

## Section E – Professional Ethics

Note: The Part 1 Exam focused on the ethical considerations for management accounting and financial management professionals. That section prepares you for the Part 1 Exam, in which you will demonstrate your understanding of ethical issues impacting **an individual person**. The IMA's **Statement of Ethical Professional Practice**, which defines the IMA's expectations for individual CMAs regarding ethical behavior, was the primary source of material for that Section. We encourage you to reread this statement as background information for this Section of the Exam.

### Ethical Considerations for the Organization

In Part 2, we turn your attention to the ethical considerations **for the organization** as a whole. Here you will demonstrate your knowledge of several topics that we will cover in the upcoming text. The Ethical topics and issues that are relevant to the organization as a whole include:

- Reasons why organizations are an important factor that impact the ethical behavior of individuals,
- Why the creation of an ethics based organizational culture is important,
- Understanding how the external environment impacts ethical business practices of organizations,
- Learning how ethical behavior impacts our daily responsibilities as management accounting professionals, and
- Learning how we can implement an ethics based environment in the organizations where we are employed.

How organizations are an important factor that impact the ethical behavior of their members

It is widely understood that corporate culture impacts behavioral values within an organization. Understanding organizational culture is therefore important for understanding and explaining the ethical behavior of the organization's members. For example, people who share the same culture will tend to share the same values. This common set of values means that decision making and behavior have some level of consistency within the culture and that deviations from the norm regarding behavior are apparent and visible to the other members of that culture. The culture also provides the basis for leadership within the organization. Finally, people within the culture will tend to influence each other and when the corporate culture is strong, this creates a self-sustaining pattern of behavior.

However, an organization's culture is not a static, unchanging, set of values that simply represent the combined values of its individual members. As the organization changes and society changes, the culture of an organization will also slowly change, or evolve. Also, the organization's ethical conduct cannot be viewed in isolation from its members' behavior.

Rather than being separated from the employees, the modern organization is now seen as having responsibilities regarding the ethical conduct of their individual members. In today's organizations we no longer expect that ethical issues impacting the organization are addressed and resolved by each individual in isolation. Instead we expect that the organization will be proactive and provide an environment where the individual employee is encouraged and feels comfortable behaving in an ethical manner that is consistent with the culture of the organization.

This expectation means that the **organization is responsible for creating and defining the ethical standards of behavior** that it expects from its members. It can also mean that the organization must take responsibility for the actions of its members when unethical behavior occurs. Both of these factors are important for the ethical environment that an organization creates.

Creation of this environment is not an easy task in today's world. Globalization of business exposes the modern organization to many cultures and business environments that are different from the home culture of the organization. The IMA summarizes this conflict as follows: "Globalization increases the potential impact of behavioral conflicts. An organization operating in different countries may find that the values and ethical standards of other cultures clash with its own."<sup>m</sup>

So how does an organization create an ethical culture when operating in this complex environment? One way to address this complexity is through creation of a company code of ethics. The IMA states that there is a need for "every organization to define its own principles of behavior by clearly outlining its organizational values and creating a code of ethics and corporate conduct that provides guidance in decision making internally and in relation to external parties and compliance requirements."<sup>n</sup> Such guidance is a critical element in the creation of a framework for ethical management.

A code of ethics is important to the organization and the organization's members for several reasons. Senior management is forced to define and document its expectations to the rest of this organization. This requirement then provides a common standard and understanding of the company's definition of ethical behavior by creating a reference point for the company employees. This reference point provides a framework for decision making in situations where an explicit company policy does not exist.

Note that the importance of a company code of conduct is acknowledged by many external authorities as well. Efforts to create a code of ethics fulfill compliance requirements with legislation in the United States. One section of the Sarbanes Oxley legislation – SOX 406 – makes reference to a corporate code of conduct. Other countries have similar legislation. In addition, many professional associations, such as the IMA, have a code of conduct for their members. These associations even expect their members to respect their code of ethics outside of the work environment. They extend these behavioral and ethical requirements into the personal lives of their members.

### Why is creation of an ethics based organizational culture important?

Other than compliance with regulation and fulfilling external expectations, why should a modern organization invest time, energy and financial resources into the creation and maintenance of its ethical environment? Is the goal simply to comply with the legal requirements that are imposed from outside?

The answer is no. Academic research shows that ethics or values based management provides answers to many issues regarding compliance and corporate obligations. These answers are obtained while still being consistent with the overall corporate objective of creating value for shareholders. This interlocking of goals is achieved when the organization creates an environment where "doing the right thing" is expected of all employees all the time. This expectation is created by actions to educate and train its members in this regard. Steps such as hiring the right people, providing them with training, and practicing ethics based leadership are examples of actions that will provide this payoff.

In fact, creation of a values based organization culture is increasingly seen as being a prerequisite for organizational success. It is necessary because the modern corporation is not able to control behavior of its employees like in the past. Many years ago corporations were managed with strong, onsite, direct control by supervisors. The company employee population was more homogenous and the external environment was less dynamic. Therefore the company itself could provide answers to most of the ethical dilemmas and issues that its employees faced.

Today the modern business environment requires a different approach. Modern organizations are learning to trust their employees through development of a values based environment. The geographic dispersion of operations makes traditional, on site management oversight mechanisms ineffective. A knowledge based work environment requires skilled, well-trained people who need to make decisions and interpret guidelines in dynamic situations where documented policies and procedures do not always exist. This trust that is given to

<sup>m</sup> Institute of Management Accountants, 2008. *Statements on Management Accounting - Values and Ethics: From Inception— to Practice.*

<sup>n</sup> Ibid.

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the employees means that the employees must be expected to do the right thing in the ambiguous situations they will face; and sometimes without much input from top management. Finally, globalization means people from different cultures with different values are working together within one organization. A modern company will have to trust their people outside the home country that they are interpreting and implementing company policy despite the cultural differences that exist between the different countries.

For all of these reasons, this effort to create a values based organizational culture should be seen as an investment in the human resources of the company. The benefits of this investment will lead to improved financial performance because a values based work environment will result in:

- 1) Higher levels of productivity through motivated, engaged employees,
- 2) Better teamwork,
- 3) Less fraud through a sense of ownership and identification with the company, and
- 4) Better business processes and higher quality of services through engaged, committed employees.

#### The external environment that impacts ethical business practices of organizations

One of the main external influences impacting the ethical business practices of organizations is the legal requirements imposed by governments and regulatory agencies. These requirements are put in place by governmental authorities when they judge that organizational behavior is not meeting minimum acceptable standards as defined by the local society. The government essentially decides that if the companies will not do what they are supposed to do by themselves, the government will make the desired behavior the law.

The first and primary legislation impacting corporate ethical business practices in the U.S. is the Foreign Corrupt Practices Act (FCPA). This legislation was established in the late 1970s as a reaction to numerous publicized scandals in which U.S. companies were making bribes and other questionable payments to foreign officials in order to obtain or renew business.

The purpose of the FCPA was to address these scandals. It created a legal framework to punish both individuals **and** companies for making payments to foreign officials that could be judged as bribes. (While this was primarily intended to be applicable to Americans and American companies, there were certain situations in which it could be applied to foreign individuals and companies.) It created the legal requirement that companies **maintain complete, accurate, and reliable accounting records** that represent, in all material aspects, the complete and true nature of business transactions. It was also intended to demonstrate the will of the American government that certain types of business behavior are judged not acceptable in the eyes of the American authorities.

The FCPA applies to any individual, firm, officer, director, employee, or agent of a firm and any stockholder acting on behalf of a firm. Individuals and firms may also be penalized if they order, authorize, or assist someone else to violate the provisions of the FCPA.

The FCPA prohibits payments to foreign officials, politicians, or political parties to obtain or renew business. Its scope includes payments made directly by an organization and also includes any actions to initiate payments by third parties to government officials. Finally, it defines government officials in a broad sense so that the scope of the law is large and all encompassing for individual country situations. For example, payments to a member of the royal family could fall within the scope of the FCPA even if the family member has no formal government position.

Note: The FCPA provides an exception to the general prohibition of payments to foreign officials. Payments to government officials for the performance of routine government services are allowed.

Sometimes it may be difficult to decide whether a payment is being made for routine government services, or is a bribe. In this case the act states that the person making or authorizing the payment must have a **corrupt intent** in order to be found guilty under the FCPA. In other words, the payment must be intended to induce the recipient to misuse his official position to direct business wrongfully to the payer or to any other person.

In addition, the FCPA contains a provision (called an **affirmative defense**) that allows someone to defend themselves if they are accused of violations of an FCPA provision. The accused person can argue that the questionable payments are explicitly legal as per the written laws of the country where the foreign individual is located, part of a demonstration, or required to perform a contractual obligation. In this situation note that the accused person has the responsibility to demonstrate that questionable payments relate to one of these three exceptions.

Another legal requirement for organizations regarding ethical business practices is found in the Sarbanes Oxley (SOX) legislation. Section 406 of SOX refers to a code of ethics for senior financial officers. It states that companies subject to SEC guidelines should develop an ethics policy to ensure that the "tone at the top" of the organization is clearly defined. If no policy is developed, the company must explain why. It is applicable to the company's principal financial officer and comptroller or principal accounting officer, or persons performing similar functions. It defines the code of ethics as a statement of standards that are necessary to promote:

- honest and ethical conduct, including the ethical handling of actual or apparent conflicts of interest between personal and professional relationships,
- full, fair, accurate, timely, and understandable disclosure in the periodic reports required to be filed by the company, and
- compliance with applicable governmental rules and regulations.

It is important to understand the difficulties to legislate ethical behavior because there are important differences between legal requirements and ethical requirements. Legal behavior, for example, is rules based and is specifically defined in the law. A rules based frame of reference, however, cannot cover all possible issues that someone can face. Ethical behavior, on the other hand, is principles based. Therefore it provides a general guideline for independent judgment and decision making where a rule does not exist. Legal behavior is also based upon external pressure to comply with some standard of behavior that is imposed from outside the organization. Ethical behavior is based upon standards set by the individual or company. Ideally, these standards will become embedded within the organization and its members. Ethical behavior is therefore based upon voluntary compliance with a set of values whereas legal based behavior is based upon the required compliance with a set of written laws.

