

    C   5.67%.

5   A company increasing its credit terms for customers from 1/10, net 30 to 1/10, net 60 will *most likely* experience:

    A an increase in cash on hand.

    B a higher level of uncollectible accounts.

    C an increase in the average collection period.

6 Suppose a company uses trade credit with the terms of 2/10, net 50. If the company pays its account on the 50th day, the effective borrowing cost of skipping the discount on day 10 is *closest* to:

    A 14.9%.

    B 15.0%.

    C 20.2%.

7 William Jones is evaluating three possible means of borrowing $1 million for one month:

- Drawing down on a line of credit at 7.2 percent with a 1/2 percent commitment fee on the full amount with no compensating balances.

- A banker's acceptance at 7.1 percent, an all-inclusive rate.

- Commercial paper at 6.9 percent with a dealer's commission of 1/4 percent and a backup line cost of 1/3 percent, both of which would be assessed on the $1 million of commercial paper issued.

Which of these forms of borrowing results in the lowest cost of credit?

    A Line of credit.

    B Banker's acceptance.

    C Commercial paper.

The following information relates to Questions 8–12

Mary Gonzales is evaluating companies in the office supply industry and has compiled the following information:

	20X1		20X2	
Company	Credit Sales ($)	Average Receivables Balance ($)	Credit Sales ($)	Average Receivables Balance ($)
A	5.0 million	1.0 million	6.0 million	1.2 million
B	3.0 million	1.2 million	4.0 million	1.5 million
C	2.5 million	0.8 million	3.0 million	1.0 million
D	0.5 million	0.1 million	0.6 million	0.2 million
Industry	25.0 million	5.0 million	28.0 million	5.4 million

8 Which of the companies had the highest number of days of receivables for the year 20X1?

    A Company A.

    B Company B.

    C Company C.

9 Which of the companies has the lowest accounts receivable turnover in the year 20X2?

    A   Company A.

    B   Company B.

    C   Company D.

10 The industry average receivables collection period:

    A   increased from 20X1 to 20X2.

    B   decreased from 20X1 to 20X2.

    C   did not change from 20X1 to 20X2.

11 Which of the companies reduced the average time it took to collect on accounts receivable from 20X1 to 20X2?

    A   Company B.

    B   Company C.

    C   Company D.

12 Mary determined that Company A had an operating cycle of 100 days in 20X2, whereas Company D had an operating cycle of 145 days for the same fiscal year. This means that:

    A   Company D's inventory turnover is less than that of Company A.

    B   Company D's inventory turnover is greater than that of Company A.

    C   Company D's cash conversion cycle is shorter than that of Company A.

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 + $2,000)/2]/($20,000/365) = 39.238 days

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

Operating cycle = 39.238 + 36.5 days = **75.738 days**

Note: The net operating cycle is 45.2 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 75.738 − 30.567 = 45.171 days

3 A is correct.

Number of days of inventory = [($2,000 + $1,500)/2]/($30,000/365) = 21.292 days

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

Operating cycle = 21.292 + 27.375 days = 48.667 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 48.667 − 47.869 = **0.798 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.

$$\text{Line cost} = \frac{\text{Interest + Commitment fee}}{\text{Net Proceed}} \times 12$$

$$= \frac{(0.072 \times \$1,000,000 \times 1/12) + (0.005 \times \$1,000,000 \times 1/12)}{\$1,000,000} \times 12$$

$$= \frac{\$6,000 + 416.67}{\$1,000,000} \times 12 = 0.077 \text{ or } 7.7 \text{ percent}$$

$$\text{Banker's acceptance cost} = \frac{\text{Interest}}{\text{Net Proceed}} \times 12$$

$$= \frac{(0.071 \times \$1,000,000 \times 1/12)}{\$1,000,000 - (0.071 \times \$1,000,000 \times 1/12)} \times 12$$

$$= \frac{\$5,916.67}{\$994,083.33} \times 12 = 0.0714 \text{ or } 7.14 \text{ percent}$$

$$\frac{\text{Commercial}}{\text{paper cost}} = \frac{\text{Interest + Dealer's commission + Backup costs}}{\text{Net proceed}} \times 12$$

$$= \frac{(0.069 \times \$1,000,000 \times 1/12) + (0.0025 \times \$1,000,000 \times 1/12) + (0.003333 \times \$1,000,000 \times 1/12)}{\$1,000,000 - (0.069 \times \$1,000,000 \times 1/12)} \times 12$$

$$= \frac{\$5,750 + 208.33 + 277.78}{\$1,000,000 - 5,750} \times 12 = 0.0753 \text{ or } 7.53 \text{ percent}$$

8   B is correct.

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

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

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

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

9   B is correct.

Company A: \$6.0 million/\$1.2 million = 5.00

Company B: \$4.0 million/\$1.5 million = 2.67

Company C: \$3.0 million/\$1.0 million = 3.00

Company D: \$0.6 million/\$0.2 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 A/R Turnover	20X1 Number of Days of Receivables	20X2 A/R Turnover	20X2 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

EXAMPLE 30

Bankrupt Traders

You are the chief executive officer of a brokerage that is a member of a clearinghouse. A trader who clears through your firm is bankrupt at midday, but you do not yet know it even though your clearing agreement with him explicitly requires that he immediately report significant losses. The trader knows that if he takes a large position, prices might move in his favor so that he will no longer be bankrupt. The trader attempts to do so and succeeds. You find out about this later in the evening.

1 Why does the clearinghouse regulate its members?

2 What should you do about the trader?

3 Why would the clearinghouse allow you to keep his trading profits?

Solution to 1:

The clearinghouse regulates its members to ensure that no member imposes costs on another member by failing to settle a trade.

Solution to 2:

You should immediately end your clearing relationship with the trader and confiscate his trading profits. The trader was trading with your firm's capital after he became bankrupt. Had he lost, your firm would have borne the loss.

Solution to 3:

If the clearinghouse did not permit you to keep his trading profits, other traders similarly situated might attempt the same strategy.

SUMMARY

This reading introduces how the financial system operates and explains how well-functioning financial systems lead to wealthy economies. Financial analysts need to understand how the financial system works because their analyses often lead to trading decisions.

The financial system consists of markets and the financial intermediaries that operate in them. These institutions allow buyers to connect with sellers. They may trade directly with each other when they trade the same instrument or they only may trade indirectly when a financial intermediary connects the buyer to the seller through transactions with each that appear on the intermediary's balance sheet. The buyer and seller may exchange instruments, cash flows, or risks.

The following points, among others, were made in this reading:

■ The financial system consists of mechanisms that allow strangers to contract with each other to move money through time, to hedge risks, and to exchange assets that they value less for those that they value more.

■ Investors move money from the present to the future when they save. They expect a normal rate of return for bearing risk through time. Borrowers move money from the future to the present to fund current projects and

expenditures. Hedgers trade to reduce their exposure to risks they prefer not to take. Information-motivated traders are active investment managers who try to identify under- and overvalued instruments.

- Securities are first sold in primary markets by their issuers. They then trade in secondary markets.

- People invest in pooled investment vehicles to benefit from the investment management services of their managers.

- Forward contracts allow buyers and sellers to arrange for future sales at predetermined prices. Futures contracts are forward contracts guaranteed by clearinghouses. The guarantee ensures that strangers are willing to trade with each other and that traders can offset their positions by trading with anybody. These features of futures contract markets make them highly attractive to hedgers and information-motivated traders.

- Many financial intermediaries connect buyers to sellers in a given instrument, acting directly as brokers and exchanges or indirectly as dealers and arbitrageurs.

- Financial intermediaries create instruments when they conduct arbitrage, securitize assets, borrow to lend, manage investment funds, or pool insurance contracts. These activities all transform cash flows and risks from one form to another. Their services allow buyers and sellers to connect with each other through instruments that meet their specific needs.

- Financial markets work best when strangers can contract with each other without worrying about whether their counterparts are able and willing to honor their contract. Clearinghouses, variation margins, maintenance margins, and settlement guarantees made by creditworthy brokers on behalf of their clients help manage credit risk and ultimately allow strangers to contract with each other.

- Information-motivated traders short sell when they expect that prices will fall. Hedgers short sell to reduce the risks of a long position in a related contract or commodity.

- Margin loans allow people to buy more securities than their equity would otherwise permit them to buy. The larger positions expose them to more risk so that gains and losses for a given amount of equity will be larger. The leverage ratio is the value of a position divided by the value of the equity supporting it. The returns to the equity in a position are equal to the leverage ratio times the returns to the unleveraged position.

- To protect against credit losses, brokers demand maintenance margin payments from their customers who have borrowed cash or securities when adverse price changes cause their customer's equity to drop below the maintenance margin ratio. Brokers close positions for customers who do not satisfy these margin calls.

- Orders are instructions to trade. They always specify instrument, side (buy or sell), and quantity. They usually also provide several other instructions.

- Market orders tend to fill quickly but often at inferior prices. Limit orders generally fill at better prices if they fill, but they may not fill. Traders choose order submission strategies on the basis of how quickly they want to trade, the prices they are willing to accept, and the consequences of failing to trade.

- Stop instructions are attached to other orders to delay efforts to fill them until the stop condition is satisfied. Although stop orders are often used to stop losses, they are not always effective.

- Issuers sell their securities using underwritten public offerings, best efforts public offerings, private placements, shelf registrations, dividend reinvestment programs, and rights offerings. Investment banks have a conflict of interests when setting the initial offering price in an IPO.

- Well-functioning secondary markets are essential to raising capital in the primary markets because investors value the ability to sell their securities if they no longer want to hold them or if they need to disinvest to raise cash. If they cannot trade their securities in a liquid market, they will not pay as much for them.

- Matching buyers and sellers in call markets is easy because the traders (or their orders) come together at the same time and place.

- Dealers provide liquidity in quote-driven markets. Public traders as well as dealers provide liquidity in order-driven markets.

- Order-driven markets arrange trades by ranking orders using precedence rules. The rules generally ensure that traders who provide the best prices, display the most size, and arrive early trade first. Continuous order-driven markets price orders using the discriminatory pricing rule. Under this rule, standing limit orders determine trade prices.

- Brokers help people trade unique instruments or positions for which finding a buyer or a seller is difficult.

- Transaction costs are lower in transparent markets than in opaque markets because traders can more easily determine market value and more easily manage their trading in transparent markets.

- A well-functioning financial system allows people to trade instruments that best solve their wealth and risk management problems with low transaction costs. Complete and liquid markets characterize a well-functioning financial system. Complete markets are markets in which the instruments needed to solve investment and risk management problems are available to trade. Liquid markets are markets in which traders can trade when they want to trade at low cost.

- The financial system is operationally efficient when its markets are liquid. Liquid markets lower the costs of raising capital.

- A well-functioning financial system promotes wealth by ensuring that capital allocation decisions are well made. A well-functioning financial system also promotes wealth by allowing people to share the risks associated with valuable products that would otherwise not be undertaken.

- Prices are informationally efficient when they reflect all available information about fundamental values. Information-motivated traders make prices informationally efficient. Prices will be most informative in liquid markets because information-motivated traders will not invest in information and research if establishing positions based on their analyses is too costly.

- Regulators generally seek to promote fair and orderly markets in which traders can trade at prices that accurately reflect fundamental values without incurring excessive transaction costs. Governmental agencies and self-regulating organizations of practitioners provide regulatory services that attempt to make markets safer and more efficient.

- Mandated financial disclosure programs for the issuers of publicly traded securities ensure that information necessary to estimate security values is available to financial analysts on a consistent basis.

PRACTICE PROBLEMS

1 Akihiko Takabe has designed a sophisticated forecasting model, which predicts the movements in the overall stock market, in the hope of earning a return in excess of a fair return for the risk involved. He uses the predictions of the model to decide whether to buy, hold, or sell the shares of an index fund that aims to replicate the movements of the stock market. Takabe would *best* be characterized as a(n):

   A   hedger.

   B   investor.

   C   information-motivated trader.

2 James Beach is young and has substantial wealth. A significant proportion of his stock portfolio consists of emerging market stocks that offer relatively high expected returns at the cost of relatively high risk. Beach believes that investment in emerging market stocks is appropriate for him given his ability and willingness to take risk. Which of the following labels *most appropriately* describes Beach?

   A   Hedger.

   B   Investor.

   C   Information-motivated trader.

3 Lisa Smith owns a manufacturing company in the United States. Her company has sold goods to a customer in Brazil and will be paid in Brazilian real (BRL) in three months. Smith is concerned about the possibility of the BRL depreciating more than expected against the US dollar (USD). Therefore, she is planning to sell three-month futures contracts on the BRL. The seller of such contracts generally gains when the BRL depreciates against the USD. If Smith were to sell these future contracts, she would *most appropriately* be described as a(n):

   A   hedger.

   B   investor.

   C   information-motivated trader.

4 Which of the following is *not* a function of the financial system?

   A   To regulate arbitrageurs' profits (excess returns).

   B   To help the economy achieve allocational efficiency.

   C   To facilitate borrowing by businesses to fund current operations.

5 An investor primarily invests in stocks of publicly traded companies. The investor wants to increase the diversification of his portfolio. A friend has recommended investing in real estate properties. The purchase of real estate would *best* be characterized as a transaction in the:

   A   derivative investment market.

   B   traditional investment market.

   C   alternative investment market.

6 A hedge fund holds its excess cash in 90-day commercial paper and negotiable certificates of deposit. The cash management policy of the hedge fund is *best described* as using:

   A   capital market instruments.

   B money market instruments.

   C intermediate-term debt instruments.

7 An oil and gas exploration and production company announces that it is offering 30 million shares to the public at $45.50 each. This transaction is *most likely* a sale in the:

   A futures market.

   B primary market.

   C secondary market.

8 Consider a mutual fund that invests primarily in fixed-income securities that have been determined to be appropriate given the fund's investment goal. Which of the following is *least likely* to be a part of this fund?

   A Warrants.

   B Commercial paper.

   C Repurchase agreements.

9 A friend has asked you to explain the differences between open-end and closed-end funds. Which of the following will you *most likely* include in your explanation?

   A Closed-end funds are unavailable to new investors.

   B When investors sell the shares of an open-end fund, they can receive a discount or a premium to the fund's net asset value.

   C When selling shares, investors in an open-end fund sell the shares back to the fund whereas investors in a closed-end fund sell the shares to others in the secondary market.

10 The usefulness of a forward contract is limited by some problems. Which of the following is *most likely* one of those problems?

   A Once you have entered into a forward contract, it is difficult to exit from the contract.

   B Entering into a forward contract requires the long party to deposit an initial amount with the short party.

   C If the price of the underlying asset moves adversely from the perspective of the long party, periodic payments must be made to the short party.

11 Tony Harris is planning to start trading in commodities. He has heard about the use of futures contracts on commodities and is learning more about them. Which of the following is Harris *least likely* to find associated with a futures contract?

   A Existence of counterparty risk.

   B Standardized contractual terms.

   C Payment of an initial margin to enter into a contract.

12 A German company that exports machinery is expecting to receive $10 million in three months. The firm converts all its foreign currency receipts into euros. The chief financial officer of the company wishes to lock in a minimum fixed rate for converting the $10 million to euro but also wants to keep the flexibility to use the future spot rate if it is favorable. What hedging transaction is *most likely* to achieve this objective?

   A Selling dollars forward.

   B Buying put options on the dollar.

   C Selling futures contracts on dollars.

13 A book publisher requires substantial quantities of paper. The publisher and a paper producer have entered into an agreement for the publisher to buy and the producer to supply a given quantity of paper four months later at a price agreed upon today. This agreement is a:

    A futures contract.

    B forward contract.

    C commodity swap.

14 The Standard & Poor's Depositary Receipts (SPDRs) is an investment that tracks the S&P 500 stock market index. Purchases and sales of SPDRs during an average trading day are *best* described as:

    A primary market transactions in a pooled investment.

    B secondary market transactions in a pooled investment.

    C secondary market transactions in an actively managed investment.

15 The Standard & Poor's Depositary Receipts (SPDRs) is an exchange-traded fund in the United States that is designed to track the S&P 500 stock market index. The latest price of a share of SPDRs is $290. A trader has just bought call options on shares of SPDRs for a premium of $3 per share. The call options expire in six months and have an exercise price of $305 per share. On the expiration date, the trader will exercise the call options (ignore any transaction costs) if and only if the shares of SPDRs are trading:

    A below $305 per share.

    B above $305 per share.

    C above $308 per share.

16 Which of the following statements about exchange-traded funds is *most correct*?

    A Exchange-traded funds are not backed by any assets.

    B The investment companies that create exchange-traded funds are financial intermediaries.

    C The transaction costs of trading shares of exchange-traded funds are substantially greater than the combined costs of trading the underlying assets of the fund.

17 Jason Schmidt works for a hedge fund and he specializes in finding profit opportunities that are the result of inefficiencies in the market for convertible bonds—bonds that can be converted into a predetermined amount of a company's common stock. Schmidt tries to find convertibles that are priced inefficiently relative to the underlying stock. The trading strategy involves the simultaneous purchase of the convertible bond and the short sale of the underlying common stock. The above process could best be described as:

    A hedging.

    B arbitrage.

    C securitization.

18 Pierre-Louis Robert just purchased a call option on shares of the Michelin Group. A few days ago he wrote a put option on Michelin shares. The call and put options have the same exercise price, expiration date, and number of shares underlying. Considering both positions, Robert's exposure to the risk of the stock of the Michelin Group is:

    A long.

    B short.

    C neutral.

19 An online brokerage firm has set the minimum margin requirement at 55 percent. What is the maximum leverage ratio associated with a position financed by this minimum margin requirement?

A 1.55.

B 1.82.

C 2.22.

20 A trader has purchased 200 shares of a non-dividend-paying firm on margin at a price of $50 per share. The leverage ratio is 2.5. Six months later, the trader sells these shares at $60 per share. Ignoring the interest paid on the borrowed amount and the transaction costs, what was the return to the trader during the six-month period?

A 20 percent.

B 33.33 percent.

C 50 percent.

21 Jason Williams purchased 500 shares of a company at $32 per share. The stock was bought on 75 percent margin. One month later, Williams had to pay interest on the amount borrowed at a rate of 2 percent per month. At that time, Williams received a dividend of $0.50 per share. Immediately after that he sold the shares at $28 per share. He paid commissions of $10 on the purchase and $10 on the sale of the stock. What was the rate of return on this investment for the one-month period?

A −12.5 percent.

B −15.4 percent.

C −50.1 percent.

22 Caroline Rogers believes the price of Gamma Corp. stock will go down in the near future. She has decided to sell short 200 shares of Gamma Corp. at the current market price of €47. The initial margin requirement is 40 percent. Which of the following is an appropriate statement regarding the margin requirement that Rogers is subject to on this short sale?

A She will need to contribute €3,760 as margin.

B She will need to contribute €5,640 as margin.

C She will only need to leave the proceeds from the short sale as deposit and does not need to contribute any additional funds.

23 The current price of a stock is $25 per share. You have $10,000 to invest. You borrow an additional $10,000 from your broker and invest $20,000 in the stock. If the maintenance margin is 30 percent, at what price will a margin call first occur?

A $9.62.

B $17.86.

C $19.71.

24 You have placed a sell market-on-open order—a market order that would automatically be submitted at the market's open tomorrow and would fill at the market price. Your instruction, to sell the shares at the market open, is a(n):

A execution instruction.

B validity instruction.

C clearing instruction.

25 A market has the following limit orders standing on its book for a particular stock. The bid and ask sizes are number of shares in hundreds.

Bid Size	Limit Price (€)	Offer Size
5	9.73	
12	9.81	
4	9.84	
6	9.95	
	10.02	5
	10.10	12
	10.14	8

What is the market?

A 9.73 bid, offered at 10.14.

B 9.81 bid, offered at 10.10.

C 9.95 bid, offered at 10.02.

26 Consider the following limit order book for a stock. The bid and ask sizes are number of shares in hundreds.

Bid Size	Limit Price (¥)	Offer Size
3	122.80	
8	123.00	
4	123.35	
	123.80	7
	124.10	6
	124.50	7

A new buy limit order is placed for 300 shares at ¥123.40. This limit order is said to:

A take the market.

B make the market.

C make a new market.

27 Currently, the market in a stock is "$54.62 bid, offered at $54.71." A new sell limit order is placed at $54.62. This limit order is said to:

A take the market.

B make the market.

C make a new market.

28 Jim White has sold short 100 shares of Super Stores at a price of $42 per share. He has also simultaneously placed a "good-till-cancelled, stop 50, limit 55 buy" order. Assume that if the stop condition specified by White is satisfied and the order becomes valid, it will get executed. Excluding transaction costs, what is the maximum possible loss that White can have?

A $800.

B $1,300.

C Unlimited.

29 You own shares of a company that are currently trading at $30 a share. Your technical analysis of the shares indicates a support level of $27.50. That is, if the price of the shares is going down, it is more likely to stay above this level rather than fall below it. If the price does fall below this level, however, you believe that the price may continue to decline. You have no immediate intent to sell the

shares but are concerned about the possibility of a huge loss if the share price declines below the support level. Which of the following types of orders could you place to most appropriately address your concern?

A Short sell order.

B Good-till-cancelled stop sell order.

C Good-till-cancelled stop buy order.

30 In an underwritten offering, the risk that the entire issue may not be sold to the public at the stipulated offering price is borne by the:

A issuer.

B investment bank.

C buyers of the part of the issue that is sold.

31 A British company listed on AIM (formerly the Alternative Investment Market) of the London Stock Exchange announced the sale of 6,686,665 shares to a small group of qualified investors at £0.025 per share. Which of the following *best describes* this sale?

A Shelf registration.

B Private placement.

C Initial public offering.

32 A German publicly traded company, to raise new capital, gave its existing shareholders the opportunity to subscribe for new shares. The existing shareholders could purchase two new shares at a subscription price of €4.58 per share for every 15 shares held. This is an example of a(n):

A rights offering.

B private placement.

C initial public offering.

33 Consider an order-driven system that allows hidden orders. The following four sell orders on a particular stock are currently in the system's limit order book. Based on the commonly used order precedence hierarchy, which of these orders will have precedence over others?

Order	Time of Arrival (HH:MM:SS)	Limit Price (€)	Special Instruction (If any)
I	9:52:01	20.33	
II	9:52:08	20.29	Hidden order
III	9:53:04	20.29	
IV	9:53:49	20.29	

A Order I (time of arrival of 9:52:01).

B Order II (time of arrival of 9:52:08).

C Order III (time of arrival of 9:53:04).

34 Zhenhu Li has submitted an immediate-or-cancel buy order for 500 shares of a company at a limit price of CNY 74.25. There are two sell limit orders standing in that stock's order book at that time. One is for 300 shares at a limit price of CNY 74.30 and the other is for 400 shares at a limit price of CNY 74.35. How many shares in Li's order would get cancelled?

A None (the order would remain open but unfilled).

B 200 (300 shares would get filled).

C 500 (there would be no fill).

35 A market has the following limit orders standing on its book for a particular stock:

Buyer	Bid Size (Number of Shares)	Limit Price (£)	Offer Size (Number of Shares)	Seller
Keith	1,000	19.70		
Paul	200	19.84		
Ann	400	19.89		
Mary	300	20.02		
		20.03	800	Jack
		20.11	1,100	Margaret
		20.16	400	Jeff

Ian submits a day order to sell 1,000 shares, limit £19.83. Assuming that no more buy orders are submitted on that day after Ian submits his order, what would be Ian's average trade price?

A £19.70.

B £19.92.

C £20.05.

36 A financial analyst is examining whether a country's financial market is well functioning. She finds that the transaction costs in this market are low and trading volumes are high. She concludes that the market is quite liquid. In such a market:

A traders will find it hard to make use of their information.

B traders will find it easy to trade and their trading will make the market less informationally efficient.

C traders will find it easy to trade and their trading will make the market more informationally efficient.

37 The government of a country whose financial markets are in an early stage of development has hired you as a consultant on financial market regulation. Your first task is to prepare a list of the objectives of market regulation. Which of the following is *least likely* to be included in this list of objectives?

A Minimize agency problems in the financial markets.

B Ensure that financial markets are fair and orderly.

C Ensure that investors in the stock market achieve a rate of return that is at least equal to the risk-free rate of return.

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 $305 per share. Note that if the stock price is above $305 but less than $308, 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 $307, the option buyer would exercise the option to make $2 = $307 − $305 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% position ÷ 55% 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 × 20%.

Another way to look at this problem is that the equity contributed by the trader (the minimum margin requirement) is 40% = 100% ÷ 2.5. The trader contributed $20 = 40% 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.

    Total cost of the purchase = $16,000 = 500 × $32

    Equity invested = $12,000 = 0.75 × $16,000

    Amount borrowed = $4,000 = 16,000 − 12,000

    Interest paid at month end = $80 = 0.02 × $4,000

    Dividend received at month end = $250 = 500 × $0.50

    Proceeds on stock sale = $14,000 = 500 × $28

    Total commissions paid = $20 = $10 + $10

    Net gain/loss = −$1,850 = −16,000 − 80 + 250 + 14,000 − 20

    Initial investment including commission on purchase = $12,010

    Return = −15.4% = −$1,850/$12,010

22 A is correct. She will need to contribute €3,760 as margin. In view of the pos-
sibility of a loss, if the stock price goes up, she will need to contribute €3,760 =
40% of €9,400 as the initial margin. Rogers will need to leave the proceeds from
the short sale (€9,400 = 200 × €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 per-
cent of the initial stock price, or $12.50 = 0.50 × $25. 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.

$$\frac{\text{Equity/Share}}{\text{Price/Share}} = \frac{12.50 + P - 25}{P} = 30\%$$

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 imme-
diately 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 undersub-
scribed 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:

$$£19.92 = \frac{300 \times £20.02 + 400 \times £19.89 \ + \ 200 \times £19.84}{300 + 400 + 200}$$

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.

Index	Representing	Number of Securities	Weighting Method	Comments
Markit iBoxx Euro High-Yield Bond Indexes	Sub-investment-grade euro-denominated corporate bonds	Varies	Market cap and variations	Rebalanced monthly. Represents tradable part of market. Price and total return versions available with such analytical values as yield, duration, modified duration, and convexity. Provides platform for research and structured products.
FTSE EPRA/NAREIT Global Real Estate Index	Real estate securities in the North American, European, and Asian markets	Varies	Float-adjusted market cap	The stocks of REITs that constitute the index trade on public stock exchanges and may be constituents of equity market indexes.
HFRX Global Hedge Fund Index	Overall composition of the HFR database	Varies	Asset weighted	Comprises all eligible hedge fund strategies. Examples include convertible arbitrage, distressed securities, market neutral, event driven, macro, and relative value arbitrage. Constituent strategies are asset weighted on the basis of asset distribution within the hedge fund industry.
HFRX Equal Weighted Strategies EUR Index	Overall composition of the HFR database	Varies	Equal weighted	Denominated in euros and is constructed from the same strategies as the HFRX Global Hedge Fund Index.
Morningstar Style Indexes	US stocks classified by market cap and value/growth orientation	Varies	Float-adjusted market cap	The nine indexes defined by combinations of market cap (large, mid, and small) and value/growth orientation (value, core, growth) have mutually exclusive constituents and are exhaustive with respect to the Morningstar US Market Index. Each is a model portfolio for one of the iShares Morningstar ETFs.

SUMMARY

This reading explains and illustrates the construction, management, and uses of security market indexes. It also discusses various types of indexes. Security market indexes are invaluable tools for investors, who can select from among thousands of indexes representing a variety of security markets, market segments, and asset classes. These indexes range from those representing the global market for major asset classes to those representing alternative investments in specific geographic markets. To benefit from the use of security market indexes, investors must understand their construction and determine whether the selected index is appropriate for their purposes. Frequently, an index that is well suited for one purpose may not be well suited for other purposes. Users of indexes must be familiar with how various indexes are constructed in order to select the index or indexes most appropriate for their needs.

Among the key points made in this reading are the following:

- Security market indexes are intended to measure the values of different target markets (security markets, market segments, or asset classes).

- The constituent securities selected for inclusion in the security market index are intended to represent the target market.

- A price return index reflects only the prices of the constituent securities.

- A total return index reflects not only the prices of the constituent securities but also the reinvestment of all income received since the inception of the index.

- Methods used to weight the constituents of an index range from the very simple, such as price and equal weightings, to the more complex, such as market-capitalization and fundamental weightings.

- Choices in index construction—in particular, the choice of weighting method—affect index valuation and returns.

- Index management includes 1) periodic rebalancing to ensure that the index maintains appropriate weightings and 2) reconstitution to ensure the index represents the desired target market.

- Rebalancing and reconstitution create turnover in an index. Reconstitution can dramatically affect prices of current and prospective constituents.

- Indexes serve a variety of purposes. They gauge market sentiment and serve as benchmarks for actively managed portfolios. They act as proxies for measuring systematic risk and risk-adjusted performance. They also serve as proxies for asset classes in asset allocation models and as model portfolios for investment products.

- Investors can choose from security market indexes representing various asset classes, including equity, fixed-income, commodity, real estate, and hedge fund indexes.

- Within most asset classes, index providers offer a wide variety of indexes, ranging from broad market indexes to highly specialized indexes based on the issuer's geographic region, economic development group, or economic sector or other factors.

- Proper use of security market indexes depends on understanding their construction and management.

PRACTICE PROBLEMS

1 A security market index represents the:

A risk of a security market.

B security market as a whole.

C security market, market segment, or asset class.

2 Security market indexes are:

A constructed and managed like a portfolio of securities.

B simple interchangeable tools for measuring the returns of different asset classes.

C valued on a regular basis using the actual market prices of the constituent securities.

3 When creating a security market index, an index provider must first determine the:

A target market.

B appropriate weighting method.

C number of constituent securities.

4 One month after inception, the price return version and total return version of a single index (consisting of identical securities and weights) will be equal if:

A market prices have not changed.

B capital gains are offset by capital losses.

C the securities do not pay dividends or interest.

5 The values of a price return index and a total return index consisting of identical equal-weighted dividend-paying equities will be equal:

A only at inception.

B at inception and on rebalancing dates.

C at inception and on reconstitution dates.

6 An analyst gathers the following information for an equal-weighted index comprised of assets Able, Baker, and Charlie:

Security	Beginning of Period Price (€)	End of Period Price (€)	Total Dividends (€)
Able	10.00	12.00	0.75
Baker	20.00	19.00	1.00
Charlie	30.00	30.00	2.00

The price return of the index is:

A 1.7%.

B 5.0%.

C 11.4%.

7 An analyst gathers the following information for an equal-weighted index comprised of assets Able, Baker, and Charlie:

Security	Beginning of Period Price (€)	End of Period Price (€)	Total Dividends (€)
Able	10.00	12.00	0.75
Baker	20.00	19.00	1.00
Charlie	30.00	30.00	2.00

The total return of the index is:

A 5.0%.

B 7.9%.

C 11.4%.

8 An analyst gathers the following information for a price-weighted index comprised of securities ABC, DEF, and GHI:

Security	Beginning of Period Price (£)	End of Period Price (£)	Total Dividends (£)
ABC	25.00	27.00	1.00
DEF	35.00	25.00	1.50
GHI	15.00	16.00	1.00

The price return of the index is:

A −4.6%.

B −9.3%.

C −13.9%.

9 An analyst gathers the following information for a market-capitalization-weighted index comprised of securities MNO, QRS, and XYZ:

Security	Beginning of Period Price (¥)	End of Period Price (¥)	Dividends per Share (¥)	Shares Outstanding
MNO	2,500	2,700	100	5,000
QRS	3,500	2,500	150	7,500
XYZ	1,500	1,600	100	10,000

The price return of the index is:

A −9.33%.

B −10.23%.

C −13.90%.

10 An analyst gathers the following information for a market-capitalization-weighted index comprised of securities MNO, QRS, and XYZ:

Security	Beginning of Period Price (¥)	End of Period Price (¥)	Dividends Per Share (¥)	Shares Outstanding
MNO	2,500	2,700	100	5,000
QRS	3,500	2,500	150	7,500
XYZ	1,500	1,600	100	10,000

The total return of the index is:

A 1.04%.

B −5.35%.

C −10.23%.

11 When creating a security market index, the target market:

    A determines the investment universe.

    B is usually a broadly defined asset class.

    C determines the number of securities to be included in the index.

12 An analyst gathers the following data for a price-weighted index:

	Beginning of Period		End of Period	
Security	**Price (€)**	**Shares Outstanding**	**Price (€)**	**Shares Outstanding**
A	20.00	300	22.00	300
B	50.00	300	48.00	300
C	26.00	2,000	30.00	2,000

    The price return of the index over the period is:

    A 4.2%.

    B 7.1%.

    C 21.4%.

13 An analyst gathers the following data for a value-weighted index:

	Beginning of Period		End of Period	
Security	**Price (£)**	**Shares Outstanding**	**Price (£)**	**Shares Outstanding**
A	20.00	300	22.00	300
B	50.00	300	48.00	300
C	26.00	2,000	30.00	2,000

    The return on the value-weighted index over the period is:

    A 7.1%.

    B 11.0%.

    C 21.4%.

14 An analyst gathers the following data for an equally-weighted index:

	Beginning of Period		End of Period	
Security	**Price (¥)**	**Shares Outstanding**	**Price (¥)**	**Shares Outstanding**
A	20.00	300	22.00	300
B	50.00	300	48.00	300
C	26.00	2,000	30.00	2,000

    The return on the index over the period is:

    A 4.2%.

    B 6.8%.

    C 7.1%.

15 Which of the following index weighting methods requires an adjustment to the divisor after a stock split?

    A Price weighting.

    B Fundamental weighting.

    C Market-capitalization weighting.

16 If the price return of an equal-weighted index exceeds that of a market-capitalization-weighted index comprised of the same securities, the *most likely* explanation is:

   A stock splits.

   B dividend distributions.

   C outperformance of small-market-capitalization stocks.

17 A float-adjusted market-capitalization-weighted index weights each of its constituent securities by its price and:

   A its trading volume.

   B the number of its shares outstanding.

   C the number of its shares available to the investing public.

18 Which of the following index weighting methods is most likely subject to a value tilt?

   A Equal weighting.

   B Fundamental weighting.

   C Market-capitalization weighting.

19 Rebalancing an index is the process of periodically adjusting the constituent:

   A securities' weights to optimize investment performance.

   B securities to maintain consistency with the target market.

   C securities' weights to maintain consistency with the index's weighting method.

20 Which of the following index weighting methods requires the most frequent rebalancing?

   A Price weighting.

   B Equal weighting.

   C Market-capitalization weighting.

21 Reconstitution of a security market index reduces:

   A portfolio turnover.

   B the need for rebalancing.

   C the likelihood that the index includes securities that are not representative of the target market.

22 Security market indexes are used as:

   A measures of investment returns.

   B proxies to measure unsystematic risk.

   C proxies for specific asset classes in asset allocation models.

23 Uses of market indexes do not include serving as a:

   A measure of systemic risk.

   B basis for new investment products.

   C benchmark for evaluating portfolio performance.

24 Which of the following statements regarding sector indexes is *most* accurate? Sector indexes:

   A track different economic sectors and cannot be aggregated to represent the equivalent of a broad market index.

   B provide a means to determine whether an active investment manager is more successful at stock selection or sector allocation.

    C apply a universally agreed upon sector classification system to identify the constituent securities of specific economic sectors, such as consumer goods, energy, finance, health care.

25 Which of the following is an example of a style index? An index based on:

    A geography.

    B economic sector.

    C market capitalization.

26 Which of the following statements regarding fixed-income indexes is *most* accurate?

    A Liquidity issues make it difficult for investors to easily replicate fixed-income indexes.

    B Rebalancing and reconstitution are the only sources of turnover in fixed-income indexes.

    C Fixed-income indexes representing the same target market hold similar numbers of bonds.

27 An aggregate fixed-income index:

    A comprises corporate and asset-backed securities.

    B represents the market of government-issued securities.

    C can be subdivided by market or economic sector to create more narrowly defined indexes.

28 Fixed-income indexes are *least likely* constructed on the basis of:

    A maturity.

    B type of issuer.

    C coupon frequency.

29 Commodity index values are based on:

    A futures contract prices.

    B the market price of the specific commodity.

    C the average market price of a basket of similar commodities.

30 Which of the following statements is *most* accurate?

    A Commodity indexes all share similar weighting methods.

    B Commodity indexes containing the same underlying commodities offer similar returns.

    C The performance of commodity indexes can be quite different from that of the underlying commodities.

31 Which of the following is *not* a real estate index category?

    A Appraisal index.

    B Initial sales index.

    C Repeat sales index.

32 A unique feature of hedge fund indexes is that they:

    A are frequently equal weighted.

    B are determined by the constituents of the index.

    C reflect the value of private rather than public investments.

33 The returns of hedge fund indexes are *most likely*:

    A biased upward.

    B biased downward.

    C similar across different index providers.

34 In comparison to equity indexes, the constituent securities of fixed-income indexes are:

    A more liquid.

    B easier to price.

    C drawn from a larger investment universe.

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:

   Able: (12 − 10 + 0.75)/10 = 27.5%

   Baker: (19 − 20 + 1)/20 = 0%

   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 (¥)
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:

Market value at beginning of period: $(20 \times 300) + (50 \times 300) + (26 \times 2,000)$ = 73,000

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 systemic 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.

The basic idea behind behavioral finance is that investors are humans and, therefore, imperfect. These observed less than rational behaviors may help explain observed pricing anomalies. The beliefs investors have about a given asset's value may not be homogeneous. But an issue, which is controversial, is whether these insights can help someone identify and exploit any mispricing. In other words, can investors use knowledge of behavioral biases to predict how asset prices will be affected and act based on the predictions to earn abnormal profits?

5.6 Behavioral Finance and Investors

Behavior biases can affect all market participants, from the novice investor to the most experienced investment manager. An understanding of behavioral finance can help market participants recognize their own and others' behavioral biases. As a result of this recognition, they may be able to respond and make improved decisions, individually and collectively.

5.7 Behavioral Finance and Efficient Markets

The use of behavioral finance to explain observed pricing is an important part of the understanding of how markets function and how prices are determined. Whether there is a behavioral explanation for market anomalies remains a debate. Pricing anomalies are continually being uncovered, and then statistical and behavioral explanations are offered to explain these anomalies.

On the one hand, if investors must be rational for efficient markets to exist, then all the imperfections of human investors suggest that markets cannot be efficient. On the other hand, if all that is required for markets to be efficient is that investors cannot consistently beat the market on a risk-adjusted basis, then the evidence does support market efficiency.

SUMMARY

This reading has provided an overview of the theory and evidence regarding market efficiency and has discussed the different forms of market efficiency as well as the implications for fundamental analysis, technical analysis, and portfolio management. The general conclusion drawn from the efficient market hypothesis is that it is not possible to beat the market on a consistent basis by generating returns in excess of those expected for the level of risk of the investment.

Additional key points include the following:

- The efficiency of a market is affected by the number of market participants and depth of analyst coverage, information availability, and limits to trading.

- There are three forms of efficient markets, each based on what is considered to be the information used in determining asset prices. In the weak form, asset prices fully reflect all market data, which refers to all past price and trading volume information. In the semi-strong form, asset prices reflect all publicly known and available information. In the strong form, asset prices fully reflect all information, which includes both public and private information.

- Intrinsic value refers to the true value of an asset, whereas market value refers to the price at which an asset can be bought or sold. When markets are efficient, the two should be the same or very close. But when markets are not efficient, the two can diverge significantly.

- Most empirical evidence supports the idea that securities markets in developed countries are semi-strong-form efficient; however, empirical evidence does not support the strong form of the efficient market hypothesis.

- A number of anomalies have been documented that contradict the notion of market efficiency, including the size anomaly, the January anomaly, and the winners–losers anomalies. In most cases, however, contradictory evidence both supports and refutes the anomaly.

- Behavioral finance uses human psychology, such as behavioral biases, in an attempt to explain investment decisions. Whereas behavioral finance is helpful in understanding observed decisions, a market can still be considered efficient even if market participants exhibit seemingly irrational behaviors, such as herding.

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PRACTICE PROBLEMS

1 In an efficient market, the change in a company's share price is *most likely* the result of:

   A insiders' private information.

   B the previous day's change in stock price.

   C new information coming into the market.

2 Regulation that restricts some investors from participating in a market will *most likely*:

   A impede market efficiency.

   B not affect market efficiency.

   C contribute to market efficiency.

3 With respect to efficient market theory, when a market allows short selling, the efficiency of the market is *most likely* to:

   A increase.

   B decrease.

   C remain the same.

4 Which of the following regulations will *most likely* contribute to market efficiency? Regulatory restrictions on:

   A short selling.

   B foreign traders.

   C insiders trading with nonpublic information.

5 Which of the following market regulations will *most likely* impede market efficiency?

   A Restricting traders' ability to short sell.

   B Allowing unrestricted foreign investor trading.

   C Penalizing investors who trade with nonpublic information.

6 If markets are efficient, the difference between the intrinsic value and market value of a company's security is:

   A negative.

   B zero.

   C positive.

7 The intrinsic value of an undervalued asset is:

   A less than the asset's market value.

   B greater than the asset's market value.

   C the value at which the asset can currently be bought or sold.

8 The market value of an undervalued asset is:

   A greater than the asset's intrinsic value.

   B the value at which the asset can currently be bought or sold.

   C equal to the present value of all the asset's expected cash flows.

9 With respect to the efficient market hypothesis, if security prices reflect *only* past prices and trading volume information, then the market is:

   A weak-form efficient.

    B strong-form efficient.

    C semi-strong-form efficient.

10 Which one of the following statements *best* describes the semi-strong form of market efficiency?

    A Empirical tests examine the historical patterns in security prices.

    B Security prices reflect all publicly known and available information.

    C Semi-strong-form efficient markets are not necessarily weak-form efficient.

11 If markets are semi-strong efficient, standard fundamental analysis will yield abnormal trading profits that are:

    A negative.