Another external factor influencing organizational ethical behavior is peer pressure by professional and business associations. This influence exists, in part, to address these differences between legal and value based behavior. Many organizations, including the IMA, have developed a set of ethical standards that they require their members to respect and comply with in both their professional and personal lives. This code of ethics of a professional organization needs to be complied with as well as the code of ethics of the company where a professional works. An individual who is a member of a number of different organizations will have a number of Codes of Ethics that they must follow.

Finally, today's commercial pressures are pushing the modern corporation towards rethinking its approach to ethical behavior and values based management. Compliance with the laws of one country is not enough in an environment that is characterized by growing globalization and dispersed operations. Values based behavior that crosses borders and cultures is becoming the norm. As with an individual who is a member of multiple professional organizations, a company that has a presence in multiple countries will need to be in compliance with the legal and ethics requirements of each country. Having a strong, global, internal code of ethics should help ensure that the company, and its employees, will be in compliance with all of the local requirements where it operates.

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#### How ethical behavior impacts daily responsibilities as accounting professionals

The starting point is to emphasize that promotion of an ethical culture in the organization is one of the responsibilities of today's management accounting professional. The IMA expects its members to be able to apply the relevant provisions of IMA's Statement on Management Accounting: "Values and Ethics: From Inception to Practice" to typical business situations. You should read this statement because it provides further details how a management accountant can proceed to help their organization to clarify, define, and develop their values and create their code of ethical conduct. It also explains the role of the management accountant, no matter at what level of the organization, in the ongoing development and maintenance of the organization's ethical environment once it is implemented.

**Internal control** and **risk management** are the primary areas where management accountants have a responsibility to act as change agents within their organizations where ethics are concerned.

There is, for example, a strong relationship between ethics and internal controls. Most people agree that a comprehensive framework of corporate ethical behavior is a prerequisite for an effective system of internal control.

This is because human behavior is a driving factor regarding control systems and the control environment of an organization. Ethics and values, as we have seen, drive human behavior. One way to look at the situation is to understand how a reasonable person would behave in a specific organization in a situation where explicit company policy guidelines are not available. Is there a values based framework available for decision making? Or will the person be forced to revert to personal individual values to resolve an ethical dilemma? If the reasonable person is left unsupported to resolve the ethical conflict, this puts at risk the organization's internal control objectives because an individual is making this decision based on their personal values and not the values of the company.

Second, the risk assessment of the organization needs to consider human behavior as a risk. As mentioned above, we do not know how a reasonable person would behave in a specific situation. The absence of a values based ethical environment could result in higher risk for the organization because a compliance/rules based environment will not be able to cover all possible situations to which an employee is exposed. This vacuum of guidance creates risk since the resolution of issues will be based upon personal values of individuals that may be inconsistent with the overall company values. An ethics/values based environment, however, provides a framework for decision making by employees when company policy does not provide a specific answer. This framework should help lead to answers that are consistent with the company's overall objectives. This fact helps ensure consistency in decisions and a common understanding of expected behaviors since personal values of each individual will not be an important driving factor in decisions.

In addition, the changing nature of organizations means that a rules-based compliance culture has limitations compared to a values-based culture. These limitations create risk for the organization because a rules based culture may not be flexible enough to address several characteristics of today's business environment including the:

- Growing geographic dispersion of operations,
- Decentralized nature of the operations,
- Fast changing business and statutory environments, and
- Knowledge based businesses where employee skills and involvement are more important than in the past

Finally, the tone at the top of the control environment is the basis for internal control within an organization. Does that tone reflect a genuine commitment to values based behavior? Is there leadership by example in the organization that helps establish and determine its ethical environment? The management accountant has to be aware of this environment in any risk or internal control assessment that he/she performs.

The tone at the top is an important issue for a company because leadership by example is a key prerequisite to understanding the organization's ethical environment. It demonstrates credibility of the ethical environment if senior management behaves in a manner consistent with the organization's stated written values. Managers themselves, as individuals, are also more credible if they act in the same way that they expect their subordinates to act. Management's actions also become a reference point for the rest of the organization – they become the role models for the company's values.

At this point it is important to recognize that issues regarding ethical behavior are often not easily classified in terms of right and wrong. You will rarely find that someone will ask you to do something that is explicitly in violation of an organization's stated ethics policy. Instead conflict situations are more subtle. What does it mean, for example, if a chief executive officer (CEO) says to "do what it takes" to achieve an objective. What are the boundaries implied in that message? What about a situation where the CEO states that your job is at risk if the organization does not achieve a goal. Does that justify a more flexible interpretation of the company policy? What happens if you observe inappropriate behavior by other people in your organization when the CEO makes statements like that? What is the right course of action? What happens if you observe that your immediate supervisor is behaving in an inappropriate manner? What do you do if you are afraid of the consequences if you openly report this behavior to someone else in the organization?

Many organizations, including the IMA, have created **confidential ethics helplines** to help their people to resolve these types of conflicts. The goal is to create a structured "whistle blowing framework" within the organization that can help to maintain an ethical organizational culture over the long term under these types of stresses and strains that exist in the real world.

Academic research shows that this type of structured, confidential communication channel is one of the six important conditions to create a value/ethics based organization. The approach works because it provides a forum to help people overcome fear or apprehension to speak openly when they see others not behaving in an appropriate manner. There is less need to fear retribution if conflicts become known. A confidential ethics hotline also provides a formal process to bypass immediate supervisors. When the supervisor is the person who is behaving inappropriately, this ability to make a confidential report could make a difference between an individual reporting the event and not reporting it.

SOX 406 and other similar legal requirements in many countries strongly encourage the creation of an ethics hotline. This means that an organization will fulfill a basic legal compliance requirement if it implements an ethics hotline. However there are other benefits to be achieved as well. Management may obtain valuable feedback from an ethics hotline regarding their organization. Tracking and monitoring the reported issues provides management the basis to implement controls and understand the real world environment within their organizations. Issues are therefore resolved at early stages and problems are avoided.

### How can management accountants help to implement an ethics-based environment in the organizations where they are employed?

Employee training, implementation of appropriate internal controls, and monitoring of the results will be the primary areas where management accountants can help with the implementation of an ethics based environment in the organizations where they are employed.

Training is important to create awareness of the standards against which individual behavior will be measured. Management accountants should help to develop training programs that will promote the creation and maintenance of an ethical culture. Everyone, even senior management, should receive the training, because such training will help to deliver a standardized message across the organization.

Examples of the topics to include in this training include:

- 1) Standards for interpersonal behavior within the company,
- 2) Prohibited business practices,
- 3) Dissemination and understanding of the company core values,
- 4) How to apply theoretical core values into real life situations, and
- 5) Providing leadership regarding ethical behavior.

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There are a number of important considerations for the company's training programs. It should focus on an understanding of the company's specific requirements and apply to real work situations for the employees. This focus will make the training relevant and meaningful because employees will learn that ethical guidelines can be applied as a basis for decision making in their actual work environment. There should be a mix of both standard themes and specific details. The general ethical culture and themes in the training should be standardized across the organization for all employee levels, so that a consistent and relevant message is delivered throughout the organization. At the same time, the training content will probably need to be different for employees at different levels within the company because each level of the company is exposed to different issues. For example, sales people are more likely to face issues regarding offering bribes and inappropriate payments to customers to win business. The purchasing department, on the other hand, may be offered bribes. Finally, the training needs to be updated and repeated on a regular basis. Ethics training should not be seen as a one-time event. Not only do new people join the company, but long-term employees need to see that the training continues to be relevant to them and the company.

Employee training is important for maintaining an ethical organizational culture for several reasons. It ensures that all levels of the company understand the company's ethical standards. It provides management with the opportunity to demonstrate commitment to the company's ethical standards. It helps to reinforce the development of an ethical organization culture so that it can become self-sustaining. The concept of self-sustaining in this context means that it is understood and lived by the people of the organization as a basis for their behavior and decision making when written company requirements are not available for a situation.

Organizations will face additional issues when implementing their values and ethical standards internationally. Management accountants will need to recognize these risks and help their organizations to adapt the training accordingly.

For example, cross cultural communication barriers will exist regarding languages. Should the organization rely on an English language only policy? If yes, what are the issues to consider regarding people who do not understand English? Or should the organization translate its ethics policy into foreign languages? If yes, how can the organization ensure that the translation reflects the spirit and intent of the original policy?

We have already discussed that culture impacts behavior. Organizations will have to learn how the foreign cultures in their organizations impact their ethical environment. For example, the management accountant may observe deviations from the company requirements in other countries. The next question to ask is whether these deviations are based upon cultural differences or based upon individual behavior. The appropriate response to a deviation will be impacted by the answer to this question.

Often organizations will find that values and standards of ethical behavior are not universally shared around the world. Behavior that is considered rude and inappropriate in one society may be perfectly acceptable behavior in another. How does the management accountant help to create an environment that overcomes this type of barrier?

In whatever way the organization decides to address these issues, ethical behavior needs to be defined in a way that the company standards can be applied consistently across the organization geographically. Delivering a consistent message is important. The company needs to be prepared to make sacrifices in some areas to ensure that its values are respected. Exceptions based upon geographical situations mean that the values are not universal within the organization.

How does the management accountant identify these exceptions? Or more importantly, what management tools exist to help the management accountant to proceed when their organization wants them to help create an internal control structure related to ethical and behavioral issues?

There are three tools that can be used to identify process controls related to ethical or behavioral issues:

- 1) **Continual Process Improvement** involves the constant monitoring of business processes as a basis to learn from experience and to adapt to new situations before they create major problems. The goal for the management accountant is to help create a "learning organization" which provides the basis for the organization to manage the impact of changes to the organization. Examples of these changes that need to be managed include new people joining the organization, new foreign geographical locations joining the organization with the associated different set of values, people with experience leaving, and new legal requirements being decided in the locations where the organization operates.
- 2) **Business Process Reengineering** is the process of analyzing the individual activities of a process as a basis to determine the most effective way to fulfill the process. By using this approach the management accountant will understand the risks associated with each activity. This understanding provides the basis to predict how a reasonable person would behave in a certain circumstance. Thereafter the management accountant will establish controls based upon an understanding of the business process activity and the associated risk to identify deviations from expected desired behavior.
- 3) **Quality Management** is based upon the goal of preventing mistakes from occurring by identifying and evaluating risk situations in advance. Once risk situations are identified, the management accountant develops alternative strategies to avoid the risk situations. The goal is to identify situations where risks exist that will result in employee behavior that does not follow accepted norms of ethical behavior. As the situations are identified and risks are analyzed, the management accountant implements controls to monitor the risks.

Examples of the primary quality management tools include:

- **Failure Mode and Effects Analysis (FMEA)** – Failure mode and effects analysis is used for risk mitigation in both product and process development. Failure modes are errors or defects in a process, design or item, especially errors or defects that affect the customer. Failure modes can be actual or potential. A failure mode and effects analysis analyzes potential failure modes in an organization's products or processes, studies the consequences of the potential failures, and classifies them according to their severity and likelihood of occurring. The failure modes are identified by looking at past experience with similar products or processes. Once a failure mode has been identified, the team looks for ways to try to eliminate it; or, if it cannot be eliminated, to minimize the severity of the failure, reduce its occurrence, and/or improve detection if it occurs. Ideally, FMEA begins during the earliest conceptual stages of design and continues throughout the life of the product or service. FMEA is used extensively in manufacturing and is beginning to be used in services industries as well.

FMEA is used during the product development stage with the goal of avoiding future failures. The way in which a company brings products and services to the marketplace reflects its ethics. Management accountants are needed in the product development stage to make sure that controls are in place at the point where decisions are being made regarding materials usage, processing product support and disposal. Controls are needed to ensure that products and/or processes are designed to minimize cost, ensure quality, and maintain an ethical environment.

After the development stage, FMEA is used for process control during ongoing operation of the process. Ethical behavior needs to be integrated with activities such as contract negotiations, selection of suppliers, processing controls, prevention of fraud in both the buying and selling processes, maintaining ethical and legal methods of waste disposal, preventing the use of corporate assets for noncorporate purposes, preventing misappropriation of funds and ensuring that the organization continues to support its products and services after the sale, even if that entails a massive recall that will lead to major losses for the organization.



In analyzing product development and ongoing processes for the risk of ethical failures, whenever the potential for a failure is identified, it can be analyzed and action can be taken in advance to mitigate the risk.

- **Poka Yoke assessment** – “Poka yoke” (pronounced “poh-kah yoh-kay”) comes from two Japanese words that mean “to avoid inadvertent errors.” It means to error proof or mistake proof production or something else. In production, the objective is to eliminate or at least minimize the need for inspections by eliminating errors, thereby eliminating the need to find them and correct them. Objects like fixtures, jigs, warning devices, and so forth are used to prevent people from making mistakes. They do things like stopping a machine and alerting the operator if something is going wrong. An example of a poka yoke device in everyday life is a memory card that is designed to be inserted into a digital camera in only one direction so that it is impossible to insert it incorrectly

While there can be no assurance that internal control actions will make ethical violations impossible, control measures can be taken to make it very difficult to commit an ethical violation.

- **Six Sigma process analysis techniques** – Six Sigma is an approach to quality that strives to virtually eliminate defects. To achieve Six Sigma, a process must produce no more than 3.4 defects per million opportunities. “Opportunities” refers to the number of opportunities for nonconformance or not meeting the required specifications. It is the total number of parts, components and designs in a product, any of which could be defective. If a product has 10,000 parts, components and designs, for example, 3:4 defects per million would amount to 34 products out of every 1,000 that would have **some** defect. The goal of Six Sigma is to improve customer satisfaction by reducing and eliminating defects, which will lead to greater profitability.

Quality in products, processes and activities requires controlled conditions, and management needs to be aware of all regulatory requirements and make sure that ethical compliance with the requirements is part of the quality management system.

Once the necessary controls related to ethical and behavioral issues are identified, the management accountant will need to help the organization monitor them to understand the state of ethical compliance in the organization.

Monitoring the status of the controls is important for several reasons. The outcome informs senior management about the implementation status of the company ethics policy. Based upon this awareness the company’s management can take remediation action if issues are identified.

Two approaches of monitoring will help. In general each approach involves asking people questions in order to learn what they know and how much they understand about the company’s ethical values.

- 1) **Human Performance Feedback Loop** involves including ethics in the performance management process for individual employees. The approach is focused on the individual and is conducted openly between individuals and their immediate supervisors. Ideally the approach is built into company human resource management processes and employee performance is measured against specific goals to ensure that the company’s ethical expectations of its employees are effective and understood.
- 2) **Survey Tools** involve submitting survey questions to the company’s employees regarding the company’s ethics policies and asking for anonymous written responses. In this approach the employee provides answers based upon standard choices. The entire employee population, or at least large portions, is involved. This gives senior management and the board of directors information about how well the organization’s code of ethics is being understood and followed.

## Appendix A – Time Value of Money (Present/Future Value)

The present value of future cash flows is one of the underlying concepts of capital budgeting. It is critical that you understand how to work with and calculate the present value of future cash flows. On the exam, when there is a question that requires a present value calculation, you will be given access to the present value tables. This is usually done with a button on the screen that you click, though it may also be done by including the table values within the question itself. These tables are included in this appendix for reference.

**Exam Related Note:** On the exam, you should be given the PV and FV tables. You will be able to access them through a link on the question screen. It is not expected that you need to know the formulas used to calculate the tables, but simply how to use the tables. However, if the table is omitted through an oversight, just go back to another problem where the table is given. It would be a good idea to write down the numbers of the problems where the tables are found as you go through the exam, so you can get back to one of them easily if necessary.

On the exam, you will be given access to four tables, the present value of \$1, the present value of an ordinary \$1 annuity, the future value of \$1 and the future value of a \$1 annuity. You do not need the future value tables. They are not used for anything on the exam, and you may ignore them.

Our discussion below includes a discussion of the present value of \$1 and the present value of an annuity. A detailed understanding of the math behind these calculations is not necessary. You simply need to know how to calculate the present value of either a single sum or an annuity.

### Present Value of \$1 (A Single Sum)

The present value (PV) of \$1 is how much money you need today in order to have some known amount in the future. In other words, if I need to pay you \$100 in one year's time, the present value is how much money I need to put into the bank today so that with interest, the amount that I deposit will be worth \$100 in one year. Obviously, the amount I need to deposit depends on the interest rate, but the amount will be less than \$100. The higher the interest rate, the smaller this amount will be. Also, if I did not need to pay the \$100 for a period of five years, the amount that I would need to deposit today would be even less than the amount I would need to deposit today to have \$100 in one year, because there will be five years of interest earned instead of only one. Present value depends on both the interest rate and the number of periods there are from the present date to the future date.

To calculate the present value of any amount, we can use the Present Value of \$1 Table. This table is set up to give the PV factor, given a certain interest rate and a certain number of periods. Since the factor represents the present value of \$1, to calculate the present value of an amount of \$X, we simply multiply that \$X amount by the PV factor that we obtained from the table.

### Present Value of an Annuity (Stream of Cash)

In addition to the present value and future value of \$1, we may also be required to calculate the **present value** or **future value of an annuity**. An annuity is simply a constant stream of the same amount of cash either paid or received regularly over a period of time and at the same point in each period. We can use an annuity factor to calculate a present or future value of an annuity **if and only if**:

- 1) The amount to be received or paid is a **constant amount** for each and every payment; **and**
- 2) This amount will be received or paid **at the same point in every period**.

For example, we could use the present value of an annuity table to calculate the present value of an amount of \$10,000 to be received each year on December 31 for five years. However, if the amount to be received were \$8,000 for the first two years, \$10,000 for the next two years and \$14,000 for the final year, we could not use the annuity table. When the amount of money changes over time – as it does in most capital budgeting situations – we need to calculate the present value of each annual amount individually. We use the Present Value of \$1 Table to find the factor for each annual amount, and for each amount we use a different

number of periods, depending on the number of periods it will be until that amount is received. We then add all the present values together. In the example above, we would find the present value of \$8,000 to be received in one year, then the present value of \$8,000 to be received in two years, then the present value of \$10,000 to be received in three years, and so forth. After calculating the present values of all of the five amounts to be received, we would add them up to get the total present value of all the amounts to be received.

There are two types of annuities:

- An **annuity in arrears** (also called an **ordinary annuity**) is an annuity with payments made or received at the **end** of each period (for example, December 31). Whether you are working with the present value of an annuity or the future value of an annuity, the annuity in arrears always means the payments occur at the **end** of each period.
- An **annuity due** is an annuity with payments made or received at the **beginning** of each period (for example, January 1). Like the annuity in arrears, it makes no difference whether you are computing present value or future value of an annuity due – an annuity due always means the payments occur at the **beginning** of each period.