    B equal to zero.

    C positive.

12 If prices reflect all public and private information, the market is *best* described as:

    A weak-form efficient.

    B strong-form efficient.

    C semi-strong-form efficient.

13 If markets are semi-strong-form efficient, then passive portfolio management strategies are *most likely* to:

    A earn abnormal returns.

    B outperform active trading strategies.

    C underperform active trading strategies.

14 If a market is semi-strong-form efficient, the risk-adjusted returns of a passively managed portfolio relative to an actively managed portfolio are *most likely*:

    A lower.

    B higher.

    C the same.

15 Technical analysts assume that markets are:

    A weak-form efficient.

    B weak-form inefficient.

    C semi-strong-form efficient.

16 Fundamental analysts assume that markets are:

    A weak-form inefficient.

    B semi-strong-form efficient.

    C semi-strong-form inefficient.

17 If a market is weak-form efficient but semi-strong-form inefficient, then which of the following types of portfolio management is *most likely* to produce abnormal returns?

    A Passive portfolio management.

    B Active portfolio management based on technical analysis.

    C Active portfolio management based on fundamental analysis.

18 An increase in the time between when an order to trade a security is placed and when the order is executed *most likely* indicates that market efficiency has:

    A decreased.

    B remained the same.

C   increased.

19 With respect to efficient markets, a company whose share price reacts gradually to the public release of its annual report *most likely* indicates that the market where the company trades is:

A   semi-strong-form efficient.

B   subject to behavioral biases.

C   receiving additional information about the company.

20 Which of the following is *least likely* to explain the January effect anomaly?

A   Tax-loss selling.

B   Release of new information in January.

C   Window dressing of portfolio holdings.

21 If a researcher conducting empirical tests of a trading strategy using time series of returns finds statistically significant abnormal returns, then the researcher has *most likely* found:

A   a market anomaly.

B   evidence of market inefficiency.

C   a strategy to produce future abnormal returns.

22 Which of the following market anomalies is inconsistent with weak-form market efficiency?

A   Earnings surprise.

B   Momentum pattern.

C   Closed-end fund discount.

23 Researchers have found that value stocks have consistently outperformed growth stocks. An investor wishing to exploit the value effect should purchase the stock of companies with above-average:

A   dividend yields.

B   market-to-book ratios.

C   price-to-earnings ratios.

24 With respect to rational and irrational investment decisions, the efficient market hypothesis requires:

A   only that the market is rational.

B   that all investors make rational decisions.

C   that some investors make irrational decisions.

25 Observed overreactions in markets can be explained by an investor's degree of:

A   risk aversion.

B   loss aversion.

C   confidence in the market.

26 Like traditional finance models, the behavioral theory of loss aversion assumes that investors dislike risk; however, the dislike of risk in behavioral theory is assumed to be:

A   leptokurtic.

B   symmetrical.

C   asymmetrical.

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.

Two models commonly used to estimate a company's cost of equity (or investors' minimum required rate of return) are the dividend discount model (DDM) and the capital asset pricing model (CAPM). These models are discussed in detail in other curriculum readings.

The cost of debt (after tax) and the cost of equity (i.e., the minimum required rates of return on debt and equity) are integral components of the capital budgeting process because they are used to estimate a company's weighted average cost of capital (WACC). Capital budgeting is the decision-making process that companies use to evaluate potential long-term investments. The WACC represents the minimum required rate of return that the company must earn on its long-term investments to satisfy all providers of capital. The company then chooses among those long-term investments with expected returns that are greater than its WACC.

SUMMARY

Equity securities play a fundamental role in investment analysis and portfolio management. The importance of this asset class continues to grow on a global scale because of the need for equity capital in developed and emerging markets, technological innovation, and the growing sophistication of electronic information exchange. Given their absolute return potential and ability to impact the risk and return characteristics of portfolios, equity securities are of importance to both individual and institutional investors.

This reading introduces equity securities and provides an overview of global equity markets. A detailed analysis of their historical performance shows that equity securities have offered average real annual returns superior to government bills and bonds, which have provided average real annual returns that have only kept pace with inflation. The different types and characteristics of common and preference equity securities are examined, and the primary differences between public and private equity securities are outlined. An overview of the various types of equity securities listed and traded in global markets is provided, including a discussion of their risk and return characteristics. Finally, the role of equity securities in creating company value is examined as well as the relationship between a company's cost of equity, its accounting return on equity, investors' required rate of return, and the company's intrinsic value.

We conclude with a summary of the key components of this reading:

- Common shares represent an ownership interest in a company and give investors a claim on its operating performance, the opportunity to participate in the corporate decision-making process, and a claim on the company's net assets in the case of liquidation.

- Callable common shares give the issuer the right to buy back the shares from shareholders at a price determined when the shares are originally issued.

- Putable common shares give shareholders the right to sell the shares back to the issuer at a price specified when the shares are originally issued.

- Preference shares are a form of equity in which payments made to preference shareholders take precedence over any payments made to common stockholders.

- Cumulative preference shares are preference shares on which dividend payments are accrued so that any payments omitted by the company must be paid before another dividend can be paid to common shareholders. Non-cumulative

> preference shares have no such provisions, implying that the dividend payments
> are at the company's discretion and are thus similar to payments made to com-
> mon shareholders.

- Participating preference shares allow investors to receive the standard preferred dividend plus the opportunity to receive a share of corporate profits above a pre-specified amount. Non-participating preference shares allow investors to simply receive the initial investment plus any accrued dividends in the event of liquidation.

- Callable and putable preference shares provide issuers and investors with the same rights and obligations as their common share counterparts.

- Private equity securities are issued primarily to institutional investors in private placements and do not trade in secondary equity markets. There are three types of private equity investments: venture capital, leveraged buyouts, and private investments in public equity (PIPE).

- The objective of private equity investing is to increase the ability of the company's management to focus on its operating activities for long-term value creation. The strategy is to take the "private" company "public" after certain profit and other benchmarks have been met.

- Depository receipts are securities that trade like ordinary shares on a local exchange but which represent an economic interest in a foreign company. They allow the publicly listed shares of foreign companies to be traded on an exchange outside their domestic market.

- American depository receipts are US dollar-denominated securities trading much like standard US securities on US markets. Global depository receipts are similar to ADRs but contain certain restrictions in terms of their ability to be resold among investors.

- Underlying characteristics of equity securities can greatly affect their risk and return.

- A company's accounting return on equity is the total return that it earns on shareholders' book equity.

- A company's cost of equity is the minimum rate of return that stockholders require the company to pay them for investing in its equity.

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PRACTICE PROBLEMS

1 Which of the following is *not* a characteristic of common equity?

   A It represents an ownership interest in the company.

   B Shareholders participate in the decision-making process.

   C The company is obligated to make periodic dividend payments.

2 The type of equity voting right that grants one vote for each share of equity owned is referred to as:

   A proxy voting.

   B statutory voting.

   C cumulative voting.

3 All of the following are characteristics of preference shares *except*:

   A They are either callable or putable.

   B They generally do not have voting rights.

   C They do not share in the operating performance of the company.

4 Participating preference shares entitle shareholders to:

   A participate in the decision-making process of the company.

   B convert their shares into a specified number of common shares.

   C receive an additional dividend if the company's profits exceed a pre-determined level.

5 Which of the following statements about private equity securities is *incorrect*?

   A They cannot be sold on secondary markets.

   B They have market-determined quoted prices.

   C They are primarily issued to institutional investors.

6 Venture capital investments:

   A can be publicly traded.

   B do not require a long-term commitment of funds.

   C provide mezzanine financing to early-stage companies.

7 Which of the following statements *most accurately* describes one difference between private and public equity firms?

   A Private equity firms are focused more on short-term results than public firms.

   B Private equity firms' regulatory and investor relations operations are less costly than those of public firms.

   C Private equity firms are incentivized to be more open with investors about governance and compensation than public firms.

8 Emerging markets have benefited from recent trends in international markets. Which of the following has *not* been a benefit of these trends?

   A Emerging market companies do not have to worry about a lack of liquidity in their home equity markets.

   B Emerging market companies have found it easier to raise capital in the markets of developed countries.

    C   Emerging market companies have benefited from the stability of foreign exchange markets.

9   When investing in unsponsored depository receipts, the voting rights to the shares in the trust belong to:

    A   the depository bank.

    B   the investors in the depository receipts.

    C   the issuer of the shares held in the trust.

10   With respect to Level III sponsored ADRs, which of the following is *least likely* to be accurate? They:

    A   have low listing fees.

    B   are traded on the NYSE, NASDAQ, and AMEX.

    C   are used to raise equity capital in US markets.

11   A basket of listed depository receipts, or an exchange-traded fund, would *most likely* be used for:

    A   gaining exposure to a single equity.

    B   hedging exposure to a single equity.

    C   gaining exposure to multiple equities.

12   Calculate the total return on a share of equity using the following data:

Purchase price: $50

Sale price: $42

Dividend paid during holding period: $2

    A   −12.0%

    B   −14.3%

    C   −16.0%

13   If a US-based investor purchases a euro-denominated ETF and the euro subsequently depreciates in value relative to the dollar, the investor will have a total return that is:

    A   lower than the ETF's total return.

    B   higher than the ETF's total return.

    C   the same as the ETF's total return.

14   Which of the following is *incorrect* about the risk of an equity security? The risk of an equity security is:

    A   based on the uncertainty of its cash flows.

    B   based on the uncertainty of its future price.

    C   measured using the standard deviation of its dividends.

15   From an investor's point of view, which of the following equity securities is the *least* risky?

    A   Putable preference shares.

    B   Callable preference shares.

    C   Non-callable preference shares.

16   Which of the following is *least likely* to be a reason for a company to issue equity securities on the primary market?

    A   To raise capital.

    B   To increase liquidity.

    C   To increase return on equity.

17 Which of the following is *not* a primary goal of raising equity capital?

A To finance the purchase of long-lived assets.

B To finance the company's revenue-generating activities.

C To ensure that the company continues as a going concern.

18 Which of the following statements is *most accurate* in describing a company's book value?

A Book value increases when a company retains its net income.

B Book value is usually equal to the company's market value.

C The ultimate goal of management is to maximize book value.

19 Calculate the book value of a company using the following information:

Number of shares outstanding	100,000
Price per share	€52
Total assets	€12,000,000
Total liabilities	€7,500,000
Net Income	€2,000,000

A €4,500,000.

B €5,200,000.

C €6,500,000.

20 Which of the following statements is *least accurate* in describing a company's market value?

A Management's decisions do not influence the company's market value.

B Increases in book value may not be reflected in the company's market value.

C Market value reflects the collective and differing expectations of investors.

21 Calculate the return on equity (ROE) of a stable company using the following data:

Total sales	£2,500,000
Net income	£2,000,000
Beginning of year total assets	£50,000,000
Beginning of year total liabilities	£35,000,000
Number of shares outstanding at the end of the year	1,000,000
Price per share at the end of the year	£20

A 10.0%.

B 13.3%.

C 16.7%.

22 Holding all other factors constant, which of the following situations will *most likely* lead to an increase in a company's return on equity?

A The market price of the company's shares increases.

B Net income increases at a slower rate than shareholders' equity.

C The company issues debt to repurchase outstanding shares of equity.

23 Which of the following measures is the *most difficult* to estimate?

A The cost of debt.

B The cost of equity.

C Investors' required rate of return on debt.

24 A company's cost of equity is often used as a proxy for investors':

    A average required rate of return.

    B minimum required rate of return.

    C maximum required rate of return.

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 €12,000,000 − €7,500,000 = €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}). The BVE_{t-1} is equal to the beginning total assets minus the beginning total liabilities, which equals £50,000,000 − £35,000,000 = £15,000,000. Therefore, ROE = £2,000,000/£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.

SUMMARY

In this reading, we have provided an overview of industry analysis and illustrated approaches that are widely used by analysts to examine an industry.

- Company analysis and industry analysis are closely interrelated. Company and industry analysis together can provide insight into sources of industry revenue growth and competitors' market shares and thus the future of an individual company's top-line growth and bottom-line profitability.

- Industry analysis is useful for:
  - understanding a company's business and business environment;
  - identifying active equity investment opportunities;
  - formulating an industry or sector rotation strategy; and
  - portfolio performance attribution.

- The three main approaches to classifying companies are:
  - products and/or services supplied;
  - business-cycle sensitivities; and
  - statistical similarities.

- Commercial industry classification systems include:
  - Global Industry Classification Standard;
  - Russell Global Sectors; and
  - Industry Classification Benchmark.

- Governmental industry classification systems include:
  - International Standard Industrial Classification of All Economic Activities;
  - Statistical Classification of Economic Activities in the European Community;
  - Australian and New Zealand Standard Industrial Classification; and
  - North American Industry Classification System.

- A limitation of current classification systems is that the narrowest classification unit assigned to a company generally cannot be assumed to constitute its peer group for the purposes of detailed fundamental comparisons or valuation.

- A peer group is a group of companies engaged in similar business activities whose economics and valuation are influenced by closely related factors.

- Steps in constructing a preliminary list of peer companies:
  - Examine commercial classification systems if available. These systems often provide a useful starting point for identifying companies operating in the same industry.
  - Review the subject company's annual report for a discussion of the competitive environment. Companies frequently cite specific competitors.
  - Review competitors' annual reports to identify other potential comparables.
  - Review industry trade publications to identify additional peer companies.
  - Confirm that each comparable or peer company derives a significant portion of its revenue and operating profit from a similar business activity as the subject company.

- Not all industries are created equal. Some are highly competitive, with many companies struggling to earn returns in excess of their cost of capital, and other industries have attractive characteristics that enable a majority of industry participants to generate healthy profits.

- Differing competitive environments are determined by the structural attributes of the industry. For this important reason, industry analysis is a vital complement to company analysis. The analyst needs to understand the context in which a company operates to fully understand the opportunities and threats that a company faces.

- The framework for strategic analysis known as "Porter's five forces" can provide a useful starting point. Porter maintains that the profitability of companies in an industry is determined by five forces: 1) The threat of new entrants, which in turn is determined by economies of scale, brand loyalty, absolute cost advantages, customer switching costs, and government regulation; 2) the bargaining power of suppliers, which is a function of the feasibility of product substitution, the concentration of the buyer and supplier groups, and switching costs and entry costs in each case; 3) the bargaining power of buyers, which is a function of switching costs among customers and the ability of customers to produce their own product; 4) the threat of substitutes; and 5) the intensity of rivalry among existing competitors, which in turn is a function of industry competitive structure, demand conditions, cost conditions, and the height of exit barriers.

- The concept of barriers to entry refers to the ease with which new competitors can challenge incumbents and can be an important factor in determining the competitive environment of an industry. If new competitors can easily enter the industry, the industry is likely to be highly competitive because incumbents that attempt to raise prices will be undercut by newcomers. As a result, industries with low barriers to entry tend to have low pricing power. Conversely, if incumbents are protected by barriers to entry, they may enjoy a more benign competitive environment that gives them greater pricing power over their customers because they do not have to worry about being undercut by upstarts.

- Industry concentration is often, although not always, a sign that an industry may have pricing power and rational competition. Industry fragmentation is a much stronger signal, however, that the industry is competitive and pricing power is limited.

- The effect of industry capacity on pricing is clear: Tight capacity gives participants more pricing power because demand for products or services exceeds supply; overcapacity leads to price cutting and a highly competitive environment as excess supply chases demand. The analyst should think about not only current capacity conditions but also future changes in capacity levels—how long it takes for supply and demand to come into balance and what effect that process has on industry pricing power and returns.

- Examining the market share stability of an industry over time is similar to thinking about barriers to entry and the frequency with which new players enter an industry. Stable market shares typically indicate less competitive industries, whereas unstable market shares often indicate highly competitive industries with limited pricing power.

- An industry's position in its life cycle often has a large impact on its competitive dynamics, so it is important to keep this positioning in mind when performing strategic analysis of an industry. Industries, like individual companies, tend to evolve over time and usually experience significant changes in the rate of growth and levels of profitability along the way. Just as an investment in an

individual company requires careful monitoring, industry analysis is a continuous process that must be repeated over time to identify changes that may be occurring.

■ A useful framework for analyzing the evolution of an industry is an industry life-cycle model, which identifies the sequential stages that an industry typically goes through. The five stages of an industry life cycle according to the Hill and Jones model are:

● embryonic;

● growth;

● shakeout;

● mature; and

● decline.

■ Price competition and thinking like a customer are important factors that are often overlooked when analyzing an industry. Whatever factors most influence customer purchasing decisions are also likely to be the focus of competitive rivalry in the industry. Broadly, industries for which price is a large factor in customer purchase decisions tend to be more competitive than industries in which customers value other attributes more highly.

■ External influences on industry growth, profitability, and risk include:

● technology;

● demographics;

● government; and

● social factors.

■ Company analysis takes place after the analyst has gained an understanding of the company's external environment and includes answering questions about how the company will respond to the threats and opportunities presented by the external environment. This intended response is the individual company's competitive strategy. The analyst should seek to determine whether the strategy is primarily defensive or offensive in its nature and how the company intends to implement it.

■ Porter identifies two chief competitive strategies:

● A low-cost strategy (cost leadership) is one in which companies strive to become the low-cost producers and to gain market share by offering their products and services at lower prices than their competition while still making a profit margin sufficient to generate a superior rate of return based on the higher revenues achieved.

● A product/service differentiation strategy is one in which companies attempt to establish themselves as the suppliers or producers of products and services that are unique either in quality, type, or means of distribution. To be successful, the companies' price premiums must be above their costs of differentiation and the differentiation must be appealing to customers and sustainable over time.

■ A checklist for company analysis includes a thorough investigation of:

● corporate profile;

● industry characteristics;

● demand for products/services;

● supply of products/services;

● pricing; and

- financial ratios.

■ Spreadsheet modeling of financial statements to analyze and forecast revenues, operating and net income, and cash flows has become one of the most widely used tools in company analysis. Spreadsheet modeling can be used to quantify the effects of the changes in certain swing factors on the various financial statements. The analyst should be aware that the output of the model will depend significantly on the assumptions that are made.

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PRACTICE PROBLEMS

1   Which of the following is *least likely* to involve industry analysis?

   A   Sector rotation strategy.

   B   Top-down fundamental investing.

   C   Tactical asset allocation strategy.

2   A sector rotation strategy involves investing in a sector by:

   A   making regular investments in it.

   B   investing in a pre-selected group of sectors on a rotating basis.

   C   timing investment to take advantage of business-cycle conditions.

3   Which of the following information about a company would *most likely* depend on an industry analysis? The company's:

   A   dividend policy.

   B   competitive environment.

   C   trends in corporate expenses.

4   Which industry classification system uses a three-tier classification system?

   A   Russell Global Sectors.

   B   Industry Classification Benchmark.

   C   Global Industry Classification Standard.

5   In which sector would a manufacturer of personal care products be classified?

   A   Health care.

   B   Consumer staples.

   C   Consumer discretionary.

6   A automotive manufacturer is *most likely* classified in which of the following industry sectors?

   A   Consumer staples

   B   Industrial durables

   C   Consumer discretionary

7   Which of the following statements about commercial and government industry classification systems is *most* accurate?

   A   Many commercial classification systems include private for-profit companies.

   B   Both commercial and government classification systems exclude not-for-profit companies.

   C   Commercial classification systems are generally updated more frequently than government classification systems.

8   Which of the following is *not* a limitation of the cyclical/non-cyclical descriptive approach to classifying companies?

   A   A cyclical company may have a growth component in it.

   B   Business-cycle sensitivity is a discrete phenomenon rather than a continuous spectrum.

   C   A global company can experience economic expansion in one part of the world while experiencing recession in another part.

9 A cyclical company is *most likely* to:

   A have low operating leverage.

   B sell relatively inexpensive products.

   C experience wider-than-average fluctuations in demand.

10 A company that is sensitive to the business cycle would *most likely*:

   A not have growth opportunities.

   B experience below-average fluctuation in demand.

   C sell products that the customer can purchase at a later date if necessary.

11 Which of the following factors would *most likely* be a limitation of applying business-cycle analysis to global industry analysis?

   A Some industries are relatively insensitive to the business cycle.

   B Correlations of security returns between different world markets are relatively low.

   C One region or country of the world may experience recession while another region experiences expansion.

12 Which of the following statements about peer groups is *most* accurate?

   A Constructing a peer group for a company follows a standardized process.

   B Commercial industry classification systems often provide a starting point for constructing a peer group.

   C A peer group is generally composed of all the companies in the most narrowly defined category used by the commercial industry classification system.

13 With regard to forming a company's peer group, which of the following statements is *not* correct?

   A Comments from the management of the company about competitors are generally not used when selecting the peer group.

   B The higher the proportion of revenue and operating profit of the peer company derived from business activities similar to the subject company, the more meaningful the comparison.

   C Comparing the company's performance measures with those for a potential peer-group company is of limited value when the companies are exposed to different stages of the business cycle.

14 When selecting companies for inclusion in a peer group, a company operating in three different business segments would:

   A be in only one peer group.

   B possibly be in more than one peer group.

   C not be included in any peer group.

15 An industry that *most likely* has both high barriers to entry and high barriers to exit is the:

   A restaurant industry.

   B advertising industry.

   C automobile industry.

16 Which factor is *most likely* associated with stable market share?

   A Low switching costs.

   B Low barriers to entry.

   C Slow pace of product innovation.

17 Which of the following companies *most likely* has the greatest ability to quickly increase its capacity?

  A Restaurant.

  B Steel producer.

  C Legal services provider.

18 A population that is rapidly aging would *most likely* cause the growth rate of the industry producing eye glasses and contact lenses to:

  A decrease.

  B increase.

  C not change.

19 If over a long period of time a country's average level of educational accomplishment increases, this development would *most likely* lead to the country's amount of income spent on consumer discretionary goods to:

  A decrease.

  B increase.

  C not change.

20 If the technology for an industry involves high fixed capital investment, then one way to seek higher profit growth is by pursuing:

  A economies of scale.

  B diseconomies of scale.

  C removal of features that differentiate the product or service provided.

21 Which of the following life-cycle phases is typically characterized by high prices?

  A Mature.

  B Growth.

  C Embryonic.

22 In which of the following life-cycle phases are price wars *most likely* to be absent?

  A Mature.

  B Decline.

  C Growth.

23 When graphically depicting the life-cycle model for an industry as a curve, the variables on the axes are:

  A price and time.

  B demand and time.

  C demand and stage of the life cycle.

24 Industry consolidation and high barriers to entry *most likely* characterize which life-cycle stage?

  A Mature

  B Growth

  C Embryonic

25 Which of the following is *most likely* a characteristic of a concentrated industry?

  A Infrequent, tacit coordination.

  B Difficulty in monitoring other industry members.

  C Industry members attempting to avoid competition on price.

26 Which of the following industry characteristics is generally *least likely* to produce high returns on capital?

   A   High barriers to entry

   B   High degree of concentration

   C   Short lead time to build new plants

27 An industry with high barriers to entry and weak pricing power *most likely* has:

   A   high barriers to exit.

   B   stable market shares.

   C   significant numbers of issued patents.

28 Economic value is created for an industry's shareholders when the industry earns a return:

   A   below the cost of capital.

   B   equal to the cost of capital.

   C   above the cost of capital.

29 Which of the following industries is *most likely* to be characterized as concentrated with strong pricing power?

   A   Asset management.

   B   Alcoholic beverages.

   C   Household and personal products.

30 With respect to competitive strategy, a company with a successful cost leadership strategy is *most likely* characterized by:

   A   a low cost of capital.

   B   reduced market share.

   C   the ability to offer products at higher prices than competitors.

31 When conducting a company analysis, the analysis of demand for a company's product is *least likely* to consider the:

   A   company's cost structure.

   B   motivations of the customer base.

   C   product's differentiating characteristics.

32 Which of the following statements about company analysis is *most* accurate?

   A   The complexity of spreadsheet modeling ensures precise forecasts of financial statements.

   B   The interpretation of financial ratios should focus on comparing the company's results over time but not with competitors.

   C   The corporate profile would include a description of the company's business, investment activities, governance, and strengths and weaknesses.

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.

2 Using a multiplier approach, estimate intrinsic value. Assume that a reasonable estimate of P/E is the average trailing twelve-month (TTM) P/E ratio over Years 1 through 4.

3 Using an asset-based valuation approach, estimate value per share from adjusted book values. Assume that the market values of accounts receivable and inventories are as reported, the market value of net fixed assets is 110 percent of reported book value, and the reported book values of liabilities reflect their market values.

Solution to 1:

$$D_5 (1 + g)^5 = D_{10} 2.43(1 + g)^5 = 3.10$$

$$g \approx 5.0\%$$

Estimate of value $= V_5 = 2.55/(0.10 - 0.05) = \$51.00$

Solution to 2:

Average P/E $= (14.0 + 15.2 + 16.4 + 13.2)/4 = 14.7$

Estimate of value $= \$4.00 \times 14.7 = \$58.80$

Solution to 3:

Market value of assets $= 5,000 + 15,000 + 30,000 + 1.1(50,000) = \$105,000$

Market value of liabilities $= \$3,000 + 17,000 + 25,000 = \$45,000$

Adjusted book value $= \$105,000 - 45,000 = \$60,000$

Estimated value (adjusted book value per share) $= \$60,000 \div 1,000$ shares $= \$60.00$

Given the current share price of $50.80, the multiplier and the asset-based valuation approaches indicate that the stock is undervalued. Given the intrinsic value estimated using the Gordon growth model, the analyst is likely to conclude that the stock is fairly priced. The analyst might examine the assumptions in the multiplier and the asset-based valuation approaches to determine why their estimated values differ from the estimated value provided by the Gordon growth model and the market price.

SUMMARY

The equity valuation models used to estimate intrinsic value—present value models, multiplier models, and asset-based valuation—are widely used and serve an important purpose. The valuation models presented here are a foundation on which to base analysis and research but must be applied wisely. Valuation is not simply a numerical analysis. The choice of model and the derivation of inputs require skill and judgment.

When valuing a company or group of companies, the analyst wants to choose a valuation model that is appropriate for the information available to be used as inputs. The available data will, in most instances, restrict the choice of model and influence the way it is used. Complex models exist that may improve on the simple valuation models described in this reading; but before using those models and assuming that complexity increases accuracy, the analyst would do well to consider the "law of parsimony:" A

model should be kept as simple as possible in light of the available inputs. Valuation is a fallible discipline, and any method will result in an inaccurate forecast at some time. The goal is to minimize the inaccuracy of the forecast.

Among the points made in this reading are the following:

■ An analyst estimating intrinsic value is implicitly questioning the market's estimate of value.

■ If the estimated value exceeds the market price, the analyst infers the security is *undervalued*. If the estimated value equals the market price, the analyst infers the security is *fairly valued*. If the estimated value is less than the market price, the analyst infers the security is *overvalued*. Because of the uncertainties involved in valuation, an analyst may require that value estimates differ markedly from market price before concluding that a misvaluation exists.

■ Analysts often use more than one valuation model because of concerns about the applicability of any particular model and the variability in estimates that result from changes in inputs.

■ Three major categories of equity valuation models are present value, multiplier, and asset-based valuation models.

■ Present value models estimate value as the present value of expected future benefits.

■ Multiplier models estimate intrinsic value based on a multiple of some fundamental variable.

■ Asset-based valuation models estimate value based on the estimated value of assets and liabilities.

■ The choice of model will depend upon the availability of information to input into the model and the analyst's confidence in both the information and the appropriateness of the model.

■ Companies distribute cash to shareholders using dividend payments and share repurchases.

■ Regular cash dividends are a key input to dividend valuation models.

■ Key dates in dividend chronology are the declaration date, ex-dividend date, holder-of-record date, and payment date.

■ In the dividend discount model, value is estimated as the present value of expected future dividends.

■ In the free cash flow to equity model, value is estimated as the present value of expected future free cash flow to equity.

■ The Gordon growth model, a simple DDM, estimates value as $D_1/(r - g)$.

■ The two stage dividend discount model estimates value as the sum of the present values of dividends over a short-term period of high growth and the present value of the terminal value at the end of the period of high growth. The terminal value is estimated using the Gordon growth model.

■ The choice of dividend model is based upon the patterns assumed with respect to future dividends.

■ Multiplier models typically use multiples of the form: P/ measure of fundamental variable or EV/ measure of fundamental variable.

■ Multiples can be based upon fundamentals or comparables.

■ Asset-based valuations models estimate value of equity as the value of the assets less the value of liabilities.

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PRACTICE PROBLEMS

1   An analyst estimates the intrinsic value of a stock to be in the range of €17.85 to €21.45. The current market price of the stock is €24.35. This stock is *most likely*:

   A   overvalued.

   B   undervalued.

   C   fairly valued.

2   An analyst determines the intrinsic value of an equity security to be equal to $55. If the current price is $47, the equity is *most likely*:

   A   undervalued.

   B   fairly valued.

   C   overvalued.

3   In asset-based valuation models, the intrinsic value of a common share of stock is based on the:

   A   estimated market value of the company's assets.

   B   estimated market value of the company's assets plus liabilities.

   C   estimated market value of the company's assets minus liabilities.

4   Which of the following is *most likely* used in a present value model?

   A   Enterprise value.

   B   Price to free cash flow.

   C   Free cash flow to equity.

5   Book value is *least likely* to be considered when using:

   A   a multiplier model.

   B   an asset-based valuation model.

   C   a present value model.

6   An analyst is attempting to calculate the intrinsic value of a company and has gathered the following company data: EBITDA, total market value, and market value of cash and short-term investments, liabilities, and preferred shares. The analyst is *least likely* to use:

   A   a multiplier model.

   B   a discounted cash flow model.

   C   an asset-based valuation model.

7   An analyst who bases the calculation of intrinsic value on dividend-paying capacity rather than expected dividends will *most likely* use the:

   A   dividend discount model.

   B   free cash flow to equity model.

   C   cash flow from operations model.

8   An investor expects to purchase shares of common stock today and sell them after two years. The investor has estimated dividends for the next two years, D_1 and D_2, and the selling price of the stock two years from now, P_2. According to the dividend discount model, the intrinsic value of the stock today is the present value of:

   A   next year's dividend, D_1.

B future expected dividends, D_1 and D_2.

C future expected dividends and price—D_1, D_2 and P_2.

9 In the free cash flow to equity (FCFE) model, the intrinsic value of a share of stock is calculated as:

A the present value of future expected FCFE.

B the present value of future expected FCFE plus net borrowing.

C the present value of future expected FCFE minus fixed capital investment.

10 With respect to present value models, which of the following statements is *most accurate*?

A Present value models can be used only if a stock pays a dividend.

B Present value models can be used only if a stock pays a dividend or is expected to pay a dividend.

C Present value models can be used for stocks that currently pay a dividend, are expected to pay a dividend, or are not expected to pay a dividend.

11 A Canadian life insurance company has an issue of 4.80 percent, $25 par value, perpetual, non-convertible, non-callable preferred shares outstanding. The required rate of return on similar issues is 4.49 percent. The intrinsic value of a preferred share is *closest to*:

A $25.00.

B $26.75.

C $28.50.

12 Two analysts estimating the value of a non-convertible, non-callable, perpetual preferred stock with a constant dividend arrive at different estimated values. The *most likely* reason for the difference is that the analysts used different:

A time horizons.

B required rates of return.

C estimated dividend growth rates.

13 The Beasley Corporation has just paid a dividend of $1.75 per share. If the required rate of return is 12.3 percent per year and dividends are expected to grow indefinitely at a constant rate of 9.2 percent per year, the intrinsic value of Beasley Corporation stock is *closest* to:

A $15.54.

B $56.45.

C $61.65.

14 An investor is considering the purchase of a common stock with a $2.00 annual dividend. The dividend is expected to grow at a rate of 4 percent annually. If the investor's required rate of return is 7 percent, the intrinsic value of the stock is *closest* to:

A $50.00.

B $66.67.

C $69.33.

15 An analyst gathers or estimates the following information about a stock:

Current price per share	€22.56
Current annual dividend per share	€1.60
Annual dividend growth rate for Years 1–4	9.00%
Annual dividend growth rate for Years 5+	4.00%
Required rate of return	12%

Based on a dividend discount model, the stock is *most likely*:

A undervalued.

B fairly valued.

C overvalued.

16 An analyst is attempting to value shares of the Dominion Company. The company has just paid a dividend of $0.58 per share. Dividends are expected to grow by 20 percent next year and 15 percent the year after that. From the third year onward, dividends are expected to grow at 5.6 percent per year indefinitely. If the required rate of return is 8.3 percent, the intrinsic value of the stock is *closest* to:

A $26.00.

B $27.00.

C $28.00.

17 Hideki Corporation has just paid a dividend of ¥450 per share. Annual dividends are expected to grow at the rate of 4 percent per year over the next four years. At the end of four years, shares of Hideki Corporation are expected to sell for ¥9000. If the required rate of return is 12 percent, the intrinsic value of a share of Hideki Corporation is *closest* to:

A ¥5,850.

B ¥7,220.

C ¥7,670.

18 The Gordon growth model can be used to value dividend-paying companies that are:

A expected to grow very fast.

B in a mature phase of growth.

C very sensitive to the business cycle.

19 The best model to use when valuing a young dividend-paying company that is just entering the growth phase is *most likely* the:

A Gordon growth model.

B two-stage dividend discount model.

C three-stage dividend discount model.

20 An equity analyst has been asked to estimate the intrinsic value of the common stock of Omega Corporation, a leading manufacturer of automobile seats. Omega is in a mature industry, and both its earnings and dividends are expected to grow at a rate of 3 percent annually. Which of the following is *most likely* to be the best model for determining the intrinsic value of an Omega share?

A Gordon growth model.

B Free cash flow to equity model.

C Multistage dividend discount model.

21 A price earnings ratio that is derived from the Gordon growth model is inversely related to the:

   A growth rate.

   B dividend payout ratio.

   C required rate of return.

22 The primary difference between P/E multiples based on comparables and P/E multiples based on fundamentals is that fundamentals-based P/Es take into account:

   A future expectations.

   B the law of one price.

   C historical information.

23 An analyst makes the following statement: "Use of P/E and other multiples for analysis is not effective because the multiples are based on historical data and because not all companies have positive accounting earnings." The analyst's statement is *most likely*:

   A inaccurate with respect to both historical data and earnings.

   B accurate with respect to historical data and inaccurate with respect to earnings.

   C inaccurate with respect to historical data and accurate with respect to earnings.

24 An analyst has prepared a table of the average trailing twelve-month price-to-earning (P/E), price-to-cash flow (P/CF), and price-to-sales (P/S) for the Tanaka Corporation for the years 2014 to 2017.

Year	P/E	P/CF	P/S
2014	4.9	5.4	1.2
2015	6.1	8.6	1.5
2016	8.3	7.3	1.9
2017	9.2	7.9	2.3

As of the date of the valuation in 2018, the trailing twelve-month P/E, P/CF, and P/S are, respectively, 9.2, 8.0, and 2.5. Based on the information provided, the analyst may reasonably conclude that Tanaka shares are *most likely*:

   A overvalued.

   B undervalued.

   C fairly valued.

25 An analyst has gathered the following information for the Oudin Corporation:

   Expected earnings per share = €5.70

   Expected dividends per share = €2.70

   Dividends are expected to grow at 2.75 percent per year indefinitely

   The required rate of return is 8.35 percent

Based on the information provided, the price/earnings multiple for Oudin is *closest* to:

   A 5.7.

   B 8.5.

   C 9.4.

26 An analyst gathers the following information about two companies:

	Alpha Corp.	Delta Co.
Current price per share	$57.32	$18.93
Last year's EPS	$3.82	$1.35
Current year's estimated EPS	$4.75	$1.40

Which of the following statements is *most accurate*?

A Delta has the higher trailing P/E multiple and lower current estimated P/E multiple.

B Alpha has the higher trailing P/E multiple and lower current estimated P/E multiple.

C Alpha has the higher trailing P/E multiple and higher current estimated P/E multiple.

27 An analyst gathers the following information about similar companies in the banking sector:

	First Bank	Prime Bank	Pioneer Trust
P/B	1.10	0.60	0.60
P/E	8.40	11.10	8.30

Which of the companies is *most likely* to be undervalued?

A First Bank.

B Prime Bank.

C Pioneer Trust.

28 The market value of equity for a company can be calculated as enterprise value:

A minus market value of debt, preferred stock, and short-term investments.

B plus market value of debt and preferred stock minus short-term investments.

C minus market value of debt and preferred stock plus short-term investments.

29 Which of the following statements regarding the calculation of the enterprise value multiple is *most likely* correct?

A Operating income may be used instead of EBITDA.

B EBITDA may not be used if company earnings are negative.

C Book value of debt may be used instead of market value of debt.

30 An analyst has determined that the appropriate EV/EBITDA for Rainbow Company is 10.2. The analyst has also collected the following forecasted information for Rainbow Company:

EBITDA = $22,000,000

Market value of debt = $56,000,000

Cash = $1,500,000

The value of equity for Rainbow Company is *closest* to:

A $169 million.

B $224 million.

C $281 million.

31 Enterprise value is most often determined as market capitalization of common equity and preferred stock minus the value of cash equivalents plus the:

    A book value of debt.

    B market value of debt.

    C market value of long-term debt.

32 Asset-based valuation models are best suited to companies where the capital structure does not have a high proportion of:

    A debt.

    B intangible assets.

    C current assets and liabilities.

33 Which of the following is *most likely* a reason for using asset-based valuation?

    A The analyst is valuing a privately held company.

    B The company has a relatively high level of intangible assets.

    C The market values of assets and liabilities are different from the balance sheet values.

34 A disadvantage of the EV method for valuing equity is that the following information may be difficult to obtain:

    A Operating income.

    B Market value of debt.

    C Market value of equity.

35 Which type of equity valuation model is *most likely* to be preferable when one is comparing similar companies?

    A A multiplier model.

    B A present value model.

    C An asset-based valuation model.

36 Which of the following is *most likely* considered a weakness of present value models?

    A Present value models cannot be used for companies that do not pay dividends.

    B Small changes in model assumptions and inputs can result in large changes in the computed intrinsic value of the security.

    C The value of the security depends on the investor's holding period; thus, comparing valuations of different companies for different investors is difficult.

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:

$$V_0 = \sum_{t=1}^{n} \frac{D_0\left(1 + g_S\right)^t}{\left(1 + r\right)^t} + \frac{V_n}{\left(1 + r\right)^n} \text{ and } V_n = \frac{D_{n+1}}{r - g_L}$$

$$D_{n+1} = D_0(1 + g_S)^n(1 + g_L)$$
$$D_1 = €1.60 \times 1.09 = €1.744$$

$$D_2 = €1.60 \times (1.09)^2 = €1.901$$
$$D_3 = €1.60 \times (1.09)^3 = €2.072$$
$$D_4 = €1.60 \times (1.09)^4 = €2.259$$
$$D_5 = [€1.60 \times (1.09)^4](1.04) = €2.349$$
$$V_4 = €2.349/(0.12 - 0.04) = €29.363$$
$$V_0 = \frac{1.744}{(1.12)^1} + \frac{1.901}{(1.12)^2} + \frac{2.072}{(1.12)^3} + \frac{2.259}{(1.12)^4} + \frac{29.363}{(1.12)^4}$$

$$= 1.557 + 1.515 + 1.475 + 1.436 + 18.661$$
$$= €24.64 \text{ (which is greater than the current price of €22.56)}$$

16 C is correct.

$$V_0 = \frac{D_1}{(1+r)} + \frac{D_2}{(1+r)^2} + \frac{P_2}{(1+r)^2}$$

$$= \frac{0.70}{(1.083)} + \frac{0.80}{(1.083)^2} + \frac{31.29}{(1.083)^2}$$

$$= \$28.01$$

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.

$$V_0 = \frac{D_1}{(1+r)} + \frac{D_2}{(1+r)^2} + \frac{D_3}{(1+r)^3} + \frac{D_4}{(1+r)^4} + \frac{P_4}{(1+r)^4}$$

$$= \frac{468}{(1.12)} + \frac{486.72}{(1.12)^2} + \frac{506.19}{(1.12)^3} + \frac{526.44}{(1.12)^4} + \frac{9000}{(1.12)^4}$$

$$= ¥7,220$$

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:

$$\frac{P_0}{E_1} = \frac{\dfrac{D_1}{E_1}}{r - g}$$

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 2018 multiples are currently above their 2014–2017 averages.

Year	P/E	P/CF	P/R
2014	4.9	5.4	1.2
2015	6.1	8.6	1.5
2016	8.3	7.3	1.9
2017	9.2	7.9	2.3
Average	7.1	7.3	1.7

25 B is correct.

$$\frac{P_0}{E_1} = \frac{\dfrac{D_1}{E_1}}{r - g} = \frac{\dfrac{2.7}{5.7}}{0.0835 - 0.0275} = 8.5$$

26 B is correct. P/E = Current price/EPS, and Estimated P/E = Current price/Estimated EPS.

Alpha P/E = $57.32/$3.82 = 15.01

Alpha estimated P/E = $57.32/4.75 = 12.07

Delta P/E = $18.93/$1.35 = 14.02

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.

EV = 10.2 × 22,000,000 = $224,400,000

Equity value = EV – Debt + Cash
            = 224,400,000 – 56,000,000 + 1,500,000
            = $169,900,000

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.

Solution to 3:

C is correct. Reinvestment risk refers to the effect that lower interest rates have on available rates of return when reinvesting the cash flows received from an earlier investment. Because bonds are typically called following a decline in market interest rates, reinvestment risk is particularly relevant for the holder of a callable bond. A is incorrect because credit risk refers to the risk of loss resulting from the issuer failing to make full and timely payments of interest and/or repayments of principal. B is incorrect because interest rate risk is the risk that a change in market interest rate affects a bond's value.

Solution to 4:

B is correct. A putable bond limits the risk to the bondholder by guaranteeing a pre-specified selling price at the redemption dates.

Solution to 5:

C is correct. The conversion value of the bond is ₩40,000 × 25 = ₩1,000,000. The price of the convertible bond is ₩1,100,000. Thus, the conversion value of the bond is less than the bond's price, and this condition is referred to as below parity.

SUMMARY

This reading provides an introduction to the salient features of fixed-income securities while noting how these features vary among different types of securities. Important points include the following:

- The three important elements that an investor needs to know when investing in a fixed-income security are: (1) the bond's features, which determine its scheduled cash flows and thus the bondholder's expected and actual return; (2) the legal, regulatory, and tax considerations that apply to the contractual agreement between the issuer and the bondholders; and (3) the contingency provisions that may affect the bond's scheduled cash flows.

- The basic features of a bond include the issuer, maturity, par value (or principal), coupon rate and frequency, and currency denomination.

- Issuers of bonds include supranational organizations, sovereign governments, non-sovereign governments, quasi-government entities, and corporate issuers.

- Bondholders are exposed to credit risk and may use bond credit ratings to assess the credit quality of a bond.

- A bond's principal is the amount the issuer agrees to pay the bondholder when the bond matures.

- The coupon rate is the interest rate that the issuer agrees to pay to the bondholder each year. The coupon rate can be a fixed rate or a floating rate. Bonds may offer annual, semi-annual, quarterly, or monthly coupon payments depending on the type of bond and where the bond is issued.

- Bonds can be issued in any currency. Bonds such as dual-currency bonds and currency option bonds are connected to two currencies.

- The yield to maturity is the discount rate that equates the present value of the bond's future cash flows until maturity to its price. Yield to maturity can be considered an estimate of the market's expectation for the bond's return.

- A plain vanilla bond has a known cash flow pattern. It has a fixed maturity date and pays a fixed rate of interest over the bond's life.

- The bond indenture or trust deed is the legal contract that describes the form of the bond, the issuer's obligations, and the investor's rights. The indenture is usually held by a financial institution called a trustee, which performs various duties specified in the indenture.

- The issuer is identified in the indenture by its legal name and is obligated to make timely payments of interest and repayment of principal.

- For asset-backed securities, the legal obligation to repay bondholders often lies with a separate legal entity—that is, a bankruptcy-remote vehicle that uses the assets as guarantees to back a bond issue.

- How the issuer intends to service the debt and repay the principal should be described in the indenture. The source of repayment proceeds varies depending on the type of bond.

- Collateral backing is a way to alleviate credit risk. Secured bonds are backed by assets or financial guarantees pledged to ensure debt payment. Examples of collateral-backed bonds include collateral trust bonds, equipment trust certificates, mortgage-backed securities, and covered bonds.

- Credit enhancement can be internal or external. Examples of internal credit enhancement include subordination, overcollateralization, and reserve accounts. A bank guarantee, a surety bond, a letter of credit, and a cash collateral account are examples of external credit enhancement.

- Bond covenants are legally enforceable rules that borrowers and lenders agree on at the time of a new bond issue. Affirmative covenants enumerate what issuers are required to do, whereas negative covenants enumerate what issuers are prohibited from doing.

- An important consideration for investors is where the bonds are issued and traded, because it affects the laws, regulation, and tax status that apply. Bonds issued in a particular country in local currency are domestic bonds if they are issued by entities incorporated in the country and foreign bonds if they are issued by entities incorporated in another country. Eurobonds are issued internationally, outside the jurisdiction of any single country and are subject to a lower level of listing, disclosure, and regulatory requirements than domestic or foreign bonds. Global bonds are issued in the Eurobond market and at least one domestic market at the same time.

- Although some bonds may offer special tax advantages, as a general rule, interest is taxed at the ordinary income tax rate. Some countries also implement a capital gains tax. There may be specific tax provisions for bonds issued at a discount or bought at a premium.

- An amortizing bond is a bond whose payment schedule requires periodic payment of interest and repayment of principal. This differs from a bullet bond, whose entire payment of principal occurs at maturity. The amortizing bond's outstanding principal amount is reduced to zero by the maturity date for a fully amortized bond, but a balloon payment is required at maturity to retire the bond's outstanding principal amount for a partially amortized bond.

- Sinking fund agreements provide another approach to the periodic retirement of principal, in which an amount of the bond's principal outstanding amount is usually repaid each year throughout the bond's life or after a specified date.

- A floating-rate note, or floater, is a bond whose coupon is set based on some reference rate plus a spread. FRNs can be floored, capped, or collared. An inverse FRN is a bond whose coupon has an inverse relationship to the reference rate.

- Other coupon payment structures include bonds with step-up coupons, which pay coupons that increase by specified amounts on specified dates; bonds with credit-linked coupons, which change when the issuer's credit rating changes; bonds with payment-in-kind coupons that allow the issuer to pay coupons with additional amounts of the bond issue rather than in cash; and bonds with deferred coupons, which pay no coupons in the early years following the issue but higher coupons thereafter.

- The payment structures for index-linked bonds vary considerably among countries. A common index-linked bond is an inflation-linked bond, or linker, whose coupon payments and/or principal repayments are linked to a price index. Index-linked payment structures include zero-coupon-indexed bonds, interest-indexed bonds, capital-indexed bonds, and indexed-annuity bonds.

- Common types of bonds with embedded options include callable bonds, putable bonds, and convertible bonds. These options are "embedded" in the sense that there are provisions provided in the indenture that grant either the issuer or the bondholder certain rights affecting the disposal or redemption of the bond. They are not separately traded securities.

- Callable bonds give the issuer the right to buy bonds back prior to maturity, thereby raising the reinvestment risk for the bondholder. For this reason, callable bonds have to offer a higher yield and sell at a lower price than otherwise similar non-callable bonds to compensate the bondholders for the value of the call option to the issuer.

- Putable bonds give the bondholder the right to sell bonds back to the issuer prior to maturity. Putable bonds offer a lower yield and sell at a higher price than otherwise similar non-putable bonds to compensate the issuer for the value of the put option to the bondholders.

- A convertible bond gives the bondholder the right to convert the bond into common shares of the issuing company. Because this option favors the bondholder, convertible bonds offer a lower yield and sell at a higher price than otherwise similar non-convertible bonds.

PRACTICE PROBLEMS

1   A 10-year bond was issued four years ago. The bond is denominated in US dollars, offers a coupon rate of 10% with interest paid semi-annually, and is currently priced at 102% of par. The bond's:

    A   tenor is six years.

    B   nominal rate is 5%.

    C   redemption value is 102% of the par value.

2   A sovereign bond has a maturity of 15 years. The bond is *best* described as a:

    A   perpetual bond.

    B   pure discount bond.

    C   capital market security.

3   A company has issued a floating-rate note with a coupon rate equal to the three-month Libor + 65 basis points. Interest payments are made quarterly on 31 March, 30 June, 30 September, and 31 December. On 31 March and 30 June, the three-month Libor is 1.55% and 1.35%, respectively. The coupon rate for the interest payment made on 30 June is:

    A   2.00%.

    B   2.10%.

    C   2.20%.

4   The legal contract that describes the form of the bond, the obligations of the issuer, and the rights of the bondholders can be *best* described as a bond's:

    A   covenant.

    B   indenture.

    C   debenture.

5   Which of the following is a type of external credit enhancement?

    A   Covenants

    B   A surety bond

    C   Overcollaterization

6   An affirmative covenant is *most likely* to stipulate:

    A   limits on the issuer's leverage ratio.

    B   how the proceeds of the bond issue will be used.

    C   the maximum percentage of the issuer's gross assets that can be sold.

7   Which of the following *best* describes a negative bond covenant? The issuer is:

    A   required to pay taxes as they come due.

    B   prohibited from investing in risky projects.

    C   required to maintain its current lines of business.

8   A South African company issues bonds denominated in pound sterling that are sold to investors in the United Kingdom. These bonds can be *best* described as:

    A   Eurobonds.

    B   global bonds.

    C   foreign bonds.

9   Relative to domestic and foreign bonds, Eurobonds are *most likely* to be:

    A bearer bonds.

    B registered bonds.

    C subject to greater regulation.

10 An investor in a country with an original issue discount tax provision purchases a 20-year zero-coupon bond at a deep discount to par value. The investor plans to hold the bond until the maturity date. The investor will *most likely* report:

    A a capital gain at maturity.

    B a tax deduction in the year the bond is purchased.

    C taxable income from the bond every year until maturity.

11 A bond that is characterized by a fixed periodic payment schedule that reduces the bond's outstanding principal amount to zero by the maturity date is *best* described as a:

    A bullet bond.

    B plain vanilla bond.

    C fully amortized bond.

12 If interest rates are expected to increase, the coupon payment structure *most likely* to benefit the issuer is a:

    A step-up coupon.

    B inflation-linked coupon.

    C cap in a floating-rate note.

13 Investors who believe that interest rates will rise *most likely* prefer to invest in:

    A inverse floaters.

    B fixed-rate bonds.

    C floating-rate notes.

14 A 10-year, capital-indexed bond linked to the Consumer Price Index (CPI) is issued with a coupon rate of 6% and a par value of 1,000. The bond pays interest semi-annually. During the first six months after the bond's issuance, the CPI increases by 2%. On the first coupon payment date, the bond's:

    A coupon rate increases to 8%.

    B coupon payment is equal to 40.

    C principal amount increases to 1,020.

15 The provision that provides bondholders the right to sell the bond back to the issuer at a predetermined price prior to the bond's maturity date is referred to as:

    A a put provision.

    B a make-whole call provision.

    C an original issue discount provision.

16 Which of the following provisions is a benefit to the issuer?

    A Put provision

    B Call provision

    C Conversion provision

17 Relative to an otherwise similar option-free bond, a:

    A putable bond will trade at a higher price.

    B callable bond will trade at a higher price.

    C convertible bond will trade at a lower price.

18 Which type of bond *most likely* earns interest on an implied basis?

   A Floater

   B Conventional bond

   C Pure discount bond

19 Clauses that specify the rights of the bondholders and any actions that the issuer is obligated to perform or is prohibited from performing are:

   A covenants.

   B collaterals.

   C credit enhancements.

20 Which of the following type of debt obligation *most likely* protects bondholders when the assets serving as collateral are non-performing?

   A Covered bonds

   B Collateral trust bonds

   C Mortgage-backed securities

21 Which of the following *best* describes a negative bond covenant? The requirement to:

   A insure and maintain assets.

   B comply with all laws and regulations.

   C maintain a minimum interest coverage ratio.

22 Contrary to positive bond covenant, negative covenants are *most likely*:

   A costlier.

   B legally enforceable.

   C enacted at time of issue.

23 A five-year bond has the following cash flows:
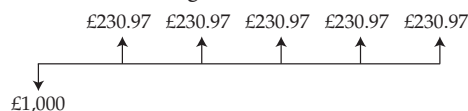
The bond can *best* be described as a:

   A bullet bond.

   B fully amortized bond.

   C partially amortized bond.

24 Investors seeking some general protection against a poor economy are *most likely* to select a:

   A deferred coupon bond.

   B credit-linked coupon bond.

   C payment-in-kind coupon bond.

25 The benefit to the issuer of a deferred coupon bond is *most likely* related to:

   A tax management.

   B cash flow management.

   C original issue discount price.

26 Which of the following bond types provides the *most* benefit to a bondholder when bond prices are declining?

   A Callable

   B Plain vanilla

   C Multiple put

27 Which type of call bond option offers the *greatest* flexibility as to when the issuer can exercise the option?

   A A Bermuda call

   B A European call

   C An American call

28 Which of the following *best* describes a convertible bond's conversion premium?

   A Bond price minus conversion value

   B Par value divided by conversion price

   C Current share price multiplied by conversion ratio

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 × (1 + 0.02) = 1,020 and the semi-annual coupon payment is equal to (0.06 × 1,020) ÷ 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 A is correct. Affirmative covenants typically do not impose additional costs to the issuer, while negative covenants are frequently costly. B is incorrect because all bond covenants are legally enforceable rules, so there is no difference in this regard between positive and negative bond covenants. C is incorrect because borrowers and lenders agree on all bond covenants at the time of a new bond issue, so there is no difference in this regard between positive and negative bond covenants.

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.

Solution to 5:

C is correct. The longer the length of the repurchase agreement, the higher the repo margin (haircut). A is incorrect because the higher the quality of the collateral, the lower the repo margin. B is incorrect because the higher the credit quality of the counterparty, the lower the repo margin.

SUMMARY

Debt financing is an important source of funds for households, governments, government-related entities, financial institutions, and non-financial companies. Well-functioning fixed-income markets help ensure that capital is allocated efficiently to its highest and best use globally. Important points include the following:

■ The most widely used ways of classifying fixed-income markets include the type of issuer; the bonds' credit quality, maturity, currency denomination, and type of coupon; and where the bonds are issued and traded.

■ Based on the type of issuer, the four major bond market sectors are the household, non-financial corporate, government, and financial institution sectors.

■ Investors make a distinction between investment-grade and high-yield bond markets based on the issuer's credit quality.

■ Money markets are where securities with original maturities ranging from overnight to one year are issued and traded, whereas capital markets are where securities with original maturities longer than one year are issued and traded.

■ The majority of bonds are denominated in either euros or US dollars.

■ Investors make a distinction between bonds that pay a fixed rate versus a floating rate of interest. The coupon rate of floating-rate bonds is often expressed as a reference rate plus a spread. Interbank offered rates, such as Libor, historically have been the most commonly used reference rates for floating-rate debt and other financial instruments but are being phased out to be replaced by alternative reference rates.

■ Based on where the bonds are issued and traded, a distinction is made between domestic and international bond markets. The latter includes the Eurobond market, which falls outside the jurisdiction of any single country and is characterized by less reporting, regulatory and tax constraints. Investors also make a distinction between developed and emerging bond markets.

■ Fixed-income indexes are used by investors and investment managers to describe bond markets or sectors and to evaluate performance of investments and investment managers.

■ The largest investors in bonds include central banks; institutional investors, such as pension funds, hedge funds, charitable foundations and endowments, insurance companies, mutual funds and ETFs, and banks; and retail investors, typically by means of indirect investments.

■ Primary markets are markets in which issuers first sell bonds to investors to raise capital. Secondary markets are markets in which existing bonds are subsequently traded among investors.

- There are two mechanisms for issuing a bond in primary markets: a public offering, in which any member of the public may buy the bonds, or a private placement, in which only an investor or small group of investors may buy the bonds either directly from the issuer or through an investment bank.

- Public bond issuing mechanisms include underwritten offerings, best effort offerings, shelf registrations, and auctions.

- When an investment bank underwrites a bond issue, it buys the entire issue and takes the risk of reselling it to investors or dealers. In contrast, in a best-efforts offering, the investment bank serves only as a broker and sells the bond issue only if it is able to do so. Underwritten and best effort offerings are frequently used in the issuance of corporate bonds.

- The underwriting process typically includes six phases: the determination of the funding needs, the selection of the underwriter, the structuring and announcement of the bond offering, pricing, issuance, and closing.

- A shelf registration is a method for issuing securities in which the issuer files a single document with regulators that describes and allows for a range of future issuances.

- An auction is a public offering method that involves bidding, and that is helpful in providing price discovery and in allocating securities. It is frequently used in the issuance of sovereign bonds.

- Most bonds are traded in over-the-counter (OTC) markets, and institutional investors are the major buyers and sellers of bonds in secondary markets.

- Sovereign bonds are issued by national governments primarily for fiscal reasons. They take different names and forms depending on where they are issued, their maturities, and their coupon types. Most sovereign bonds are fixed-rate bonds, although some national governments also issue floating-rate bonds and inflation-linked bonds.

- Local governments, quasi-government entities, and supranational agencies issue bonds, which are named non-sovereign, quasi-government, and supranational bonds, respectively.

- Companies raise debt in the form of bilateral loans, syndicated loans, commercial paper, notes, and bonds.

- Commercial paper is a short-term unsecured security that is used by companies as a source of short-term and bridge financing. Investors in commercial paper are exposed to credit risk, although defaults are rare. Many issuers roll over their commercial paper on a regular basis.

- Corporate bonds and notes take different forms depending on the maturities, coupon payment, and principal repayment structures. Important considerations also include collateral backing and contingency provisions.

- Medium-term notes are securities that are offered continuously to investors by an agent of the issuer. They can have short-term or long-term maturities.

- The structured finance sector includes asset-backed securities, collateralized debt obligations, and other structured financial instruments. All of these seemingly disparate financial instruments share the common attribute of repackaging risks.

- Many structured financial instruments are customized instruments that often combine a bond and at least one derivative. The redemption and often the coupons of these structured financial instruments are linked via a formula to the performance of the underlying asset(s). Thus, the bond's payment features are replaced with non-traditional payoffs that are derived not from the issuer's cash

flows but from the performance of the underlying asset(s). Capital protected, yield enhancement, participation and leveraged instruments are typical examples of structured financial instruments.

■ Financial institutions have access to additional sources of funds, such as retail deposits, central bank funds, interbank funds, large-denomination negotiable certificates of deposit, and repurchase agreements.

■ A repurchase agreement is similar to a collateralized loan. It involves the sale of a security (the collateral) with a simultaneous agreement by the seller (the borrower) to buy the same security back from the purchaser (the lender) at an agreed-on price in the future. Repurchase agreements are a common source of funding for dealer firms and are also used to borrow securities to implement short positions.

PRACTICE PROBLEMS

1 In most countries, the bond market sector with the smallest amount of bonds outstanding is *most likely* the:

   A government sector.

   B financial corporate sector.

   C non-financial corporate sector.

2 The distinction between investment grade debt and non-investment grade debt is *best* described by differences in:

   A tax status.

   B credit quality.

   C maturity dates.

3 A bond issued internationally, outside the jurisdiction of the country in whose currency the bond is denominated, is *best* described as a:

   A Eurobond.

   B foreign bond.

   C municipal bond.

4 When classified by type of issuer, asset-backed securities are part of the:

   A corporate sector.

   B structured finance sector.

   C government and government-related sector.

5 Compared with developed markets bonds, emerging markets bonds *most likely*:

   A offer lower yields.

   B exhibit higher risk.

   C benefit from lower growth prospects.

6 With respect to floating-rate bonds, a reference rate such as the London inter-bank offered rate (Libor) is *most likely* used to determine the bond's:

   A spread.

   B coupon rate.

   C frequency of coupon payments.

7 The variability of the coupon rate on a Libor-based floating-rate bond is *most likely* due to:

   A periodic resets of the reference rate.

   B market-based reassessments of the issuer's creditworthiness.

   C changing estimates by the Libor administrator of borrowing capacity.

8 Which of the following statements is *most accurate*? An interbank offered rate:

   A is a single reference rate.

   B applies to borrowing periods of up to 10 years.

   C is used as a reference rate for interest rate swaps.

9 An investment bank that underwrites a bond issue *most likely*:

   A buys and resells the newly issued bonds to investors or dealers.

   B acts as a broker and receives a commission for selling the bonds to investors.

C incurs less risk associated with selling the bonds than in a best efforts offering.

10 In major developed bond markets, newly issued sovereign bonds are *most* often sold to the public via a(n):

A auction.

B private placement.

C best efforts offering.

11 Which of the following describes privately placed bonds?

A They are non-underwritten and unregistered.

B They usually have active secondary markets.

C They are less customized than publicly offered bonds.

12 A mechanism by which an issuer may be able to offer additional bonds to the general public without preparing a new and separate offering circular *best* describes:

A the grey market.

B a shelf registration.

C a private placement.

13 Which of the following statements related to secondary bond markets is *most accurate*?

A Newly issued corporate bonds are issued in secondary bond markets.

B Secondary bond markets are where bonds are traded between investors.

C The major participants in secondary bond markets globally are retail investors.

14 A bond market in which a communications network matches buy and sell orders initiated from various locations is *best* described as an:

A organized exchange.

B open market operation.

C over-the-counter market.

15 A liquid secondary bond market allows an investor to sell a bond at:

A the desired price.

B a price at least equal to the purchase price.

C a price close to the bond's fair market value.

16 Corporate bond secondary market trading *most often* occurs:

A on a book-entry basis.

B on organized exchanges.

C prior to settlement at $T + 1$.

17 Sovereign bonds are *best* described as:

A bonds issued by local governments.

B secured obligations of a national government.

C bonds backed by the taxing authority of a national government.

18 Which factor is associated with a more favorable quality sovereign bond credit rating?

A Issued in local currency, only

B Strong domestic savings base, only

C Issued in local currency of country with strong domestic savings base

19 Which type of sovereign bond has the lowest interest rate risk for an investor?

A Floaters

B Coupon bonds

C Discount bonds

20 Agency bonds are issued by:

A local governments.

B national governments.

C quasi-government entities.

21 The type of bond issued by a multilateral agency such as the International Monetary Fund (IMF) is *best* described as a:

A sovereign bond.

B supranational bond.

C quasi-government bond.

22 A bond issued by a local government authority, typically without an explicit funding commitment from the national government, is *most likely* classified as a:

A sovereign bond.

B quasi-government bond

C non-sovereign government bond.

23 Which of the following statements relating to commercial paper is *most accurate*?

A There is no secondary market for trading commercial paper.

B Only the strongest, highly rated companies issue commercial paper.

C Commercial paper is a source of interim financing for long-term projects.

24 Eurocommerical paper is *most likely*:

A negotiable.

B denominated in euro.

C issued on a discount basis.

25 For the issuer, a sinking fund arrangement is *most similar* to a:

A term maturity structure.

B serial maturity structure.

C bondholder put provision.

26 When issuing debt, a company may use a sinking fund arrangement as a means of reducing:

A credit risk.

B inflation risk.

C interest rate risk.

27 Which of the following is a source of wholesale funds for banks?

A Demand deposits

B Money market accounts

C Negotiable certificates of deposit

28 A characteristic of negotiable certificates of deposit is:

A they are mostly available in small denominations.

B they can be sold in the open market prior to maturity.

C a penalty is imposed if the depositor withdraws funds prior to maturity.

29 A repurchase agreement is *most* comparable to a(n):

    A   interbank deposit.

    B   collateralized loan.

    C   negotiable certificate of deposit.

30 The repo margin is:

    A   negotiated between counterparties.

    B   established independently of market-related conditions.

    C   structured on an agreement assuming equal credit risks to all counterparties.

31 The repo margin on a repurchase agreement is *most likely* to be lower when:

    A   the underlying collateral is in short supply.

    B   the maturity of the repurchase agreement is long.

    C   the credit risk associated with the underlying collateral is high.

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.

SUMMARY

This reading covers the principles and techniques that are used in the valuation of fixed-rate bonds, as well as floating-rate notes and money market instruments. These building blocks are used extensively in fixed-income analysis. The following are the main points made in the reading:

- The market discount rate is the rate of return required by investors given the risk of the investment in the bond.

- A bond is priced at a premium above par value when the coupon rate is greater than the market discount rate.

- A bond is priced at a discount below par value when the coupon rate is less than the market discount rate.

- The amount of any premium or discount is the present value of the "excess" or "deficiency" in the coupon payments relative to the yield-to-maturity.

- The yield-to-maturity, the internal rate of return on the cash flows, is the implied market discount rate given the price of the bond.

- A bond price moves inversely with its market discount rate.

- The relationship between a bond price and its market discount rate is convex.

- The price of a lower-coupon bond is more volatile than the price of a higher-coupon bond, other things being equal.

- Generally, the price of a longer-term bond is more volatile than the price of shorter-term bond, other things being equal. An exception to this phenomenon can occur on low-coupon (but not zero-coupon) bonds that are priced at a discount to par value.

- Assuming no default, premium and discount bond prices are "pulled to par" as maturity nears.

- A spot rate is the yield-to-maturity on a zero-coupon bond.

- A yield-to-maturity can be approximated as a weighted average of the underlying spot rates.

- Between coupon dates, the full (or invoice, or "dirty") price of a bond is split between the flat (or quoted, or "clean") price and the accrued interest.

- Flat prices are quoted to not misrepresent the daily increase in the full price as a result of interest accruals.

- Accrued interest is calculated as a proportional share of the next coupon payment using either the actual/actual or 30/360 methods to count days.

- Matrix pricing is used to value illiquid bonds by using prices and yields on comparable securities having the same or similar credit risk, coupon rate, and maturity.

- The periodicity of an annual interest rate is the number of periods in the year.

- A yield quoted on a semiannual bond basis is an annual rate for a periodicity of two. It is the yield per semiannual period times two.

- The general rule for periodicity conversions is that compounding more frequently at a lower annual rate corresponds to compounding less frequently at a higher annual rate.

- Street convention yields assume payments are made on scheduled dates, neglecting weekends and holidays.

- The current yield is the annual coupon payment divided by the flat price, thereby neglecting as a measure of the investor's rate of return the time value of money, any accrued interest, and the gain from buying at a discount and the loss from buying at a premium.

- The simple yield is like the current yield but includes the straight-line amortization of the discount or premium.

- The yield-to-worst on a callable bond is the lowest of the yield-to-first-call, yield-to-second-call, and so on, calculated using the call price for the future value and the call date for the number of periods.

- The option-adjusted yield on a callable bond is the yield-to-maturity after adding the theoretical value of the call option to the price.

- A floating-rate note (floater, or FRN) maintains a more stable price than a fixed-rate note because interest payments adjust for changes in market interest rates.

- The quoted margin on a floater is typically the specified yield spread over or under the reference rate, which often is Libor.

- The discount margin on a floater is the spread required by investors, and to which the quoted margin must be set, for the FRN to trade at par value on a rate reset date.

- Money market instruments, having one year or less time-to-maturity, are quoted on a discount rate or add-on rate basis.

- Money market discount rates understate the investor's rate of return (and the borrower's cost of funds) because the interest income is divided by the face value or the total amount redeemed at maturity, and not by the amount of the investment.

- Money market instruments need to be converted to a common basis for analysis.

- A money market bond equivalent yield is an add-on rate for a 365-day year.

- The periodicity of a money market instrument is the number of days in the year divided by the number of days to maturity. Therefore, money market instruments with different times-to-maturity have annual rates for different periodicities.

- In theory, the maturity structure, or term structure, of interest rates is the relationship between yields-to-maturity and times-to-maturity on bonds having the same currency, credit risk, liquidity, tax status, and periodicity.

- A spot curve is a series of yields-to-maturity on zero-coupon bonds.

- A frequently used yield curve is a series of yields-to-maturity on coupon bonds.

- A par curve is a series of yields-to-maturity assuming the bonds are priced at par value.

- In a cash market, the delivery of the security and cash payment is made on a settlement date within a customary time period after the trade date—for example, "$T + 3$."

- In a forward market, the delivery of the security and cash payment is made on a predetermined future date.

- A forward rate is the interest rate on a bond or money market instrument traded in a forward market.

- An implied forward rate (or forward yield) is the breakeven reinvestment rate linking the return on an investment in a shorter-term zero-coupon bond to the return on an investment in a longer-term zero-coupon bond.

- An implied forward curve can be calculated from the spot curve.

- Implied spot rates can be calculated as geometric averages of forward rates.

- A fixed-income bond can be valued using a market discount rate, a series of spot rates, or a series of forward rates.

- A bond yield-to-maturity can be separated into a benchmark and a spread.

- Changes in benchmark rates capture macroeconomic factors that affect all bonds in the market—inflation, economic growth, foreign exchange rates, and monetary and fiscal policy.

- Changes in spreads typically capture microeconomic factors that affect the particular bond—credit risk, liquidity, and tax effects.

- Benchmark rates are usually yields-to-maturity on government bonds or fixed rates on interest rate swaps.

- A G-spread is the spread over or under a government bond rate, and an I-spread is the spread over or under an interest rate swap rate.

- A G-spread or an I-spread can be based on a specific benchmark rate or on a rate interpolated from the benchmark yield curve.

- A Z-spread (zero-volatility spread) is based on the entire benchmark spot curve. It is the constant spread that is added to each spot rate such that the present value of the cash flows matches the price of the bond.

- An option-adjusted spread (OAS) on a callable bond is the Z-spread minus the theoretical value of the embedded call option.

PRACTICE PROBLEMS

1   A portfolio manager is considering the purchase of a bond with a 5.5% coupon rate that pays interest annually and matures in three years. If the required rate of return on the bond is 5%, the price of the bond per 100 of par value is *closest* to:

   A   98.65.

   B   101.36.

   C   106.43.

2   A bond with two years remaining until maturity offers a 3% coupon rate with interest paid annually. At a market discount rate of 4%, the price of this bond per 100 of par value is *closest* to:

   A   95.34.

   B   98.00.

   C   98.11.

3   An investor who owns a bond with a 9% coupon rate that pays interest semiannually and matures in three years is considering its sale. If the required rate of return on the bond is 11%, the price of the bond per 100 of par value is *closest* to:

   A   95.00.

   B   95.11.

   C   105.15.

4   A bond offers an annual coupon rate of 4%, with interest paid semiannually. The bond matures in two years. At a market discount rate of 6%, the price of this bond per 100 of par value is *closest* to:

   A   93.07.

   B   96.28.

   C   96.33.

5   A bond offers an annual coupon rate of 5%, with interest paid semiannually. The bond matures in seven years. At a market discount rate of 3%, the price of this bond per 100 of par value is *closest* to:

   A   106.60.

   B   112.54.

   C   143.90.

6   A zero-coupon bond matures in 15 years. At a market discount rate of 4.5% per year and assuming annual compounding, the price of the bond per 100 of par value is *closest* to:

   A   51.30.

   B   51.67.

   C   71.62.

7   Consider the following two bonds that pay interest annually:

Bond	Coupon Rate	Time-to-Maturity
A	5%	2 years
B	3%	2 years

At a market discount rate of 4%, the price difference between Bond A and Bond B per 100 of par value is *closest* to:

A 3.70.

B 3.77.

C 4.00.

The following information relates to Questions 8 and 9

Bond	Price	Coupon Rate	Time-to-Maturity
A	101.886	5%	2 years
B	100.000	6%	2 years
C	97.327	5%	3 years

8 Which bond offers the lowest yield-to-maturity?

A Bond A

B Bond B

C Bond C

9 Which bond will *most likely* experience the smallest percent change in price if the market discount rates for all three bonds increase by 100 basis points?

A Bond A

B Bond B

C Bond C

10 Suppose a bond's price is expected to increase by 5% if its market discount rate decreases by 100 basis points. If the bond's market discount rate increases by 100 basis points, the bond price is *most likely* to change by:

A 5%.

B less than 5%.

C more than 5%.

The following information relates to Questions 11 and 12

Bond	Coupon Rate	Maturity (years)
A	6%	10
B	6%	5
C	8%	5

All three bonds are currently trading at par value.

11 Relative to Bond C, for a 200 basis point decrease in the required rate of return, Bond B will *most likely* exhibit a(n):

   A equal percentage price change.

   B greater percentage price change.

   C smaller percentage price change.

12 Which bond will *most likely* experience the greatest percentage change in price if the market discount rates for all three bonds increase by 100 basis points?

   A Bond A

   B Bond B

   C Bond C

---

13 An investor considers the purchase of a 2-year bond with a 5% coupon rate, with interest paid annually. Assuming the sequence of spot rates shown below, the price of the bond is *closest* to:

Time-to-Maturity	Spot Rates
1 year	3%
2 years	4%

   A 101.93.

   B 102.85.

   C 105.81.

14 A 3-year bond offers a 10% coupon rate with interest paid annually. Assuming the following sequence of spot rates, the price of the bond is *closest* to:

Time-to-Maturity	Spot Rates
1 year	8.0%
2 years	9.0%
3 years	9.5%

   A 96.98.

   B 101.46.

   C 102.95.

The following information relates to Questions 15–17

Bond	Coupon Rate	Time-to-Maturity	Time-to-Maturity	Spot Rates
X	8%	3 years	1 year	8%
Y	7%	3 years	2 years	9%
Z	6%	3 years	3 years	10%

All three bonds pay interest annually.

15 Based upon the given sequence of spot rates, the price of Bond X is *closest* to:

   A 95.02.

   B 95.28.

   C 97.63.

16 Based upon the given sequence of spot rates, the price of Bond Y is *closest* to:

   A 87.50.

   B 92.54.

   C 92.76.

17 Based upon the given sequence of spot rates, the yield-to-maturity of Bond Z is *closest* to:

   A 9.00%.

   B 9.92%.

   C 11.93%

---

18 Bond dealers *most* often quote the:

   A flat price.

   B full price.

   C full price plus accrued interest.

The following information relates to Questions 19–21

Bond G, described in the exhibit below, is sold for settlement on 16 June 2020.

Annual Coupon	5%
Coupon Payment Frequency	Semiannual
Interest Payment Dates	10 April and 10 October
Maturity Date	10 October 2022
Day Count Convention	30/360
Annual Yield-to-Maturity	4%

19 The full price that Bond G settles at on 16 June 2020 is *closest* to:

   A 102.36.

   B 103.10.

   C   103.65.

20 The accrued interest per 100 of par value for Bond G on the settlement date of 16 June 2020 is *closest* to:

   A   0.46.

   B   0.73.

   C   0.92.

21 The flat price for Bond G on the settlement date of 16 June 2020 is *closest* to:

   A   102.18.

   B   103.10.

   C   104.02.

---

22 Matrix pricing allows investors to estimate market discount rates and prices for bonds:

   A   with different coupon rates.

   B   that are not actively traded.

   C   with different credit quality.

23 When underwriting new corporate bonds, matrix pricing is used to get an estimate of the:

   A   required yield spread over the benchmark rate.

   B   market discount rate of other comparable corporate bonds.

   C   yield-to-maturity on a government bond having a similar time-to-maturity.

24 A bond with 20 years remaining until maturity is currently trading for 111 per 100 of par value. The bond offers a 5% coupon rate with interest paid semiannually. The bond's annual yield-to-maturity is *closest* to:

   A   2.09%.

   B   4.18%.

   C   4.50%.

25 The annual yield-to-maturity, stated for with a periodicity of 12, for a 4-year, zero-coupon bond priced at 75 per 100 of par value is *closest* to:

   A   6.25%.

   B   7.21%.

   C   7.46%.

26 A 5-year, 5% semiannual coupon payment corporate bond is priced at 104.967 per 100 of par value. The bond's yield-to-maturity, quoted on a semiannual bond basis, is 3.897%. An analyst has been asked to convert to a monthly periodicity. Under this conversion, the yield-to-maturity is *closest to*:

   A   3.87%.

   B   4.95%.

   C   7.67%.

The following information relates to Questions 27–30

A bond with 5 years remaining until maturity is currently trading for 101 per 100 of par value. The bond offers a 6% coupon rate with interest paid semiannually. The bond is first callable in 3 years, and is callable after that date on coupon dates according to the following schedule:

End of Year	Call Price
3	102
4	101
5	100

27 The bond's annual yield-to-maturity is *closest* to:

  A 2.88%.

  B 5.77%.

  C 5.94%.

28 The bond's annual yield-to-first-call is *closest* to:

  A 3.12%.

  B 6.11%.

  C 6.25%.

29 The bond's annual yield-to-second-call is *closest* to:

  A 2.97%.

  B 5.72%.

  C 5.94%.

30 The bond's yield-to-worst is *closest* to:

  A 2.88%.

  B 5.77%.

  C 6.25%.

31 A two-year floating-rate note pays 6-month Libor plus 80 basis points. The floater is priced at 97 per 100 of par value. Current 6-month Libor is 1.00%. Assume a 30/360 day-count convention and evenly spaced periods. The discount margin for the floater in basis points (bps) is *closest* to:

  A 180 bps.

  B 236 bps.

  C 420 bps.

32 An analyst evaluates the following information relating to floating rate notes (FRNs) issued at par value that have 3-month Libor as a reference rate:

Floating Rate Note	Quoted Margin	Discount Margin
X	0.40%	0.32%
Y	0.45%	0.45%
Z	0.55%	0.72%

Based only on the information provided, the FRN that will be priced at a premium on the next reset date is:

A FRN X.

B FRN Y.

C FRN Z.

33 A 365-day year bank certificate of deposit has an initial principal amount of USD 96.5 million and a redemption amount due at maturity of USD 100 million. The number of days between settlement and maturity is 350. The bond equivalent yield is *closest* to:

A 3.48%.

B 3.65%.

C 3.78%.

34 The bond equivalent yield of a 180-day banker's acceptance quoted at a discount rate of 4.25% for a 360-day year is *closest* to:

A 4.31%.

B 4.34%.

C 4.40%.

35 Which of the following statements describing a par curve is *incorrect*?

A A par curve is obtained from a spot curve.

B All bonds on a par curve are assumed to have different credit risk.

C A par curve is a sequence of yields-to-maturity such that each bond is priced at par value.

36 A yield curve constructed from a sequence of yields-to-maturity on zero-coupon bonds is the:

A par curve.

B spot curve.

C forward curve.

37 The rate, interpreted to be the incremental return for extending the time-to-maturity of an investment for an additional time period, is the:

A add-on rate.

B forward rate.

C yield-to-maturity.

The following information relates to Questions 38 and 39

Time Period	Forward Rate
"0y1y"	0.80%
"1y1y"	1.12%
"2y1y"	3.94%
"3y1y"	3.28%
"4y1y"	3.14%

All rates are annual rates stated for a periodicity of one (effective annual rates).

38 The 3-year implied spot rate is *closest* to:

    A 1.18%.

    B 1.94%.

    C 2.28%.

39 The value per 100 of par value of a two-year, 3.5% coupon bond, with interest payments paid annually, is *closest* to:

    A 101.58.

    B 105.01.

    C 105.82.

---

40 The spread component of a specific bond's yield-to-maturity is *least likely* impacted by changes in:

    A its tax status.

    B its quality rating.

    C inflation in its currency of denomination.

41 The yield spread of a specific bond over the standard swap rate in that currency of the same tenor is *best* described as the:

    A I-spread.

    B Z-spread.

    C G-spread.

The following information relates to Question 42

Bond	Coupon Rate	Time-to-Maturity	Price
UK Government Benchmark Bond	2%	3 years	100.25
UK Corporate Bond	5%	3 years	100.65

Both bonds pay interest annually. The current three-year EUR interest rate swap benchmark is 2.12%.

42 The G-spread in basis points (bps) on the UK corporate bond is *closest* to:

    A 264 bps.

    B 285 bps.

    C 300 bps.

---

43 A corporate bond offers a 5% coupon rate and has exactly 3 years remaining to maturity. Interest is paid annually. The following rates are from the benchmark spot curve:

Time-to-Maturity	Spot Rate
1 year	4.86%
2 years	4.95%
3 years	5.65%

The bond is currently trading at a Z-spread of 234 basis points. The value of the bond is *closest to*:

A 92.38.

B 98.35.

C 106.56.

44 An option-adjusted spread (OAS) on a callable bond is the Z-spread:

A over the benchmark spot curve.

B minus the standard swap rate in that currency of the same tenor.

C minus the value of the embedded call option expressed in basis points per year.