**The following information is for the next two Questions:** Crown Corporation has agreed to sell some used computer equipment to Bob Parsons, a company employee, for \$5,000. Crown and Parsons have been discussing alternative financing arrangements for the sale. The information in the following column is pertinent to these discussions.

| Present Value of an Ordinary Annuity of \$1 |       |       |       |       |
|---|-------|-------|-------|-------|
| Payments                                    | 5%    | 6%    | 7%    | 8%    |
| 2   | 1.859 | 1.833 | 1.808 | 1.783 |
| 3   | 2.723 | 2.673 | 2.624 | 2.577 |
| 4   | 3.546 | 3.465 | 3.387 | 3.312 |
| 5   | 4.329 | 4.212 | 4.100 | 3.993 |

Question 70: Crown has offered to accept a \$1,000 down payment and set up a note receivable for Bob Parsons that calls for a \$1,000 payment at the end of this year and the next three years. If Crown uses a 6% discount rate, the present value of the note receivable would be:

- a) \$2,940
- b) \$4,465
- c) \$4,212
- d) \$3,465

Question 71: Bob Parsons has agreed to the immediate down payment of \$1,000 but would like the note for \$4,000 to be payable in full at the end of the fourth year. Because of the increased risk associated with the terms of this note, Crown Corporation would apply an 8% discount rate. The present value of this note would be:

- a) \$2,940
- b) \$3,312
- c) \$3,940
- d) \$2,557

(CMA Adapted)

## Time Value of Money

### CMA Part 2

Question 72: A corporation is contemplating the purchase of a new piece of equipment with a purchase price of \$500,000. It plans to make a 10% down payment and will receive a loan for 25 years at 10% interest. The present value interest factor for an annuity of \$1 per year for 25 years at 10% is 9.8226. The annual payment (to the nearest dollar) required on the loan will be:

- a) \$18,000
- b) \$45,813
- c) \$45,000
- d) \$50,903

(CIA Adapted)

Question 73: Janet Taylor Casual Wear has \$75,000 in a bank account as of December 31, Year 1. If the company plans on depositing \$4,000 in the account at the end of each of the next 3 years (Year 2, Year 3 and Year 4) and all amounts in the account earn 8% per year, what will the account balance be at December 31, Year 4? Ignore the effect of income taxes.

| 8% Interest Rate Factors |                     |                            |
|--------------------------|---------------------|----------------------------|
| Period                   | Future Value        | Future Value of            |
|                          | of an Amount of \$1 | an Ordinary Annuity of \$1 |
| 1                        | 1.08                | 1.00                       |
| 2                        | 1.17                | 2.08                       |
| 3                        | 1.26                | 3.25                       |
| 4                        | 1.36                | 4.51                       |

- a) \$87,000
- b) \$88,000
- c) \$96,070
- d) \$107,500

(CMA Adapted)

Present Value of \$1 Table

|                   |    | Interest Rate |      |      |      |      |      |      |      |      |      |      |      |      |      |      |    |
|-------------------|----|---------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|----|
| Number of Periods |    | 1%            | 2%   | 3%   | 4%   | 5%   | 6%   | 7%   | 8%   | 9%   | 10%  | 12%  | 14%  | 16%  | 18%  | 20%  |    |
|                   | 1  | .990          | .980 | .971 | .962 | .952 | .943 | .935 | .926 | .917 | .909 | .893 | .877 | .862 | .847 | .833 | 1  |
|                   | 2  | .980          | .961 | .943 | .925 | .907 | .890 | .873 | .857 | .842 | .826 | .797 | .769 | .743 | .718 | .694 | 2  |
|                   | 3  | .971          | .942 | .915 | .889 | .864 | .840 | .816 | .794 | .772 | .751 | .712 | .675 | .641 | .609 | .579 | 3  |
|                   | 4  | .961          | .924 | .888 | .855 | .823 | .792 | .763 | .735 | .708 | .683 | .636 | .592 | .552 | .516 | .482 | 4  |
|                   | 5  | .951          | .906 | .863 | .822 | .784 | .747 | .713 | .681 | .650 | .621 | .567 | .519 | .476 | .437 | .402 | 5  |
|                   | 6  | .942          | .888 | .837 | .790 | .746 | .705 | .666 | .630 | .596 | .564 | .507 | .456 | .410 | .370 | .335 | 6  |
|                   | 7  | .933          | .871 | .813 | .760 | .711 | .665 | .623 | .583 | .547 | .513 | .452 | .400 | .354 | .314 | .279 | 7  |
|                   | 8  | .923          | .853 | .789 | .731 | .677 | .627 | .582 | .540 | .502 | .467 | .404 | .351 | .305 | .266 | .233 | 8  |
|                   | 9  | .914          | .837 | .766 | .703 | .645 | .592 | .544 | .500 | .460 | .424 | .361 | .308 | .263 | .225 | .194 | 9  |
|                   | 10 | .905          | .820 | .744 | .676 | .614 | .558 | .508 | .463 | .422 | .386 | .322 | .270 | .227 | .191 | .162 | 10 |
|                   | 11 | .896          | .804 | .722 | .650 | .585 | .527 | .475 | .429 | .388 | .350 | .287 | .237 | .195 | .162 | .135 | 11 |
|                   | 12 | .887          | .788 | .701 | .625 | .557 | .497 | .444 | .397 | .356 | .319 | .257 | .208 | .168 | .137 | .112 | 12 |
|                   | 13 | .879          | .773 | .681 | .601 | .530 | .469 | .415 | .368 | .326 | .290 | .229 | .182 | .145 | .116 | .093 | 13 |
|                   | 14 | .870          | .758 | .661 | .577 | .505 | .442 | .388 | .340 | .299 | .263 | .205 | .160 | .125 | .099 | .078 | 14 |
|                   | 15 | .861          | .743 | .642 | .555 | .481 | .417 | .362 | .315 | .275 | .239 | .183 | .140 | .108 | .084 | .065 | 15 |
|                   | 16 | .853          | .728 | .623 | .534 | .458 | .394 | .339 | .292 | .252 | .218 | .163 | .123 | .093 | .071 | .054 | 16 |
|                   | 18 | .836          | .700 | .587 | .494 | .416 | .350 | .296 | .250 | .212 | .180 | .130 | .095 | .069 | .051 | .038 | 18 |
|                   | 20 | .820          | .673 | .554 | .456 | .377 | .312 | .258 | .215 | .178 | .149 | .104 | .073 | .051 | .037 | .026 | 20 |
|                   | 30 | .742          | .552 | .412 | .308 | .231 | .174 | .131 | .099 | .075 | .057 | .033 | .020 | .012 | .007 | .004 | 30 |
|                   | 40 | .672          | .453 | .307 | .208 | .142 | .097 | .067 | .046 | .032 | .022 | .011 | .005 | .003 | .001 | .001 | 40 |

Present Value of a \$1 Annuity Table

| Number of Periods |  | Interest Rate |        |        |        |        |        |        |        |        |       |       |       |       |       |       |  |  |  |  |  |  |  |  |  |
|-------------------|--|---------------|--------|--------|--------|--------|--------|--------|--------|--------|-------|-------|-------|-------|-------|-------|--|--|--|--|--|--|--|--|--|
|                   |  | 1%            | 2%     | 3%     | 4%     | 5%     | 6%     | 7%     | 8%     | 9%     | 10%   | 12%   | 14%   | 16%   | 18%   | 20%   |  |  |  |  |  |  |  |  |  |
| 1                 |  | .990          | .980   | .971   | .962   | .952   | .943   | .935   | .926   | .917   | .909  | .893  | .877  | .862  | .847  | .833  |  |  |  |  |  |  |  |  |  |
| 2                 |  | 1.970         | 1.942  | 1.913  | 1.886  | 1.859  | 1.833  | 1.808  | 1.783  | 1.759  | 1.736 | 1.690 | 1.647 | 1.605 | 1.566 | 1.528 |  |  |  |  |  |  |  |  |  |
| 3                 |  | 2.941         | 2.884  | 2.829  | 2.775  | 2.723  | 2.673  | 2.624  | 2.577  | 2.531  | 2.487 | 2.402 | 2.322 | 2.246 | 2.174 | 2.106 |  |  |  |  |  |  |  |  |  |
| 4                 |  | 3.902         | 3.808  | 3.717  | 3.630  | 3.546  | 3.465  | 3.387  | 3.312  | 3.240  | 3.170 | 3.037 | 2.914 | 2.798 | 2.690 | 2.589 |  |  |  |  |  |  |  |  |  |
| 5                 |  | 4.853         | 4.713  | 4.580  | 4.452  | 4.329  | 4.212  | 4.100  | 3.993  | 3.890  | 3.791 | 3.605 | 3.433 | 3.274 | 3.127 | 2.991 |  |  |  |  |  |  |  |  |  |
| 6                 |  | 5.795         | 5.601  | 5.417  | 5.242  | 5.076  | 4.917  | 4.767  | 4.623  | 4.486  | 4.355 | 4.111 | 3.889 | 3.685 | 3.498 | 3.326 |  |  |  |  |  |  |  |  |  |
| 7                 |  | 6.728         | 6.472  | 6.230  | 6.002  | 5.786  | 5.582  | 5.389  | 5.206  | 5.033  | 4.868 | 4.564 | 4.288 | 4.039 | 3.812 | 3.605 |  |  |  |  |  |  |  |  |  |
| 8                 |  | 7.652         | 7.325  | 7.020  | 6.733  | 6.463  | 6.210  | 5.971  | 5.747  | 5.535  | 5.335 | 4.968 | 4.639 | 4.344 | 4.078 | 3.837 |  |  |  |  |  |  |  |  |  |
| 9                 |  | 8.566         | 8.162  | 7.786  | 7.435  | 7.108  | 6.802  | 6.515  | 6.247  | 5.995  | 5.759 | 5.328 | 4.946 | 4.607 | 4.303 | 4.031 |  |  |  |  |  |  |  |  |  |
| 10                |  | 9.471         | 8.983  | 8.530  | 8.111  | 7.722  | 7.360  | 7.024  | 6.710  | 6.418  | 6.145 | 5.650 | 5.216 | 4.833 | 4.494 | 4.192 |  |  |  |  |  |  |  |  |  |
| 11                |  | 10.368        | 9.787  | 9.253  | 8.760  | 8.306  | 7.887  | 7.499  | 7.139  | 6.805  | 6.495 | 5.938 | 5.453 | 5.029 | 4.656 | 4.327 |  |  |  |  |  |  |  |  |  |
| 12                |  | 11.255        | 10.575 | 9.954  | 9.385  | 8.863  | 8.384  | 7.943  | 7.536  | 7.161  | 6.814 | 6.194 | 5.660 | 5.197 | 4.793 | 4.439 |  |  |  |  |  |  |  |  |  |
| 13                |  | 12.134        | 11.348 | 10.635 | 9.986  | 9.394  | 8.853  | 8.358  | 7.904  | 7.487  | 7.103 | 6.424 | 5.842 | 5.342 | 4.910 | 4.533 |  |  |  |  |  |  |  |  |  |
| 14                |  | 13.004        | 12.106 | 11.296 | 10.563 | 9.899  | 9.295  | 8.745  | 8.244  | 7.786  | 7.367 | 6.628 | 6.002 | 5.468 | 5.008 | 4.611 |  |  |  |  |  |  |  |  |  |
| 15                |  | 13.865        | 12.849 | 11.938 | 11.118 | 10.380 | 9.712  | 9.108  | 8.559  | 8.061  | 7.606 | 6.811 | 6.142 | 5.575 | 5.092 | 4.675 |  |  |  |  |  |  |  |  |  |
| 16                |  | 14.718        | 13.578 | 12.561 | 11.652 | 10.838 | 10.106 | 9.447  | 8.851  | 8.313  | 7.824 | 6.974 | 6.265 | 5.668 | 5.162 | 4.730 |  |  |  |  |  |  |  |  |  |
| 18                |  | 16.398        | 14.992 | 13.754 | 12.659 | 11.690 | 10.828 | 10.059 | 9.372  | 8.756  | 8.201 | 7.250 | 6.467 | 5.818 | 5.273 | 4.812 |  |  |  |  |  |  |  |  |  |
| 20                |  | 18.046        | 16.351 | 14.877 | 13.590 | 12.462 | 11.470 | 10.594 | 9.818  | 9.129  | 8.514 | 7.469 | 6.623 | 5.929 | 5.353 | 4.870 |  |  |  |  |  |  |  |  |  |
| 30                |  | 25.808        | 22.396 | 19.600 | 17.292 | 15.372 | 13.765 | 12.409 | 11.258 | 10.274 | 9.427 | 8.055 | 7.003 | 6.177 | 5.517 | 4.979 |  |  |  |  |  |  |  |  |  |
| 40                |  | 32.835        | 27.355 | 23.115 | 19.793 | 17.159 | 15.046 | 13.332 | 11.925 | 10.757 | 9.779 | 8.244 | 7.105 | 6.233 | 5.548 | 4.997 |  |  |  |  |  |  |  |  |  |