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:

$$PV = \frac{PMT}{(1 + r)^1} + \frac{PMT}{(1 + r)^2} + \frac{PMT}{(1 + r)^3} + \cdots + \frac{PMT + FV}{(1 + r)^{14}}$$

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

$$PV = \frac{2.5}{(1 + 0.015)^1} + \frac{2.5}{(1 + 0.015)^2} + \frac{2.5}{(1 + 0.015)^3} + \cdots + \frac{2.5}{(1 + 0.015)^{13}} + \frac{2.5 + 100}{(1 + 0.015)^{14}}$$

$PV = 2.46 + 2.43 + 2.39 + \ldots + 2.06 + 83.21 = 112.54$

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

$$PV = \frac{100}{\left(1 + 0.045\right)^{15}}$$

$PV = 51.67$

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:

$$PV = \frac{PMT}{\left(1 + r\right)^{1}} + \frac{PMT}{\left(1 + r\right)^{2}}$$

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%.

$$PV = \frac{2}{\left(1 + 0.04\right)^{1}} + \frac{2}{\left(1 + 0.04\right)^{2}} = 1.92 + 1.85 = 3.77$$

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:

$$PV = \frac{PMT}{\left(1 + Z_1\right)^1} + \frac{PMT}{\left(1 + Z_2\right)^2} + \frac{PMT + FV}{\left(1 + Z_3\right)^3}$$

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

$$PV = \frac{8}{\left(1 + 0.08\right)^1} + \frac{8}{\left(1 + 0.09\right)^2} + \frac{8 + 100}{\left(1 + 0.10\right)^3}$$

$PV = 7.41 + 6.73 + 81.14 = 95.28$

16   C is correct. The bond price is closest to 92.76. The formula for calculating this bond price is:

$$PV = \frac{PMT}{\left(1 + Z_1\right)^1} + \frac{PMT}{\left(1 + Z_2\right)^2} + \frac{PMT + FV}{\left(1 + Z_3\right)^3}$$

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

$$PV = \frac{7}{\left(1 + 0.08\right)^1} + \frac{7}{\left(1 + 0.09\right)^2} + \frac{7 + 100}{\left(1 + 0.10\right)^3}$$

$PV = 6.48 + 5.89 + 80.39 = 92.76$

17   B is correct. The yield-to-maturity is closest to 9.92%. The formula for calculating the price of Bond Z is:

$$PV = \frac{PMT}{\left(1 + Z_1\right)^1} + \frac{PMT}{\left(1 + Z_2\right)^2} + \frac{PMT + FV}{\left(1 + Z_3\right)^3}$$

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 2020, there are 2.5 years (5 semiannual periods) to maturity. These five semiannual periods occur on 10 October 2020, 10 April 2021, 10 October 2021, 10 April 2022 and 10 October 2022.

$$PV = \frac{PMT}{(1+r)^1} + \frac{PMT}{(1+r)^2} + \frac{PMT}{(1+r)^3} + \frac{PMT}{(1+r)^4} + \frac{PMT + FV}{(1+r)^5}$$

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 2020 and 16 June 2020 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 2020 and 16 June 2020 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

$$\text{Accrued interest} = \frac{66}{180} \times \frac{5.00}{2} = 0.92$$

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% × 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:

$$PV = \frac{FV}{(1+r)^N}$$

$$75 = \left(\frac{100}{(1+r)^{4\times12}} \right)$$

$$\frac{100}{75} = (1+r)^{48}$$

$$1.33333 = (1+r)^{48}$$

$$[1.33333]^{1/48} = [(1+r)^{48}]^{1/48}$$

$$1.33333^{02083} = (1+r)$$

$$1.00601 = (1+r)$$

$$1.00601 - 1 = r$$

$$0.00601 = r$$

$r \times 12 = 0.07212$, 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:

$$\left(1 + \frac{APR_m}{m}\right)^m = \left(1 + \frac{APR_n}{n}\right)^n$$

$$\left(1 + \frac{0.03897}{2}\right)^2 = \left(1 + \frac{APR_{12}}{12}\right)^{12}$$

$$(1.01949)^2 = \left(1 + \frac{APR_{12}}{12}\right)^{12}$$

$$1.03935 = \left(1 + \frac{APR_{12}}{12}\right)^{12}$$

$$(1.03935)^{1/12} = \left[\left(1 + \frac{APR_{12}}{12}\right)^{12}\right]^{1/12}$$

$$1.00322 = \left(1 + \frac{APR_{12}}{12}\right)$$

$$1.00322 - 1 = \left(\frac{APR_{12}}{12}\right)$$

$APR_{12} = 0.00322 \times 12 = 0.03865$, 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% × 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

$$101 = \frac{3}{(1+r)^1} + \frac{3}{(1+r)^2} + \frac{3}{(1+r)^3} + \cdots + \frac{3}{(1+r)^5} + \frac{3+102}{(1+r)^6}$$

$r = 0.03123$

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% × 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:

$$PV = \frac{PMT}{(1+r)^1} + \frac{PMT}{(1+r)^2} + \frac{PMT}{(1+r)^3} + \cdots + \frac{PMT}{(1+r)^7} + \frac{PMT+FV}{(1+r)^8}$$

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

$$101 = \frac{3}{(1+r)^1} + \frac{3}{(1+r)^2} + \frac{3}{(1+r)^3} + \cdots\frac{3}{(1+r)^7} + \frac{3+101}{(1+r)^8}$$

$r = 0.0297$

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% × 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:

$$PV = \frac{\dfrac{(\text{Index} + QM) \times FV}{m}}{\left(1 + \dfrac{\text{Index} + DM}{m}\right)^1} + \frac{\dfrac{(\text{Index} + QM) \times FV}{m}}{\left(1 + \dfrac{\text{Index} + DM}{m}\right)^2} + \cdots + \frac{\dfrac{(\text{Index} + QM) \times FV}{m} + FV}{\left(1 + \dfrac{\text{Index} + DM}{m}\right)^4}$$

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:

$$97 = \cfrac{\cfrac{(0.01 + 0.0080) \times 100}{2}}{\left(1 + \cfrac{0.01 + DM}{2}\right)^1} + \cfrac{\cfrac{(0.01 + 0.0080) \times 100}{2}}{\left(1 + \cfrac{0.01 + DM}{2}\right)^2} + \cdots + \cfrac{\cfrac{(0.01 + 0.0080) \times 100}{2} + 100}{\left(1 + \cfrac{0.01 + DM}{2}\right)^4}$$

$$97 = \cfrac{0.90}{\left(1 + \cfrac{0.01 + DM}{2}\right)^1} + \cfrac{0.90}{\left(1 + \cfrac{0.01 + DM}{2}\right)^2} + \cfrac{0.90}{\left(1 + \cfrac{0.01 + DM}{2}\right)^3} + \cfrac{0.90 + 100}{\left(1 + \cfrac{0.01 + DM}{2}\right)^4}$$

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).

$$AOR = \left(\frac{365}{350}\right) \times \left(\frac{100 - 96.5}{96.5}\right)$$

$AOR = 1.04286 \times 0.03627$

$AOR = 0.03783$ 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

$$AOR = \left(\frac{365}{180}\right) \times \left(\frac{100 - PV}{PV}\right)$$

$$AOR = \left(\frac{365}{180}\right) \times \left(\frac{100 - 97.875}{97.875}\right)$$

$AOR = 2.02778 \times 0.02171$

$AOR = 0.04402$, 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:

$(1.0080 \times 1.0112 \times 1.0394) = (1 + z_3)^3$

$1.05945 = (1 + z_3)^3$

$[1.05945]^{1/3} = [(1 + z_3)^3]^{1/3}$

$1.01944 = 1 + z_3$

$1.01944 - 1 = z_3$

$0.01944 = z_3$, $z_3 = 1.944\%$ 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:

$$PV = \frac{PMT}{(1+z_1+Z)^1} + \frac{PMT}{(1+z_2+Z)^2} + \frac{PMT+FV}{(1+z_3+Z)^3}$$

$$= \frac{5}{(1+0.0486+0.0234)^1} + \frac{5}{(1+0.0495+0.0234)^2} + \frac{105}{(1+0.0565+0.0234)^3}$$

$$= \frac{5}{1.0720} + \frac{5}{1.15111} + \frac{105}{1.25936} = 4.66 + 4.34 + 83.38 = 92.38$$

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.

simplifying assumptions, the example does demonstrate the economics of an arbitrage CDO transaction, the need for the use of an interest rate swap, and how the equity tranche will realize a return.

In practice, CDOs are subject to risks that investors should be aware of. For example, in the case of defaults in the collateral, there is a risk that the manager will fail to earn a return sufficient to pay off the investors in the senior and mezzanine tranches, resulting in a loss for these investors. Investors in the equity tranche risk the loss of their entire investment. Even if payments are made to these investors, the return they realize may not be the return expected at the time of purchase.

Moreover, after some period, the CDO manager must begin repaying principal to the senior and mezzanine tranches. The interest rate swap must be structured to take this requirement into account because the entire amount of the senior tranche is not outstanding for the life of the collateral.

EXAMPLE 11

Collateralized Debt Obligations

An additional risk of an investment in an arbitrage collateralized debt obligation relative to an investment in an asset-backed security is:

A the default risk on the collateral assets.

B the risk that the CDO manager fails to earn a return sufficient to pay off the investors in the senior and the mezzanine tranches.

C the risk due to the mismatch between the collateral making fixed-rate payments and the bond classes making floating-rate payments.

Solution:

B is correct. In addition to the risks associated with investments in ABS, such as the default risk on the collateral assets and the risk due to the potential mismatch between the collateral making fixed-rate payments and the bond classes making floating-rate payments, investors in CDOs face the risk that the CDO manager fails to earn a return sufficient to pay off the investors in the senior and the mezzanine tranches. With an ABS, the cash flows from the collateral are used to pay off the holders of the bond classes without the active management of the collateral—that is, without a manager altering the composition of the debt obligations in the pool that is backing the securitization. In contrast, in an arbitrage CDO, a CDO manager buys and sells debt obligations with the dual purpose of not only paying off the holders of the bond classes but also generating an attractive/competitive return for the equity tranche and for the manager.

SUMMARY

■ Securitization involves pooling debt obligations, such as loans or receivables, and creating securities backed by the pool of debt obligations called asset-backed securities (ABS). The cash flows of the debt obligations are used to make interest payments and principal repayments to the holders of the ABS.

- Securitization has several benefits. It allows investors direct access to liquid investments and payment streams that would be unattainable if all the financing were performed through banks. It enables banks to increase loan originations at economic scales greater than if they used only their own in-house loan portfolios. Thus, securitization contributes to lower costs of borrowing for entities raising funds, higher risk-adjusted returns to investors, and greater efficiency and profitability for the banking sector.

- The parties to a securitization include the seller of the collateral (pool of loans), the servicer of the loans, and the special purpose entity (SPE). The SPE is bankruptcy remote, which plays a pivotal role in the securitization.

- A common structure in a securitization is subordination, which leads to the creation of more than one bond class or tranche. Bond classes differ as to how they will share any losses resulting from defaults of the borrowers whose loans are in the collateral. The credit ratings assigned to the various bond classes depend on how the credit-rating agencies evaluate the credit risks of the collateral and any credit enhancements.

- The motivation for the creation of different types of structures is to redistribute prepayment risk and credit risk efficiently among different bond classes in the securitization. Prepayment risk is the uncertainty that the actual cash flows will be different from the scheduled cash flows as set forth in the loan agreements because borrowers may choose to repay the principal early to take advantage of interest rate movements.

- Because of the SPE, the securitization of a company's assets may include some bond classes that have better credit ratings than the company itself or its corporate bonds. Thus, the company's funding cost is often lower when raising funds through securitization than when issuing corporate bonds.

- A mortgage is a loan secured by the collateral of some specified real estate property that obliges the borrower to make a predetermined series of payments to the lender. The cash flow of a mortgage includes (1) interest, (2) scheduled principal payments, and (3) prepayments (any principal repaid in excess of the scheduled principal payment).

- The various mortgage designs throughout the world specify (1) the maturity of the loan; (2) how the interest rate is determined (i.e., fixed rate versus adjustable or variable rate); (3) how the principal is repaid (i.e., whether the loan is amortizing and if it is, whether it is fully amortizing or partially amortizing with a balloon payment); (4) whether the borrower has the option to prepay and if so, whether any prepayment penalties might be imposed; and (5) the rights of the lender in a foreclosure (i.e., whether the loan is a recourse or non-recourse loan).

- In the United States, there are three sectors for securities backed by residential mortgages: (1) those guaranteed by a federal agency (Ginnie Mae) whose securities are backed by the full faith and credit of the US government, (2) those guaranteed by a GSE (e.g., Fannie Mae and Freddie Mac) but not by the US government, and (3) those issued by private entities that are not guaranteed by a federal agency or a GSE. The first two sectors are referred to as agency residential mortgage-backed securities (RMBS), and the third sector as non-agency RMBS.

- A mortgage pass-through security is created when one or more holders of mortgages form a pool of mortgages and sell shares or participation certificates in the pool. The cash flow of a mortgage pass-through security depends on the

cash flow of the underlying pool of mortgages and consists of monthly mortgage payments representing interest, the scheduled repayment of principal, and any prepayments, net of servicing and other administrative fees.

- Market participants measure the prepayment rate using two measures: the single monthly mortality rate (SMM) and its corresponding annualized rate—namely, the conditional prepayment rate (CPR). For MBS, a measure widely used by market participants to assess is the weighted average life or simply the average life of the MBS.

- Market participants use the Public Securities Association (PSA) prepayment benchmark to describe prepayment rates. A PSA assumption greater than 100 PSA means that prepayments are assumed to occur faster than the benchmark, whereas a PSA assumption lower than 100 PSA means that prepayments are assumed to occur slower than the benchmark.

- Prepayment risk includes two components: contraction risk and extension risk. The former is the risk that when interest rates decline, the security will have a shorter maturity than was anticipated at the time of purchase because homeowners will refinance at the new, lower interest rates. The latter is the risk that when interest rates rise, fewer prepayments will occur than what was anticipated at the time of purchase because homeowners are reluctant to give up the benefits of a contractual interest rate that now looks low.

- The creation of a collateralized mortgage obligation (CMO) can help manage prepayment risk by distributing the various forms of prepayment risk among different classes of bondholders. The CMO's major financial innovation is that the securities created more closely satisfy the asset/liability needs of institutional investors, thereby broadening the appeal of mortgage-backed products.

- The most common types of CMO tranches are sequential-pay tranches, planned amortization class (PAC) tranches, support tranches, and floating-rate tranches.

- Non-agency RMBS share many features and structuring techniques with agency CMOs. However, they typically include two complementary mechanisms. First, the cash flows are distributed by rules that dictate the allocation of interest payments and principal repayments to tranches with various degrees of priority/seniority. Second, there are rules for the allocation of realized losses, which specify that subordinated bond classes have lower payment priority than senior classes.

- In order to obtain favorable credit ratings, non-agency RMBS and non-mortgage ABS often require one or more credit enhancements. The most common forms of internal credit enhancement are senior/subordinated structures, reserve funds, and overcollateralization. In external credit enhancement, credit support in the case of defaults resulting in losses in the pool of loans is provided in the form of a financial guarantee by a third party to the transaction.

- Commercial mortgage-backed securities (CMBS) are securities backed by a pool of commercial mortgages on income-producing property.

- Two key indicators of the potential credit performance of CMBS are the debt-service-coverage (DSC) ratio and the loan-to-value ratio (LTV). The DSC ratio is the property's annual net operating income divided by the debt service.

- CMBS have considerable call protection, which allows CMBS to trade in the market more like corporate bonds than like RMBS. This call protection comes in two forms: at the structure level and at the loan level. The creation of sequential-pay tranches is an example of call protection at the structure level. At the loan level, four mechanisms offer investors call protection: prepayment lockouts, prepayment penalty points, yield maintenance charges, and defeasance.

- ABS are backed by a wide range of asset types. The most popular non-mortgage ABS are auto loan ABS and credit card receivable ABS. The collateral is amortizing for auto loan ABS and non-amortizing for credit card receivable ABS. As with non-agency RMBS, these ABS must offer credit enhancement to be appealing to investors.

- A collateralized debt obligation (CDO) is a generic term used to describe a security backed by a diversified pool of one or more debt obligations (e.g., corporate and emerging market bonds, leveraged bank loans, ABS, RMBS, and CMBS).

- A CDO involves the creation of an SPE. The funds necessary to pay the bond classes come from a pool of loans that must be serviced. A CDO requires a collateral manager to buy and sell debt obligations for and from the CDO's portfolio of assets to generate sufficient cash flows to meet the obligations of the CDO bondholders and to generate a fair return for the equity holders.

- The structure of a CDO includes senior, mezzanine, and subordinated/equity bond classes.

PRACTICE PROBLEMS

1 Securitization is beneficial for banks because it:

   A repackages bank loans into simpler structures.

   B increases the funds available for banks to lend.

   C allows banks to maintain ownership of their securitized assets.

2 Securitization benefits financial markets by:

   A increasing the role of intermediaries.

   B establishing a barrier between investors and originating borrowers.

   C allowing investors to tailor credit risk and interest rate risk exposures to meet their individual needs.

3 A benefit of securitization is the:

   A reduction in disintermediation.

   B simplification of debt obligations.

   C creation of tradable securities with greater liquidity than the original loans.

4 Securitization benefits investors by:

   A providing more direct access to a wider range of assets.

   B reducing the inherent credit risk of pools of loans and receivables.

   C eliminating cash flow timing risks of an ABS, such as contraction and extension risks.

5 In a securitization, the special purpose entity (SPE) is responsible for the:

   A issuance of the asset-backed securities.

   B collection of payments from the borrowers.

   C recovery of underlying assets from delinquent borrowers.

6 In a securitization, the collateral is initially sold by the:

   A issuer.

   B depositor.

   C underwriter.

7 A special purpose entity issues asset-backed securities in the following structure.

Bond Class	Par Value (€ millions)
A (senior)	200
B (subordinated)	20
C (subordinated)	5

At which of the following amounts of default in par value would Bond Class A experience a loss?

   A €20 million

   B €25 million

   C €26 million

8 In a securitization, time tranching provides investors with the ability to choose between:

    A extension and contraction risks.

    B senior and subordinated bond classes.

    C fully amortizing and partially amortizing loans.

9 The creation of bond classes with a waterfall structure for sharing losses is referred to as:

    A time tranching.

    B credit tranching.

    C overcollateralization.

10 Which of the following statements related to securitization is correct?

    A Time tranching addresses the uncertainty of a decline in interest rates.

    B Securitizations are rarely structured to include both credit tranching and time tranching.

    C Junior and senior bond classes differ in that junior classes can only be paid off at the bond's set maturity.

11 A goal of securitization is to:

    A separate the seller's collateral from its credit ratings.

    B uphold the absolute priority rule in bankruptcy reorganizations.

    C account for collateral's primary influence on corporate bond credit spreads.

12 The last payment in a partially amortizing residential mortgage loan is *best* referred to as a:

    A waterfall.

    B principal repayment.

    C balloon payment.

13 If a mortgage borrower makes prepayments without penalty to take advantage of falling interest rates, the lender will *most likely* experience:

    A extension risk.

    B contraction risk.

    C yield maintenance.

14 Which of the following characteristics of a residential mortgage loan would *best* protect the lender from a strategic default by the borrower?

    A Recourse

    B A prepayment option

    C Interest-only payments

15 William Marolf obtains a 5 million EUR mortgage loan from Bank Nederlandse. A year later the principal on the loan is 4 million EUR and Marolf defaults on the loan. Bank Nederlandse forecloses, sells the property for 2.5 million EUR, and is entitled to collect the 1.5 million EUR shortfall, from Marolf. Marolf *most likely* had a:

    A bullet loan.

    B recourse loan.

    C non-recourse loan.

16 Fran Martin obtains a non-recourse mortgage loan for $500,000. One year later, when the outstanding balance of the mortgage is $490,000, Martin cannot make his mortgage payments and defaults on the loan. The lender forecloses on the loan and sells the house for $315,000. What amount is the lender entitled to claim from Martin?

    A $0.

    B $175,000.

    C $185,000.

17 A ba1lloon payment equal to a mortgage's original loan amount is a characteristic of a:

    A   bullet mortgage.

    B   fully amortizing mortgage.

    C   partially amortizing mortgage.

18 Which of the following statements is correct concerning mortgage loan defaults?

    A   A non-recourse jurisdiction poses higher default risks for lenders.

    B   In a non-recourse jurisdiction, strategic default will not affect the defaulting borrower's future access to credit.

    C   When a recourse loan defaults, the mortgaged property is the lender's sole source for recovery of the outstanding mortgage balance.

19 Which of the following describes a typical feature of a non-agency residential mortgage-backed security (RMBS)?

    A   Senior/subordinated structure

    B   A pool of conforming mortgages as collateral

    C   A guarantee by a government-sponsored enterprise

20 If interest rates increase, an investor who owns a mortgage pass-through security is *most likely* affected by:

    A   credit risk.

    B   extension risk.

    C   contraction risk.

21 Which of the following is *most likely* an advantage of collateralized mortgage obligations (CMOs)? CMOs can

    A   eliminate prepayment risk.

    B   be created directly from a pool of mortgage loans.

    C   meet the asset/liability requirements of institutional investors.

22 The longest-term tranche of a sequential-pay CMO is *most likely* to have the lowest:

    A   average life.

    B   extension risk.

    C   contraction risk.

23 The tranches in a collateralized mortgage obligation (CMO) that are *most likely* to provide protection for investors against both extension and contraction risk are:

    A   planned amortization class (PAC) tranches.

    B   support tranches.

    C   sequential-pay tranches.

24 Support tranches are *most* appropriate for investors who are:

    A   concerned about their exposure to extension risk.

    B   concerned about their exposure to concentration risk.

    C   willing to accept prepayment risk in exchange for higher returns.

25 In the context of mortgage-backed securities, a conditional prepayment rate (CPR) of 8% means that approximately 8% of the outstanding mortgage pool balance at the beginning of the year is expected to be prepaid:

A in the current month.

B by the end of the year.

C over the life of the mortgages.

26 For a mortgage pass-through security, which of the following risks *most likely* increases as interest rates decline?

A Balloon

B Extension

C Contraction

27 Compared with the weighted average coupon rate of its underlying pool of mortgages, the pass-through rate on a mortgage pass-through security is:

A lower.

B the same.

C higher.

28 The single monthly mortality rate (SMM) *most likely:*

A increases as extension risk rises.

B decreases as contraction risk falls.

C stays fixed over time when the standard prepayment model remains at 100 PSA.

29 Credit risk is an important consideration for commercial mortgage-backed securities (CMBS) if the CMBS are backed by mortgage loans that:

A are non-recourse.

B have call protection.

C haveprepayment penalty points.

30 Which commercial mortgage-backed security (CMBS) characteristic causes a CMBS to trade more like a corporate bond than a residential mortgage-backed security (RMBS)?

A Call protection

B Internal credit enhancement

C Debt-service coverage ratio level

31 A commercial mortgage-backed security (CMBS) does not meet the debt-to-service coverage at the loan level necessary to achieve a desired credit rating. Which of the following features would *most likely* improve the credit rating of the CMBS?

A Subordination

B Call protection

C Balloon payments

32 If a default occurs in a non-recourse commercial mortgage-backed security (CMBS), the lender will *most likely*:

A recover prepayment penalty points paid by the borrower to offset losses.

B use only the proceeds received from the sale of the property to recover losses.

C initiate a claim against the borrower for any shortfall resulting from the sale of the property.

33 Which of the following investments is least subject to prepayment risk?

   A   Auto loan receivable–backed securities

   B   Commercial mortgage-backed securities (CMBSs)

   C   Non-agency residential mortgage-backed securities (RMBSs)

34 An excess spread account incorporated into a securitization is designed to limit:

   A   credit risk.

   B   extension risk.

   C   contraction risk.

35 Which of the following *best* describes the cash flow that owners of credit card receivable asset-backed securities receive during the lockout period?

   A   No cash flow

   B   Only principal payments collected

   C   Only finance charges collected and fees

36 Which type of asset-backed security is not affected by prepayment risk?

   A   Auto loan ABSs

   B   Residential MBSs

   C   Credit card receivable ABSs

37 In auto loan ABSs, the form of credit enhancement that *most likely* serves as the first line of loss protection is the:

   A   excess spread account.

   B   sequential pay structure.

   C   proceeds from repossession sales.

38 In credit card receivable ABSs, principal cash flows can be altered only when the:

   A   lockout period expires.

   B   excess spread account is depleted.

   C   early amortization provision is triggered.

39 The CDO tranche with a credit rating status between senior and subordinated bond classes is called the:

   A   equity tranche.

   B   residual tranche.

   C   mezzanine tranche.

40 The key to a CDO's viability is the creation of a structure with a competitive return for the:

   A   senior tranche.

   B   mezzanine tranche.

   C   subordinated tranche.

41 When the collateral manager fails pre-specified risk tests, a CDO is:

   A   deleveraged by reducing the senior bond class.

   B   restructured to reduce its most expensive funding source.

   C   liquidated by paying off the bond classes in order of seniority.

42 Collateralized mortgage obligations (CMOs) are designed to:

   A   eliminate contraction risk in support tranches.

   B   distribute prepayment risk to various tranches.

   C   eliminate extension risk in planned amortization tranches.

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. Securitization allows investors to achieve more direct legal claims on loans and portfolios of receivables. As a result, investors can add to their portfolios exposure to the risk–return characteristics provided by a wider range of assets.

B is incorrect because securitization does not reduce credit risk but, rather, provides a structure to mitigate and redistribute the inherent credit risks of pools of loans and receivables.

C is incorrect because securitization does not eliminate the timing risks associated with ABS cash flows but, rather, provides a structure to mitigate and redistribute those risks, such as contraction risk and extension risk.

5 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.

6 B is correct. In a securitization, the loans or receivables are initially sold by the depositor to the special purpose entity (SPE) that uses them as collateral to issue the ABS.

A is incorrect because the SPE, often referred to as the issuer, is the purchaser of the collateral rather than the seller of the collateral.

C is incorrect because the underwriter neither sells nor purchases the collateral in a securitization. The underwriter performs the same functions in a securitization as it does in a standard bond offering.

7 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.

8 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.

9   B is correct. Credit tranching is a form of credit enhancement called subordination in which bond classes or tranches differ as to how they will share losses resulting from defaults of the borrowers whose loans are part of the collateral. This type of protection is commonly referred to as a waterfall structure because of the cascading flow of payments between bond classes in the event of default.

A is incorrect because time tranching involves the creation of bond classes that possess different expected maturities rather than bond classes that differ as to how credit losses will be shared. Time tranching involves the redistribution of prepayment risk, whereas credit tranching involves the redistribution of credit risk.

C is incorrect because although overcollateralization is a form of internal credit enhancement similar to subordination, it is the amount by which the principal amount of the pool of collateral exceeds the principal balance of the securities issued and backed by the collateral pool. Losses are absorbed first by the amount of overcollateralization and then according to the credit tranching structure.

10   A is correct. Time tranching is the creation of bond classes that possess different expected maturities so that prepayment risk can be redistributed among bond classes. When loan agreements provide borrowers the ability to alter payments, in the case of declining interest rates, this prepayment risk increases because borrowers tend to pay off part or all of their loans and refinance at lower interest rates.

B is incorrect because it is possible, and quite common, for a securitization to have structures with both credit tranching and time tranching.

C is incorrect because the subordinated structures of junior and senior bond classes differ as to how they will share any losses relative to defaults of the borrowers whose loans are in the collateral pool. Junior classes offer protection for senior classes, with losses first realized by the former. The classes are not distinguished by scheduled repayment terms but, rather, by a loss sharing hierarchy in the event of borrower default.

11   A is correct. The legal implication of a special purpose entity (SPE), a prerequisite for securitization, is that investors contemplating the purchase of bond classes backed by the assets of the SPE will evaluate the credit risk of those assets independently from the credit rating of the entity that sold the assets to the SPE. This separation of the seller's collateral from its credit rating provides the opportunity for the SPE to access a lower aggregate funding cost than what the seller might otherwise obtain.

B is incorrect because the absolute priority rule, under which senior creditors are paid in full before subordinated creditors, has not always been upheld in bankruptcy reorganizations. There is no assurance that if a corporate bond has collateral, the rights of the bondholders will be respected. It is this uncertainty that creates the dominant influence of credit ratings over collateral in credit spreads.

C is incorrect because corporate bond credit spreads will reflect the seller's credit rating primarily and the collateral slightly. Securitization separates the seller's collateral from its credit rating, effectively altering the influence of collateral on the credit spread.

12   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."

13 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.

14 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.

15 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.

16 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.

17 A is correct. A bullet mortgage is a special type of interest-only mortgage in which there are no scheduled principal repayments over the entire life of the loan. At maturity, a balloon payment is required equal to the original loan amount.

B is incorrect because with a fully amortizing mortgage, the sum of all the scheduled principal repayments during the mortgage's life is such that when the last mortgage payment is made, the loan is fully repaid, with no balloon payment required.

C is incorrect because with a partially amortizing mortgage, the sum of all the scheduled principal repayments is less than the amount borrowed, resulting in a balloon payment equal to the unpaid mortgage balance (rather than the original loan amount).

18 A is correct. In non-recourse loan jurisdictions, the borrower may have an incentive to default on an underwater mortgage and allow the lender to foreclose on the property because the lender has no claim against the borrower for the shortfall. For this reason, such defaults, known as strategic defaults, are more likely in non-recourse jurisdictions and less likely in recourse jurisdictions, where the lender does have a claim against the borrower for the shortfall.

B is incorrect because strategic defaults in non-recourse jurisdictions do have negative consequences for the defaulting borrowers in the form of a lower credit score and a reduced ability to borrow in the future. These negative consequences can be a deterrent in the incidence of underwater mortgage defaults.

C is incorrect because when a recourse loan defaults, the lender can look to both the property and the borrower to recover the outstanding mortgage balance. In a recourse loan, the lender has a claim against the borrower for the shortfall between the amount of the outstanding mortgage balance and the proceeds received from the sale of the property.

19 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.

20 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.

21 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.

22 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.

23 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.

24 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.

25 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.

26 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.

27 A is correct. The coupon rate of a mortgage pass-through security is called the pass-through rate, whereas the mortgage rate on the underlying pool of mortgages is calculated as a weighted average coupon rate (WAC). The pass-through rate is lower than the WAC by an amount equal to the servicing fee and other administrative fees.

28 B is correct. The SMM is a monthly measure of the prepayment rate or prepayment speed. Contraction risk is the risk that when interest rates decline, actual prepayments will be higher than forecast. So if contraction risk falls, prepayments are likely to be lower than forecast, which would imply a decrease in the SMM.

A is incorrect because the SMM is a monthly measure of the prepayment rate or prepayment speed. Extension risk is the risk that when interest rates rise, actual prepayments will be lower than forecast. So if extension risk rises, prepayments are likely to be lower than forecast, which would imply a decrease, not an increase, in the SMM.

C is incorrect because at 100 PSA, investors can expect prepayments to follow the PSA prepayment benchmark. Based on historical patterns, the PSA standard model assumes that prepayment rates are low for newly initiated mortgages and then speed up as mortgages season. Thus, 100 PSA does not imply that the SMM remains the same but, rather, implies that it will vary over the life of the mortgage.

29 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.

30 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.

31 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.

32 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.

33 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.

34 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.

35 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.

36 C is correct. Because credit card receivable ABSs are backed by non-amortizing loans that do not involve scheduled principal repayments, they are not affected by prepayment risk.

A is incorrect because auto loan ABSs are affected by prepayment risk since they are backed by amortizing loans involving scheduled principal repayments.

B is incorrect because residential MBSs are affected by prepayment risk since they are backed by amortizing loans involving scheduled principal repayments.

37 A is correct. In addition to a senior/subordinated (sequential pay) structure, many auto loan ABSs are structured with additional credit enhancement in the form of overcollateralization and a reserve account, often an excess spread account. The excess spread is an amount that can be retained and deposited into a reserve account that can serve as a first line of protection against losses.

B is incorrect because in an auto loan ABS, losses are typically applied against the excess spread account and the amount of overcollateralization before the waterfall loss absorption of the sequential pay structure.

C is incorrect because in auto loan ABSs, proceeds from the repossession and resale of autos are prepayment cash flows rather than a form of credit enhancement for loss protection.

38 C is correct. In credit card receivable ABSs, the only way the principal cash flows can be altered is by triggering the early amortization provision. Such provisions are included in the ABS structure to safeguard the credit quality of the issue.

A is incorrect because expiration of the lockout period does not result in the alteration of principal cash flows but instead defines when principal repayments are distributed to the ABS investors. During the lockout period, principal repayments by cardholders are reinvested. When the lockout period expires, principal repayments by cardholders are distributed to investors.

B is incorrect because the excess spread account is a credit enhancement for loss absorption. When the excess spread account is depleted, losses are applied against the overcollateralization amount followed by the senior/subordinated structure. The only way principal cash flows can be altered is by triggering the early amortization provision.

39 C is correct. The mezzanine tranche consists of bond classes with credit ratings between senior and subordinated bond classes.

A is incorrect because the equity tranche falls within and carries the credit rating applicable to the subordinated bond classes.

B is incorrect because the residual tranche falls within and carries the credit ratings applicable to the subordinated bond classes.

40 C is correct. The key to whether a CDO is viable is whether a structure can be created that offers a competitive return for the subordinated tranche (often referred to as the residual or equity tranche). Investors in a subordinated tranche typically use borrowed funds (the bond classes issued) to generate a return above the funding cost.

A is incorrect because the viability of a CDO depends on a structure that offers a competitive return for the subordinated tranche rather than the senior tranche.

B is incorrect because the viability of a CDO depends on a structure that offers a competitive return for the subordinated tranche rather than the mezzanine tranche.

41 A is correct. When the collateral manager fails pre-specified tests, a provision is triggered that requires the payoff of the principal to the senior class until the tests are satisfied. This reduction of the senior class effectively deleverages the CDO because the CDO's cheapest funding source is reduced.

42 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.

to quality" can cause government benchmark yields to fall as credit spreads widen. An unexpected credit downgrade on a corporate bond can result in greater credit as well as liquidity risk.

EXAMPLE 17

The (flat) price on a fixed-rate corporate bond falls one day from 92.25 to 91.25 per 100 of par value because of poor earnings and an unexpected ratings downgrade of the issuer. The (annual) modified duration for the bond is 7.24. Which of the following is *closest* to the estimated change in the credit spread on the corporate bond, assuming benchmark yields are unchanged?

A 15 bps

B 100 bps

C 108 bps

Solution:

Given that the price falls from 92.25 to 91.25, the percentage price decrease is 1.084%.

$$\frac{91.25 - 92.25}{92.25} = -0.01084$$

Given an annual modified duration of 7.24, the change in the yield-to-maturity is 14.97 bps.

$$-0.01084 \approx -7.24 \times \Delta\text{Yield}, \Delta\text{Yield} = 0.001497$$

Therefore, the answer is A. The change in price reflects a credit spread increase on the bond of about 15 bps.

SUMMARY

This reading covers the risk and return characteristics of fixed-rate bonds. The focus is on the widely used measures of interest rate risk—duration and convexity. These statistics are used extensively in fixed-income analysis. The following are the main points made in the reading:

- The three sources of return on a fixed-rate bond purchased at par value are: (1) receipt of the promised coupon and principal payments on the scheduled dates, (2) reinvestment of coupon payments, and (3) potential capital gains, as well as losses, on the sale of the bond prior to maturity.

- For a bond purchased at a discount or premium, the rate of return also includes the effect of the price being "pulled to par" as maturity nears, assuming no default.

- The total return is the future value of reinvested coupon interest payments and the sale price (or redemption of principal if the bond is held to maturity).

- The horizon yield (or holding period rate of return) is the internal rate of return between the total return and purchase price of the bond.

- Coupon reinvestment risk increases with a higher coupon rate and a longer reinvestment time period.

- Capital gains and losses are measured from the carrying value of the bond and not from the purchase price. The carrying value includes the amortization of the discount or premium if the bond is purchased at a price below or above par value. The carrying value is any point on the constant-yield price trajectory.

- Interest income on a bond is the return associated with the passage of time. Capital gains and losses are the returns associated with a change in the value of a bond as indicated by a change in the yield-to-maturity.

- The two types of interest rate risk on a fixed-rate bond are coupon reinvestment risk and market price risk. These risks offset each other to a certain extent. An investor gains from higher rates on reinvested coupons but loses if the bond is sold at a capital loss because the price is below the constant-yield price trajectory. An investor loses from lower rates on reinvested coupon but gains if the bond is sold at a capital gain because the price is above the constant-yield price trajectory.

- Market price risk dominates coupon reinvestment risk when the investor has a short-term horizon (relative to the time-to-maturity on the bond).

- Coupon reinvestment risk dominates market price risk when the investor has a long-term horizon (relative to the time-to-maturity)—for instance, a buy-and-hold investor.

- Bond duration, in general, measures the sensitivity of the full price (including accrued interest) to a change in interest rates.

- Yield duration statistics measuring the sensitivity of a bond's full price to the bond's own yield-to-maturity include the Macaulay duration, modified duration, money duration, and price value of a basis point.

- Curve duration statistics measuring the sensitivity of a bond's full price to the benchmark yield curve are usually called "effective durations."

- Macaulay duration is the weighted average of the time to receipt of coupon interest and principal payments, in which the weights are the shares of the full price corresponding to each payment. This statistic is annualized by dividing by the periodicity (number of coupon payments or compounding periods in a year).

- Modified duration provides a linear estimate of the percentage price change for a bond given a change in its yield-to-maturity.

- Approximate modified duration approaches modified duration as the change in the yield-to-maturity approaches zero.

- Effective duration is very similar to approximate modified duration. The difference is that approximate modified duration is a yield duration statistic that measures interest rate risk in terms of a change in the bond's own yield-to-maturity, whereas effective duration is a curve duration statistic that measures interest rate risk assuming a parallel shift in the benchmark yield curve.

- Key rate duration is a measure of a bond's sensitivity to a change in the benchmark yield curve at specific maturity segments. Key rate durations can be used to measure a bond's sensitivity to changes in the shape of the yield curve.

- Bonds with an embedded option do not have a meaningful internal rate of return because future cash flows are contingent on interest rates. Therefore, effective duration is the appropriate interest rate risk measure, not modified duration.

- The effective duration of a traditional (option-free) fixed-rate bond is its sensitivity to the benchmark yield curve, which can differ from its sensitivity to its own yield-to-maturity. Therefore, modified duration and effective duration on a traditional (option-free) fixed-rate bond are not necessarily equal.

- During a coupon period, Macaulay and modified durations decline smoothly in a "saw-tooth" pattern, assuming the yield-to-maturity is constant. When the coupon payment is made, the durations jump upward.

- Macaulay and modified durations are inversely related to the coupon rate and the yield-to-maturity.

- Time-to-maturity and Macaulay and modified durations are *usually* positively related. They are *always* positively related on bonds priced at par or at a premium above par value. They are *usually* positively related on bonds priced at a discount below par value. The exception is on long-term, low-coupon bonds, on which it is possible to have a lower duration than on an otherwise comparable shorter-term bond.

- The presence of an embedded call option reduces a bond's effective duration compared with that of an otherwise comparable non-callable bond. The reduction in the effective duration is greater when interest rates are low and the issuer is more likely to exercise the call option.

- The presence of an embedded put option reduces a bond's effective duration compared with that of an otherwise comparable non-putable bond. The reduction in the effective duration is greater when interest rates are high and the investor is more likely to exercise the put option.

- The duration of a bond portfolio can be calculated in two ways: (1) the weighted average of the time to receipt of *aggregate* cash flows and (2) the weighted average of the durations of individual bonds that compose the portfolio.

- The first method to calculate portfolio duration is based on the cash flow yield, which is the internal rate of return on the aggregate cash flows. It cannot be used for bonds with embedded options or for floating-rate notes.

- The second method is simpler to use and quite accurate when the yield curve is relatively flat. Its main limitation is that it assumes a parallel shift in the yield curve in that the yields on all bonds in the portfolio change by the same amount.

- Money duration is a measure of the price change in terms of units of the currency in which the bond is denominated.

- The price value of a basis point (PVBP) is an estimate of the change in the full price of a bond given a 1 bp change in the yield-to-maturity.

- Modified duration is the primary, or first-order, effect on a bond's percentage price change given a change in the yield-to-maturity. Convexity is the secondary, or second-order, effect. It indicates the change in the modified duration as the yield-to-maturity changes.

- Money convexity is convexity times the full price of the bond. Combined with money duration, money convexity estimates the change in the full price of a bond in units of currency given a change in the yield-to-maturity.

- Convexity is a positive attribute for a bond. Other things being equal, a more convex bond appreciates in price more than a less convex bond when yields fall and depreciates less when yields rise.

- Effective convexity is the second-order effect on a bond price given a change in the benchmark yield curve. It is similar to approximate convexity. The difference is that approximate convexity is based on a yield-to-maturity change and effective convexity is based on a benchmark yield curve change.

- Callable bonds have negative effective convexity when interest rates are low. The increase in price when the benchmark yield is reduced is less in absolute value than the decrease in price when the benchmark yield is raised.

- The change in a bond price is the product of: (1) the impact per basis-point change in the yield-to-maturity and (2) the number of basis points in the yield change. The first factor is estimated by duration and convexity. The second factor depends on yield volatility.

- The investment horizon is essential in measuring the interest rate risk on a fixed-rate bond.

- For a particular assumption about yield volatility, the Macaulay duration indicates the investment horizon for which coupon reinvestment risk and market price risk offset each other. The assumption is a one-time parallel shift to the yield curve in which the yield-to-maturity and coupon reinvestment rates change by the same amount in the same direction.

- When the investment horizon is greater than the Macaulay duration of the bond, coupon reinvestment risk dominates price risk. The investor's risk is to lower interest rates. The duration gap is negative.

- When the investment horizon is equal to the Macaulay duration of the bond, coupon reinvestment risk offsets price risk. The duration gap is zero.

- When the investment horizon is less than the Macaulay duration of the bond, price risk dominates coupon reinvestment risk. The investor's risk is to higher interest rates. The duration gap is positive.

- Credit risk involves the probability of default and degree of recovery if default occurs, whereas liquidity risk refers to the transaction costs associated with selling a bond.

- For a traditional (option-free) fixed-rate bond, the same duration and convexity statistics apply if a change occurs in the benchmark yield or a change occurs in the spread. The change in the spread can result from a change in credit risk or liquidity risk.

- In practice, there often is interaction between changes in benchmark yields and in the spread over the benchmark.

PRACTICE PROBLEMS

1   A "buy-and-hold" investor purchases a fixed-rate bond at a discount and holds
    the security until it matures. Which of the following sources of return is *least
    likely* to contribute to the investor's total return over the investment horizon,
    assuming all payments are made as scheduled?

    A   Capital gain

    B   Principal payment

    C   Reinvestment of coupon payments

2   Which of the following sources of return is *most likely* exposed to interest rate
    risk for an investor of a fixed-rate bond who holds the bond until maturity?

    A   Capital gain or loss

    B   Redemption of principal

    C   Reinvestment of coupon payments

3   An investor purchases a bond at a price above par value. Two years later, the
    investor sells the bond. The resulting capital gain or loss is measured by com-
    paring the price at which the bond is sold to the:

    A   carrying value.

    B   original purchase price.

    C   original purchase price value plus the amortized amount of the premium.

The following information relates to Problems 4–6

An investor purchases a nine-year, 7% annual coupon payment bond at a price equal
to par value. After the bond is purchased and before the first coupon is received,
interest rates increase to 8%. The investor sells the bond after five years. Assume that
interest rates remain unchanged at 8% over the five-year holding period.

4   Per 100 of par value, the future value of the reinvested coupon payments at the
    end of the holding period is *closest* to:

    A   35.00.

    B   40.26.

    C   41.07.

5   The capital gain/loss per 100 of par value resulting from the sale of the bond at
    the end of the five-year holding period is *closest* to a:

    A   loss of 8.45.

    B   loss of 3.31.

    C   gain of 2.75.

6   Assuming that all coupons are reinvested over the holding period, the investor's
    five-year horizon yield is *closest* to:

    A   5.66%.

  B   6.62%.

  C   7.12%.

---

7   An investor buys a three-year bond with a 5% coupon rate paid annually. The bond, with a yield-to-maturity of 3%, is purchased at a price of 105.657223 per 100 of par value. Assuming a 5-basis point change in yield-to-maturity, the bond's approximate modified duration is *closest* to:

  A   2.78.

  B   2.86.

  C   5.56.

8   Which of the following statements about duration is correct? A bond's:

  A   effective duration is a measure of yield duration.

  B   modified duration is a measure of curve duration.

  C   modified duration cannot be larger than its Macaulay duration (assuming a positive yield-to-maturity).

9   An investor buys a 6% annual payment bond with three years to maturity. The bond has a yield-to-maturity of 8% and is currently priced at 94.845806 per 100 of par. The bond's Macaulay duration is *closest* to:

  A   2.62.

  B   2.78.

  C   2.83.

10   The interest rate risk of a fixed-rate bond with an embedded call option is *best* measured by:

  A   effective duration.

  B   modified duration.

  C   Macaulay duration.

11   Which of the following is *most* appropriate for measuring a bond's sensitivity to shaping risk?

  A   key rate duration

  B   effective duration

  C   modified duration

12   A Canadian pension fund manager seeks to measure the sensitivity of her pension liabilities to market interest rate changes. The manager determines the present value of the liabilities under three interest rate scenarios: a base rate of 7%, a 100 basis point increase in rates up to 8%, and a 100 basis point drop in rates down to 6%. The results of the manager's analysis are presented below:

Interest Rate Assumption	Present Value of Liabilities
6%	CAD 510.1 million
7%	CAD 455.4 million
8%	CAD 373.6 million

The effective duration of the pension fund's liabilities is *closest* to:

  A   1.49.

  B   14.99.

  C   29.97.

13 Which of the following statements about Macaulay duration is correct?

   A A bond's coupon rate and Macaulay duration are positively related.

   B A bond's Macaulay duration is inversely related to its yield-to-maturity.

   C The Macaulay duration of a zero-coupon bond is less than its time-to-maturity.

14 Assuming no change in the credit risk of a bond, the presence of an embedded put option:

   A reduces the effective duration of the bond.

   B increases the effective duration of the bond.

   C does not change the effective duration of the bond.

15 A bond portfolio consists of the following three fixed-rate bonds. Assume annual coupon payments and no accrued interest on the bonds. Prices are per 100 of par value.

Bond	Maturity	Market Value	Price	Coupon	Yield-to-Maturity	Modified Duration
A	6 years	170,000	85.0000	2.00%	4.95%	5.42
B	10 years	120,000	80.0000	2.40%	4.99%	8.44
C	15 years	100,000	100.0000	5.00%	5.00%	10.38

The bond portfolio's modified duration is *closest* to:

   A 7.62.

   B 8.08.

   C 8.20.

16 A limitation of calculating a bond portfolio's duration as the weighted average of the yield durations of the individual bonds that compose the portfolio is that it:

   A assumes a parallel shift to the yield curve.

   B is less accurate when the yield curve is less steeply sloped.

   C is not applicable to portfolios that have bonds with embedded options.

17 Using the information below, which bond has the *greatest* money duration per 100 of par value assuming annual coupon payments and no accrued interest?

Bond	Time-to-Maturity	Price Per 100 of Par Value	Coupon Rate	Yield-to-Maturity	Modified Duration
A	6 years	85.00	2.00%	4.95%	5.42
B	10 years	80.00	2.40%	4.99%	8.44
C	9 years	85.78	3.00%	5.00%	7.54

   A Bond A

   B Bond B

   C Bond C

18 A bond with exactly nine years remaining until maturity offers a 3% coupon rate with annual coupons. The bond, with a yield-to-maturity of 5%, is priced at 85.784357 per 100 of par value. The estimated price value of a basis point for the bond is *closest* to:

   A 0.0086.

   B 0.0648.

C 0.1295.

19 The "second-order" effect on a bond's percentage price change given a change in yield-to-maturity can be *best* described as:

   A duration.

   B convexity.

   C yield volatility.

20 A bond is currently trading for 98.722 per 100 of par value. If the bond's yield-to-maturity (YTM) rises by 10 basis points, the bond's full price is expected to fall to 98.669. If the bond's YTM decreases by 10 basis points, the bond's full price is expected to increase to 98.782. The bond's approximate convexity is *closest* to:

   A 0.071.

   B 70.906.

   C 1,144.628.

21 A bond has an annual modified duration of 7.020 and annual convexity of 65.180. If the bond's yield-to-maturity decreases by 25 basis points, the expected percentage price change is *closest* to:

   A 1.73%.

   B 1.76%.

   C 1.78%.

22 A bond has an annual modified duration of 7.140 and annual convexity of 66.200. The bond's yield-to-maturity is expected to increase by 50 basis points. The expected percentage price change is *closest* to:

   A −3.40%.

   B −3.49%.

   C −3.57%.

23 Which of the following statements relating to yield volatility is *most* accurate? If the term structure of yield volatility is downward sloping, then:

   A short-term rates are higher than long-term rates.

   B long-term yields are more stable than short-term yields.

   C short-term bonds will always experience greater price fluctuation than long-term bonds.

24 The holding period for a bond at which the coupon reinvestment risk offsets the market price risk is *best* approximated by:

   A duration gap.

   B modified duration.

   C Macaulay duration.

25 When the investor's investment horizon is less than the Macaulay duration of the bond she owns:

   A the investor is hedged against interest rate risk.

   B reinvestment risk dominates, and the investor is at risk of lower rates.

   C market price risk dominates, and the investor is at risk of higher rates.

26 An investor purchases an annual coupon bond with a 6% coupon rate and exactly 20 years remaining until maturity at a price equal to par value. The investor's investment horizon is eight years. The approximate modified duration of the bond is 11.470 years. The duration gap at the time of purchase is *closest* to:

    A −7.842.

    B 3.470.

    C 4.158.

27 A manufacturing company receives a ratings upgrade and the price increases on its fixed-rate bond. The price increase was *most likely* caused by a(n):

    A decrease in the bond's credit spread.

    B increase in the bond's liquidity spread.

    C increase of the bond's underlying benchmark rate.

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:

$$ApproxModDur = \frac{(PV_-) - (PV_+)}{2 \times (\Delta Yield) \times (PV_0)}$$

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%:

$$PV_+ = \frac{5}{(1+0.0305)^1} + \frac{5}{(1+0.0305)^2} + \frac{5+100}{(1+0.0305)^3} = 105.510494$$

$PV_0 = 105.657223$, $\Delta Yield = 0.0005$

$$ApproxModDur = \frac{105.804232 - 105.510494}{2 \times 0.0005 \times 105.657223} = 2.78$$

8 C is correct. A bond's modified duration cannot be larger than its Macaulay duration assuming a positive yield-to-maturity. The formula for modified duration is:

$$ModDur = \frac{MacDur}{1+r}$$

where r is the bond's yield-to-maturity per period. 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:

$$MacDur = \left\{ \frac{1+r}{r} - \frac{1+r+\left[N \times (c-r)\right]}{c \times \left[(1+r)^N - 1\right] + r} \right\} - (t/T)$$

$$MacDur = \left\{ \frac{1.08}{0.08} - \frac{1.08 + \left[3 \times (0.06 - 0.08)\right]}{0.06 \times \left[(1.08)^3 - 1\right] + 0.08} \right\} - 0$$

$$MacDur = 13.50 - 10.67 = 2.83$$

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:

$$EffDur = \frac{(PV_-) - (PV_+)}{2 \times (\Delta Curve) \times (PV_0)}$$

$PV_0 = 455.4$, $PV_+ = 373.6$, $PV_- = 510.1$, and $\Delta Curve = 0.0100$.

$$EffDur = \frac{510.1 - 373.6}{2 \times 0.0100 \times 455.4} = 14.99$$

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 × (170,000/390,000) + 8.44 × (120,000/390,000) + 10.38 × (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.

$$\text{MoneyDur} = \text{AnnModDur} \times PV^{Full}$$

MoneyDur of Bond A = 5.42 × 85.00 = 460.70

MoneyDur of Bond B = 8.44 × 80.00 = 675.20

MoneyDur of Bond C = 7.54 × 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:

$$ApproxModDur = \frac{(PV_-) - (PV_+)}{2 \times (\Delta Yield) \times (PV_0)}$$

$$ApproxModDur = \frac{85.849134 - 85.719638}{2 \times 0.0001 \times 85.784357} = 7.548$$

$$PVBP = 7.548 \times 85.784357 \times 0.0001 = 0.06475$$

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:

$$ApproxCon = [PV_- + PV_+ - (2 \times PV_0)]/(\Delta Yield^2 \times PV_0)$$

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
$\Delta Yield$ = change in yield-to-maturity
$ApproxCon = [98.782 + 98.669 - (2 \times 98.722)]/(0.001^2 \times 98.722) = 70.906$

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:

$$\%\Delta PV^{Full} \approx [-AnnModDur \times \Delta Yield] + [0.5 \times AnnConvexity \times (\Delta Yield)^2]$$

$$\%\Delta PV^{Full} \approx [-7.020 \times (-0.0025)] + [0.5 \times 65.180 \times (-0.0025)^2] = 0.017754,$$
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:

$$\%\Delta PV^{Full} \approx [-AnnModDur \times \Delta Yield] + [0.5 \times AnnConvexity \times (\Delta Yield)^2]$$

$$\%\Delta PV^{Full} \approx [-7.140 \times 0.005] + [0.5 \times 66.200 \times (0.005)^2] = -0.034873,$$ 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 × 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.

utilization of the project, as well as on the economic base supporting the project. The financial analysis has some similarities to the analysis of a corporate bond in that it is focused on operating results, cash flow, liquidity, capital structure, and the ability to service and repay the debt. A key credit measure for revenue-backed non-sovereign government bonds is the debt-service-coverage (DSC) ratio, which measures how much revenue is available to cover debt payments (principal and interest) after operating expenses. Many revenue bonds have a minimum DSC ratio covenant; the higher the DSC ratio, the stronger the creditworthiness.

SUMMARY

In this reading, we introduced readers to the basic principles of credit analysis. We described the importance of the credit markets and credit and credit-related risks. We discussed the role and importance of credit ratings and the methodology associated with assigning ratings, as well as the risks of relying on credit ratings. The reading covered the key components of credit analysis and the financial measure used to help assess creditworthiness.

We also discussed risk versus return when investing in credit and how spread changes affect holding period returns. In addition, we addressed the special considerations to take into account when doing credit analysis of high-yield companies, sovereign borrowers, and non-sovereign government bonds.

- Credit risk is the risk of loss resulting from the borrower failing to make full and timely payments of interest and/or principal.
- The key components of credit risk are risk of default and loss severity in the event of default. The product of the two is expected loss. Investors in higher-quality bonds tend not to focus on loss severity because default risk for those securities is low.
- Loss severity equals (1 – Recovery rate).
- Credit-related risks include downgrade risk (also called credit migration risk) and market liquidity risk. Either of these can cause yield spreads—yield premiums—to rise and bond prices to fall.
- Downgrade risk refers to a decline in an issuer's creditworthiness. Downgrades will cause its bonds to trade with wider yield spreads and thus lower prices.
- Market liquidity risk refers to a widening of the bid–ask spread on an issuer's bonds. Lower-quality bonds tend to have greater market liquidity risk than higher-quality bonds, and during times of market or financial stress, market liquidity risk rises.
- The composition of an issuer's debt and equity is referred to as its "capital structure." Debt ranks ahead of all types of equity with respect to priority of payment, and within the debt component of the capital structure, there can be varying levels of seniority.
- With respect to priority of claims, secured debt ranks ahead of unsecured debt, and within unsecured debt, senior debt ranks ahead of subordinated debt. In the typical case, all of an issuer's bonds have the same probability of default due to cross-default provisions in most indentures. Higher priority of claim implies higher recovery rate—lower loss severity—in the event of default.

- For issuers with more complex corporate structures—for example, a parent holding company that has operating subsidiaries—debt at the holding company is structurally subordinated to the subsidiary debt, although the possibility of more diverse assets and earnings streams from other sources could still result in the parent having higher effective credit quality than a particular subsidiary.

- Recovery rates can vary greatly by issuer and industry. They are influenced by the composition of an issuer's capital structure, where in the economic and credit cycle the default occurred, and what the market's view of the future prospects are for the issuer and its industry.

- The priority of claims in bankruptcy is not always absolute. It can be influenced by several factors, including some leeway accorded to bankruptcy judges, government involvement, or a desire on the part of the more senior creditors to settle with the more junior creditors and allow the issuer to emerge from bankruptcy as a going concern, rather than risking smaller and delayed recovery in the event of a liquidation of the borrower.

- Credit rating agencies, such as Moody's, Standard & Poor's, and Fitch, play a central role in the credit markets. Nearly every bond issued in the broad debt markets carries credit ratings, which are opinions about a bond issue's creditworthiness. Credit ratings enable investors to compare the credit risk of debt issues and issuers within a given industry, across industries, and across geographic markets.

- Bonds rated Aaa to Baa3 by Moody's and AAA to BBB– by Standard & Poor's (S&P) and/or Fitch (higher to lower) are referred to as "investment grade." Bonds rated lower than that—Ba1 or lower by Moody's and BB+ or lower by S&P and/or Fitch—are referred to as "below investment grade" or "speculative grade." Below-investment-grade bonds are also called "high-yield" or "junk" bonds.

- The rating agencies rate both issuers and issues. Issuer ratings are meant to address an issuer's overall creditworthiness—its risk of default. Ratings for issues incorporate such factors as their rankings in the capital structure.

- The rating agencies will notch issue ratings up or down to account for such factors as capital structure ranking for secured or subordinated bonds, reflecting different recovery rates in the event of default. Ratings may also be notched due to structural subordination.

- There are risks in relying too much on credit agency ratings. Creditworthiness may change over time, and initial/current ratings do not necessarily reflect the creditworthiness of an issuer or bond over an investor's holding period. Valuations often adjust before ratings change, and the notching process may not adequately reflect the price decline of a bond that is lower ranked in the capital structure. Because ratings primarily reflect the probability of default but not necessarily the severity of loss given default, bonds with the same rating may have significantly different expected losses (default probability times loss severity). And like analysts, credit rating agencies may have difficulty forecasting certain credit-negative outcomes, such as adverse litigation, leveraging corporate transactions, and such low probability/high severity events as earthquakes and hurricanes.

- The role of corporate credit analysis is to assess the company's ability to make timely payments of interest and to repay principal at maturity.

- Credit analysis is similar to equity analysis. It is important to understand, however, that bonds are contracts and that management's duty to bondholders and other creditors is limited to the terms of the contract. In contrast,

management's duty to shareholders is to act in their best interest by trying to maximize the value of the company—perhaps even at the expense of bondholders at times.

■ Credit analysts tend to focus more on the downside risk given the asymmetry of risk/return, whereas equity analysts focus more on upside opportunity from earnings growth, and so on.

■ The "4 Cs" of credit—capacity, collateral, covenants, and character—provide a useful framework for evaluating credit risk.

■ Credit analysis focuses on an issuer's ability to generate cash flow. The analysis starts with an industry assessment—structure and fundamentals—and continues with an analysis of an issuer's competitive position, management strategy, and track record.

■ Credit measures are used to calculate an issuer's creditworthiness, as well as to compare its credit quality with peer companies. Key credit ratios focus on leverage and interest coverage and use such measures as EBITDA, free cash flow, funds from operations, interest expense and balance sheet debt.

■ An issuer's ability to access liquidity is also an important consideration in credit analysis.

■ The higher the credit risk, the greater the offered/required yield and potential return demanded by investors. Over time, bonds with more credit risk offer higher returns but with greater volatility of return than bonds with lower credit risk.

■ The yield on a credit-risky bond comprises the yield on a default risk–free bond with a comparable maturity plus a yield premium, or "spread," that comprises a credit spread and a liquidity premium. That spread is intended to compensate investors for credit risk—risk of default and loss severity in the event of default—and the credit-related risks that can cause spreads to widen and prices to decline—downgrade or credit migration risk and market liquidity risk.

Yield spread = Liquidity premium + Credit spread.

■ In times of financial market stress, the liquidity premium can increase sharply, causing spreads to widen on all credit-risky bonds, with lower-quality issuers most affected. In times of credit improvement or stability, however, credit spreads can narrow sharply as well, providing attractive investment returns.

■ Credit curves—the plot of yield spreads for a given bond issuer across the yield curve—are typically upward sloping, with the exception of high premium-priced bonds and distressed bonds, where credit curves can be inverted because of the fear of default, when all creditors at a given ranking in the capital structure will receive the same recovery rate without regard to debt maturity.

■ The impact of spread changes on holding period returns for credit-risky bonds are a product of two primary factors: the basis point spread change and the sensitivity of price to yield as reflected by (end-of-period) modified duration and convexity. Spread narrowing enhances holding period returns, whereas spread widening has a negative impact on holding period returns. Longer-duration bonds have greater price and return sensitivity to changes in spread than shorter-duration bonds.

Price impact $\approx -(\text{MDur} \times \Delta\text{Spread}) + \frac{1}{2}\text{Cvx} \times (\Delta\text{Spread})^2$

■ For high-yield bonds, with their greater risk of default, more emphasis should be placed on an issuer's sources of liquidity, as well as on its debt structure and corporate structure. Credit risk can vary greatly across an issuer's debt structure

depending on the seniority ranking. Many high-yield companies have complex capital structures, resulting in different levels of credit risk depending on where the debt resides.

- Covenant analysis is especially important for high-yield bonds. Key covenants include payment restrictions, limitation on liens, change of control, coverage maintenance tests (often limited to bank loans), and any guarantees from restricted subsidiaries. Covenant language can be very technical and legalistic, so it may help to seek legal or expert assistance.

- An equity-like approach to high-yield analysis can be helpful. Calculating and comparing enterprise value with EBITDA and debt/EBITDA can show a level of equity "cushion" or support beneath an issuer's debt.

- Sovereign credit analysis includes assessing both an issuer's ability and willingness to pay its debt obligations. Willingness to pay is important because, due to sovereign immunity, a sovereign government cannot be forced to pay its debts.

- In assessing sovereign credit risk, a helpful framework is to focus on five broad areas: (1) institutional effectiveness and political risks, (2) economic structure and growth prospects, (3) external liquidity and international investment position, (4) fiscal performance, flexibility, and debt burden, and (5) monetary flexibility.

- Among the characteristics of a high-quality sovereign credit are the absence of corruption and/or challenges to political framework; governmental checks and balances; respect for rule of law and property rights; commitment to honor debts; high per capita income with stable, broad-based growth prospects; control of a reserve or actively traded currency; currency flexibility; low foreign debt and foreign financing needs relative to receipts in foreign currencies; stable or declining ratio of debt to GDP; low debt service as a percent of revenue; low ratio of net debt to GDP; operationally independent central bank; track record of low and stable inflation; and a well-developed banking system and active money market.

- Non-sovereign or local government bonds, including municipal bonds, are typically either general obligation bonds or revenue bonds.

- General obligation (GO) bonds are backed by the taxing authority of the issuing non-sovereign government. The credit analysis of GO bonds has some similarities to sovereign analysis—debt burden per capita versus income per capita, tax burden, demographics, and economic diversity. Underfunded and "off-balance-sheet" liabilities, such as pensions for public employees and retirees, are debt-like in nature.

- Revenue-backed bonds support specific projects, such as toll roads, bridges, airports, and other infrastructure. The creditworthiness comes from the revenues generated by usage fees and tolls levied.

PRACTICE PROBLEMS

1 The risk that a bond's creditworthiness declines is *best* described by:

   A credit migration risk.

   B market liquidity risk.

   C spread widening risk.

2 Stedsmart Ltd and Fignermo Ltd are alike with respect to financial and operating characteristics, except that Stedsmart Ltd has less publicly traded debt outstanding than Fignermo Ltd. Stedsmart Ltd is *most likely* to have:

   A no market liquidity risk.

   B lower market liquidity risk.

   C higher market liquidity risk.

3 In the event of default, the recovery rate of which of the following bonds would *most likely* be the highest?

   A First mortgage debt

   B Senior unsecured debt

   C Junior subordinate debt

4 During bankruptcy proceedings of a firm, the priority of claims was not strictly adhered to. Which of the following is the *least likely* explanation for this outcome?

   A Senior creditors compromised.

   B The value of secured assets was less than the amount of the claims.

   C A judge's order resulted in actual claims not adhering to strict priority of claims.

5 A fixed income analyst is *least likely* to conduct an independent analysis of credit risk because credit rating agencies:

   A may at times mis-rate issues.

   B often lag the market in pricing credit risk.

   C cannot foresee future debt-financed acquisitions.

6 If goodwill makes up a large percentage of a company's total assets, this *most likely* indicates that:

   A the company has low free cash flow before dividends.

   B there is a low likelihood that the market price of the company's common stock is below book value.

   C a large percentage of the company's assets are not of high quality.

7 In order to analyze the **collateral** of a company a credit analyst should assess the:

   A cash flows of the company.

   B soundness of management's strategy.

   C value of the company's assets in relation to the level of debt.

8 In order to determine the **capacity** of a company, it would be *most* appropriate to analyze the:

   A company's strategy.

    B growth prospects of the industry.

    C aggressiveness of the company's accounting policies.

9 A credit analyst is evaluating the credit worthiness of three companies: a construction company, a travel and tourism company, and a beverage company. Both the construction and travel and tourism companies are cyclical, whereas the beverage company is non-cyclical. The construction company has the highest debt level of the three companies. The highest credit risk is *most likely* exhibited by the:

    A construction company.

    B beverage company.

    C travel and tourism company.

10 Based on the information provided in Exhibit 1, the EBITDA interest coverage ratio of Adidas AG is *closest* to:

    A 7.91x.

    B 10.12x.

    C 12.99x.

Exhibit 1	Adidas AG Excerpt from Consolidated Income Statement in a given year (€ in millions)
Gross profit	5,730
Royalty and commission income	100
Other operating income	110
Other operating expenses	5,046
Operating profit	894
Interest income	25
Interest expense	113
Income before taxes	806
Income taxes	238
Net income	568
Additional information:	
Depreciation and amortization: €249 million	

Source: Adidas AG Annual Financial Statements, December 2010

11 The following information is from the annual report of Adidas AG for December 2010:

    ● Depreciation and amortization: €249 million

    ● Total assets: €10,618 million

    ● Total debt: €1,613 million

    ● Shareholders' equity: €4,616 million

    The debt/capital ratio of Adidas AG is *closest* to:

    A 15.19%.

    B 25.90%.

    C 34.94%.

12 Funds from operations (FFO) of Pay Handle Ltd increased in 2011. In 2011 the total debt of the company remained unchanged, while additional common shares were issued. Pay Handle Ltd's ability to service its debt in 2011, as compared to 2010, *most likely*:

   A improved.

   B worsened.

   C remained the same.

13 Based on the information in Exhibit 2, Grupa Zywiec SA's credit risk is *most likely*:

   A lower than the industry.

   B higher than the industry.

   C the same as the industry.

Exhibit 2 European Food, Beverage, and Tobacco Industry and Grupa Zywiec SA Selected Financial Ratios for 2010

	Total debt/Total capital (%)	FFO/Total debt (%)	Return on capital (%)	Total debt/ EBITDA (x)	EBITDA interest coverage (x)
Grupa Zywiec SA	47.1	77.5	19.6	1.2	17.7
Industry Median	**42.4**	**23.6**	**6.55**	**2.85**	**6.45**

14 Based on the information in Exhibit 3, the credit rating of Davide Campari-Milano S.p.A. is *most likely*:

   A lower than Associated British Foods plc.

   B higher than Associated British Foods plc.

   C the same as Associated British Foods plc.

Exhibit 3 European Food, Beverage, and Tobacco Industry; Associated British Foods plc; and Davide Campari-Milano S.p.A Selected Financial Ratios, 2010

Company	Total debt/total capital (%)	FFO/total debt (%)	Return on capital (%)	Total debt/EBITDA (x)	EBITDA interest coverage (x)
Associated British Foods plc	0.2	84.3	0.1	1.0	13.9
Davide Campari-Milano S.p.A.	42.9	22.9	8.2	3.2	3.2
European Food, Beverage, and Tobacco Median	**42.4**	**23.6**	**6.55**	**2.85**	**6.45**

15 Holding all other factors constant, the *most likely* effect of low demand and heavy new issue supply on bond yield spreads is that yield spreads will:

   A widen.

   B tighten.

   C not be affected.

16 Credit risk of a corporate bond is *best* described as the:

   A risk that an issuer's creditworthiness deteriorates.

   B probability that the issuer fails to make full and timely payments.

   C risk of loss resulting from the issuer failing to make full and timely payments.

17 The risk that the price at which investors can actually transact differs from the quoted price in the market is called:

   A spread risk.

   B credit migration risk.

   C market liquidity risk.

18 Loss severity is *best* described as the:

   A default probability multiplied by the loss given default.

   B portion of a bond's value recovered by bondholders in the event of default.

   C portion of a bond's value, including unpaid interest, an investor loses in the event of default.

19 The two components of credit risk are default probability and:

   A spread risk.

   B loss severity.

   C market liquidity risk.

20 For a high-quality debt issuer with a large amount of publicly traded debt, bond investors tend to devote *most* effort to assessing the issuer's:

   A default risk.

   B loss severity.

   C market liquidity risk.

21 The expected loss for a given debt instrument is estimated as the product of default probability and:

   A (1 + Recovery rate).

   B (1 − Recovery rate).

   C 1/(1 + Recovery rate).

22 The priority of claims for senior subordinated debt is:

   A lower than for senior unsecured debt.

   B the same as for senior unsecured debt.

   C higher than for senior unsecured debt.

23 A senior unsecured credit instrument holds a higher priority of claims than one ranked as:

   A mortgage debt.

   B second lien loan.

   C senior subordinated.

24 In a bankruptcy proceeding, when the absolute priority of claims is enforced:

   A senior subordinated creditors rank above second lien holders.

    B preferred equity shareholders rank above unsecured creditors.

    C creditors with a secured claim have the first right to the value of that specific property.

25 In the event of default, which of the following is *most likely* to have the highest recovery rate?

    A Second lien

    B Senior unsecured

    C Senior subordinated

26 The process of moving credit ratings of different issues up or down from the issuer rating in response to different payment priorities is *best* described as:

    A notching.

    B structural subordination.

    C cross-default provisions.

27 The factor considered by rating agencies when a corporation has debt at both its parent holding company and operating subsidiaries is *best* referred to as:

    A credit migration risk.

    B corporate family rating.

    C structural subordination.

28 Which type of security is *most likely* to have the same rating as the issuer?

    A Preferred stock

    B Senior secured bond

    C Senior unsecured bond

29 Which of the following corporate debt instruments has the highest seniority ranking?

    A Second lien

    B Senior unsecured

    C Senior subordinated

30 An issuer credit rating usually applies to a company's:

    A secured debt.

    B subordinated debt.

    C senior unsecured debt.

31 The rating agency process whereby the credit ratings on issues are moved up or down from the issuer rating *best* describes:

    A notching.

    B pari passu ranking.

    C cross-default provisions.

32 The notching adjustment for corporate bonds rated Aa2/AA is *most likely*:

    A larger than the notching adjustment for corporate bonds rated B2/B.

    B the same as the notching adjustment for corporate bonds rated B2/B.

    C smaller than the notching adjustment for corporate bonds rated B2/B.

33 Which of the following statements about credit ratings is *most accurate*?

    A Credit ratings can migrate over time.

    B Changes in bond credit ratings precede changes in bond prices.

    C Credit ratings are focused on expected loss rather than risk of default.

34 Which industry characteristic *most likely* has a positive effect on a company's ability to service debt?

   A Low barriers to entry in the industry

   B High number of suppliers to the industry

   C Broadly dispersed market share among large number of companies in the industry

35 When determining the capacity of a borrower to service debt, a credit analyst should begin with an examination of:

   A industry structure.

   B industry fundamentals.

   C company fundamentals.

36 Which of the following accounting issues should *mostly likely* be considered a character warning flag in credit analysis?

   A Expensing items immediately

   B Changing auditors infrequently

   C Significant off-balance-sheet financing

37 In credit analysis, capacity is *best* described as the:

   A quality of management.

   B ability of the borrower to make its debt payments on time.

   C quality and value of the assets supporting an issuer's indebtedness.

38 Among the Four Cs of credit analysis, the recognition of revenue prematurely *most likely* reflects a company's:

   A character.

   B covenants.

   C collateral.

Use the following Exhibit for Questions 39 and 40

Exhibit 4	Industrial Comparative Ratio Analysis, Year 20XX					
	EBITDA Margin (%)	Return on Capital (%)	EBIT/ Interest Expense (×)	EBITDA/ Interest Expense (×)	Debt/ EBITDA (×)	Debt/ Capital (%)
Company A	25.1	25.0	15.9	19.6	1.6	35.2
Company B	29.6	36.3	58.2	62.4	0.5	15.9
Company C	21.8	16.6	8.9	12.4	2.5	46.3

39 Based on only the leverage ratios in Exhibit 4, the company with the *highest* credit risk is:

   A Company A.

   B Company B.

   C Company C.

40 Based on only the coverage ratios in Exhibit 4, the company with the *highest* credit quality is:

    A   Company A.

    B   Company B.

    C   Company C.

Use the following Exhibits for Questions 41 and 42

Exhibit 5 Consolidated Income Statement (£ millions)		
	Company X	**Company Y**
Net revenues	50.7	83.7
Operating expenses	49.6	70.4
Operating income	1.1	13.3
Interest income	0.0	0.0
Interest expense	0.6	0.8
Income before income taxes	0.5	12.5
Provision for income taxes	−0.2	−3.5
Net income	0.3	9.0

Exhibit 6 Consolidated Balance Sheets (£ millions)		
	Company X	**Company Y**
ASSETS		
Current assets	10.3	21.9
Property, plant, and equipment, net	3.5	20.1
Goodwill	8.3	85.0
Other assets	0.9	5.1
Total assets	23.0	132.1
LIABILITIES AND SHAREHOLDERS' EQUITY		
Current liabilities		
Accounts payable and accrued expenses	8.4	16.2
Short-term debt	0.5	8.7

(continued)

Exhibit 6   (Continued)

	Company X	Company Y
Total current liabilities	8.9	24.9
Long-term debt	11.7	21.1
Other non-current liabilities	1.1	22.1
Total liabilities	21.7	68.1
Total shareholders' equity	1.3	64.0
Total liabilities and shareholders' equity	23.0	132.1

Exhibit 7   Consolidated Statements of Cash Flow (£ millions)

	Company X	Company Y
CASH FLOWS FROM OPERATING ACTIVITIES		
Net income	0.3	9.0
Depreciation	1.0	3.8
Goodwill impairment	2.0	1.6
Changes in working capital	0.0	−0.4
Net cash provided by operating activities	3.3	14.0
CASH FLOWS FROM INVESTING ACTIVITIES		
Additions to property and equipment	−1.0	−4.0
Additions to marketable securities	−0.1	0.0
Proceeds from sale of property and equipment	0.2	2.9
Proceeds from sale of marketable securities	0.3	0.0
Net cash used in investing activities	−0.6	−1.1
CASH FLOWS FROM FINANCING ACTIVITIES		
Repurchase of common stock	−1.5	−4.0
Dividends to shareholders	−0.3	−6.1
Change in short-term debt	0.0	−3.4
Additions to long-term debt	3.9	3.9
Reductions in long-term debt	−3.4	−2.5
Net cash – financing activities	−1.3	−12.1

	Company X	Company Y
Exhibit 7 **(Continued)**		
NET INCREASE IN CASH AND CASH EQUIVALENTS	1.4	0.8

41 Based on Exhibits 5–7, in comparison to Company X, Company Y has a higher:

   A debt/capital ratio.

   B debt/EBITDA ratio.

   C free cash flow after dividends/debt ratio.

42 Based on Exhibits 5–7, in comparison to Company Y, Company X has greater:

   A leverage.

   B interest coverage.

   C operating profit margin.

43 Credit yield spreads *most likely* widen in response to:

   A high demand for bonds.

   B weak performance of equities.

   C strengthening economic conditions.

44 The factor that *most likely* results in corporate credit spreads widening is:

   A an improving credit cycle.

   B weakening economic conditions.

   C a period of high demand for bonds.

45 Credit spreads are *most likely* to widen:

   A in a strengthening economy.

   B as the credit cycle improves.

   C in periods of heavy new issue supply and low borrower demand.

46 Which of the following factors in credit analysis is more important for general obligation non-sovereign government debt than for sovereign debt?

   A Per capita income

   B Power to levy and collect taxes

   C Requirement to balance an operating budget

47 In contrast to high-yield credit analysis, investment-grade analysis is *more likely* to rely on:

   A spread risk.

   B an assessment of bank credit facilities.

   C matching of liquidity sources to upcoming debt maturities.

48 Which of the following factors would *best* justify a decision to avoid investing in a country's sovereign debt?

   A Freely floating currency

B   A population that is not growing

C   Suitable checks and balances in policymaking

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 Fignermo 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 A 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 – 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	£2.2	£6.8
Debt	£12.2	£29.8

(continued)

	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

	Company X	Company Y
Capital		
Debt	2.2	29.8
+ Equity	4.3	64.0
Capital	£6.5	£93.8
Debt/Capital (%)	(12.2/13.5) × 100	(29.8/93.8) × 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	£3.3	£14.0
Less		
Net capital expenditures	−0.8	−1.1
Dividends	−0.3	−6.1
Free cash flow after dividends	£2.2	£6.8
Debt	£12.2	£29.8
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%

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.

    C An opportunity to earn a return in excess of the return appropriate for the risk assumed

4 Which of the following ways best describes how arbitrage contributes to market efficiency?

    A Arbitrage penalizes those who trade too rapidly.

    B Arbitrage equalizes the risks taken by all market participants.

    C Arbitrage improves the rate at which prices converge to their relative fair values.

Solution to 1:

A is correct. Arbitrage forces equivalent assets to have a single price. There is nothing called the law of similar prices or the law of limited profitability.

Solution to 2:

A is correct. Prices converge because of the heavy demand for the cheaper asset and the heavy supply of the more expensive asset. Profits are not sustained, and, in fact, they are eradicated as prices converge. Locked-limit is a condition in the futures market and has nothing to do with arbitrage.

Solution to 3:

B is correct. An opportunity to profit at no risk could merely describe the purchase of a risk-free asset. An opportunity to earn a return in excess of the return appropriate for the risk assumed is a concept studied in portfolio management and is often referred to as an abnormal return. It is certainly desirable but is hardly an arbitrage because it requires the assumption of risk and the investment of capital. Arbitrage is risk free and requires no capital because selling the overpriced asset produces the funds to buy the underpriced asset.

Solution to 4:

C is correct. Arbitrage imposes no penalties on rapid trading; in fact, it tends to reward those who trade rapidly to take advantage of arbitrage opportunities. Arbitrage has no effect of equalizing risk among market participants. Arbitrage does result in an acceleration of price convergence to fair values relative to instruments with equivalent payoffs.

SUMMARY

This first reading on derivatives introduces you to the basic characteristics of derivatives, including the following points:

- A derivative is a financial instrument that derives its performance from the performance of an underlying asset.
- The underlying asset, called the underlying, trades in the cash or spot markets and its price is called the cash or spot price.
- Derivatives consist of two general classes: forward commitments and contingent claims.
- Derivatives can be created as standardized instruments on derivatives exchanges or as customized instruments in the over-the-counter market.

- Exchange-traded derivatives are standardized, highly regulated, and transparent transactions that are guaranteed against default through the clearinghouse of the derivatives exchange.

- Over-the-counter derivatives are customized, flexible, and more private and less regulated than exchange-traded derivatives, but are subject to a greater risk of default.

- A forward contract is an over-the-counter derivative contract in which two parties agree that one party, the buyer, will purchase an underlying asset from the other party, the seller, at a later date and at a fixed price they agree upon when the contract is signed.

- A futures contract is similar to a forward contract but is a standardized derivative contract created and traded on a futures exchange. In the contract, two parties agree that one party, the buyer, will purchase an underlying asset from the other party, the seller, at a later date and at a price agreed on by the two parties when the contract is initiated. In addition, there is a daily settling of gains and losses and a credit guarantee by the futures exchange through its clearinghouse.

- A swap is an over-the-counter derivative contract in which two parties agree to exchange a series of cash flows whereby one party pays a variable series that will be determined by an underlying asset or rate and the other party pays either a variable series determined by a different underlying asset or rate or a fixed series.

- An option is a derivative contract in which one party, the buyer, pays a sum of money to the other party, the seller or writer, and receives the right to either buy or sell an underlying asset at a fixed price either on a specific expiration date or at any time prior to the expiration date.

- A call is an option that provides the right to buy the underlying.

- A put is an option that provides the right to sell the underlying.

- Credit derivatives are a class of derivative contracts between two parties, the credit protection buyer and the credit protection seller, in which the latter provides protection to the former against a specific credit loss.

- A credit default swap is the most widely used credit derivative. It is a derivative contract between two parties, a credit protection buyer and a credit protection seller, in which the buyer makes a series of payments to the seller and receives a promise of compensation for credit losses resulting from the default of a third party.

- An asset-backed security is a derivative contract in which a portfolio of debt instruments is assembled and claims are issued on the portfolio in the form of tranches, which have different priorities of claims on the payments made by the debt securities such that prepayments or credit losses are allocated to the most-junior tranches first and the most-senior tranches last.

- Derivatives can be combined with other derivatives or underlying assets to form hybrids.

- Derivatives are issued on equities, fixed-income securities, interest rates, currencies, commodities, credit, and a variety of such diverse underlyings as weather, electricity, and disaster claims.

- Derivatives facilitate the transfer of risk, enable the creation of strategies and payoffs not otherwise possible with spot assets, provide information about the spot market, offer lower transaction costs, reduce the amount of capital required, are easier than the underlyings to go short, and improve the efficiency of spot markets.

- Derivatives are sometimes criticized for being a form of legalized gambling and for leading to destabilizing speculation, although these points can generally be refuted.

- Derivatives are typically priced by forming a hedge involving the underlying asset and a derivative such that the combination must pay the risk-free rate and do so for only one derivative price.

- Derivatives pricing relies heavily on the principle of storage, meaning the ability to hold or store the underlying asset. Storage can incur costs but can also generate cash, such as dividends and interest.

- Arbitrage is the condition that two equivalent assets or derivatives or combinations of assets and derivatives sell for different prices, leading to an opportunity to buy at the low price and sell at the high price, thereby earning a risk-free profit without committing any capital.

- The combined actions of arbitrageurs bring about a convergence of prices. Hence, arbitrage leads to the law of one price: Transactions that produce equivalent results must sell for equivalent prices.

PRACTICE PROBLEMS

1   A derivative is *best* described as a financial instrument that derives its performance by:

   A   passing through the returns of the underlying.

   B   replicating the performance of the underlying.

   C   transforming the performance of the underlying.

2   Derivatives are similar to insurance in that both:

   A   have an indefinite life span.

   B   allow for the transfer of risk from one party to another.

   C   allow for the transformation of the underlying risk itself.

3   A beneficial opportunity created by the derivatives market is the ability to:

   A   adjust risk exposures to desired levels.

   B   generate returns proportional to movements in the underlying.

   C   simultaneously take long positions in multiple highly liquid fixed-income securities.

4   Compared with exchange-traded derivatives, over-the-counter derivatives would *most likely* be described as:

   A   standardized.

   B   less transparent.

   C   more transparent.

5   Exchange-traded derivatives are:

   A   largely unregulated.

   B   traded through an informal network.

   C   guaranteed by a clearinghouse against default.

6   The clearing and settlement process of an exchange-traded derivatives market:

   A   provides a credit guarantee.

   B   provides transparency and flexibility.

   C   takes longer than that of most securities exchanges.

7   Which of the following statements *best* portrays the full implementation of post-financial-crisis regulations in the OTC derivatives market?

   A   Transactions are no longer private.

   B   Most transactions need to be reported to regulators.

   C   All transactions must be cleared through central clearing agencies.

8   A characteristic of forward commitments is that they:

   A   provide linear payoffs.

   B   do not depend on the outcome or payoff of an underlying asset.

   C   provide one party the right to engage in future transactions on terms agreed on in advance.

9   In contrast to contingent claims, forward contracts:

   A   have their prices chosen by the participants.

   B   could end in default by either party.

    C can be exercised by physical or cash delivery.

10 Which of the following statements *best* describes the payoff from a forward contract?

    A The buyer has more to gain going long than the seller has to lose going short.

    B The buyer profits if the price of the underlying at expiration exceeds the forward price.

    C The gains from owning the underlying versus owning the forward contract are equivalent.

11 Which of the following statements regarding the settlement of forward contracts is correct?

    A Contract settlement by cash has different economic effects from those of a settlement by delivery.

    B Non-deliverable forwards and contracts for differences have distinct settlement procedures.

    C At cash settlement, when the long party acquires the asset in the market, it effectively pays the forward price.

12 A futures contract is *best* described as a contract that is:

    A standardized.

    B subject to credit risk.

    C marked to market throughout the trading day.

13 Which of the following statements explains a characteristic of futures price limits? Price limits:

    A help the clearinghouse manage its credit exposure.

    B can typically be expanded intra-day by willing traders.

    C establish a band around the final trade of the previous day.

14 Which of the following statements describes an aspect of margin accounts for futures?

    A The maintenance margin is always less than the initial margin.

    B The initial margin required is typically at least 10% of the futures price.

    C A margin call requires a deposit sufficient to raise the account balance to the maintenance margin.

15 Which of the following factors is shared by forwards and futures contracts?

    A Timing of profits

    B Flexible settlement arrangements

    C Nearly equivalent profits by expiration

16 Which of the following derivatives is classified as a contingent claim?

    A Futures contracts

    B Interest rate swaps

    C Credit default swaps

17 In contrast to contingent claims, forward commitments provide the:

    A right to buy or sell the underlying asset in the future.

    B obligation to buy or sell the underlying asset in the future.

    C promise to provide credit protection in the event of default.

18 Which of the following derivatives provide payoffs that are non-linearly related to the payoffs of the underlying?

    A Options

    B Forwards

    C Interest-rate swaps

19 An interest rate swap is a derivative contract in which:

    A two parties agree to exchange a series of cash flows.

    B the credit seller provides protection to the credit buyer.

    C the buyer has the right to purchase the underlying from the seller.

20 Forward commitments subject to default are:

    A forwards and futures.

    B futures and interest rate swaps.

    C interest rate swaps and forwards.

21 A swap is:

    A more like a forward than a futures contract.