## Appendix B – Example of IRR

When the cash flows are uneven, the calculation of the IRR becomes more complicated. The steps that are required are set out below, followed by a numerical example in which all of the calculations are shown.

This is not something that you will need to do on the Exam, but it is presented here as an appendix so that you can see how this is done. This may be useful in understanding the concept fully. The steps in the calculation of IRR when there are uneven cash flows are:

- 1) Once you have the NPV of the project, you can use that discount rate and the NPV at that rate to make an initial estimate of what discount rate might cause the NPV to become zero. For instance:
  - If the NPV of the project is **negative**, the IRR will be **lower** than the discount rate used in calculating NPV.
  - If the NPV of the project is **positive**, the IRR will be **higher** than the discount rate used in calculating NPV.
- 2) Make the initial estimate of the discount rate that would bring the NPV to zero, and calculate the NPV of the project using that estimated discount rate.
- 3) If your initial estimated discount rate results in an NPV that is on the **opposite side of zero** from the original NPV, the IRR will be somewhere in between the two rates. If the NPV at that discount rate is not on the other side of zero, try another discount rate until you find a rate that does result in an NPV that is on the opposite side of zero from the original NPV. Look at the given answers to the question to see if there is one unique rate that falls between the two rates. If so, that is your answer.
- 4) If there is more than one possible answer, you will need to look further. First, try straight-line interpolation to find the discount rate in between your two rates:
  - Calculate the difference between the two NPVs on either side of zero. Since one is negative and one is positive, you will add the absolute values of the two numbers to get the difference.
  - Calculate the difference between the two discount rates (that is, the difference between the discount rates you have that are on either side of the NPV of zero). Do this by subtracting the smaller rate from the larger rate.
  - The rate at which NPV will be zero will be in between the two rates, a pro rata distance from the lower rate that is equivalent to the NPV at the lower rate divided by the difference between the two NPVs, and **that quantity multiplied by the difference between the two rates**.

If this gives you a rate that is close to one of the given answers, stop here. If this still does not give you a usable answer, it may be because the two rates you are using are too far apart, and your interpolation is not accurate enough. Go to Step 5.

- 5) Find two discount rates that are only 1% apart that will result in NPVs that are on either side of zero. Do this by calculating NPV using additional rates to narrow the spread down so that you can know, for example, that the rate you are looking for will be between 13% and 14%. Having only a 1% spread makes the interpolation more accurate. Check the given answers again to see if you can choose one now. If not, go to the next step.
- 6) Use straight-line interpolation as described in Step 4 to calculate what discount rate in between the two rates closest on either side of zero NPV (that are 1% apart) will cause NPV to be zero.

**Example:** ACM Petroleum, Inc., an oil wholesaler, is planning to purchase an additional truck to transport its oil because of a recent growth in sales. The new truck will cost \$100,000. ACM estimates the cash flow from the new truck will be \$20,000 per year (starting 1 year after the purchase), and the truck will last for 7 years. ACM's required rate-of-return is 10%. ACM projects that at the end of 7 years, it will be able to sell the truck for \$30,000. (Tax considerations are ignored.)

The discounted cash flows are calculated as follows – **first using 10%**:

PV of Cash Inflows, Years 1 - 6:

$$\text{PV of ordinary annuity } i=10\%, n=6 \times \$20,000 = 4.35526 \times \$20,000 = \$87,105$$

Plus:  $\text{PV of } \$1 \text{ } i=10\%, n=7 \times (\$20,000 + \$30,000) = .51316 \times \$50,000 = \underline{25,658}$

Equals: Discounted Cash Inflows of the Project \$112,763

$$\text{NPV} = \$112,763 - \$100,000 = \mathbf{\$12,763}$$

With a discount rate of 10%, the NPV is \$12,763. Therefore, because we want to bring the NPV down, our initial estimate of the discount rate that would cause NPV to be zero will be **higher** than 10%.

Now we will calculate the NPV **using 15%**:

PV of Cash Inflows, Years 1 - 6:

$$\text{PV of ordinary annuity } i=15\%, n=6 \times \$20,000 = 3.78448 \times \$20,000 = \$75,690$$

Plus:  $\text{PV of } \$1 \text{ } i=15\%, n=7 \times (\$20,000 + \$30,000) = .37594 \times \$50,000 = \underline{18,797}$

Equals: Discounted Cash Inflows of the Project \$94,487

$$\text{NPV} = \$94,487 - \$100,000 = \mathbf{\$(5,513)}$$

Since NPV has gone from positive at 10% to negative at 15%, we know the discount rate that will result in an NPV of zero will be somewhere in between 10% and 15%. We can now interpolate using the two rates of 10% and 15%.

|    |              |                |
|----|--------------|----------------|
| 1) | NPV at 10% = | 12,763         |
|    | NPV at 15% = | <u>(5,513)</u> |
|    | Difference   | 18,276         |

2) The difference between 10% and 15% is 5%, or .05

3) Therefore, the discount rate that will cause NPV to be zero will be 10% plus a fraction of another 5%.

That fraction is 12,763 (the amount by which 10% puts the NPV over zero) divided by 18,276 (the difference between the NPV at 10% and the NPV at 15%), multiplied by the difference between 10% and 15%, which is 5% or .05.

4)  $\text{IRR} = .10 + [ (12,763 / 18,276) \times .05 ] = .1349, \text{ or } \mathbf{13.49\%}$



If that gives you an answer that is accurate enough, you may stop. If that answer is not accurate enough, you will need to narrow the range of rates so there is no more than 1% between the two rates that are on opposite sides of zero NPV. Do this by trial and error, calculating NPV using different rates until you have it narrowed down to two rates that are only 1% apart.

#### Trying 14%:

PV of Cash Inflows, Years 1 - 6:

$$\text{PV of ordinary annuity } i=14\%, n=6 \times \$20,000 = 3.8887 \times \$20,000 = \$77,774$$

$$\text{Plus: PV of \$1, } i=14\%, n=7 \times (\$20,000 + \$30,000) = .39964 \times \$50,000 = \underline{19,982}$$

Equals: Discounted Cash Inflows of the Project

$$\$97,756$$

$$\text{NPV} = \$97,756 - \$100,000 = \mathbf{\$(2,244)}$$

#### Trying 13%:

PV of Cash Inflows, Years 1 - 6:

$$\text{PV of ordinary annuity } i=13\%, n=6 \times \$20,000 = 3.9976 \times \$20,000 = \$79,952$$

$$\text{Plus: PV of \$1, } i=13\%, n=7 \times (\$20,000 + \$30,000) = .42506 \times \$50,000 = \underline{21,253}$$

Equals: Discounted Cash Inflows of the Project

$$\$101,205$$

$$\text{NPV} = \$101,205 - \$100,000 = \mathbf{\$1,205}$$

Now we have the range narrowed down to somewhere between 13% and 14%. Since NPV has gone from negative at 14% to positive at 13%, we know the discount rate that will result in an NPV of zero is somewhere between 13% and 14%. And intuitively, we can guess that it will be closer to 13% than to 14%, because the positive NPV of \$1,205 at a discount rate of 13% is a smaller absolute number than is the negative NPV of \$(2,244) at a discount rate of 14%. If this gives you the answer, stop. If not, go to the next step, which is to interpolate.

$$1) \quad \text{NPV at 13\%} = 1,205$$

$$\text{NPV at 14\%} = \underline{(2,244)}$$

$$\text{Difference} \quad 3,449$$

$$2) \quad \text{The difference between 13\% and 14\% is 1\%, or .01.}$$

$$3) \quad \text{Therefore, the discount rate that will cause NPV to be zero will be 13\% plus a fraction of another 1\%.}$$

That fraction is  $1,205$  (the amount by which 13% puts the NPV over zero) divided by  $3,449$  (the difference between the NPV at 13% and the NPV at 14%), multiplied by the difference between 13% and 14%, which is 1% or .01.

$$4) \quad \text{IRR} = .13 + [ (1,205 / 3,449) \times .01 ] = .13349, \text{ or } \mathbf{13.349\%}$$

**The IRR for this project is 13.349%.**

## Answers to Questions

**1 b** – In this question we need to compare the difference between the two options in order to calculate the opportunity cost. The first option is to buy the zippers each month as they are needed. In this case the company would spend \$3,000 per month. The second option is to buy all of the zippers in January. If the company did this they would spend \$36,000 in January. So, the January expenditure would be \$33,000 different under the two options. This \$33,000 could be invested and provide a return of 8% per year. However, if the company were to use the first option, they would not be able to invest \$33,000 for the entire year. Rather, they would have \$33,000 to invest in January, but only \$30,000 in February, \$27,000 in March and so on. Therefore, we need to calculate the interest for \$33,000 for the year and divide this by 2. The opportunity cost is \$1,320 ( $\$33,000 \times 8\% \div 2$ ).