    B subject to simultaneous default by both parties.

    C based on an exchange of two series of fixed cash flows.

22 A plain vanilla interest rate swap is also known as:

    A a basis swap.

    B a fixed-for-floating swap.

    C an overnight indexed swap.

23 The notional principal of a swap is:

    A not exchanged in the case of an interest rate swap.

    B a fixed amount whenever it is matched with a loan.

    C equal to the amount owed by one swap party to the other.

24 Which of the following derivatives is *least likely* to have a value of zero at initiation of the contract?

    A Futures

    B Options

    C Forwards

25 The buyer of an option has a contingent claim in the sense that the option creates:

    A a right.

    B an obligation.

    C a linear payoff with respect to gains and losses of the underlying.

26 Which of the following options grants the holder the right to purchase the underlying prior to expiration?

    A American-style put option

    B European-style call option

    C American-style call option

27 A credit derivative is a derivative contract in which the:

    A clearinghouse provides a credit guarantee to both the buyer and the seller.

    B seller provides protection to the buyer against the credit risk of a third party.

    C the buyer and seller provide a performance bond at initiation of the contract.

28 The junior and senior tranches of an asset-backed security:

A   have equivalent expected returns.

B   have claims on separate underlying portfolios.

C   may be differentially impacted by prepayments or credit losses.

29 In a declining interest rate environment, compared with a CMO's Class A tranche, its Class C tranche will be repaid:

A   earlier.

B   at the same pace.

C   later.

30 For a given CDO, which of the following tranches is *most likely* to have the highest expected return?

A   Equity

B   Senior

C   Mezzanine

31 Which of the following derivatives allows an investor to pay the return on a stock index and receive a fixed rate?

A   Equity swap

B   Stock warrant

C   Index futures contract

32 Which of the following is *most likely* the underlying of a plain vanilla interest rate swap?

A   180-day Libor

B   10-year US Treasury bond

C   Bloomberg Barclay's US Aggregate Bond Index

33 Currency swaps are:

A   rarely used.

B   commonly used to manage interest rate risk.

C   executed by two parties making a series of interest rate payments in the same currency.

34 Which of the following statements regarding commodity derivatives is correct?

A   The primary commodity derivatives are futures.

B   Commodities are subject to a set of well-defined risk factors.

C   Commodity traders and financial traders today are distinct groups within the financial world.

35 Compared with the underlying spot market, derivative markets are *more likely* to have:

A   greater liquidity.

B   higher transaction costs.

C   higher capital requirements.

36 Which of the following characteristics is *least likely* to be a benefit associated with using derivatives?

A   More effective management of risk

B   Payoffs similar to those associated with the underlying

C   Greater opportunities to go short compared with the spot market

37 Which of the following statements *best* represents information discovery in the futures market?

    A The futures price is predictive.

    B Information flows more slowly into the futures market than into the spot market.

    C The futures market reveals the price that the holder of the asset can take to avoid uncertainty.

38 The derivative markets tend to:

    A transfer liquidity from the broader financial markets.

    B not reflect fundamental value after it is restored in the underlying market.

    C offer a less costly way to exploit mispricing in comparison to other free and competitive financial markets.

39 Which of the following statements *most likely* contributes to the view that derivatives have some role in causing financial crashes?

    A Derivatives are the primary means by which leverage and related excessive risk is brought into financial markets.

    B Growth in the number of investors willing to speculate in derivatives markets leads to excessive speculative trading.

    C Restrictions on derivatives, such as enhanced collateral requirements and credit mitigation measures, in the years leading up to crashes introduce market rigidity.

40 In contrast to gambling, derivatives speculation:

    A has a positive public image.

    B is a form of financial risk taking.

    C benefits the financial markets and thus society.

41 Derivatives may contribute to financial contagion because of the:

    A centrally cleared nature of OTC derivatives.

    B associated significant costs and high capital requirements.

    C reliance by derivatives speculators on large amounts of leverage.

42 The complex nature of derivatives has led to:

    A reliable financial models of derivatives markets.

    B widespread trust in applying scientific principles to derivatives.

    C financial industry employment of mathematicians and physicists.

43 Which of the following is *most likely* to be a destabilizing consequence of speculation using derivatives?

    A Increased defaults by speculators and creditors

    B Market price swings resulting from arbitrage activities

    C The creation of trading strategies that result in asymmetric performance

44 The law of one price is *best* described as:

    A the true fundamental value of an asset.

    B earning a risk-free profit without committing any capital.

    C two assets that will produce the same cash flows in the future must sell for equivalent prices.

45 Arbitrage opportunities exist when:

    A two identical assets or derivatives sell for different prices.

    B combinations of the underlying asset and a derivative earn the risk-free rate.

    C arbitrageurs simultaneously buy takeover targets and sell takeover acquirers.

For questions 46–49, consider a call option selling for $4 in which the exercise price is $50.

46 Determine the value at expiration and the profile for a *buyer* if the price of the underlying at expiration is $55.

 A $5

 B $1

 C −$1

47 Determine the value at expiration and the profile for a *buyer* if the price of the underlying at expiration is $48.

 A −$4

 B $0

 C $2

48 Determine the value at expiration and the profit for a *seller* if the price of the underling at expiration is $49.

 A $4

 B $0

 C −$1

49 Determine the value at expiration and the profit for a *seller* if the price of the underling at expiration is $52.

 A −$2

 B $5

 C $2

For questions 50–52, consider the following scenario:

Suppose you believe that the price of a particular underlying, currently selling at $99, is going to increase substantially in the next six months. You decide to purchase a call option expiring in six months on this underlying. The call option has an exercise price of $105 and sells for $7.

50 Determine the profit if the price of the underlying six months from now is $99.

 A $6

 B $0

 C −$7

51 Determine the profit if the price of the underlying six months from now is $112.

 A $7

 B $0

 C −$3

52 Determine the profit if the price of the underlying six months from now is $115.

 A $0

B $3

C   −$3

For questions 53–55, consider the following scenario:

Suppose you believe that the price of a particular underlying, currently selling at $99, is going to decrease substantially in the next six months. You decide to purchase a put option expiring in six months on this underlying. The put option has an exercise price of $95 and sells for $5.

53 Determine the profit for you if the price of the underlying six months from now is $100.

   A $0

   B $5

   C   −$5

54 Determine the profit for you if the price of the underlying six months from now is $95.

   A $0

   B $5

   C   −$5

55 Determine the profit for you if the price of the underlying six months from now is $85.

   A $10

   B $5

   C $0

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. Insurance is a financial contract that provides protection against loss. The party bearing the risk purchases an insurance policy, which transfers the risk to the other party, the insurer, for a specified period of time. The risk itself does not change, but the party bearing it does. Derivatives allow for this same type of risk transfer.

A is incorrect because derivatives, like insurance, have a definite, as opposed to indefinite, life span and expire on a specified date.

C is incorrect because both derivatives and insurance allow for the transfer of risk from one party (the purchaser of the insurance policy or of a derivative) to another party (the insurer or a derivative seller), for a specified period of time. The risk itself does not change, but the party bearing it does.

3 A is correct. Derivatives allow market participants to practice more effective risk management, a process by which an organization, or individual, defines the level of risk it wishes to take, measures the level of risk it is taking, and adjusts the latter to equal the former.

B is incorrect because derivatives are characterized by a relatively high degree of leverage, meaning that participants in derivatives transactions usually have to invest only a small amount, as opposed to a large amount, of their own capital relative to the value of the underlying. This allows participants to generate returns that are disproportional, as opposed to proportional, to movements in the underlying.

C is incorrect because derivatives are not needed to copy strategies that can be implemented with the underlying on a standalone basis. Rather, derivatives can be used to create strategies that cannot be implemented with the underlying alone. Simultaneously taking long positions in multiple highly liquid fixed-income securities is a strategy that can be implemented with the underlying securities on a standalone basis.

4 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.

5 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.

6   A is correct. The clearing and settlement process of derivative transactions provides a credit guarantee.

B is incorrect because although the exchange markets are said to have transparency, they also involve standardization. That entails a loss of flexibility, with participants limited to only those transactions permitted on the exchange.

C is incorrect because derivatives exchanges clear and settle all contracts overnight, which is faster than most securities exchanges, which require two business days.

7   B is correct. With full implementation of these regulations in the OTC derivatives market, most OTC transactions need to be reported to regulators.

A is incorrect because although under full implementation of the regulations information on most OTC transactions needs to be reported to regulators, many transactions retain a degree of privacy with lower transparency.

C is incorrect because although under full implementation of new regulations a number of OTC transactions have to be cleared through central clearing agencies, there are exemptions that cover a significant percentage of derivative transactions.

8   A is correct because forward commitments provide linear payoffs.

B is incorrect because forward commitments depend on the outcome or payoff of an underlying asset.

C is incorrect because forward commitments obligate parties to make (not provide the right to engage) a final payment contingent on the performance of the underlying.

9   B is correct. In a forward contract, either party could default, whereas in a contingent claim, default is possible only from the short to the long.

A is incorrect because the forward price is set in the pricing of the contract such that the starting contract value is zero, unlike contingent claims, under which parties can select any starting value.

C is incorrect because both forward contracts and contingent claims can be settled by either physical or cash delivery.

10   B is correct. The buyer is obligated to pay the forward price $F_0(T)$ at expiration and receives an asset worth S_T, the price of the underlying. The contract effectively pays off $S_T - F_0(T)$, the value of the contract at expiration. The buyer therefore profits if $S_T > F_0(T)$.

A is incorrect because the long and the short are engaged in a zero-sum game. This is a type of competition in which one participant's gains are the other's losses, with their payoffs effectively being mirror images.

C is incorrect because although the gain from owning the underlying and the gain from owning the forward are both driven by S_T, the price of the underlying at expiration, they are not the same value. The gain from owning the underlying would be $S_T - S_0$, the change in its price, whereas the gain from owning the forward would be $S_T - F_0(T)$, the value of the forward at expiration.

11   C is correct. In the case of cash settlement, the long can acquire the asset, effectively paying the forward price, $F_0(T)$.

A is incorrect because forward contracts settled by cash or by delivery have the same economic effect.

B is incorrect because both non-deliverable forwards and contracts for differences can settle by an exchange of cash.

12 A is correct. A futures contract is a standardized derivative contract.

B is incorrect because through its clearinghouse the futures exchange provides a credit guarantee that it will make up a loss in the event a losing party cannot pay.

C is incorrect because a futures contract is marked to market at the end of each day, a process in which the futures clearinghouse determines an average of the final futures trade of the day and designates that price as the settlement price.

13 A is correct. Price limits are important in helping the clearinghouse manage its credit exposure. Sharply moving prices make it more difficult for the clearinghouse to collect from parties losing money.

B is incorrect because typically the exchange rules allow for an expansion of price limits the next day (not intra-day) if traders are willing.

C is incorrect because price limits establish a band relative to the previous day's settlement price (not final trade).

14 A is correct. The maintenance margin is always significantly lower than the initial margin.

B is incorrect because the initial margin required is typically at most (not at least) 10% of the futures price.

C is incorrect because a margin call requires a deposit large enough to bring the balance up to the initial (not maintenance) margin.

15 C is correct. Comparing the derivatives, forward and futures contracts have nearly equivalent profits by the time of expiration of the forward.

A is incorrect because the timing of profits for a futures contract is different from that of forwards. Forwards realize the full amount at expiration, whereas futures contracts realize their profit in parts on a day-to-day basis.

B is incorrect because the settlement arrangements for the forwards can be agreed on at initiation and written in the contract based on the desires of the engaged parties. However, in the case of a futures contract, the exchange (not the engaged parties) specifies whether physical delivery or cash settlement applies.

16 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.

17 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.

18 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.

19 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.

20 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.

21 A is correct. A swap is a bit more like a forward contract than a futures contract in that it is an OTC contract, so it is privately negotiated and subject to default.

B is incorrect because in a swap, although either party can default, only one party can do so at a particular time. Money owed is based on the net owed by one party to the other, and only the party owing the greater amount can default to the counterparty owing the lesser amount.

C is incorrect because a swap involves an exchange between parties in which at least one party pays a variable series of cash flows determined by an underlying asset or rate.

22 B is correct. A plain vanilla swap is a fixed-for-floating interest rate swap, which is the most common type of swap.

A is incorrect because a basis swap is a transaction based on the TED spread (T-bills versus Eurodollars) and is not the same as a plain vanilla swap.

C is incorrect because an overnight indexed swap is a swap that is tied to a federal funds type of rate, reflecting the rate at which banks borrow overnight, and is not the same as a plain vanilla swap.

23 A is correct. The notional principal of a swap is not exchanged in the case of an interest rate swap.

B is incorrect because an amortizing loan will be matched with a swap with a pre-specified declining (not fixed) notional principal that matches the loan balance.

C is incorrect because the notional principal is equal to the loan balance. Although the loan has an actual balance (the amount owed by the borrower to the creditor), the swap does not have such a balance owed by one swap party to the other.

24 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.

25 A is correct. A contingent claim, a derivative in which the outcome or payoff depends on the outcome or payoff of an underlying asset, has come to be associated with a right, but not an obligation, to make a final payment contingent on the performance of the underlying.

B is incorrect because an option, as a contingent claim, grants the right but not the obligation to buy or sell the underlying at a later date.

C is incorrect because the holder of an option has a choice of whether to exercise the option. This choice creates a payoff that transforms the underlying payoff in a more pronounced manner than does a forward, futures, or swap, which provide linear payoffs. Options are different in that they limit losses in one direction.

26 C is correct. The right to buy the underlying is referred to as a call option. Furthermore, options that can be exercised prior to the expiration date are referred to as American-style options.

A is incorrect because a put option grants the holder the right to sell, as opposed to buy, the underlying.

B is incorrect because European-style options can only be exercised at expiration.

27 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.

28 C is correct. An asset-backed security is a derivative contract in which a portfolio of debt instruments is assembled and claims are issued on the portfolio in the form of tranches, which have different priorities of claims on the payments made by the debt securities such that prepayments or credit losses are allocated to the most junior tranches first and the most senior tranches last.

A is incorrect because the expected returns of the tranches vary according to the perceived credit risk, with the senior tranches having the highest credit quality and the junior tranches the lowest. Thus, the senior tranches have the lowest expected returns and the junior tranches have the highest. Notably, in a bond mutual fund or an ETF, all investors in the fund have equal claims, and so the rate of return earned by each investor is the same.

B is incorrect because an asset-backed security is a derivative contract in which a single portfolio of securities is assembled and claims are issued on the portfolio in the form of tranches.

29 A is correct. Lower interest rates entice homeowners to pay off their mortgages early because they can refinance at lower rates. The most junior tranche in a CMO will bear the first wave of prepayments until that tranche has been

completely repaid its full principal investment. At that point, the next tranche will bear prepayments until that tranche has been fully repaid. Therefore, the Class C tranche of a CMO will be repaid before the more senior Class A tranche.

B is incorrect because the tranches, which have different priorities of claims on the principal payments made by the underlying mortgages, will see prepayments allocated to the most junior tranches first and the most senior tranches last.

C is incorrect because the most junior tranche in a CMO will bear the first wave of prepayments until that tranche has been completely repaid its full principal investment. At that point, the next tranche will bear prepayments until that tranche has been fully repaid. Therefore, the Class C tranche will be repaid prior to, not after, the Class A tranche.

30 A is correct. The expected returns of the tranches vary according to the perceived credit risk, with the senior tranches having the highest credit quality and the junior tranches the lowest. Thus, the senior tranches have the lowest expected returns and the junior tranches have the highest. The most junior tranche is sometimes called the "equity tranche."

B is incorrect because the senior tranches in a CDO have the lowest expected returns and the junior (or equity) tranches have the highest.

C is incorrect because the senior tranches in a CDO have the lowest expected returns and the junior (or equity) tranches have the highest. A mezzanine tranche is intermediate between the senior and junior tranches.

31 A is correct. Equity swaps, also known as index swaps, are quite popular and permit investors to pay the return on one stock index and receive the return on another index or a fixed rate.

B is incorrect because warrants are options that are sold directly to the public, allowing holders to exercise and buy shares directly from the company as opposed to using stock indexes to determine returns.

C is incorrect because although index derivatives in the form of options, forwards, futures, and swaps are very popular, paying the return on a stock index and receiving a fixed rate describes an equity swap (or index swap), not a futures contract.

32 A is correct. In a plain vanilla interest rate swap, an interest rate, such as Libor, serves as the underlying. A plain vanilla interest rate swap is one of many derivatives in which a rate, not the instrument that pays the rate, is the underlying.

B is incorrect because a plain vanilla interest rate swap is one of many derivatives in which a rate, not an instrument that pays a rate, is the underlying.

C is incorrect because a plain vanilla interest rate swap is one of many derivatives in which a rate, not an instrument (or index) that pays a rate, is the underlying.

33 B is correct. Because interest rates and currencies are both subject to change, a currency swap has two sources of risk. Furthermore, companies operating across borders are subject to both interest rate risk and currency risk, and currency swaps are commonly used to manage these risks.

A is incorrect because currency risk is a major factor in global financial markets, and the currency derivatives market is extremely large, as opposed to small.

C is incorrect because a currency swap is executed by two parties making a series of interest rate payments to each other in different currencies, as opposed to the same currency.

34 A is correct. The primary commodity derivatives are futures, but forwards, swaps, and options are also used.

B is incorrect because the commodity market is extremely large and subject to an almost unimaginable array of risks.

C is incorrect because commodity and financial traders have become relatively homogeneous since the creation of financial futures. Historically, commodity traders and financial traders were quite different groups, and there used to be a tendency to think of the commodity world as somewhat separate from the financial world.

35 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.

36 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.

37 C is correct. The futures market reveals the price that the holder of an asset could take and avoid the risk of uncertainty.

A is incorrect because although the futures price is sometimes thought of as predictive, it provides only a little more information than does a spot price and is not really a forecast of the futures spot price.

B is incorrect because by virtue of the fact that the futures market requires less capital, information can flow into the futures market before it gets into the spot market.

38 C is correct. When prices deviate from fundamental values, derivative markets offer a less costly way to exploit mispricing in comparison to other free and competitive financial markets.

A is incorrect because derivative markets tend to transfer liquidity to (not from) the broader financial markets, because investors are far more willing to trade if they can more easily manage their risk, trade at lower cost and with less capital, and go short more easily. An increased willingness to trade leads to a more liquid market.

B is incorrect because it is likely (not unlikely) that fundamental value will be reflected in the derivative markets both before and after it is restored in the underlying market owing to lower capital requirements and transaction costs in the derivative markets.

39 B is correct. Opponents of derivatives claim that excessive speculative trading brings instability to the markets. Defaults by speculators can lead to defaults by their creditors, their creditors' creditors, and so on.

A is incorrect because derivatives are one of many mechanisms through which excessive risk can be taken. There are many ways to take on leverage that look far less harmful but can be just as risky.

C is incorrect because responses to crashes and crises typically call for more rules and regulations restricting the use of derivatives, such as requiring more collateral and credit mitigation measures. Such rules and regulations are generally implemented after a crash and are directed at limiting government bailouts of the costs from derivatives risks.

40 C is correct. Derivatives trading brings extensive benefits to financial markets (low costs, low capital requirements, ease of going short, etc.) and thus benefits society as a whole. Gambling, on the other hand, typically benefits only a limited number of participants.

A is incorrect because the general image of speculators is not a good one. Speculators are often thought to be short-term traders who attempt to exploit temporary inefficiencies, caring little about long-term fundamental values.

B is incorrect because speculation and gambling are both forms of financial risk taking.

41 C is correct. Opponents argue that speculators use large amounts of leverage, thereby subjecting themselves and their creditors to substantial risk if markets do not move in their hoped-for direction. Defaults by speculators can then lead to defaults by their creditors, their creditors' creditors, and so on. These effects can, therefore, be systemic and reflect an epidemic contagion whereby instability can spread throughout markets and an economy, if not the entire world.

A is incorrect because central clearing of OTC derivatives, similar to how exchange-traded derivatives are cleared, is intended to lessen the risk of contagion.

B is incorrect because it is derivatives' low cost and low capital requirements, not high cost and high capital requirements, that opponents point to as contributing to an excessive amount of speculative trading that brings instability to the markets.

42 C is correct. Many derivatives are extremely complex and require a high-level understanding of mathematics. As a result, the financial industry employs many mathematicians, physicists, and computer scientists.

A is incorrect because scientists create models of markets by using scientific principles that often fail. For example, to a physicist modeling the movements of celestial bodies, the science is reliable and the physicist is unlikely to misapply the science. The same science applied to financial markets is far less reliable. Financial markets are driven by the actions of people who are not as consistent as the movements of celestial bodies.

B is incorrect because the complex nature of derivatives has made many distrust, as opposed to trust, derivatives, the people who work with them, and the scientific methods they use.

43 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.

44 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 refers to arbitrage not the law of one price.

45 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.

46 B is correct. $C_T = Max(0, S_T - X) = Max(0, 55 - 50) = 5$

$\Pi = C_T - C_0 = 5 - 4 = 1$

47 A is correct. $C_T = Max(0, S_T - X) = Max(0, 48 - 50) = 0$

$\Pi = C_T - C_0 = 0 - 4 = -4$

48 A is correct. $-C_T = -Max(0, S_T - X) = -Max(0, 49 - 50) = 0$

$\Pi = -C_T + C_0 = -0 + 4 = 4$

49 C is correct. $-C_T = -Max(0, S_T - X) = -Max(0, 52 - 50) = -2$

$\Pi = -C_T + C_0 = -2 + 4 = 2$

50 C is correct. $C_T = Max(0, S_T - X) = Max(0, 99 - 105) = 0$

$\Pi = C_T - C_0 = 0 - 7 = -7$

51 B is correct. $C_T = Max(0, S_T - X) = Max(0, 112 - 105) = 7$

$\Pi = C_T - C_0 = 7 - 7 = 0$

Note: $112 is the breakeven price

52 B is correct. $C_T = Max(0, S_T - X) = Max(0, 115 - 105) = 10$

$\Pi = C_T - C_0 = 10 - 7 = 3$

53 C is correct. $C_T = Max(0, S_T - X) = Max(0, 95 - 100) = 0$

$\Pi = C_T - C_0 = 0 - 5 = -5$

54 C is correct. $C_T = Max(0, S_T - X) = Max(0, 95 - 95) = 0$

$\Pi = C_T - C_0 = 0 - 5 = -5$

55 B is correct. $C_T = Max(0, S_T - X) = Max(0, 95 - 85) = 10$

$\Pi = C_T - C_0 = 10 - 5 = 5$

American Option Pricing

1   With respect to American calls, which of the following statements is *most* accurate?

   A   American calls should be exercised early if the underlying has reached its expected maximum price.

   B   American calls should be exercised early if the underlying has a lower expected return than the risk-free rate.

   C   American calls should be exercised early only if there is a dividend or other cash payment on the underlying.

2   The effect of dividends on a stock on early exercise of a put is to:

   A   make early exercise less likely.

   B   have no effect on early exercise.

   C   make early exercise more likely.

Solution to 1:

C is correct. Cash payments on the underlying are the only reason to exercise American calls early. Interest rates, the expected return on the underlying, and any notion of a maximum price is irrelevant. But note that a dividend does not mean that early exercise should automatically be conducted. A dividend is only a necessary condition to justify early exercise for calls.

Solution to 2:

A is correct. Dividends drive down the stock price when the dividend is paid. Thus, all else being equal, a stock paying dividends has a built-in force that drives down the stock price. This characteristic discourages early exercise, because stock price declines are beneficial to holders of puts.

SUMMARY

This reading on derivative pricing provides a foundation for understanding how derivatives are valued and traded. Key points include the following:

■   The price of the underlying asset is equal to the expected future price discounted at the risk-free rate, plus a risk premium, plus the present value of any benefits, minus the present value of any costs associated with holding the asset.

■   An arbitrage opportunity occurs when two identical assets or combinations of assets sell at different prices, leading to the possibility of buying the cheaper asset and selling the more expensive asset to produce a risk-free return without investing any capital.

■   In well-functioning markets, arbitrage opportunities are quickly exploited, and the resulting increased buying of underpriced assets and increased selling of overpriced assets returns prices to equivalence.

- Derivatives are priced by creating a risk-free combination of the underlying and a derivative, leading to a unique derivative price that eliminates any possibility of arbitrage.

- Derivative pricing through arbitrage precludes any need for determining risk premiums or the risk aversion of the party trading the option and is referred to as risk-neutral pricing.

- The value of a forward contract at expiration is the value of the asset minus the forward price.

- The value of a forward contract prior to expiration is the value of the asset minus the present value of the forward price.

- The forward price, established when the contract is initiated, is the price agreed to by the two parties that produces a zero value at the start.

- Costs incurred and benefits received by holding the underlying affect the forward price by raising and lowering it, respectively.

- Futures prices can differ from forward prices because of the effect of interest rates on the interim cash flows from the daily settlement.

- Swaps can be priced as an implicit series of off-market forward contracts, whereby each contract is priced the same, resulting in some contracts being positively valued and some negatively valued but with their combined value equaling zero.

- At expiration, a European call or put is worth its exercise value, which for calls is the greater of zero or the underlying price minus the exercise price and for puts is the greater of zero and the exercise price minus the underlying price.

- European calls and puts are affected by the value of the underlying, the exercise price, the risk-free rate, the time to expiration, the volatility of the underlying, and any costs incurred or benefits received while holding the underlying.

- Option values experience time value decay, which is the loss in value due to the passage of time and the approach of expiration, plus the moneyness and the volatility.

- The minimum value of a European call is the maximum of zero and the underlying price minus the present value of the exercise price.

- The minimum value of a European put is the maximum of zero and the present value of the exercise price minus the price of the underlying.

- European put and call prices are related through put–call parity, which specifies that the put price plus the price of the underlying equals the call price plus the present value of the exercise price.

- European put and call prices are related through put–call–forward parity, which shows that the put price plus the value of a risk-free bond with face value equal to the forward price equals the call price plus the value of a risk-free bond with face value equal to the exercise price.

- The values of European options can be obtained using the binomial model, which specifies two possible prices of the asset one period later and enables the construction of a risk-free hedge consisting of the option and the underlying.

- American call prices can differ from European call prices only if there are cash flows on the underlying, such as dividends or interest; these cash flows are the only reason for early exercise of a call.

- American put prices can differ from European put prices, because the right to exercise early always has value for a put, which is because of a lower limit on the value of the underlying.

PRACTICE PROBLEMS

1 For a risk-averse investor, the price of a risky asset, assuming no additional costs and benefits of holding the asset, is:

   A unrelated to the risk-free rate.

   B directly related to its level of risk.

   C inversely related to its level of risk.

2 An arbitrage opportunity is *least likely* to be exploited when:

   A one position is illiquid.

   B the price differential between assets is large.

   C the investor can execute a transaction in large volumes.

3 An arbitrageur will *most likely* execute a trade when:

   A transaction costs are low.

   B costs of short-selling are high.

   C prices are consistent with the law of one price.

4 An arbitrage transaction generates a net inflow of funds:

   A throughout the holding period.

   B at the end of the holding period.

   C at the start of the holding period.

5 Which of the following combinations replicates a long derivative position?

   A A short derivative and a long asset

   B A long asset and a short risk-free bond

   C A short derivative and a short risk-free bond

6 Most derivatives are priced by:

   A assuming that the market offers arbitrage opportunities.

   B discounting the expected payoff of the derivative at the risk-free rate.

   C applying a risk premium to the expected payoff of the derivative and its risk.

7 The price of a forward contract:

   A is the amount paid at initiation.

   B is the amount paid at expiration.

   C fluctuates over the term of the contract.

8 Assume an asset pays no dividends or interest, and also assume that the asset does not yield any non-financial benefits or incur any carrying cost. At initiation, the price of a forward contract on that asset is:

   A lower than the value of the contract.

   B equal to the value of the contract.

   C greater than the value of the contract.

9 With respect to a forward contract, as market conditions change:

   A only the price fluctuates.

   B only the value fluctuates.

   C both the price and the value fluctuate.

10 The value of a forward contract at expiration is:

    A positive to the long party if the spot price is higher than the forward price.

    B negative to the short party if the forward price is higher than the spot price.

    C positive to the short party if the spot price is higher than the forward price.

11 At the initiation of a forward contract on an asset that neither receives benefits nor incurs carrying costs during the term of the contract, the forward price is equal to the:

    A spot price.

    B future value of the spot price.

    C present value of the spot price.

12 Stocks BWQ and ZER are each currently priced at $100 per share. Over the next year, stock BWQ is expected to generate significant benefits whereas stock ZER is not expected to generate any benefits. There are no carrying costs associated with holding either stock over the next year. Compared with ZER, the one-year forward price of BWQ is *most likely*:

    A lower.

    B the same.

    C higher.

13 If the net cost of carry of an asset is positive, then the price of a forward contract on that asset is *most likely*:

    A lower than if the net cost of carry was zero.

    B the same as if the net cost of carry was zero.

    C higher than if the net cost of carry was zero.

14 If the present value of storage costs exceeds the present value of its convenience yield, then the commodity's forward price is *most likely*:

    A less than the spot price compounded at the risk-free rate.

    B the same as the spot price compounded at the risk-free rate.

    C higher than the spot price compounded at the risk-free rate.

15 Which of the following factors *most likely* explains why the spot price of a commodity in short supply can be greater than its forward price?

    A Opportunity cost

    B Lack of dividends

    C Convenience yield

16 When interest rates are constant, futures prices are *most likely*:

    A less than forward prices.

    B equal to forward prices.

    C greater than forward prices.

17 In contrast to a forward contract, a futures contract:

    A trades over-the-counter.

    B is initiated at a zero value.

    C is marked-to-market daily.

18 To the holder of a long position, it is more desirable to own a forward contract than a futures contract when interest rates and futures prices are:

    A negatively correlated.

    B uncorrelated.

    C positively correlated.

19 The value of a swap typically:

A is non-zero at initiation.

B is obtained through replication.

C does not fluctuate over the life of the contract.

20 The price of a swap typically:

A is zero at initiation.

B fluctuates over the life of the contract.

C is obtained through a process of replication.

21 The value of a swap is equal to the present value of the:

A fixed payments from the swap.

B net cash flow payments from the swap.

C underlying at the end of the contract.

22 If no cash is initially exchanged, a swap is comparable to a series of forward contracts when:

A the swap payments are variable.

B the combined value of all the forward contracts is zero.

C all the forward contracts have the same agreed-on price.

23 For a swap in which a series of fixed payments is exchanged for a series of floating payments, the parties to the transaction:

A designate the value of the underlying at contract initiation.

B value the underlying solely on the basis of its market value at the end of the swap.

C value the underlying sequentially at the time of each payment to determine the floating payment.

24 A European call option and a European put option are written on the same underlying, and both options have the same expiration date and exercise price. At expiration, it is possible that both options will have:

A negative values.

B the same value.

C positive values.

25 At expiration, a European put option will be valuable if the exercise price is:

A less than the underlying price.

B equal to the underlying price.

C greater than the underlying price.

26 The value of a European call option at expiration is the greater of zero or the:

A value of the underlying.

B value of the underlying minus the exercise price.

C exercise price minus the value of the underlying.

27 For a European call option with two months until expiration, if the spot price is below the exercise price, the call option will *most likely* have:

A zero time value.

B positive time value.

C positive exercise value.

28 When the price of the underlying is below the exercise price, a put option is:

A in-the-money.

B at-the-money.

    C   out-of-the-money.

29 If the risk-free rate increases, the value of an in-the-money European put option will *most likely*:

    A   decrease.

    B   remain the same.

    C   increase.

30 The value of a European call option is inversely related to the:

    A   exercise price.

    B   time to expiration.

    C   volatility of the underlying.

31 The table below shows three European call options on the same underlying:

	Time to Expiration	Exercise Price
Option 1	3 months	$100
Option 2	6 months	$100
Option 3	6 months	$105

The option with the highest value is *most likely*:

    A   Option 1.

    B   Option 2.

    C   Option 3.

32 The value of a European put option can be either directly or inversely related to the:

    A   exercise price.

    B   time to expiration.

    C   volatility of the underlying.

33 Prior to expiration, the lowest value of a European put option is the greater of zero or the:

    A   exercise price minus the value of the underlying.

    B   present value of the exercise price minus the value of the underlying.

    C   value of the underlying minus the present value of the exercise price.

34 A European put option on a dividend-paying stock is *most likely* to increase if there is an increase in:

    A   carrying costs.

    B   the risk-free rate.

    C   dividend payments.

35 Based on put-call parity, a trader who combines a long asset, a long put, and a short call will create a synthetic:

    A   long bond.

    B   fiduciary call.

    C   protective put.

36 Which of the following transactions is the equivalent of a synthetic long call position?

    A   Long asset, long put, short call

    B   Long asset, long put, short bond

    C   Short asset, long call, long bond

37 Which of the following is *least likely* to be required by the binomial option pricing model?

   A Spot price

   B Two possible prices one period later

   C Actual probabilities of the up and down moves

38 To determine the price of an option today, the binomial model requires:

   A selling one put and buying one offsetting call.

   B buying one unit of the underlying and selling one matching call.

   C using the risk-free rate to determine the required number of units of the underlying.

39 Assume a call option's strike price is initially equal to the price of its underlying asset. Based on the binomial model, if the volatility of the underlying decreases, the lower of the two potential payoff values of the hedge portfolio:

   A decreases.

   B remains the same.

   C increases.

40 Based on the binomial model, an increase in the actual probability of an upward move in the underlying will result in the option price:

   A decreasing.

   B remaining the same.

   C increasing.

41 If a call option is priced higher than the binomial model predicts, investors can earn a return in excess of the risk-free rate by:

   A investing at the risk-free rate, selling a call, and selling the underlying.

   B borrowing at the risk-free rate, buying a call, and buying the underlying.

   C borrowing at the risk-free rate, selling a call, and buying the underlying.

42 An at-the-money American call option on a stock that pays no dividends has three months remaining until expiration. The market value of the option will *most likely* be:

   A less than its exercise value.

   B equal to its exercise value.

   C greater than its exercise value.

43 At expiration, American call options are worth:

   A less than European call options.

   B the same as European call options.

   C more than European call options.

44 Which of the following circumstances will *most likely* affect the value of an American call option relative to a European call option?

   A Dividends are declared

   B Expiration date occurs

   C The risk-free rate changes

45 Combining a protective put with a forward contract generates equivalent outcomes at expiration to those of a:

   A fiduciary call.

   B long call combined with a short asset.

   C forward contract combined with a risk-free bond.

46 Holding an asset and buying a put on that asset is equivalent to:

A initiating a fiduciary call.

B buying a risk-free zero-coupon bond and selling a call option.

C selling a risk-free zero-coupon bond and buying a call option.

47 If an underlying asset's price is less than a related option's strike price at expiration, a protective put position on that asset versus a fiduciary call position has a value that is:

A lower.

B the same.

C higher.

48 Based on put–call parity, which of the following combinations results in a synthetic long asset position?

A A long call, a short put, and a long bond

B A short call, a long put, and a short bond

C A long call, a short asset, and a long bond

49 For a holder of a European option, put–call–forward parity is based on the assumption that:

A no arbitrage is possible within the spot, forward, and option markets.

B the value of a European put at expiration is the greater of zero or the underlying value minus the exercise price.

C the value of a European call at expiration is the greater of zero or the exercise price minus the value of the underlying.

50 Under put–call–forward parity, which of the following transactions is risk free?

A Short call, long put, long forward contract, long risk-free bond

B Long call, short put, long forward contract, short risk-free bond

C Long call, long put, short forward contract, short risk-free bond

SOLUTIONS

1 C is correct. An asset's current price, S_0, is determined by discounting the expected future price of the asset by r (the risk free rate) plus λ (the risk premium) over the period from 0 to T, as illustrated in the following equation:

$$S_0 = \frac{E(S_T)}{(1 + r + \lambda)^T}$$

Thus, an asset's current price inversely relates to its level of risk via the related risk premium, λ.

A is incorrect because an asset's current price in spot markets is calculated using the risk-free rate plus a risk premium.

B is incorrect because an asset's current price in spot markets is inversely related, not directly related, to its level of risk.

2 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.

3 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.

4 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.

5 B is correct. A long asset and a short risk-free asset (meaning to borrow at the risk-free rate) can be combined to produce a long derivative position.

A is incorrect because a short derivative and a long asset combine to produce a position equivalent to a long risk-free bond, not a long derivative.

C is incorrect because a short derivative and a short risk-free bond combine to produce a position equivalent to a short asset, not a long derivative.

6 B is correct. Virtually all derivative pricing models discount the expected payoff of the derivative at the risk-free rate.

A is incorrect because derivatives are priced by assuming that the market is free of arbitrage opportunities via the principle of no arbitrage, not by assuming that the market offers them.

C is incorrect because the application of a risk premium to the expected payoff of the derivative and its risk is not appropriate in the pricing of derivatives. An investor's risk premium is not relevant to pricing a derivative.

7 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.

8   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.

9   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.

10   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).

11   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.

12   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.

13   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.

14   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.

15   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 it 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.

16   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.

17 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.

18 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.

19 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.

20 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.

21 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.

22 B is correct. When two parties engage in a series of forward contracts and initially agree on a price of $FS_0(T)$, some of the forward contracts have positive values and some have negative values, but their combined value equals zero.

A is incorrect because for a swap, all payments are fixed and equal, not variable.

C is incorrect because forward prices are determined by the spot price and the net cost of carry, meaning that forward contracts expiring at different times will have different prices, not the same price.

23 C is correct. On each payment date, the swap owner receives a payment based on the value of the underlying at the time of each respective payment.

A is incorrect because in a swap involving a series of fixed payments exchanged for a series of floating payments, each floating payment reflects the value of the underlying at the time of payment, not a designated value at contract initiation.

B is incorrect because in a swap involving a series of fixed payments exchanged for a series of floating payments, each floating payment is based on the value of the underlying at the time of each respective payment, not on the market value at the end of the swap.

24 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.

25 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.

26 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.

27 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.

28 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.

29 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.

30 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.

31 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.

32 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.

33 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.

34 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.

35 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.

36 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.

37 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.

38 C is correct. Pricing an option relies on the facts that a perfectly hedged investment earns the risk-free rate and that, based on the binomial option pricing model, the size of the two possible changes in the option price (meaning the potential step up or step down in the option value) after one period are equivalent.

39 B is correct. When the volatility of the underlying decreases, the value of the option also decreases, meaning that the upper payoff value of the hedge portfolio combining them declines. However, the lower payoff value remains at zero.

40 B is correct. The binomial model does not consider the actual probabilities of upward and downward movements in determining the option value. Thus, a change in this probability has no effect on the calculated option price.

41 C is correct. If an option is trading above the value predicted by the binomial model, investors can engage in arbitrage by selling a call, buying shares of the underlying, and funding the transaction by borrowing at the risk-free rate. This will earn a return in excess of the risk-free rate.

42 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.

43 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.

44 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.

45 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).

46 A is correct. Under put–call parity, initiating a fiduciary call (buying a call option on an asset that expires at time T together with a risk-free zero-coupon bond that also expires at time T) is equivalent to holding the same asset and initiating a protective put on it (buying a put option with an exercise price of X that can be used to sell the asset for X at time T).

47 B is correct. On the one hand, buying a call option on an asset and a risk-free bond with the same maturity is known as a fiduciary call. If the fiduciary call expires in the money (meaning that the value of the call, $S_T - X$, is greater than the risk-free bond's price at expiration, X), then the total value of the fiduciary call is $(S_T - X) + X$, or S_T. On the other hand, holding an underlying asset, S_T, and buying a put on that asset is known as a protective put. If the put expires out of the money, meaning that the value of the asset, S_T, is greater than the put's value at expiration, 0, then the total value of the protective put is $S_T - 0$, or S_T. A protective put and a fiduciary call produce the same result.

48 A is correct. One can synthetically create a long asset position by buying a call, shorting a put, and buying a bond.

B is incorrect because combining a short call and a short bond with the right to sell (not buy) another asset via a long put could not result in a new synthetic long asset position.

C is incorrect because combining a long call, a short asset, and a long bond creates a long put, not a synthetic long asset.

49 A is correct. Put–call–forward parity is based on the assumption that no arbitrage is possible within the spot, forward, and option markets.

B is incorrect because the value of a European put at expiration is the greater of either zero or the exercise price minus the value of the underlying, not the greater of zero or the underlying value minus the exercise price. In addition, put–call–forward parity is related to the equality of a fiduciary call and a synthetic protective put or to a protective put and a synthetic fiduciary call, not specifically to the value of a put at expiration.

C is incorrect because the value of a European call at expiration is the greater of either zero or the underlying value minus the exercise price, not the greater of zero or the exercise price minus the value of the underlying. In addition, put–call–forward parity is related to the equality of a fiduciary call and a synthetic protective put or to a protective put and a synthetic fiduciary call, not specifically to the value of a call at expiration.

50 A is correct. Purchasing a long forward contract and a risk-free bond creates a synthetic asset. Combining a long synthetic asset, a long put, and a short call is risk free because its payoffs produce a known cash flow of the value of the exercise price.

SUMMARY

This reading has provided an overview of the characteristics, potential benefits, and risks of alternative investments. It also described features of some categories of alternative investments. Including alternative investments in an investor's portfolio may result in a higher Sharpe ratio for the overall portfolio because of diversification benefits. However, these benefits do not come without associated risks. It is important for investors to understand these risks before including alternative investments in their portfolios. Some key points of the reading are summarized as follows:

■ Alternative investments are supplemental strategies to traditional long-only positions in stocks, bonds, and cash. Alternative investments include investments in long–short public market strategies and such less common assets as private equity, real estate, infrastructure, and commodities. Often these investments are made via limited partnerships and special purpose vehicles.

■ Alternative investment strategies are typically active, return-seeking strategies that often have different risks from those in indexed public markets.

■ Characteristics common to many alternative investments, when compared with traditional investments, include the following: lower liquidity, less regulation, lower transparency, higher fees, and limited and potentially problematic historical risk and return data.

■ Alternative investments often have complex legal and tax considerations and may be highly leveraged.

■ Alternative investments are attractive to investors because of the potential for portfolio diversification (reduced risk) and higher portfolio returns when added to a portfolio of traditional investments.

■ The risks associated with alternative investments must be factored into the investment decision-making process.

■ Many alternative investments are valued by using estimated values rather than actual market prices. These values are then reported to index providers for performance-reporting purposes. As a result, the volatility of returns and correlation of returns vis-à-vis traditional investments will tend to be underestimated. It is important to identify and understand how alternative investments are valued, particularly owing to illiquidity.

■ Indexes for alternative investments may be subject to a variety of biases, including survivorship and backfill biases.

■ Many alternative investments, such as hedge and private equity funds, use a partnership structure with a general partner that manages the business and limited partners (investors) who own fractional interests in the partnership.

■ The general partner typically receives a management fee based on assets under management or committed capital (the former is common to hedge funds and the latter is common to private equity funds) and an incentive fee based on realized profits.

■ Hurdle rates, high-water marks, lockup and notice periods, and clawback provisions are often specified in a partnership agreement.

■ The fee structure affects the returns to investors (limited partners) in such alternative investments as hedge and private equity funds.

■ Hedge funds are typically classified by strategy. One such classification includes four broad categories of strategies: event driven, relative value, macro, and equity hedge.

- Primary private equity fund strategies include leveraged buyouts, venture capital, development capital, and distressed investing. Leveraged buyouts and venture capital are the dominant strategies.

- Real estate investing includes direct and indirect ownership of real estate property and lending against real estate property.

- Real estate property has some unique features, including basic indivisibility, heterogeneity (no two properties are identical), and fixed location.

- The required amount to directly invest in real estate may be large in order to achieve adequate diversification, and the investment may be relatively illiquid. Various investment forms, such as REITs and mortgage securitizations, partially address these issues.

- Commodity investments may involve investing in actual physical commodities or in producers of commodities, but more typically, these investments are made using commodity derivatives (futures or swaps).

- Returns to commodity investing are based on changes in price and do not include an income stream, such as dividends, interest, or rent (apart from income earned on the collateral).

- Infrastructure assets are capital intensive, long-lived, real assets that are intended for public use and provide essential services. Investors expect these assets to generate stable cash flows, which typically are adjusted upward with economic growth and inflation, and they may also expect capital appreciation of the infrastructure assets.

- Category, stage of development, and geographic location of underlying assets and the form of infrastructure investment affect risks and expected returns of infrastructure investments.

- Managing risks associated with alternative investments can be challenging because these investments are often characterized by asymmetric risk/return profiles, limited portfolio transparency, and illiquidity.

- Traditional risk and return measures (such as mean return, standard deviation of returns, and beta) may provide an inadequate picture of alternative investments' risk and return characteristics. Moreover, these measures may be unreliable or not representative of specific investments.

- Operational, financial, counterparty, and liquidity risks may be key considerations for those investing in alternative investments.

- It is critical to perform due diligence to assess whether or not (a) the manager can effectively pursue the proposed investment strategy; (b) the appropriate organizational structure and policies for managing investments, operations, risk, and compliance are in place; and (c) the fund terms appear reasonable.

- The inclusion of alternative investments in a portfolio, including the amounts to allocate, should be considered in the context of an investor's risk–return objectives, constraints, and preferences.

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PRACTICE PROBLEMS

1 Which of the following is *least likely* to be considered an alternative investment?

   A Real estate

   B Commodities

   C Long-only equity funds

2 Private equity funds are *most likely* to use:

   A merger arbitrage strategies.

   B leveraged buyouts.

   C market-neutral strategies.

3 An investor is seeking an investment that can take long and short positions, may use multi-strategies, and historically exhibits low correlation with a traditional investment portfolio. The investor's goals will be *best* satisfied with an investment in:

   A real estate.

   B a hedge fund.

   C a private equity fund.

4 Relative to traditional investments, alternative investments are *least likely* to be characterized by:

   A high levels of transparency.

   B limited historical return data.

   C significant restrictions on redemptions.

5 Alternative investment funds are typically managed:

   A actively.

   B to generate positive beta return.

   C assuming that markets are efficient.

6 Compared with traditional investments, alternative investments are *more likely* to have:

   A greater use of leverage.

   B long-only positions in liquid assets.

   C more transparent and reliable risk and return data.

7 The potential benefits of allocating a portion of a portfolio to alternative investments include:

   A ease of manager selection.

   B improvement in the portfolio's risk–return relationship.

   C accessible and reliable measures of risk and return.

8 An investor may prefer a single hedge fund to a fund of funds if he seeks:

   A due diligence expertise.

   B better redemption terms.

   C a less complex fee structure.

9 Hedge funds are similar to private equity funds in that both:

   A are typically structured as partnerships.

    B   assess management fees based on assets under management.

    C   do not earn an incentive fee until the initial investment is repaid.

10 An investor seeks a current income stream as a component of total return, and desires an investment that historically has low correlation with other asset classes. The investment *most likely* to achieve the investor's goals is:

    A   timberland.

    B   collectibles.

    C   commodities.

11 Both event-driven and macro hedge fund strategies use:

    A   long–short positions.

    B   a top-down approach.

    C   long-term market cycles.

12 Hedge fund losses are *most likely* to be magnified by a:

    A   margin call.

    B   lockup period.

    C   redemption notice period.

13 The first stage of financing at which a venture capital fund *most likely* invests is the:

    A   seed stage.

    B   mezzanine stage.

    C   angel investing stage.

14 What is the most significant drawback of a repeat sales index to measure returns to real estate?

    A   Sample selection bias

    B   Understatement of volatility

    C   Reliance on subjective appraisals

15 Compared with direct investment in infrastructure, publicly traded infrastructure securities are characterized by:

    A   higher concentration risk.

    B   more-transparent governance.

    C   greater control over the infrastructure assets.

16 An equity hedge fund following a fundamental growth strategy uses fundamental analysis to identify companies that are *most likely* to:

    A   be undervalued.

    B   be either undervalued or overvalued.

    C   experience high growth and capital appreciation.

17 Which of the following is most likely to be available when conducting hedge fund due diligence?

    A   The benchmark used by the fund

    B   Information on systems risk management

    C   Details of investment strategies and processes

18 A private equity fund desiring to realize an immediate and complete cash exit from a portfolio company is *most likely* to pursue a(n):

    A   IPO.

    B   trade sale.

C recapitalization.

19 As the loan-to-value ratio increases for a real estate investment, risk *most likely* increases for:

A debt investors only.

B equity investors only.

C both debt and equity investors.

20 Which of the following forms of infrastructure investments is the most liquid?

A An unlisted infrastructure mutual fund

B A direct investment in a greenfield project

C An exchange-traded master limited partnership (MLP)

21 An investor chooses to invest in a brownfield rather than a greenfield infrastructure project. The investor is *most likely* motivated by:

A growth opportunities.

B predictable cash flows.

C higher expected returns.

22 The privatization of an existing hospital is best described as:

A a greenfield investment.

B a brownfield investment.

C an economic infrastructure investment.

23 A hedge fund invests primarily in distressed debt. Quoted market prices are available for the underlying holdings but they trade infrequently. Which of the following will the hedge fund *most likely* use in calculating net asset value for trading purposes?

A Average quotes

B Average quotes adjusted for liquidity

C Bid prices for short positions and ask prices for long positions

24 Angel investing capital is typically provided in which stage of financing?

A Later-stage.

B Formative-stage.

C Mezzanine-stage.

25 If a commodity's forward curve is in contango, the component of a commodities futures return *most likely* to reflect this is:

A spot prices.

B the roll yield.

C the collateral yield.

26 United Capital is a hedge fund with $250 million of initial capital. United charges a 2% management fee based on assets under management at year end, and a 20% incentive fee based on returns in excess of an 8% hurdle rate. In its first year, United appreciates 16%. Assume management fees are calculated using end-of-period valuation. The investor's net return assuming the performance fee is calculated net of the management fee is *closest* to:

A 11.58%.

B 12.54%.

C 12.80%.

27 Capricorn Fund of Funds invests GBP 100 million in each of Alpha Hedge Fund and ABC Hedge Fund. Capricorn FOF has a "1 and 10" fee structure. Management fees and incentive fees are calculated independently at the end of each year. After one year, net of their respective management and incentive fees, the investment in Alpha is valued at GBP80 million and the investment in ABC is valued at GBP140 million. The annual return to an investor in Capricorn, net of fees assessed at the fund of funds level, is *closest* to:

A 7.9%.

B 8.0%.

C 8.1%.

28 The following information applies to Rotunda Advisors, a hedge fund:

- $288 million in assets under management (AUM) as of prior year-end

- 2% management fee (based on year-end AUM)

- 20% incentive fee calculated:

  - net of management fee

  - using a 5% soft hurdle rate

  - using a high-water mark (high-water mark is $357 million)

- Current year fund return is 25%

The total fee earned by Rotunda in the current year is *closest* to:

A $7.20 million.

B $20.16 million.

C $21.60 million.

29 A hedge fund has the following fee structure:

Annual management fee based on year-end AUM	2%
Incentive fee	20%
Hurdle rate before incentive fee collection starts	4%
Current high-water mark	$610 million

The fund has a value of $583.1 million at the beginning of the year. After one year, it has a value of $642 million before fees. The net return to an investor for this year is *closest* to:

A 6.72%.

B 6.80%.

C 7.64%.

30 Ash Lawn Partners, a fund of hedge funds, has the following fee structure:

- 2/20 underlying fund fees with incentive fees calculated independently

- Ash Lawn fees are calculated net of all underlying fund fees

- 1% management fee (based on year-end market value)

- 10% incentive fee calculated net of management fee

- The fund and all underlying funds have no hurdle rate or high-water mark fee conditions

In the latest year, Ash Lawn's fund value increased from $100 million to $133 million before deduction of management and incentive fees of the fund or underlying funds. Based on the information provided, the total fee earned by *all* funds in the aggregate is *closest* to:

A $11.85 million.

    B $12.75 million.

    C $12.87 million.

31 Risks in infrastructure investing are *most likely* greatest when the project involves:

    A   construction of infrastructure assets.

    B   investment in existing infrastructure assets.

    C   investing in assets that will be leased back to a government.

32 An investor in a private equity fund is concerned that the general partner can receive incentive fees in excess of the agreed-on incentive fees by making distributions over time based on profits earned rather than making distributions only at exit from investments of the fund. Which of the following is most likey to protect the investor from the general partner receiving excess fees?

    A   A high hurdle rate

    B   A clawback provision

    C   A lower capital commitment

33 Until the committed capital is fully drawn down and invested, the management fee for a private equity fund is based on:

    A   invested capital.

    B   committed capital.

    C   assets under management.

34 An analyst wanting to assess the downside risk of an alternative investment is *least likely* to use the investment's:

    A   Sortino ratio.

    B   value at risk (VaR).

    C   standard deviation of returns.

35 An effective risk management process used by alternative investment funds *most likely* includes:

    A   in-house valuations.

    B   internal custody of assets.

    C   segregation of risk and investment process duties.

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   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.

8   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.

9   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.

10 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.

11 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.

12 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.

13 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.

14 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.

15 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.

16 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.

17 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 much information to potential investors.

18 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.

19 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.

20 C is correct. A publicly traded infrastructure security, such as an exchange-traded MLP, provides the benefit of liquidity.

21 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.

22 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.

23 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.

24 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.

25 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.

26 B is correct. The net investor return is 12.54%, calculated as:

End of year capital = $250 million × 1.16 = $290 million

Management fee = $290 million × 2% = $5.8 million

Hurdle amount = 8% of $250 million = $20 million;

Incentive fee = ($290 – $250 – $20 – $5.8) million × 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%

27 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 × 1% = GBP2.2 million

Incentive fee = (GBP220 – GBP200) million × 10% = GBP2 million

Total fees to Capricorn = (GBP2.2 + GBP2) million = GBP4.2 million

Investor net return: (GBP220 – GBP200 – GBP4.2) / GBP200 = 7.9%

28 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 × (1 + Fund return) = $288 million × 1.25 = $360 million

$360 million × 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.

29 C is correct. The management fee for the year is

$642 × 0.02 = $12.84 million.

Because the ending value exceeds the high-water mark, the hedge fund can collect an incentive fee. The incentive fee is

{$642 − [$610 × (1 + 0.04)]} × 0.20 = $1.52 million.

The net return to the investor for the year is

[($642 − $12.84 − $1.52)/$583.1] − 1 ≈ 0.07638 ≈ 7.64%.

30 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 × 0.02 = $2.66 million.

Incentive fee = ($133 − $100) million × 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 × 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 × 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).

31 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.

32 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.

33 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.

34 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.

35 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.

- *Carried interest:* Carried interest is the GP's share of profits (typically 20%) on sales of portfolio companies. Most GPs do not earn the incentive fee until LPs have recovered their initial investment.
- *Investment income.* Investment income includes profits generated on capital contributed to the fund by the GP.

SUMMARY

- A portfolio approach to investing could be preferable to simply investing in individual securities.
- The problem with focusing on individual securities is that this approach may lead to the investor "putting all her eggs in one basket."
- Portfolios provide important diversification benefits, allowing risk to be reduced without necessarily affecting or compromising return.
- Understanding the needs of your client and preparing an investment policy statement represent the first steps of the portfolio management process. Those steps are followed by asset allocation, security analysis, portfolio construction, portfolio monitoring and rebalancing, and performance measurement and reporting.
- Types of investors include individual and institutional investors. Institutional investors include defined benefit pension plans, endowments and foundations, banks, insurance companies, and sovereign wealth funds.
- The asset management industry is an integral component of the global financial services sector. Asset managers offer either active management, passive management, or both. Asset managers are typically categorized as traditional or alternative, although the line between traditional and alternative has blurred.
- Three key trends in the asset management industry include the growth of passive investing, "big data" in the investment process, and robo-advisers in the wealth management industry.
- Investors use different types of investment products in their portfolios. These include mutual funds, separately managed accounts, exchange-traded funds, hedge funds, and private equity and venture capital funds.

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PRACTICE PROBLEMS

1   Investors should use a portfolio approach to:

    A   reduce risk.

    B   monitor risk.

    C   eliminate risk.

2   Which of the following is the *best* reason for an investor to be concerned with the composition of a portfolio?

    A   Risk reduction.

    B   Downside risk protection.

    C   Avoidance of investment disasters.

3   With respect to the formation of portfolios, which of the following statements is *most accurate*?

    A   Portfolios affect risk less than returns.

    B   Portfolios affect risk more than returns.

    C   Portfolios affect risk and returns equally.

4   Which of the following institutions will *on average* have the greatest need for liquidity?

    A   Banks.

    B   Investment companies.

    C   Non-life insurance companies.

5   Which of the following institutional investors will *most likely* have the longest time horizon?

    A   Defined benefit plan.

    B   University endowment.

    C   Life insurance company.

6   A defined benefit plan with a large number of retirees is *likely* to have a high need for

    A   income.

    B   liquidity.

    C   insurance.

7   Which of the following institutional investors is *most likely* to manage investments in mutual funds?

    A   Insurance companies.

    B   Investment companies.

    C   University endowments.

8   With respect to the portfolio management process, the asset allocation is determined in the:

    A   planning step.

    B   feedback step.

    C   execution step.

9   The planning step of the portfolio management process is *least likely* to include an assessment of the client's

    A securities.

    B constraints.

    C risk tolerance.

10 With respect to the portfolio management process, the rebalancing of a portfolio's composition is *most likely* to occur in the:

    A planning step.

    B feedback step.

    C execution step.

11 An analyst gathers the following information for the asset allocations of three portfolios:

Portfolio	Fixed Income (%)	Equity (%)	Alternative Assets (%)
1	25	60	15
2	60	25	15
3	15	60	25

Which of the portfolios is *most likely* appropriate for a client who has a high degree of risk tolerance?

    A Portfolio 1.

    B Portfolio 2.

    C Portfolio 3.

12 Which of the following investment products is *most likely* to trade at their net asset value per share?

    A Exchange traded funds.

    B Open-end mutual funds.

    C Closed-end mutual funds.

13 Which of the following financial products is *least likely* to have a capital gain distribution?

    A Exchange traded funds.

    B Open-end mutual funds.

    C Closed-end mutual funds.

14 Which of the following forms of pooled investments is subject to the *least* amount of regulation?

    A Hedge funds.

    B Exchange traded funds.

    C Closed-end mutual funds.

15 Which of the following pooled investments is *most likely* characterized by a few large investments?

    A Hedge funds.

    B Buyout funds.

    C Venture capital funds.

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).

Thus, moving from the risk-free asset along the capital allocation line, we encounter investors who are willing to accept more risk. At Point P, the investor is 100 percent invested in the optimal risky portfolio. Beyond Point P, the investor accepts even more risk by borrowing money and investing in the optimal risky portfolio.

Note that we are able to accommodate all types of investors with just two portfolios: the risk-free asset and the optimal risky portfolio. Exhibit 28 is also an illustration of the two-fund separation theorem. Portfolio P is the optimal risky portfolio that is selected without regard to investor preferences. The optimal investor portfolio is selected on the capital allocation line by overlaying the indifference curves that incorporate investor preferences.

SUMMARY

This reading provides a description and computation of investment characteristics, such as risk and return, that investors use in evaluating assets for investment. This was followed by sections about portfolio construction, selection of an optimal risky portfolio, and an understanding of risk aversion and indifference curves. Finally, the tangency point of the indifference curves with the capital allocation line allows identification of the optimal investor portfolio. Key concepts covered in the reading include the following:

- Holding period return is most appropriate for a single, predefined holding period.

- Multiperiod returns can be aggregated in many ways. Each return computation has special applications for evaluating investments.

- Risk-averse investors make investment decisions based on the risk–return trade-off, maximizing return for the same risk, and minimizing risk for the same return. They may be concerned, however, by deviations from a normal return distribution and from assumptions of financial markets' operational efficiency.

- Investors are risk averse, and historical data confirm that financial markets price assets for risk-averse investors.

- The risk of a two-asset portfolio is dependent on the proportions of each asset, their standard deviations and the correlation (or covariance) between the asset's returns. As the number of assets in a portfolio increases, the correlation among asset risks becomes a more important determinate of portfolio risk.

- Combining assets with low correlations reduces portfolio risk.

- The two-fund separation theorem allows us to separate decision making into two steps. In the first step, the optimal risky portfolio and the capital allocation line are identified, which are the same for all investors. In the second step, investor risk preferences enable us to find a unique optimal investor portfolio for each investor.

- The addition of a risk-free asset creates portfolios that are dominant to portfolios of risky assets in all cases except for the optimal risky portfolio.

By successfully understanding the content of this reading, you should be comfortable calculating an investor's optimal portfolio given the investor's risk preferences and universe of investable assets available.

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PRACTICE PROBLEMS

1 An investor purchased 100 shares of a stock for $34.50 per share at the beginning of the quarter. If the investor sold all of the shares for $30.50 per share after receiving a $51.55 dividend payment at the end of the quarter, the holding period return is *closest* to:

   A −13.0%.

   B −11.6%.

   C −10.1%.

2 An analyst obtains the following annual rates of return for a mutual fund:

Year	Return (%)
2008	14
2009	−10
2010	−2

   The fund's holding period return over the three-year period is *closest* to:

   A 0.18%.

   B 0.55%.

   C 0.67%.

3 An analyst observes the following annual rates of return for a hedge fund:

Year	Return (%)
2008	22
2009	−25
2010	11

   The hedge fund's annual geometric mean return is *closest* to:

   A 0.52%.

   B 1.02%.

   C 2.67%.

4 Which of the following return calculating methods is *best* for evaluating the annualized returns of a buy-and-hold strategy of an investor who has made annual deposits to an account for each of the last five years?

   A Geometric mean return.

   B Arithmetic mean return.

   C Money-weighted return.

5 An investor performs the following transactions on the shares of a firm.

   ● At $t = 0$, she purchases a share for $1,000.

   ● At $t = 1$, she receives a dividend of $25 and then purchases three additional shares for $1,055 each.

   ● At $t = 2$, she receives a total dividend of $100 and then sells the four shares for $1,100 each.

   The money-weighted rate of return is *closest* to:

   A 4.5%.

B 6.9%.

C 7.3%.

6 A fund receives investments at the beginning of each year and generates returns as shown in the table.

Year of Investment	Assets Under Management at the beginning of each year	Return during Year of Investment
1	$1,000	15%
2	$4,000	14%
3	$45,000	−4%

Which return measure over the three-year period is negative?

A Geometric mean return

B Time-weighted rate of return

C Money-weighted rate of return

7 At the beginning of Year 1, a fund has $10 million under management; it earns a return of 14% for the year. The fund attracts another $100 million at the start of Year 2 and earns a return of 8% for that year. The money-weighted rate of return is *most likely*:

A less than the time-weighted rate of return.

B the same as the time-weighted rate of return.

C greater than the time-weighted rate of return.

8 An investor evaluating the returns of three recently formed exchange-traded funds gathers the following information:

ETF	Time Since Inception	Return Since Inception (%)
1	146 days	4.61
2	5 weeks	1.10
3	15 months	14.35

The ETF with the highest annualized rate of return is:

A ETF 1.

B ETF 2.

C ETF 3.

9 With respect to capital market theory, which of the following asset characteristics is *least likely* to impact the variance of an investor's equally weighted portfolio?

A Return on the asset.

B Standard deviation of the asset.

C Covariances of the asset with the other assets in the portfolio.

10 A portfolio manager creates the following portfolio:

Security	Security Weight (%)	Expected Standard Deviation (%)
1	30	20
2	70	12

If the correlation of returns between the two securities is 0.40, the expected standard deviation of the portfolio is *closest* to:

A   10.7%.

B   11.3%.

C   12.1%.

11 A portfolio manager creates the following portfolio:

Security	Security Weight (%)	Expected Standard Deviation (%)
1	30	20
2	70	12

If the covariance of returns between the two securities is −0.0240, the expected standard deviation of the portfolio is *closest* to:

A   2.4%.

B   7.5%.

C   9.2%.

The following information relates to Questions 12–13

A portfolio manager creates the following portfolio:

Security	Security Weight (%)	Expected Standard Deviation (%)
1	30	20
2	70	12

12 If the standard deviation of the portfolio is 14.40%, the correlation between the two securities is equal to:

A   −1.0.

B   0.0.

C   1.0.

13 If the standard deviation of the portfolio is 14.40%, the covariance between the two securities is equal to:

A   0.0006.

B   0.0240.

C   1.0000.

The following information relates to Questions 14–17

An analyst observes the following historic geometric returns:

Asset Class	Geometric Return (%)
Equities	8.0
Corporate Bonds	6.5
Treasury bills	2.5
Inflation	2.1

14 The real rate of return for equities is *closest* to:

   A 5.4%.

   B 5.8%.

   C 5.9%.

15 The real rate of return for corporate bonds is *closest* to:

   A 4.3%.

   B 4.4%.

   C 4.5%.

16 The risk premium for equities is *closest* to:

   A 5.4%.

   B 5.5%.

   C 5.6%.

17 The risk premium for corporate bonds is *closest* to:

   A 3.5%.

   B 3.9%.

   C 4.0%.

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18 With respect to trading costs, liquidity is *least likely* to impact the:

   A stock price.

   B bid–ask spreads.

   C brokerage commissions.

19 Evidence of risk aversion is *best* illustrated by a risk–return relationship that is:

   A negative.

   B neutral.

   C positive.

20 With respect to risk-averse investors, a risk-free asset will generate a numerical utility that is:

   A the same for all individuals.

   B positive for risk-averse investors.

   C equal to zero for risk seeking investors.

21 With respect to utility theory, the most risk-averse investor will have an indifference curve with the:

   A most convexity.

   B smallest intercept value.

   C greatest slope coefficient.

22 With respect to an investor's utility function expressed as: $U = E(r) - \frac{1}{2}A\sigma^2$,

which of the following values for the measure for risk aversion has the *least* amount of risk aversion?

A   −4.

B   0.

C   4.

The following information relates to Questions 23–26

A financial planner has created the following data to illustrate the application of utility theory to portfolio selection:

Investment	Expected Return (%)	Expected Standard Deviation (%)
1	18	2
2	19	8
3	20	15
4	18	30

23 A risk-neutral investor is *most likely* to choose:

A   Investment 1.

B   Investment 2.

C   Investment 3.

24 If an investor's utility function is expressed as $U = E(r) - \frac{1}{2}A\sigma^2$ and the

measure for risk aversion has a value of −2, the risk-seeking investor is *most likely* to choose:

A   Investment 2.

B   Investment 3.

C   Investment 4.

25 If an investor's utility function is expressed as $U = E(r) - \frac{1}{2}A\sigma^2$ and the

measure for risk aversion has a value of 2, the risk-averse investor is *most likely* to choose:

A   Investment 1.

B   Investment 2.

C   Investment 3.

26 If an investor's utility function is expressed as $U = E(r) - \frac{1}{2}A\sigma^2$ and the

measure for risk aversion has a value of 4, the risk-averse investor is *most likely* to choose:

A   Investment 1.

B Investment 2.

C Investment 3.

---

27 With respect to the mean–variance portfolio theory, the capital allocation line, CAL, is the combination of the risk-free asset and a portfolio of all:

A risky assets.

B equity securities.

C feasible investments.

28 Two individual investors with different levels of risk aversion will have optimal portfolios that are:

A below the capital allocation line.

B on the capital allocation line.

C above the capital allocation line.

The following information relates to Questions 29–31

A portfolio manager creates the following portfolio:

Security	Expected Annual Return (%)	Expected Standard Deviation (%)
1	16	20
2	12	20

29 If the portfolio of the two securities has an expected return of 15%, the proportion invested in Security 1 is:

A 25%.

B 50%.

C 75%.

30 If the correlation of returns between the two securities is −0.15, the expected standard deviation of an equal-weighted portfolio is *closest* to:

A 13.04%.

B 13.60%.

C 13.87%.

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

A 14.00%.

B 14.14%.

C 20.00%.

---

32 As the number of assets in an equally-weighted portfolio increases, the contribution of each individual asset's variance to the volatility of the portfolio:

A increases.

B decreases.

   C remains the same.

33 With respect to an equally-weighted portfolio made up of a large number of assets, which of the following contributes the *most* to the volatility of the portfolio?

   A Average variance of the individual assets.

   B Standard deviation of the individual assets.

   C Average covariance between all pairs of assets.

34 The correlation between assets in a two-asset portfolio increases during a market decline. If there is no change in the proportion of each asset held in the portfolio or the expected standard deviation of the individual assets, the volatility of the portfolio is *most likely* to:

   A increase.

   B decrease.

   C remain the same.

The following information relates to Questions 35–37

An analyst has made the following return projections for each of three possible outcomes with an equal likelihood of occurrence:

Asset	Outcome 1 (%)	Outcome 2 (%)	Outcome 3 (%)	Expected Return (%)
1	12	0	6	6
2	12	6	0	6
3	0	6	12	6

35 Which pair of assets is perfectly negatively correlated?

   A Asset 1 and Asset 2.

   B Asset 1 and Asset 3.

   C Asset 2 and Asset 3.

36 If the analyst constructs two-asset portfolios that are equally-weighted, which pair of assets has the *lowest* expected standard deviation?

   A Asset 1 and Asset 2.

   B Asset 1 and Asset 3.

   C Asset 2 and Asset 3.

37 If the analyst constructs two-asset portfolios that are equally weighted, which pair of assets provides the *least* amount of risk reduction?

   A Asset 1 and Asset 2.

   B Asset 1 and Asset 3.

   C Asset 2 and Asset 3.

38 Which of the following statements is *least* accurate? The efficient frontier is the set of all attainable risky assets with the:

   A highest expected return for a given level of risk.

B lowest amount of risk for a given level of return.

C highest expected return relative to the risk-free rate.

39 The portfolio on the minimum-variance frontier with the lowest standard deviation is:

A unattainable.

B the optimal risky portfolio.

C the global minimum-variance portfolio.

40 The set of portfolios on the minimum-variance frontier that dominates all sets of portfolios below the global minimum-variance portfolio is the:

A capital allocation line.

B Markowitz efficient frontier.

C set of optimal risky portfolios.

41 The dominant capital allocation line is the combination of the risk-free asset and the:

A optimal risky portfolio.

B levered portfolio of risky assets.

C global minimum-variance portfolio.

42 Compared to the efficient frontier of risky assets, the dominant capital allocation line has higher rates of return for levels of risk greater than the optimal risky portfolio because of the investor's ability to:

A lend at the risk-free rate.

B borrow at the risk-free rate.

C purchase the risk-free asset.

43 With respect to the mean–variance theory, the optimal portfolio is determined by each individual investor's:

A risk-free rate.

B borrowing rate.

C risk preference.

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. Computation of the money-weighted return, r, requires finding the discount rate that sums the present value of cash flows to zero.

The first step is to group net cash flows by time. For this example, we have −$1,000 for the $t = 0$ net cash flow, −$3,140 = −$3,165 + $25 for the $t = 1$ net cash flow, and $4,500 = $4,400 + $100 for the $t = 2$ net cash flow

Solving for r,

$$CF_0 = -1,000$$
$$CF_1 = -3,140$$
$$CF_2 = +4,500$$

$$\frac{CF_0}{(1 + IRR)^0} + \frac{CF_1}{(1 + IRR)^1} + \frac{CF_2}{(1 + IRR)^2}$$

$$= \frac{-1,000}{1} + \frac{-3,140}{(1 + IRR)^1} + \frac{4,500}{(1 + IRR)^2} = 0$$

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

6 C is correct. The money-weighted rate of return considers both the timing and amounts of investments into the fund. To calculate the money-weighted rate of return, tabulate the annual returns and investment amounts to determine the cash flows

Year	1	2	3
Balance from previous year	0	$1,150	$4,560
New investment	$1,000	$2,850	$40,440
Net balance at the beginning of year	$1,000	$4,000	$45,000
Investment return for the year	15%	14%	−4%
Investment gain (loss)	$150	$560	−$1,800
Balance at the end of year	$1,150	$4,560	$43,200

$CF_0 = -\$1,000$, $CF_1 = -\$2,850$, $CF_2 = -\$40,440$, $CF_3 = +\$43,200$

Each cash inflow or outflow occurs at the end of each year. Thus, CF_0 refers to the cash flow at the end of Year 0 or beginning of Year 1, and CF_3 refers to the cash flow at end of Year 3 or beginning of Year 4. Because cash flows are being discounted to the present—that is, end of Year 0 or beginning of Year 1—the period of discounting CF_0 is zero whereas the period of discounting for CF_3 is 3 years.

Solving for r,

$$CF_0 = -1,000$$
$$CF_1 = -2,850$$
$$CF_2 = -40,440$$
$$CF_3 = +43,200$$

$$\frac{CF_0}{(1+IRR)^0} + \frac{CF_1}{(1+IRR)^1} + \frac{CF_2}{(1+IRR)^2} + \frac{CF_3}{(1+IRR)^3}$$

$$= \frac{-1,000}{1} + \frac{-2,850}{(1+IRR)^1} + \frac{-40,440}{(1+IRR)^2} + \frac{43,200}{(1+IRR)^3} = 0$$

results in a value of $r = -2.22\%$

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:

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

7 A is correct. Computation of the money-weighted return, r, requires finding the discount rate that sums the present value of cash flows to zero. Because most of the investment came during Year 2, the measure will be biased toward the performance of Year 2. The cash flows are as follows:

$$CF_0 = -10$$

$$CF_1 = -100$$

$$CF_2 = +120.31$$

The terminal value is determined by summing the investment returns for each period $[(10 \times 1.14 \times 1.08) + (100 \times 1.08)]$

$$\frac{CF_0}{(1+IRR)^0} + \frac{CF_1}{(1+IRR)^1} + \frac{CF_2}{(1+IRR)^2}$$

$$= \frac{-10}{1} + \frac{-100}{(1+IRR)^1} + \frac{120.31}{(1+IRR)^2}$$

results in a value of $r = 8.53\%$

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

8 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.

9 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].

10 C is correct.

$$\sigma_{port} = \sqrt{w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2w_1 w_2 \rho_{1,2} \sigma_1 \sigma_2}$$

$$= \sqrt{(0.3)^2 (20\%)^2 + (0.7)^2 (12\%)^2 + 2(0.3)(0.7)(0.40)(20\%)(12\%)}$$

$$= (0.3600\% + 0.7056\% + 0.4032\%)^{0.5} = (1.4688\%)^{0.5} = 12.11\%$$

11 A is correct.

$$\sigma_{port} = \sqrt{w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2w_1 w_2 Cov(R_1 R_2)}$$

$$= \sqrt{(0.3)^2 (20\%)^2 + (0.7)^2 (12\%)^2 + 2(0.3)(0.7)(-0.0240)}$$

$$= (0.3600\% + 0.7056\% - 1.008\%)^{0.5} = (0.0576\%)^{0.5} = 2.40\%$$

12 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.

13 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: $Cov(R_1,R_2) = \rho_{12}\sigma_1\sigma_2 = (1.0)(20\%)(12\%) = 2.40\% = 0.0240$.

14 B is correct. $(1 + 0.080)/(1 + 0.0210) - 1 = 5.8\%$

15 A is correct. $(1 + 0.065)/(1 + 0.0210) - 1 = 4.3\%$

16 A is correct. $(1 + 0.080)/(1 + 0.0250) - 1 = 5.4\%$

17 B is correct. $(1 + 0.0650)/(1 + 0.0250) - 1 = 3.9\%$

18 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).

19 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.

20 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).

21 C is correct. The most risk-averse investor has the indifference curve with the greatest slope.

22 A is correct. A negative value in the given utility function indicates that the investor is a risk seeker.

23 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

24 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

25 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

26 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

27 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.

28 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.

29 C is correct.

$$R_p = w_1 \times R_1 + (1 - w_1) \times R_2$$
$$R_p = w_1 \times 16\% + (1 - w_1) \times 12\%$$
$$15\% = 0.75(16\%) + 0.25(12\%)$$

30 A is correct.

$$\sigma_{port} = \sqrt{w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2 w_1 w_2 \rho_{1,2} \sigma_1 \sigma_2}$$
$$= \sqrt{(0.5)^2 (20\%)^2 + (0.5)^2 (20\%)^2 + 2(0.5)(0.5)(-0.15)(20\%)(20\%)}$$
$$= (1.0000\% + 1.0000\% - 0.3000\%)^{0.5} = (1.7000\%)^{0.5} = 13.04\%$$

31 B is correct.

$$\sigma_{port} = \sqrt{w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2\rho_{1,2}\sigma_1\sigma_2}$$

$$= \sqrt{(0.5)^2(20\%)^2 + (0.5)^2(20\%^2) + 2(0.5)(0.5)(0.00)(20\%)(20\%)}$$

$$= (1.0000\% + 1.0000\% + 0.0000\%)^{0.5} = (2.0000\%)^{0.5} = 14.14\%$$

32 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: $\sigma_p^2 = \dfrac{\overline{\sigma}^2}{N} + \dfrac{N-1}{N}\overline{COV} = \dfrac{\overline{\sigma}^2}{N} + \dfrac{N-1}{N}\overline{\rho}\,\overline{\sigma}^2$.

33 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:

$$\sigma_p^2 = \frac{\overline{\sigma}^2}{N} + \frac{N-1}{N}\overline{COV} = \frac{\overline{\sigma}^2}{N} + \frac{N-1}{N}\overline{\rho}\,\overline{\sigma}^2$$

34 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).

35 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.

36 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).

37 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.

38 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.

39 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.

40 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.

41 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).

42 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.

43 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.

Solution to 3:

Stock P has a negative α and should not be included in the portfolio, unless a negative position can be assumed through short selling. Stocks Q and R have a positive α; therefore, they should be included in the portfolio with positive weights.

The relative weight of Q is 0.04/0.0158 = 2.53.

The relative weight of R is 0.03/0.0137 = 2.19.

Stock Q will have the largest weight among the nonmarket securities to be added to the portfolio. In relative terms, the weight of Q will be 15.5 percent greater than the weight of R (2.53/2.19 = 1.155). As the number of securities increases, the analysis becomes more complex. However, the contribution of each additional security toward improvement in the risk–return trade-off will decrease and eventually disappear, resulting in a well-diversified portfolio.

SUMMARY

In this reading, we discussed the capital asset pricing model in detail and covered related topics such as the capital market line. The reading began with an interpretation of the CML, uses of the market portfolio as a passive management strategy, and leveraging of the market portfolio to obtain a higher expected return. Next, we discussed systematic and nonsystematic risk and why one should not expect to be compensated for taking on nonsystematic risk. The discussion of systematic and nonsystematic risk was followed by an introduction to beta and return-generating models. This broad topic was then broken down into a discussion of the CAPM and, more specifically, the relationship between beta and expected return. The final section included applications of the CAPM to capital budgeting, portfolio performance evaluation, and security selection. The highlights of the reading are as follows.

- The capital market line is a special case of the capital allocation line, where the efficient portfolio is the market portfolio.

- Obtaining a unique optimal risky portfolio is not possible if investors are permitted to have heterogeneous beliefs because such beliefs will result in heterogeneous asset prices.

- Investors can leverage their portfolios by borrowing money and investing in the market.

- Systematic risk is the risk that affects the entire market or economy and is not diversifiable.

- Nonsystematic risk is local and can be diversified away by combining assets with low correlations.

- Beta risk, or systematic risk, is priced and earns a return, whereas nonsystematic risk is not priced.

- The expected return of an asset depends on its beta risk and can be computed using the CAPM, which is given by $E(R_i) = R_f + \beta_i[E(R_m) - R_f]$.

- The security market line is an implementation of the CAPM and applies to all securities, whether they are efficient or not.

- Expected return from the CAPM can be used for making capital budgeting decisions.

- Portfolios can be evaluated by several CAPM-based measures, such as the Sharpe ratio, the Treynor ratio, M^2, and Jensen's alpha.

- The SML can assist in security selection and optimal portfolio construction.

By successfully understanding the content of this reading, you should feel comfortable decomposing total variance into systematic and nonsystematic variance, analyzing beta risk, using the CAPM, and evaluating portfolios and individual securities.

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PRACTICE PROBLEMS

1   The line depicting the total risk and expected return of portfolio combinations
    of a risk-free asset and any risky asset is the:

    A   security market line.

    B   capital allocation line.

    C   security characteristic line.

2   The portfolio of a risk-free asset and a risky asset has a better risk-return
    tradeoff than investing in only one asset type because the correlation between
    the risk-free asset and the risky asset is equal to:

    A   −1.0.

    B   0.0.

    C   1.0.

3   With respect to capital market theory, an investor's optimal portfolio is the
    combination of a risk-free asset and a risky asset with the highest:

    A   expected return.

    B   indifference curve.

    C   capital allocation line slope.

4   Highly risk-averse investors will *most likely* invest the majority of their wealth
    in:

    A   risky assets.

    B   risk-free assets.

    C   the optimal risky portfolio.

5   The capital market line (CML) is the graph of the risk and return of portfolio
    combinations consisting of the risk-free asset and:

    A   any risky portfolio.

    B   the market portfolio.

    C   the leveraged portfolio.

6   Which of the following statements *most accurately* defines the market portfolio
    in capital market theory? The market portfolio consists of all:

    A   risky assets.

    B   tradable assets.

    C   investable assets.

7   With respect to capital market theory, the optimal risky portfolio:

    A   is the market portfolio.

    B   has the highest expected return.

    C   has the lowest expected variance.

8   Relative to portfolios on the CML, any portfolio that plots above the CML is
    considered:

    A   inferior.

    B   inefficient.

    C   unachievable.

9 A portfolio on the capital market line with returns greater than the returns on the market portfolio represents a(n):

    A lending portfolio.

    B borrowing portfolio.

    C unachievable portfolio.

10 With respect to the capital market line, a portfolio on the CML with returns less than the returns on the market portfolio represents a(n):

    A lending portfolio.

    B borrowing portfolio.

    C unachievable portfolio.

11 Which of the following types of risk is *most likely* avoided by forming a diversified portfolio?

    A Total risk.

    B Systematic risk.

    C Nonsystematic risk.

12 Which of the following events is *most likely* an example of nonsystematic risk?

    A A decline in interest rates.

    B The resignation of chief executive officer.

    C An increase in the value of the US dollar.

13 With respect to the pricing of risk in capital market theory, which of the following statements is *most accurate*?

    A All risk is priced.

    B Systematic risk is priced.

    C Nonsystematic risk is priced.

14 The sum of an asset's systematic variance and its nonsystematic variance of returns is equal to the asset's:

    A beta.

    B total risk.

    C total variance.

15 With respect to return-generating models, the intercept term of the market model is the asset's estimated:

    A beta.

    B alpha.

    C variance.

16 With respect to return-generating models, the slope term of the market model is an estimate of the asset's:

    A total risk.

    B systematic risk.

    C nonsystematic risk.

17 With respect to return-generating models, which of the following statements is *most accurate*? Return-generating models are used to directly estimate the:

    A expected return of a security.

    B weights of securities in a portfolio.

    C parameters of the capital market line.

The following information relates to Questions 18–20

An analyst gathers the following information:

Security	Expected Annual Return (%)	Expected Standard Deviation (%)	Correlation between Security and the Market
Security 1	11	25	0.6
Security 2	11	20	0.7
Security 3	14	20	0.8
Market	10	15	1.0

18 Which security has the *highest* total risk?

   A   Security 1.

   B   Security 2.

   C   Security 3.

19 Which security has the *highest* beta measure?

   A   Security 1.

   B   Security 2.

   C   Security 3.

20 Which security has the *least* amount of market risk?

   A   Security 1.

   B   Security 2.

   C   Security 3.

---

21 With respect to capital market theory, the average beta of all assets in the market is:

   A   less than 1.0.

   B   equal to 1.0.