**2 d** – A sunk cost is any cost that has already been spent and is unable to be changed. In this question, the book value of the old machine is a sunk cost. This is because the book value represents the price paid for the old machine (minus depreciation) and this is unable to be changed, no matter what decision is currently made.

**3 b** – To answer this question we simply need to calculate what the current cost is if Leland continues to produce the part, and calculate what the costs would be if Leland purchases the part from Scott. These costs in the second situation will include the purchase price as well as any costs that will continue to be incurred by Leland even if the product is not produced. The current cost of production is \$21,200. If Leland were to purchase the part, the purchase price would be \$15,000. However, the Materials Handling charge would still need to be made since this is an overhead allocation. This cost is 20% of the purchase price, or \$3,000. Also, because the overhead is 2/3 fixed, then 2/3 of the \$12,000 overhead would also continue to be incurred even if the unit is purchased from Scott. This is \$8,000 and brings the total "cost" of purchasing the unit to \$26,000. This is \$4,800 more than if the unit were produced internally.

**4 a** – If the factory space that had been used to produce this part could be rented for \$25,000, then Leland would have a decrease in net income of \$23,000. This is calculated as: The \$4,800 greater cost per unit for purchasing the units leads to an increase in total of \$48,000 (10 units need to be purchased); this is partially offset by the rental income of \$25,000, but in total, Leland is still \$23,000 worse off by purchasing rather than producing this unit.

**5 c** – The maximum that they could pay a supplier is equal to all of the costs that would be avoided if they were to not produce the item themselves. The variable costs that would be avoided completely are the variable costs of manufacturing ( $\$2.00 + \$2.40 + \$1.60 = \$6.00$ ). In addition, the variable costs of marketing would be reduced by 30%, or \$.75. In total, the company would reduce their costs by \$6.75 if they did not produce the item, so this is the maximum amount that they should pay to an outside supplier for this item.

**6 a** – When making a bid for business, the company needs to make certain that they cover at least their variable costs of production. If they are operating at capacity, they also need to cover the contribution of the item that will no longer be produced. In this question, though, the company is operating at less than capacity so they do not need to worry about this missing contribution. The variable costs of production (or more accurately, the costs that would be incurred only if they decide to produce the item) are direct materials (\$200,000), direct labor (\$150,000), the supervisor's salary (\$20,000) and the fringe benefits on the direct labor (\$15,000). The rent and depreciation would continue to be incurred, but would need to be absorbed by other products. The total avoidable costs are \$385,000 and this is the minimum price that they should bid for the project.

**7 c** – The minimum price that will be charged in a situation of excess capacity is the variable costs that will be incurred by the production and processing of the order. The variable costs (including the variable selling costs) total \$137, so this is the minimum price to be charged.

**8 b** – When the company is operating at 100% capacity, the amount that needs to be charged must cover the variable costs of the item as well as the contribution that is lost by not producing something else. Since they would lose \$15,000 in contribution by producing these 500 backstops, they need to cover \$30 per backstop to recover this lost contribution ( $\$15,000 \div 500$  units). This is added to the \$137 of variable costs to get a minimum selling price of \$167.

**9 a** – This question and the following two questions are a little bit longer in the way that they are set up, but the questions simply require you to determine what would be the result of a decision compared to the status quo. In this question we need to determine how much total operating income would change if the Suburban Store were closed. If this happened, all of the contribution of the Suburban Store would be lost. This is a \$36,000 decrease in total income. Also, the Urban Store would lose 10% of its sales, or \$4,800 of contribution. If the Suburban Store were closed, only 25% of their direct fixed costs would continue, so this would be a savings of \$30,000. Adding these amounts together, we get a total decrease in operating income of \$10,800 if the Suburban Store were to be closed.

- 10 b** – If the Suburban Store's sales were increased by 10%, this would increase contribution by \$3,600 per month. However, in order to get this increase, they would need to spend \$5,000 per month in advertising. This advertising campaign would actually lead to a decrease in operating income of \$1,400 per month.
- 11 b** – If one half of the Suburban Store's sales were made at cost, the elimination of these items would not impact the contribution of the store. However, the corresponding decrease in other sales of 20% would eliminate 20% of the contribution, or \$7,200. This lost contribution would be offset by lower fixed costs. The fixed costs would be reduced by 15%, or \$6,000. So, they would be \$1,200 worse off per month.
- 12 b** – To be compensated for the costs of the plant, Hermo will charge Quigley for the variable costs of production plus depreciation. At 60% capacity the total costs are \$1,800,000. Of these 80%, or \$1,440,000, are fixed. This means variable costs are \$360,000. In order to increase production from 60% to 90% of capacity, Hermo will incur variable costs of \$180,000. In addition to this is the depreciation, which is currently \$1,050,000. However, because of this increase in capacity, the useful life will be decreased and depreciation will be \$1,500,000. This increase in depreciation expense is \$450,000 and this is what Hermo will charge Quigley. Therefore, the total amount that Hermo will charge is \$630,000 (\$180,000 in variable costs and \$450,000 in increased depreciation costs).
- 13 c** – The maximum amount that Quigley will pay is \$1,200,000 because this is what they are currently paying.
- 14 c** – By definition if the elasticity is greater than 1, then the demand is considered relatively elastic.
- 15 b** – The % change in P is 15% ( $.30 / 2$ ). If the elasticity of demand is 1.9 and the change in P is 15%, we can calculate the change in Q as 1.9 the change in P. The change in Q is therefore 28.5% ( $1.9 \times 15\%$ ).
- 16 d** – If the demand were elastic, a decrease in the price would bring a greater increase in the quantity demanded than was the decrease in the price. Thus the total revenue will increase.
- 17 c** – If the elasticity of demand for a normal good were 2.5, the 10% reduction in the price would bring a 25% increase in the demand ( $2.5 \times 10\% = 25\%$ ).
- 18 c** – The cost per unit is \$90. We need to set up a simple formula to determine what selling price will give a 30% gross profit. The formula is:  $P - 90 = .3P$ ;  $.7P = 90$ ;  $P = \$128.57$ , or \$129.
- 19 b** – To answer this question, let us assume that the company has variable costs of \$10. If they then mark this up by 60%, that gives a sales price of \$16. A markdown of 10% makes the sales price only \$14.40. This gives a contribution of \$4.40, which is 30.6% of the sales price ( $\$4.40 \div \$14.40$ ). This question is much easier if we make an assumption regarding variable costs.
- Another way to approach the problem is by using algebra, as follows: The original sale prices are 1.60 times the variable costs, or 1.6VC. Markdowns are 10% off the sales price. Therefore, the marked down prices are 90% of the original sale prices. Therefore, the marked down sales price =  $1.6VC \times .9$ . When you combine the terms by multiplying 1.6 by .9, you get the marked down price = 1.44VC. Now, it is easy to calculate the contribution margin. If we say one single product has a variable cost of \$1.00, then the marked down sales price for that one product must be 1.44 times \$1.00, which is \$1.44. The unit sale price = \$1.44. The unit variable cost = \$1.00. The unit contribution margin = \$.44. So the contribution margin ratio is  $\$.44 / \$1.44$ , which is .3055, or 30.6%.
- 20 c** – Because the commission is a percentage of the sales price, it is also a variable cost and needs to be deducted from the sales price to calculate the contribution per unit. The commission is \$2 and this makes the contribution per unit \$16. The fixed costs are \$9,331,200 and given a contribution of \$16 per unit, a total of 583,200 units must be sold ( $\$9,331,200 \div 16$ ).
- 21 d** – At the current loss position of 40,000, 24,000 units are sold ( $\$300,000$  of revenue  $\div$  \$12.50 selling price). This means that the variable costs per unit are \$7.50 ( $\$180,000 \div 24,000$ ), and the contribution is \$5 per unit. To cover the \$40,000 loss the company needs to sell 8,000 additional units ( $\$40,000 \div 5$  per unit).
- 22 c** – Given that the sales price is \$36 and that the variable costs are \$16, there is a contribution of \$20 per unit. With fixed costs of \$450,000, they must sell 22,500 units to break even ( $\$450,000 \div \$20$  per unit).
- 23 a** – Since only 25,000 units can be sold, the maximum contribution margin will be \$500,000. This will be reduced by the fixed costs of \$450,000 giving a maximum pre-tax profit of \$50,000. As taxes are 40%, the maximum after-tax profit is \$30,000.
- 24 d** – If the management of Delphi has required that this project have an after-tax profit of \$75,000, we will need to include this pre-tax required income as a fixed cost. The pre-tax income that is required is \$125,000 ( $\$75,000 \div .6$ ). Adding this to the fixed costs of \$450,000, the company now needs to cover \$575,000 of costs with the sale of the 25,000 units that can be sold. This means that each unit must provide \$23 of contribution. Adding this \$23 to the variable costs of \$16 per unit, we get a selling price of \$39 per unit. If they sell each of the 25,000 units for \$39, they will have an after-tax profit of \$75,000.

**25 a** – At the current situation, the fixed costs must be \$50,000. We know this because if sales are \$500,000, variable costs \$300,000, and profit is \$150,000, there is only \$50,000 left of the sales price to be fixed costs. Because the question is about the new breakeven dollars of sales, we can simply create a revised contribution statement incorporating the changes, and then divide the new Fixed Costs by the new Contribution Margin Ratio. The revised contribution statement incorporating the changes will be:

Sales (assume the same number of units sold but the selling price is increased by 10%): \$500,000 × 1.10 = \$550,000

Variable Costs (unchanged): \$300,000

Contribution Margin: \$250,000

Contribution Margin Ratio: \$250,000 / \$550,000 = .454545

Fixed Costs: \$50,000 × .80 = \$40,000

Total Fixed Costs of \$40,000 / Contribution Margin of .454545 = \$88,000, and that will be the new breakeven point in sales dollars.