   C   greater than 1.0.

22 The slope of the security characteristic line is an asset's:

   A   beta.

   B   excess return.

   C   risk premium.

23 The graph of the capital asset pricing model is the:

   A   capital market line.

   B   security market line.

   C   security characteristic line.

24 With respect to capital market theory, correctly priced individual assets can be plotted on the:

   A   capital market line.

   B   security market line.

   C   capital allocation line.

25 With respect to the capital asset pricing model, the primary determinant of expected return of an individual asset is the:

   A asset's beta.

   B market risk premium.

   C asset's standard deviation.

26 With respect to the capital asset pricing model, which of the following values of beta for an asset is *most likely* to have an expected return for the asset that is less than the risk-free rate?

   A −0.5

   B 0.0

   C 0.5

27 With respect to the capital asset pricing model, the market risk premium is:

   A less than the excess market return.

   B equal to the excess market return.

   C greater than the excess market return.

The following information relates to Questions 28–31

An analyst gathers the following information:

Security	Expected Standard Deviation (%)	Beta
Security 1	25	1.50
Security 2	15	1.40
Security 3	20	1.60

28 With respect to the capital asset pricing model, if the expected market risk premium is 6% and the risk-free rate is 3%, the expected return for Security 1 is *closest* to:

   A 9.0%.

   B 12.0%.

   C 13.5%.

29 With respect to the capital asset pricing model, if expected return for Security 2 is equal to 11.4% and the risk-free rate is 3%, the expected return for the market is *closest* to:

   A 8.4%.

   B 9.0%.

   C 10.3%.

30 With respect to the capital asset pricing model, if the expected market risk premium is 6% the security with the *highest* expected return is:

   A Security 1.

   B Security 2.

   C Security 3.

31 With respect to the capital asset pricing model, a decline in the expected market return will have the *greatest* impact on the expected return of:

A Security 1.

B Security 2.

C Security 3.

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32 Three equity fund managers have performance records summarized in the following table:

	Mean Annual Return (%)	Standard Deviation of Return (%)
Manager 1	14.38	10.53
Manager 2	9.25	6.35
Manager 3	13.10	8.23

Given a risk-free rate of return of 2.60%, which manager performed best based on the Sharpe ratio?

A Manager 1

B Manager 2

C Manager 3

33 Which of the following performance measures is consistent with the CAPM?

A *M*-squared.

B Sharpe ratio.

C Jensen's alpha.

34 Which of the following performance measures does *not* require the measure to be compared to another value?

A Sharpe ratio.

B Treynor ratio.

C Jensen's alpha.

35 Which of the following performance measures is *most* appropriate for an investor who is *not* fully diversified?

A *M*-squared.

B Treynor ratio.

C Jensen's alpha.

36 Analysts who have estimated returns of an asset to be greater than the expected returns generated by the capital asset pricing model should consider the asset to be:

A overvalued.

B undervalued.

C properly valued.

37 With respect to capital market theory, which of the following statements *best* describes the effect of the homogeneity assumption? Because all investors have the same economic expectations of future cash flows for all assets, investors will invest in:

A the same optimal risky portfolio.

B the Standard and Poor's 500 Index.

C assets with the same amount of risk.

38 With respect to capital market theory, which of the following assumptions allows for the existence of the market portfolio? All investors:

   A are price takers.

   B have homogeneous expectations.

   C plan for the same, single holding period.

39 The intercept of the best fit line formed by plotting the excess returns of a manager's portfolio on the excess returns of the market is *best* described as Jensen's:

   A beta.

   B ratio.

   C alpha.

40 Portfolio managers who are maximizing risk-adjusted returns will seek to invest *more* in securities with:

   A lower values of Jensen's alpha.

   B values of Jensen's alpha equal to 0.

   C higher values of Jensen's alpha.

41 Portfolio managers, who are maximizing risk-adjusted returns, will seek to invest *less* in securities with:

   A lower values for nonsystematic variance.

   B values of nonsystematic variance equal to 0.

   C higher values for nonsystematic variance.

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 risk = 0.25 compared to Security 2 and Security 3 with a total risk of 0.20.

19 C is correct. Security 3 has the highest beta value; $1.07 = \dfrac{\rho_{3,m}\sigma_3}{\sigma_m} = \dfrac{(0.80)(20\%)}{15\%}$ 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; $0.93 = \dfrac{\rho_{2,m}\sigma_2}{\sigma_m} = \dfrac{(0.70)(20\%)}{15\%}$ 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% = 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. The Sharpe ratio $\left(\widehat{SR}\right)$ is the mean excess portfolio return per unit of risk, where a higher Sharpe ratio indicates better performance:

$$\widehat{SR}_1 = \frac{\bar{R}_p - \bar{R}_f}{\hat{\sigma}_p} = \frac{14.38 - 2.60}{10.53} = 1.12$$

$$\widehat{SR}_2 = \frac{\bar{R}_p - \bar{R}_f}{\hat{\sigma}_p} = \frac{9.25 - 2.60}{6.35} = 1.05$$

$$\widehat{SR}_3 = \frac{\bar{R}_p - \bar{R}_f}{\hat{\sigma}_p} = \frac{13.10 - 2.60}{8.23} = 1.28$$

33 C is correct. Jensen's alpha adjusts for systematic risk, and M-squared and the Sharpe Ratio adjust for total risk.

34 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.

35 A is the correct. M-squared adjusts for risk using standard deviation (i.e., total risk).

36 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).

37 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).

38 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.

39 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.

40 C is correct. Since managers are concerned with maximizing risk-adjusted returns, securities with a higher value of Jensen's alpha, α_i, should have a higher weight.

41 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.

indices as well as commodities, enable retail investors to obtain fast, inexpensive, and liquid exposure to asset classes. Robo-advice has further reduced the costs for retail investors to create a well-diversified portfolio.

The second development relates to criticism of asset class return forecasts over relevant time horizons, and the perceived instability of asset class correlations and volatilities. Some market participants argue that poor investment portfolio results reflect the sensitivity of modern portfolio theory-based portfolio construction methodologies to small errors in return forecasts or estimated correlations. In response, practitioners developed an investment approach where asset classes were weighted according to risk contribution. This approach is known as *risk parity investing.* Proponents of risk parity investing argue that traditionally constructed portfolios have considerable risk from equities. That is, the typically high (60% or more) weight of equities in institutional portfolios understates the risk impact: equities tend to be much more volatile than fixed income. Opponents of risk parity argue that following the global financial crisis of 2007–2009, favorable results of risk parity portfolios were caused by the long period of decline in interest rates that benefited bond market performance.

4   CONCLUSION AND SUMMARY

In this reading, we have discussed construction of a client's investment policy statement, including discussion of risk and return objectives and the various constraints that will apply to the portfolio. We have also discussed the portfolio construction process, with emphasis on the strategic asset allocation decisions that must be made.

■ The IPS is the starting point of the portfolio management process. Without a full understanding of the client's situation and requirements, it is unlikely that successful results will be achieved.

■ The IPS can take a variety of forms. A typical format will include the client's investment objectives and also list the constraints that apply to the client's portfolio.

■ The client's objectives are specified in terms of risk tolerance and return requirements.

■ The constraints section covers factors that need to be considered when constructing a portfolio for the client that meets the objectives. The typical constraint categories are liquidity requirements, time horizon, regulatory requirements, tax status, and unique needs.

■ Clients may have personal objections to certain products or practices, which could lead to the exclusion of certain companies, countries, or types of securities from the investable universe as well as the client's benchmark. Such considerations are often referred to as ESG (environmental, social, governance).

■ ESG considerations can be integrated into an investment policy by exclusionary screening, best-in-class selection, active ownership, thematic and impact investing and ESG integration in security analysis.

■ Risk objectives are specifications for portfolio risk that reflect the risk tolerance of the client. Quantitative risk objectives can be absolute or relative or a combination of the two.

■ The client's overall risk tolerance is a function of the client's ability to accept risk and their "risk attitude," which can be considered the client's willingness to take risk.

- The client's return objectives can be stated on an absolute or a relative basis. As an example of an absolute objective, the client may want to achieve a particular percentage rate of return. Alternatively, the return objective can be stated on a relative basis, for example, relative to a benchmark return.

- The liquidity section of the IPS should state what the client's requirements are to draw cash from the portfolio.

- The time horizon section of the IPS should state the time horizon over which the investor is investing. This horizon may be the period during which the portfolio is accumulating before any assets need to be withdrawn.

- Tax status varies among investors and a client's tax status should be stated in the IPS.

- The IPS should state any legal or regulatory restrictions that constrain the investment of the portfolio.

- The unique circumstances section of the IPS should cover any other aspect of a client's circumstances that is likely to have a material impact on the composition of the portfolio. Certain ESG implementation approaches, such as negative (exclusionary) screening, best-in-class, thematic investing, impact investing, and ESG integration may be discussed in this section.

- Asset classes are the building blocks of an asset allocation. An asset class is a category of assets that have similar characteristics, attributes, and risk/return relationships. Traditionally, investors have distinguished cash, equities, bonds, and real estate as the major asset classes.

- A strategic asset allocation results from combining the constraints and objectives articulated in the IPS and capital market expectations regarding the asset classes.

- As time goes on, a client's asset allocation will drift from the target allocation, and the amount of allowable drift as well as a rebalancing policy should be formalized.

- In addition to taking systematic risk, an investment committee may choose to take tactical asset allocation risk or security selection risk. The amount of return attributable to these decisions can be measured.

- ESG considerations may be integrated into the portfolio planning and construction process. Such considerations can be difficult given that ESG data is often not required to be disclosed by companies. ESG implementation approaches require a set of instructions for investment managers with regards to the selection of securities, the exercise of shareholder rights and the selection of investment strategies.

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PRACTICE PROBLEMS

1 Which of the following is *least* important as a reason for a written investment policy statement (IPS)?

   A The IPS may be required by regulation.

   B Having a written IPS is part of best practice for a portfolio manager.

   C Having a written IPS ensures the client's risk and return objectives can be achieved.

2 Which of the following *best* describes the underlying rationale for a written investment policy statement (IPS)?

   A A written IPS communicates a plan for trying to achieve investment success.

   B A written IPS provides investment managers with a ready defense against client lawsuits.

   C A written IPS allows investment managers to instruct clients about the proper use and purpose of investments.

3 A written investment policy statement (IPS) is *most* likely to succeed if:

   A it is created by a software program to assure consistent quality.

   B it is a collaborative effort of the client and the portfolio manager.

   C it reflects the investment philosophy of the portfolio manager.

4 The section of the investment policy statement (IPS) that provides information about how policy may be executed, including investment constraints, is *best* described as the:

   A *Investment Objectives.*

   B *Investment Guidelines.*

   C *Statement of Duties and Responsibilities.*

5 Which of the following is *least* likely to be placed in the appendices to an investment policy statement (IPS)?

   A *Rebalancing Policy.*

   B *Strategic Asset Allocation.*

   C *Statement of Duties and Responsibilities.*

6 Which of the following typical topics in an investment policy statement (IPS) is *most* closely linked to the client's "distinctive needs"?

   A *Procedures.*

   B *Investment Guidelines.*

   C *Statement of Duties and Responsibilities.*

7 An investment policy statement that includes a return objective of outperforming the FTSE 100 by 120 basis points is *best* characterized as having a(n):

   A relative return objective.

   B absolute return objective.

   C arbitrage-based return objective.

8 Risk assessment questionnaires for investment management clients are *most* useful in measuring:

   A value at risk.

    B   ability to take risk.

    C   willingness to take risk.

9 Which of the following is *best* characterized as a relative risk objective?

    A   Value at risk for the fund will not exceed US$3 million.

    B   The fund will not underperform the DAX by more than 250 basis points.

    C   The fund will not lose more than €2.5 million in the coming 12-month period.

10 In preparing an investment policy statement, which of the following is *most* difficult to quantify?

    A   Time horizon.

    B   Ability to accept risk.

    C   Willingness to accept risk.

11 After interviewing a client in order to prepare a written investment policy statement (IPS), you have established the following:

- The client has earnings that vary dramatically between £30,000 and £70,000 (pre-tax) depending on weather patterns in Britain.
- In three of the previous five years, the after-tax income of the client has been less than £20,000.
- The client's mother is dependent on her son (the client) for approximately £9,000 per year support.
- The client's own subsistence needs are approximately £12,000 per year.
- The client has more than 10 years' experience trading investments including commodity futures, stock options, and selling stock short.
- The client's responses to a standard risk assessment questionnaire suggest he has above average risk tolerance.

The client is *best* described as having a:

    A   low ability to take risk, but a high willingness to take risk.

    B   high ability to take risk, but a low willingness to take risk.

    C   high ability to take risk and a high willingness to take risk.

12 After interviewing a client in order to prepare a written investment policy statement (IPS), you have established the following:

- The client has earnings that have exceeded €120,000 (pre-tax) each year for the past five years.
- She has no dependents.
- The client's subsistence needs are approximately €45,000 per year.
- The client states that she feels uncomfortable with her lack of understanding of securities markets.
- All of the client's current savings are invested in short-term securities guaranteed by an agency of her national government.
- The client's responses to a standard risk assessment questionnaire suggest she has low risk tolerance.

The client is *best* described as having a:

    A   low ability to take risk, but a high willingness to take risk.

    B   high ability to take risk, but a low willingness to take risk.

    C   high ability to take risk and a high willingness to take risk.

13 A client who is a 34-year old widow with two healthy young children (aged 5 and 7) has asked you to help her form an investment policy statement. She has been employed as an administrative assistant in a bureau of her national government for the previous 12 years. She has two primary financial goals—her retirement and providing for the college education of her children. This client's time horizon is *best* described as being:

A long term.

B short term.

C medium term.

14 The timing of payouts for property and casualty insurers is unpredictable ("lumpy") in comparison with the timing of payouts for life insurance companies. Therefore, in general, property and casualty insurers have:

A lower liquidity needs than life insurance companies.

B greater liquidity needs than life insurance companies.

C a higher return objective than life insurance companies.

15 A client who is a director of a publicly listed corporation is required by law to refrain from trading that company's stock at certain points of the year when disclosure of financial results are pending. In preparing a written investment policy statement (IPS) for this client, this restriction on trading:

A is irrelevant to the IPS.

B should be included in the IPS.

C makes it illegal for the portfolio manager to work with this client.

16 Consider the pairwise correlations of monthly returns of the following asset classes:

	Brazilian Equities	East Asian Equities	European Equities	US Equities
Brazilian equities	1.00	0.70	0.85	0.76
East Asian equities	0.70	1.00	0.91	0.88
European equities	0.85	0.91	1.00	0.90
US equities	0.76	0.88	0.90	1.00

Based solely on the information in the above table, which equity asset class is *most* sharply distinguished from US equities?

A Brazilian equities.

B European equities.

C East Asian equities.

17 Returns on asset classes are *best* described as being a function of:

A the failure of arbitrage.

B exposure to the idiosyncratic risks of those asset classes.

C exposure to sets of systematic factors relevant to those asset classes.

18 In defining asset classes as part of the strategic asset allocation decision, pairwise correlations within asset classes should generally be:

A equal to correlations among asset classes.

B lower than correlations among asset classes.

C higher than correlations among asset classes.

19 Tactical asset allocation is *best* described as:

A attempts to exploit arbitrage possibilities among asset classes.

B the decision to deliberately deviate from the policy portfolio.

C selecting asset classes with the desired exposures to sources of systematic risk in an investment 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.

> **Solution to 2:**
>
> B is correct. Delta and gamma are measures of the movement in an option price, given a movement in the underlying. The other answers can reflect some elements of derivatives risk, but they are not direct measures of the risk.
>
> **Solution to 3:**
>
> C is correct. VaR measures a minimum loss expected over a holding period a certain percentage of the time. It is not an expected loss nor does it reflect the maximum possible loss, which is the entire equity of the organization.
>
> **Solution to 4:**
>
> C is correct. Scenario analysis and stress testing both examine the performance of a portfolio subject to extreme events. The other two answers are metrics used in portfolio analysis but are not typically associated with extreme events.
>
> **Solution to 5:**
>
> C is correct. Insurance works by pooling risks. It is not necessarily less costly than derivatives nor does it have lower loss limits.

SUMMARY

Success in business and investing requires the skillful selection and management of risks. A well-developed risk management process ties together an organization's goals, strategic competencies, and tools to create value to help it both thrive and survive. Good risk management results in better decision making and a keener assessment of the many important trade-offs in business and investing, helping managers maximize value.

- Risk and risk management are critical to good business and investing. Risk management is *not* only about avoiding risk.

- Taking risk is an active choice by boards and management, investment managers, and individuals. Risks must be understood and carefully chosen and managed.

- Risk exposure is the extent to which an organization's value may be affected through sensitivity to underlying risks.

- Risk management is a process that defines risk tolerance and measures, monitors, and modifies risks to be in line with that tolerance.

- A risk management framework is the infrastructure, processes, and analytics needed to support effective risk management; it includes risk governance, risk identification and measurement, risk infrastructure, risk policies and processes, risk mitigation and management, communication, and strategic risk analysis and integration.

- Risk governance is the top-level foundation for risk management, including risk oversight and setting risk tolerance for the organization.

- Risk identification and measurement is the quantitative and qualitative assessment of all potential sources of risk and the organization's risk exposures.

- Risk infrastructure comprises the resources and systems required to track and assess the organization's risk profile.

- Risk policies and processes are management's complement to risk governance at the operating level.

- Risk mitigation and management is the active monitoring and adjusting of risk exposures, integrating all the other factors of the risk management framework.

- Communication includes risk reporting and active feedback loops so that the risk process improves decision making.

- Strategic risk analysis and integration involves using these risk tools to rigorously sort out the factors that are and are not adding value as well as incorporating this analysis into the management decision process, with the intent of improving outcomes.

- Employing a risk management committee, along with a chief risk officer (CRO), are hallmarks of a strong risk governance framework.

- Governance and the entire risk process should take an enterprise risk management perspective to ensure that the value of the entire enterprise is maximized.

- Risk tolerance, a key element of good risk governance, delineates which risks are acceptable, which are unacceptable, and how much risk the overall organization can be exposed to.

- Risk budgeting is any means of allocating investments or assets by their risk characteristics.

- Financial risks are those that arise from activity in the financial markets.

- Non-financial risks arise from actions within an organization or from external origins, such as the environment, the community, regulators, politicians, suppliers, and customers.

- Financial risks consist of market risk, credit risk, and liquidity risk.

- Market risk arises from movements in stock prices, interest rates, exchange rates, and commodity prices.

- Credit risk is the risk that a counterparty will not pay an amount owed.

- Liquidity risk is the risk that, as a result of degradation in market conditions or the lack of market participants, one will be unable to sell an asset without lowering the price to less than the fundamental value.

- Non-financial risks consist of a variety of risks, including settlement risk, legal risk, regulatory risk, accounting risk, tax risk, model risk, tail risk, and operational risk.

- Operational risk is the risk that arises either from within the operations of an organization or from external events that are beyond the control of the organization but affect its operations. Operational risk can be caused by employees, the weather and natural disasters, vulnerabilities of IT systems, or terrorism.

- Solvency risk is the risk that the organization does not survive or succeed because it runs out of cash to meet its financial obligations.

- Individuals face many of the same organizational risks outlined here but also face health risk, mortality or longevity risk, and property and casualty risk.

- Risks are not necessarily independent because many risks arise as a result of other risks; risk interactions can be extremely non-linear and harmful.

- Risk drivers are the fundamental global and domestic macroeconomic and industry factors that create risk.

- Common measures of risk include standard deviation or volatility; asset-specific measures, such as beta or duration; derivative measures, such as delta, gamma, vega, and rho; and tail measures such as value at risk, CVaR and expected loss given default.

- Risk can be modified by prevention and avoidance, risk transfer (insurance), or risk shifting (derivatives).
- Risk can be mitigated internally through self-insurance or diversification.
- The primary determinants of which method is best for modifying risk are the benefits weighed against the costs, with consideration for the overall final risk profile and adherence to risk governance objectives.

PRACTICE PROBLEMS

1 Risk management in the case of individuals is *best* described as concerned with:
   A hedging risk exposures.
   B maximizing utility while bearing a tolerable level of risk.
   C maximizing utility while avoiding exposure to undesirable risks.

2 Which of the following may be controlled by an investor?
   A Risk
   B Raw returns
   C Risk-adjusted returns

3 The process of risk management includes:
   A minimizing risk.
   B maximizing returns.
   C defining and measuring risks being taken.

4 Risk governance:
   A aligns risk management activities with the goals of the overall enterprise.
   B defines the qualitative assessment and evaluation of potential sources of risk in an organization.
   C delegates responsibility for risk management to all levels of the organization's hierarchy.

5 The factors a risk management framework should address include all of the following *except*:
   A communications.
   B policies and processes.
   C names of responsible individuals.

6 Which of the following is the correct sequence of events for risk governance and management that focuses on the entire enterprise? Establishing:
   A risk tolerance, then risk budgeting, and then risk exposures.
   B risk exposures, then risk tolerance, and then risk budgeting.
   C risk budgeting, then risk exposures, and then risk tolerance.

7 Which of the following *best* describes activities that are supported by a risk management infrastructure?
   A Risk tolerance, budgeting, and reporting
   B Risk tolerance, measurement, and monitoring
   C Risk identification, measurement, and monitoring

8 Effective risk governance in an enterprise provides guidance on all of the following *except*:
   A unacceptable risks.
   B worst losses that may be tolerated.
   C specific methods to mitigate risk for each subsidiary in the enterprise.

9 A firm's risk management committee would be expected to do all of the following *except*:
   A approving the governing body's proposed risk policies.

    B   deliberating the governing body's risk policies at the operational level.

    C   providing top decision-makers with a forum for considering risk management issues.

10 Once an enterprise's risk tolerance is determined, the role of risk management is to:

    A   analyze risk drivers.

    B   align risk exposures with risk appetite.

    C   identify the extent to which the enterprise is willing to fail in meeting its objectives.

11 Which factor should *most* affect a company's ability to tolerate risk?

    A   A stable market environment

    B   The beliefs of the individual board members

    C   The ability to dynamically respond to adverse events

12 Risk budgeting includes all of the following *except*:

    A   determining the target return.

    B   quantifying tolerable risk by specific metrics.

    C   allocating a portfolio by some risk characteristics of the investments.

13 A benefit of risk budgeting is that it:

    A   considers risk tradeoffs.

    B   establishes a firm's risk tolerance.

    C   reduces uncertainty facing the firm.

14 Which of the following risks is *best* described as a financial risk?

    A   Credit

    B   Solvency

    C   Operational

15 Liquidity risk is *most* associated with:

    A   the probability of default.

    B   a widening bid–ask spread.

    C   a poorly functioning market.

16 An example of a non-financial risk is:

    A   market risk.

    B   liquidity risk.

    C   settlement risk.

17 If a company has a one-day 5% Value at Risk of $1 million, this means:

    A   5% of the time the firm is expected to lose at least $1 million in one day.

    B   95% of the time the firm is expected to lose at least $1 million in one day.

    C   5% of the time the firm is expected to lose no more than $1 million in one day.

18 An organization choosing to accept a risk exposure may:

    A   buy insurance.

    B   enter into a derivative contract.

    C   establish a reserve fund to cover losses.

19 The choice of risk-modification method is based on:

    A   minimizing risk at the lowest cost.

B maximizing returns at the lowest cost.

C weighing costs versus benefits in light of the organization's risk tolerance.

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 organization'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 organization 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.

Intermarket analysis can also be used to identify sectors of the equity market to invest in—often in connection with technical observations of the business cycle at any time. The equities of certain industry sectors tend to perform best at the beginning of an economic cycle. These sectors include utilities, financials, consumer nondurables, and transportation stocks. As an economic recovery gets under way, retailers, manufacturers, health care, and consumer durables tend to outperform. Lagging sectors include those tied to commodity prices, such as energy and basic industrial commodities, and also technology stocks.

Observations based on intermarket analysis can also help in allocating funds across national markets. Certain countries' economies are closely tied to commodities—for example, Australia, Canada, and South Africa. As economies evolve, these relationships change. So, the relationships must be monitored closely.

SUMMARY

This reading has introduced the investment tools known as technical analysis. Among the points made are the following:

- Technical analysis is a form of security analysis that uses price and volume market data, often graphically displayed.

- Technical analysis can be used for any freely traded security in the global market and is used on a wide range of financial instruments, such as equities, bonds, commodity futures, and currency futures.

- Technical analysis is the study of market trends or patterns and relies on recognition of patterns that have worked in the past in an attempt to predict future security prices. Technicians believe that market trends and patterns repeat themselves and are somewhat predictable because human behavior tends to repeat itself and is somewhat predictable.

- Another tenet of technical analysis is that the market brings together the collective wisdom of multiple participants, weights it according to the size of the trades they make, and allows analysts to understand this collective sentiment. Technical analysis relies on knowledgeable market participants putting this knowledge to work in the market and thereby influencing prices and volume.

- Technical analysis and fundamental analysis are equally useful and valid, but they approach the market in different ways. Technical analysis focuses solely on analyzing markets and the trading of financial instruments, whereas fundamental analysis is a much wider ranging field encompassing financial and economic analysis as well as analysis of societal and political trends.

- Technical analysis relies primarily on information gathered from market participants that is expressed through the interaction of price and volume. Fundamental analysis relies on information that is external to the market (e.g., economic data, company financial information) in an attempt to evaluate a security's value relative to its current price.

- The usefulness of technical analysis is diminished by any constraints on the security being freely traded, by large outside manipulation of the market, and in illiquid markets.

- Charts provide information about past price behavior and provide a basis for inferences about likely future price behavior. Various types of charts can be useful in studying the markets: line charts, bar charts, candlestick charts, and point and figure charts.

- Relative strength analysis is based on the ratio of the prices of a security to a benchmark and is used to compare the performance of one asset with the performance of another asset.

- Many technicians consider volume information to be very important and watch for the confirmation in volume of a price trend or the divergence of volume from a price trend.

- The concept of trend is perhaps the most important aspect of technical analysis. An uptrend is defined as a security making higher highs and higher lows. To draw an uptrend line, a technician draws a line connecting the lows of the price chart. A downtrend is defined as a security making lower highs and lower lows. To draw a downtrend line, a technician draws a line connecting the highs of the price chart.

- Support is defined as a low price range in which the price stops declining because of buying activity. It is the opposite of resistance, which is a price range in which price stops rising because of selling activity.

- Chart patterns are formations appearing in price charts that create some type of recognizable shape.

- Reversal patterns signal the end of a trend. Common reversal patterns are the head and shoulders, the inverse head and shoulders, double tops and bottoms, and triple tops and bottoms.

- Continuation patterns indicate that a market trend in place prior to the pattern formation will continue once the pattern is completed. Common continuation patterns are triangles, rectangles, flags, and pennants.

- Price-based indicators incorporate information contained in market prices. Common price-based indicators are the moving average and Bollinger Bands.

- Momentum oscillator indicators are constructed from price data, but they are calculated so that they fluctuate either between a high and low, typically 0 and 100, or around 0 or 100. Some examples are momentum (or rate of change) oscillators, the RSI, stochastic measures, and MACD.

- Sentiment indicators attempt to gauge investor activity for signs of increasing bullishness or bearishness. Sentiment indicators come in two forms—investor polls and calculated statistical indexes. Opinion polls to gauge investors' sentiment toward the equity market are conducted by a variety of services. Commonly used calculated statistical indexes are the put/call ratio, the VIX, margin debt, and the short interest ratio.

- Flow-of-funds indicators help technicians gauge potential changes in supply and demand for securities. Some commonly used indicators are the ARMS Index (also called the TRIN), margin debt (also a sentiment indicator), mutual fund liquidity positions, new equity issuance, and secondary equity offerings.

- Many technicians use various observed cycles to predict future movements in security prices; these cycles include Kondratieff waves, decennial patterns, and the US presidential cycle.

- Elliott Wave Theory is an approach to market forecasting that assumes that markets form repetitive wave patterns, which are themselves composed of smaller and smaller subwaves. The relationships among wave heights are frequently Fibonacci ratios.

- Intermarket analysis is based on the principle that all markets are interrelated and influence each other. This approach involves the use of relative strength analysis for different groups of securities (e.g., stocks versus bonds, sectors in an economy, and securities from different countries) to make allocation decisions.

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Brown, Constance M. 2012. *Technical Analysis for the Trading Professional*, 2nd edition. McGraw-Hill.

Murphy, John J. 1991. *Intermarket Technical Analysis: Trading Strategies for the Global Stock, Bond, Commodity, and Currency Markets*. John Wiley & Sons, Inc.

PRACTICE PROBLEMS

1 Technical analysis relies most importantly on:

A price and volume data.

B accurate financial statements.

C fundamental analysis to confirm conclusions.

2 Which of the following is *not* an assumption of technical analysis?

A Security markets are efficient.

B The security under analysis is freely traded.

C Market trends and patterns tend to repeat themselves.

3 Drawbacks of technical analysis include which of the following?

A It identifies changes in trends only after the fact.

B Deviations from intrinsic value can persist for long periods.

C It usually requires detailed knowledge of the financial instrument under analysis.

4 Why is technical analysis especially useful in the analysis of commodities and currencies?

A Valuation models cannot be used to determine fundamental intrinsic value for these securities.

B Government regulators are more likely to intervene in these markets.

C These types of securities display clearer trends than equities and bonds do.

5 A daily bar chart provides:

A a logarithmically scaled horizontal axis.

B a horizontal axis that represents changes in price.

C high and low prices during the day and the day's opening and closing prices.

6 A candlestick chart is similar to a bar chart *except* that the candlestick chart:

A represents upward movements in price with X's.

B also graphically shows the range of the period's highs and lows.

C has a body that is light or dark depending on whether the security closed higher or lower than its open.

7 In analyzing a price chart, high or increasing volume *most likely* indicates which of the following?

A Predicts a reversal in the price trend.

B Predicts that a trendless period will follow.

C Confirms a rising or declining trend in prices.

8 In constructing a chart, using a logarithmic scale on the vertical axis is likely to be *most useful* for which of the following applications?

A The price of gold for the past 100 years.

B The share price of a company over the past month.

C Yields on 10-year US Treasuries for the past 5 years.

9 A downtrend line is constructed by drawing a line connecting:

A the lows of the price chart.

> **B**   the highs of the price chart.
>
> **C**   the highest high to the lowest low of the price chart.

10 Exhibit 1 depicts GreatWall Information Industry Co., Ltd., ordinary shares, traded on the Shenzhen Stock Exchange, for late 2008 through late 2009 in renminbi (RMB).

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

Based on Exhibit 1, the uptrend was *most likely* broken at a price level nearest to:

A   7 RMB.

B   8.5 RMB.

C   10 RMB.

11 The "change in polarity" principle states which of the following?

A   Once an uptrend is broken, it becomes a downtrend.

B   Once a resistance level is breached, it becomes a support level.

C   The short-term moving average has crossed over the longer-term moving average.

12 Exhibit 2 depicts Barclays ordinary shares, traded on the London Stock Exchange, for 2009 in British pence.

Exhibit 2   Candlestick Chart: Barclays plc Price Data, January 2009–January 2010 (Price Measured in British Pence)
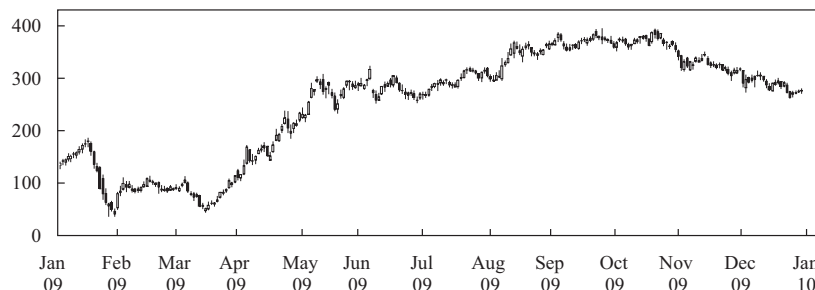
Based on Exhibit 2, Barclays appears to show resistance at a level nearest to:

A   50p.

B   275p.

C   390p.

13 Exhibit 3 depicts Archer Daniels Midland Company common shares, traded on the New York Stock Exchange, for 1996 to 2001 in US dollars.

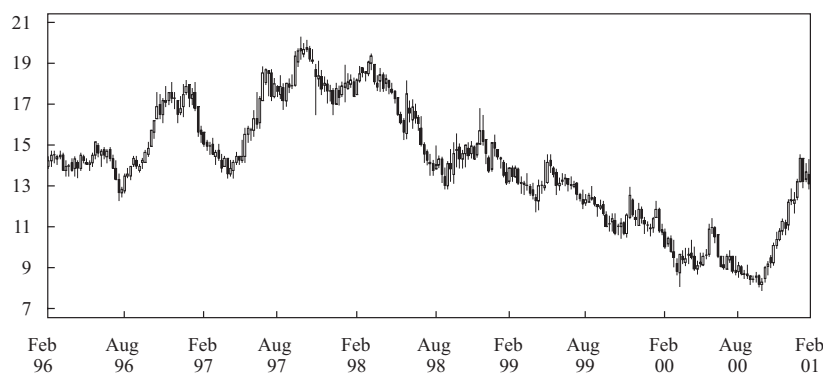**Exhibit 3   Candlestick Chart: Archer Daniels Midland Company, February 1996–February 2001**

Exhibit 3 illustrates *most* clearly which type of pattern?

A   Triangle.

B   Triple top.

C   Head and shoulders.

14 In an inverted head and shoulders pattern, if the neckline is at €100, the shoulders at €90, and the head at €75, the price target is *closest* to which of the following?

A   €50.

B   €110.

C   €125.

15 Which flow-of-funds indicator is considered bearish for equities?

     A   A large increase in the number of IPOs.

     B   Higher-than-average cash balances in mutual funds.

     C   An upturn in margin debt but one that is still below the long-term average.

16   A TRIN with a value of less than 1.0 indicates:

     A   the market is in balance.

     B   there is more volume in rising shares.

     C   there is more volume in declining shares.

17   Bollinger Bands are constructed by plotting:

     A   a MACD line and a signal line.

     B   a moving-average line with an uptrend line above and downtrend line below.

     C   a moving-average line with upper and lower lines that are at a set number of standard deviations apart.

18   Which of the following is *not* a momentum oscillator?

     A   MACD.

     B   Stochastic oscillator.

     C   Bollinger Bands.

19   Which of the following is a continuation pattern?

     A   Triangle.

     B   Triple top.

     C   Head and shoulders.

20   Which of the following is a reversal pattern?

     A   Pennant.

     B   Rectangle.

     C   Double bottom.

21   Which of the following is generally true of the head and shoulders pattern?

     A   Volume is important in interpreting the data.

     B   The neckline, once breached, becomes a support level.

     C   Head and shoulders patterns are generally followed by an uptrend in the security's price.

22   Nikolai Kondratieff concluded in the 1920s that since the 1780s, Western economies have generally followed a cycle of how many years?

     A   18.

     B   54.

     C   76.

23   Based on the decennial pattern of cycles, how would the return of the Dow Jones Industrial Average (DJIA) in the year 2015 compare with the return in 2020?

     A   The return would be better.

     B   The return would be worse.

     C   The answer cannot be determined because the theory does not apply to both of those years.

24   According to the US presidential cycle theory, the DJIA has the best performance during which year?

     A   The presidential election year itself.

     B   The first year following a presidential election.

    C The third year following a presidential election.

25 What is a major problem with long-term cycle theories?

    A The sample size is small.

    B The data are usually hard to observe.

    C They occur over such a long period that they are difficult to discern.

26 In 1938, R. N. Elliott proposed a theory that equity markets move:

    A in stochastic waves.

    B in cycles following Fibonacci ratios.

    C in waves dependent on other securities.

27 All of the following are names of Elliott cycles *except*:

    A presidential.

    B supercycle.

    C grand supercycle.

28 To identify intermarket relationships, technicians commonly use:

    A stochastic oscillators.

    B Fibonacci ratios.

    C relative strength analysis.

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)
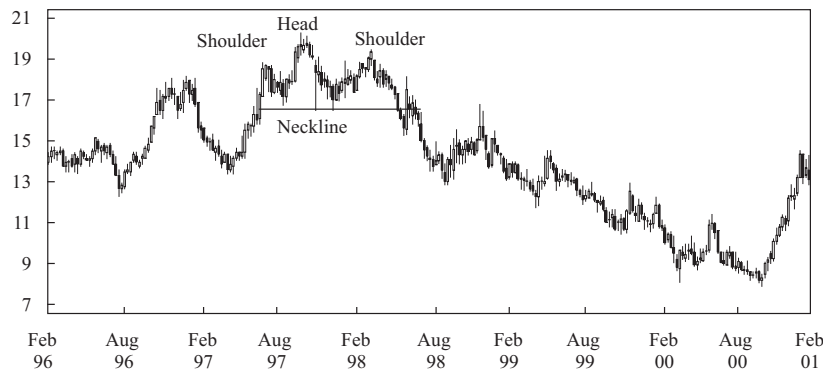
11 B is correct.

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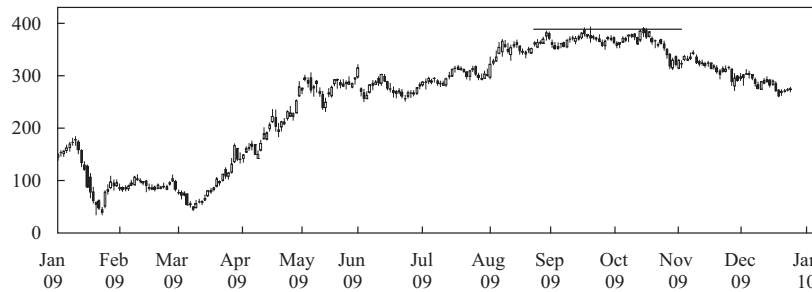
13 C is correct. The left shoulder formed at around US$18.50, the head formed at around US$20.50, and the second shoulder formed at around US$19.

| 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.

DLT Challenges

A number of challenges exist before DLT may be successfully adopted by the investment industry. These include the following:

■ There is a lack of DLT network standardization, as well as difficulty integrating with legacy systems.

■ DLT processing capabilities may not be financially competitive with existing solutions.

■ Increasing the scale of DLT systems requires substantial (storage) resources.

■ Immutability of transactions means accidental or "canceled" trades can be undone only by submitting an equal and offsetting trade.

■ DLT requires huge amounts of computer power normally associated with high electricity usage.

■ Regulatory approaches may differ by jurisdiction.

SUMMARY

■ The term "fintech" refers to technological innovation in the design and delivery of financial services and products.

■ Areas of fintech development include the analysis of large datasets, analytical techniques, automated trading, automated advice, and financial record keeping.

■ Big Data is characterized by the three Vs—volume, velocity, and variety—and includes both traditional and non-traditional (or alternative) datasets.

■ Among the main sources of alternative data are data generated by individuals, business processes, and sensors.

■ Artificial intelligence computer systems are capable of performing tasks that traditionally required human intelligence at levels comparable (or superior) to those of human beings.

■ Machine learning seeks to extract knowledge from large amounts of data by "learning" from known examples and then generating structure or predictions. Simply put, ML algorithms aim to "find the pattern, apply the pattern." Main types of ML include supervised learning, unsupervised learning, and deep learning.

■ Natural language processing is an application of text analytics that uses insight into the structure of human language to analyze and interpret text- and voice-based data.

■ Robo-advisory services are providing automated advisory services to increasing numbers of retail investors. Services include asset allocation, portfolio optimization, trade execution, rebalancing, and tax strategies.

■ Big Data and ML techniques may provide insights into real-time and changing market circumstances to help identify weakening or adverse trends in advance, allowing for improved risk management and investment decision making.

- Algorithmic traders use automated trading programs to determine when, where, and how to trade an order on the basis of pre-specified rules and market conditions. Benefits include speed of executions, lower trading costs, and anonymity.
- Blockchain and distributed ledger technology (DLT) may offer a new way to store, record, and track financial assets on a secure, distributed basis. Applications include cryptocurrencies and tokenization. Additionally, DLT may bring efficiencies to post-trade and compliance processes through automation, smart contracts, and identity verification.

PRACTICE PROBLEMS

1   A correct description of fintech is that it:

     A   is driven by rapid growth in data and related technological advances.

     B   increases the need for intermediaries.

     C   is at its most advanced state using systems that follow specified rules and instructions.

2   A characteristic of Big Data is that:

     A   one of its traditional sources is business processes.

     B   it involves formats with diverse types of structures.

     C   real-time communication of it is uncommon due to vast content.

3   In the use of machine learning (ML):

     A   some techniques are termed "black box" due to data biases.

     B   human judgment is not needed because algorithms continuously learn from data.

     C   training data can be learned too precisely, resulting in inaccurate predictions when used with different datasets.

4   Text Analytics is appropriate for application to:

     A   economic trend analysis.

     B   large, structured datasets.

     C   public but not private information.

5   In providing investment services, robo-advisers are *most likely* to:

     A   rely on their cost effectiveness to pursue active strategies.

     B   offer fairly conservative advice as easily accessible guidance.

     C   be free from regulation when acting as fully-automated wealth managers.

6   Which of the following statements on fintech's use of data as part of risk analysis is correct?

     A   Stress testing requires precise inputs and excludes qualitative data.

     B   Machine learning ensures that traditional and alternative data are fully segregated.

     C   For real-time risk monitoring, data may be aggregated for reporting and used as model inputs.

7   A factor associated with the widespread adoption of algorithmic trading is increased:

     A   market efficiency.

     B   average trade sizes.

     C   trading destinations.

8   A benefit of distributed ledger technology (DLT) favoring its use by the investment industry is its:

     A   scalability of underlying systems.

     B   ease of integration with existing systems.

     C   streamlining of current post-trade processes.

9 What is a distributed ledger technology (DLT) application suited for physical assets?

A Tokenization

B Cryptocurrencies

C Permissioned networks

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.