**26 b** – Product XY-7 has a contribution of \$1 per unit. Therefore, if the entire \$160,000 were spent for this product, they would need to sell an additional 160,000 units to pay for the advertisement.

**27 c** – If the entire amount were invested in BD-4 they would need to sell 320,000 units of BD-4 because the contribution margin is only \$.50 per unit. At a sales price of \$3 per unit, this would cause an increase in revenues of \$960,000.

**28 d** – Since fixed manufacturing cost is applied at the rate of \$1.00 per machine hour, we can use that to calculate the number of machine hours required to manufacture one unit of each product. Thus, XY-7 requires .75 machine hours per unit to produce, whereas BD-4 requires only .20 machine hours per unit to produce. The unit contribution margins for XY-7 and BD-4 are \$1.00 and \$.50, respectively. Therefore, the contribution per machine hour for XY-7 is \$1.00 ÷ .75, or \$1.33. The contribution margin per machine hour for BD-4 is \$.50 ÷ .20, or \$2.50. Since the contribution margin per machine hour for BD-4 is higher, BD-4 should be produced. The total contribution margin is the 100,000 available machine hours × \$2.50 contribution per machine hour, or \$250,000.

**29 a** – Plastic frames have a contribution of \$5 per unit and glass frames have a contribution of \$7 per unit. Plastic frames make up 100,000 units of the total production of 400,000 units, or 25%. Glass frames make up 300,000 units of the total production of 400,000 units, or 75%. To calculate the weighted average contribution margin, weight each individual product's contribution margin by its percentage of total production, as follows: \$5 × .25 = \$1.25; \$7 × .75 = \$5.25; the Weighted Average Contribution Margin is \$6.50. Given fixed overhead of \$975,000, they must sell \$975,000 ÷ \$6.50 = 150,000 total "weighted-average" units to break even.

**30 b** – The change in labor costs makes the contribution of plastic frames \$6 per unit and will increase the weighted average unit contribution to \$6.75. This will make the breakeven number of units 144,444 units (\$975,000 ÷ \$6.75).

**31 c** – With this new percentage weighting of .33 for plastic frames and .67 for glass frames, the weighted average contribution margin becomes \$6.33: (\$5 × .3333) + (\$7 × .6666) = 6.3333. The breakeven point would be 153,947 (\$975,000 ÷ \$6.3333). Note: In this question if you divide \$975,000 by 6.33 instead of 6.3333 you get a slightly higher number than what is listed as the correct answer.

**32 b** – Product 158-D accounts for 35% of total sales revenue and its contribution margin ratio is (1 – .45 or .55). Product 074-J accounts for 65% of total sales revenue, and its contribution margin ratio is (1 – .55), or .45. Therefore, the weighted average contribution margin ratio of the product mix is: (.35 × .55) + (.65 × .45) = .485. Thus, the breakeven sales revenue for the two products together is: \$250,000 / .485 = \$515,464.

**33 b** – The two compensation plans simply need to be set equal to each other in this formula, where S is equal to the level of sales. .05 S = \$45,000. Solving for S we get \$900,000. If the expected level of sales is \$900,000, it does not matter who Carter hires. If sales are expected to be more than \$900,000 Carter is better off hiring the sales person who wants a fixed salary. At an expected sales level of less than \$900,000, the commissioned sales person would be preferable.

**34 a** – To solve this question, we need to create the two profit formulas and set them equal to one another, then create the two revenue formulas and set them equal to one another. After this, we can solve for the one unknown that remains after we plug the second formula into the first, eliminating one of the unknowns.

The two formulas we end up with are:

Profit formula: 35.2M – 369,600 = 27.2T – 316,800; Revenue formula: \$.88M = \$80T

Solving the revenue formula for M in order to express T in terms of M, we get: M = 80/88T or M = .90909T

We will then substitute this value for M into the profit formula, and get the following formula:  $35.2(-.90909T) - 369,600 = 27.2T - 316,800$ . This is equivalent to:  $32T - 369,600 = 27.2T - 316,800$

Subtracting  $27.2T$  from both sides and adding  $369,600$  to both sides, we get:  $4.8T = 52,800$ ;  $T = 11,000$

Using that value for T, we can now calculate the revenue:  $11,000 \text{ units} \times \$80/\text{unit} = \$880,000$

If we were to do the same, but solve for T first, we would get the same answer.

**35 d** – In order to solve this problem, we can simply calculate the profit from each of the products if sales are 12,000 units. Using the formulas from the previous question, we can calculate the expected profits at 12,000 units as follows:

For Mountain Skis:  $\$35.20 (12,000) - \$369,600 = \$52,800$

For Touring Skis:  $\$27.2 (12,000) - \$316,800 = \$9,600$

Clearly, there is a higher profit from selling 12,000 mountain skis, so this is what they should do.

**36 d** – Because the factory is automated, the limitation on production will be machine hours. Therefore, with demand exceeding production, the company needs to make certain that they maximize the contribution per the limited resource, or machine hours.

**37 b** – The expected value is calculated by taking the probability of each result and multiplying it by that result. These numbers are added to calculate the expected value. The calculations for this are:  $200,000 \times .2 = 40,000$ .  $250,000 \times .5 = 125,000$ .  $300,000 \times .2 = 60,000$ .  $350,000 \times .10 = 35,000$ . Adding these amounts together, we get 260,000 units as the expected level of sales.

**38 b** – Under the deterministic approach we simply choose the possible outcome that has the highest probability. This is the outcome of 300,000 units. However, as the question is about revenue, we need to multiply this by the sales price of \$1.80. This gives a most probable revenue using the deterministic approach of \$540,000.

**39 c** – The expected value of the operating profit of desserts is calculated by first determining the expected level of sales. This is done in the same manner that was used earlier for rolls:  $250,000 \times .3 = 75,000$ .  $300,000 \times .4 = 120,000$ .  $350,000 \times .2 = 70,000$ .  $400,000 \times .10 = 40,000$ . Adding these amounts together, we get 305,000 units as the expected level of sales. With variable costs of \$1.15 per unit, the contribution per unit is \$.65. This is a total contribution of \$198,250. Subtracting from this the fixed costs and advertising costs (\$78,000 in total) we get an operating profit from desserts of \$120,250.

**40 b** – For breakfast rolls the contribution margin per unit is \$.45 per unit ( $\$1.20 - \$.75$ ). The production tooling and advertising total \$45,000. Therefore, to cover these costs, Gleason must sell 100,000 breakfast rolls.

**41 c** – Last year the contribution margin was 70% ( $\$5.25 \text{ contribution} \div \$7.50 \text{ selling price}$ ). If the variable costs will increase to \$3 this period, the selling price needs to be \$10 in order to have a 70% contribution margin. Algebraically:  $X - 3 = .7X$ ;  $.3X = 3$ ;  $X = 10$

**42 b** – In the coming year the selling price will be \$9.00 and the variable selling costs will be \$3.00. This gives a contribution of \$6 per unit. The fixed costs will be 10% more than last year, but we do not yet know last year's fixed costs. Last year the contribution per unit was \$5.25 and they needed to sell 20,000 units to break even. Therefore, fixed costs must have been \$105,000. Adding 10% to this we get fixed costs for the current year of \$115,500. Now we can calculate the breakeven point at  $19,250 \text{ units} (\$115,500 \div 6)$ .

**43 a** – Last year the sales were enough to break even (20,000 units) and to provide an after-tax profit of \$5,040. The pre-tax profit was \$8,400 ( $\$5,040 \div [1 - .4]$ ). In order to have a pretax profit of \$8,400, they needed to sell  $8,400 \div \$5.25$ , or 1,600 units above the breakeven point, or 21,600 units. 1,000 more than that is 22,600 units.

**44 d** – Legal risk includes the legal system in which the company operates and the risks of losses from legal cases.

**45 d** – By moving the risk away from themselves to another party, Buckeye Conferencing is transferring the risk of loss to another party. This is risk transferring.

**46 a** – When the risk of loss is high and the likelihood is high, the best course of action is probably to avoid the risk. This might include selling the business unit or in some other way eliminating this activity from the company.

**47 d** – By definition value at risk provides a confidence interval which provides a range of results with a percentage chance that the result will be within that range.

**48 b** – In this question there is a lot of information that is not relevant to the question that is asked, which is simply what the cash flows in the final year of this project will be. There will be \$11,000 of cash inflows that are a result of profits. In addition to this, there is the sale of the equipment for \$9,000, bringing the total to \$20,000. There is also a total of \$12,000 of working capital invested in the project that will be released in

Year 10. In addition to these items, we need to take into account taxes and the fact that taxes will need to be paid on the profits. The equipment is fully depreciated, so the full \$9,000 proceeds from the sale will be taxable gain. Income tax will be paid on that \$9,000 and on the operating income of \$11,000, for a taxable income of \$20,000. The freeing up of working capital is not a taxable event. Therefore, there is \$8,000 spent for taxes (\$20,000 × 40%). This makes the Year 10 cash flows a total of \$24,000 (\$20,000 operating income and gain + \$12,000 working capital released – \$8,000 income tax).

**49 c –** This question is asking for the cash flows in the last year of the project's life. There is the \$10,000 cash received from the salvage value of the project and the \$40,000 that is spent on the removal of the equipment. This is a net outflow of \$(30,000) so far. In addition, there is a \$105,000 capital loss from the disposal of the equipment which will lead to a tax savings. The capital loss is calculated as the \$10,000 cash received from the sale of the equipment minus the \$75,000 tax basis ("tax basis" is book value for tax purposes) minus the \$40,000 disposal cost. This \$105,000 capital loss leads to a tax savings, or cash inflow, of \$42,000 (\$105,000 × 40%). This \$42,000 is added to the \$(30,000) cash outflow from above, giving us a net cash inflow of \$12,000 for the final year of the project.

**50 c –** The calculation of the payback period is done by determining after how many years it will take for the net after-tax cash inflows to equal the initial investment. The yearly cash flow includes the \$80,000 in cost reductions, which is a cash inflow. The cash inflows will be reduced by the payment of taxes. However, in the calculation of taxes, we need include the depreciation expense that will be recognized. This will be \$50,000 per year and this makes the taxable income only \$30,000 per year (the \$80,000 savings minus the \$50,000 depreciation expense). The taxes on this amount are \$12,000 (\$30,000 × 40). This makes the total cash flows per year \$80,000 – \$12,000, or \$68,000. (Remember that the depreciation expense is a non-cash expenditure.) Given a \$250,000 initial investment and a cash inflow of \$68,000 per year, the payback period is 3.68 years (\$250,000 ÷ \$68,000).

**51 d –** We need to calculate the amount that needs to be saved in operating cash flow before tax (not including the depreciation tax shield) in order for the project to have a payback period of 3 years. The depreciation tax shield from the new sorter will be a cash inflow, so we will calculate that first. The depreciation expensed in each year will be  $\$450,000 \div 5 \text{ years life} = \$90,000$  in depreciation each year. The depreciation tax shield each year will be  $\$90,000 \times .40$ , or \$36,000. Since we are looking for the operating cash flow that will create a payback period of 3 years, we will multiply the \$36,000 annual cash inflow from the depreciation tax shield by 3 years to find the total cash inflow from the tax shield over those 3 years. That is \$108,000. We now use that to find the annual after tax operating cash flows needed for 3 years in order to achieve Jasper's payback goal of 3 years. That will be \$450,000 – the \$108,000 inflow from the tax depreciation shield, or \$342,000. Next, we divide \$342,000 by 3 to get the after-tax operating cash flow needed for each of the 3 years. That is \$114,000. However, we need to convert that to before-tax cash flow, because the question asks for the reductions in annual cash operating costs that are needed, and that is a before-tax amount. The company's tax rate is .40. Therefore, to convert the required annual after-tax operating cash flow of \$114,000 to before-tax cash flow, we need to divide it by  $(1 - \text{the tax rate})$ , which is .60.  $\$114,000 \div .60 = \$190,000$ .

The first line of the formula is essentially: the required savings being adjusted for taxes. Taxes will be calculated as the savings minus the depreciation multiplied by the tax rate.

**52 a –** To calculate the NPV of the investment, we simply need to multiply each year's cash inflow by the given present value of \$1 factor for the appropriate time period, add these numbers together and then subtract the cash investment of \$200,000 from the total. The calculations are as follows:

|        | Cash Inflow | Factor | PV of \$1          |             |
|--------|-------------|--------|--------------------|-------------|
| Year 1 | \$120,000   | x      | .91                | = \$109,200 |
| Year 2 | 60,000      | x      | .76                | = 45,600    |
| Year 3 | 40,000      | x      | .63                | = 25,200    |
| Year 4 | 40,000      | x      | .53                | = 21,200    |
| Year 5 | 40,000      | x      | .44                | = 17,600    |
|        |             |        | PV of Cash Inflows | = \$218,800 |

Given that there was a cash investment of \$200,000, the NPV of the project is \$18,800.

**53 b –** This question becomes a little more complicated because of the fact that the depreciation is not straight-line. This means that we will need to calculate each year's cash flows separately. All 3 years have \$85,000 of cost savings. Even though there is a \$10,000 resale value, when we calculate the depreciation tax shield, we always use the depreciation method used for tax purposes; and the depreciable base for tax purposes is always 100% of the asset's value. Therefore, the depreciation is \$48,000 in the first and third years (30% of \$160,000) and \$64,000 in the second year (40% of \$160,000). Depreciation is not a cash flow, but it will reduce profit for the calculation of income taxes. Also, in the third year, the company will sell the

asset for \$10,000. Since 100% of the asset's cost is depreciated, that \$10,000 will be fully taxable at 40%. We now need to calculate the tax for each of the 3 years. In Years 1 and 3, the taxable income is \$37,000 (\$85,000 – \$48,000) and this gives a tax payment of \$14,800 ( $\$37,000 \times .40$ ). This reduces cash flows in Year 1 to \$70,200 ( $\$85,000 - \$14,800$ ). In Year 3, cash flows will be \$76,200 ( $\$95,000$  including the \$10,000 from the sale of the asset less taxes of \$18,800 (40% of taxable income of \$47,000)). In Year 2 the taxes will be only \$8,400 ( $\$85,000 - \$64,000 =$  taxable income of \$21,000, and  $\$21,000 \times .40 = \$8,400$ ) so the cash inflow will be \$85,000 – \$8,400, or \$76,600. We now need to take the PV of these 3 cash flows. Year 1:  $\$70,200 \times .862 = \$60,512$ ; Year 2:  $\$76,600 \times .743 = \$56,914$ ; Year 3:  $\$76,200 \times .641 = \$48,844$ . Adding these together we get a present value of cash inflows of \$166,270. Subtracting the initial cash investment of \$160,000 gives a net present value of \$6,270.

**54 c** – To calculate the NPV of Project A we simply need to calculate the present value of the cash inflow at the end of the 5th year. The cash inflow is \$7,400,000 and given an 18% cost of capital, the present value of \$1 factor for 5 years is .4371.  $\$7,400,000 \times .4371 = \$3,234,540$ . Given an initial investment of \$3,500,000 this project has a negative NPV of \$(265,460).

**55 d** – The IRR is the rate at which the NPV is equal to \$0. Since in this problem, we have only one annual cash flow, we can find use the PV of \$1 table to find the rate for a 5-year period that will make the following equation true:  $9,950,000 \times X = 4,000,000$ ;  $X = 4,000,000 / 9,950,000$ ;  $X = .402$ . Looking for .402 on the PV of \$1 table on the line for 5 years, we find .4019 under the rate of 20%. Thus, the answer is 20%.

**56 d** – The use of MACRS instead of straight-line depreciation will cause the depreciation expense to be higher in the early years of the project, and lower in the later years. This will raise the NPV of the project because there will be larger cash inflows in the early years of the project. (Remember that \$1 today is worth more than \$1 tomorrow.) Therefore, if the NPV increases, the profitability index will also increase.

**57 d** – The net investment includes not only the cost of the machine itself, but also the costs of shipping and installation. This adds up to \$105,000.

**58 a** – In the third year the unit will produce 2,000 units (as it does in each year). The profit from these units will be \$100,000 (\$50 profit per unit). In addition, there will be depreciation of \$21,000 per year for the first 5 years, resulting in a taxable income of \$79,000 in Year 3. Given a tax rate of 40%, the company will need to pay \$31,600 in taxes in Year 3. This reduces their cash flows to \$68,400 ( $\$100,000 - \$31,600$ ).

**59 d** – In the tenth year the profit will still be \$100,000, but there will be no depreciation. Also, there will be \$5,000 gain on the sale of the equipment. The sale will increase the cash received to \$105,000, but also increase the taxable income. Given a 40% tax rate, they will pay \$42,000 in taxes during Year 10. That will reduce their net cash inflows to \$63,000 ( $\$105,000 - \$42,000$ ).

**60 c** – The annual cash inflows at which Yipann would be indifferent to this investment is the cash inflows that would make the NPV = \$0. We can calculate this simply by dividing the cash investment by the PV of an annuity factor for 24% and 5 years. The factor is 2.74 and  $\$105,000 \div 2.74$  is equal to \$38,321. This means that if the average cash inflow is \$38,321 per year, Yipann would have an NPV of \$0, and would be indifferent to the investment project.

**61 b** – The accounting rate-of-return over its life using the initial investment will require us to calculate the average yearly income. The average income is calculated by adding all of the individual incomes and dividing by 5. This is \$19,000. The accounting rate-of-return is 18.1% ( $\$19,000$  annual income  $\div$   $\$105,000$  initial investment).

**62 c** – The after tax cash flows exceed the initial investment sometime during the third year. As there is only one choice with during the third year as the answer, C must be correct.

**63 b** – To calculate the NPV, we simply need to multiply each annual after tax cash flow amount by the appropriate present value of \$1 factor. Both of these amounts are given to us, which means that our work is simply mathematical.

|        | Cash Inflow | PV of \$1 factor   |             |
|--------|-------------|--------------------|-------------|
| Year 1 | \$50,000    | $\times .81$       | = \$40,500  |
| Year 2 | 45,000      | $\times .65$       | = \$29,250  |
| Year 3 | 40,000      | $\times .52$       | = \$20,800  |
| Year 4 | 35,000      | $\times .42$       | = \$14,700  |
| Year 5 | 30,000      | $\times .34$       | = \$10,200  |
|        |             | PV of Cash Inflows | = \$115,450 |

Compared to the initial investment of \$105,000, the NPV is \$10,450.

**64 c** – If there are no budget restrictions, they should invest in every project that has a positive NPV. This is Projects 2, 3 and 4.

- 65 d** – When there are limited funds, we should use the profitability index to allocate those funds. Projects 3 and 4 have the highest profitability index and both investments can be made with the \$600,000 available.
- 66 c** – The MACRS depreciation in the fourth year will be 7% of the initial cost, or \$84,000 ( $\$1,200,000 \times .07$ ). This will lead to a tax deduction that will reduce the amount of taxes payable by 40% of this amount, or \$33,600. This tax savings in Year 4 must now be discounted back to the first year, using the present value of \$1 factor of .64. This gives a discounted cash flow from MACRS depreciation of \$21,504 ( $\$33,600 \times .64$ ).
- 67 b** – The existing asset will be sold for \$180,000, which will give a taxable gain of \$30,000. The tax on this gain will be \$12,000, but the taxes will not be paid until the end of the year, so we need to discount this tax payment for 12 months, using the present value of \$1 factor of .89. This gives us a discounted value of the taxes of \$10,680 ( $\$12,000 \times .89$ ). Subtracting this from the \$180,000 received, we get a discounted cash effect of the disposal of the existing asset of \$169,320 ( $\$180,000 - \$10,680$ ).
- 68 d** – The additional sales will be \$600,000 per year (30,000 units @ \$20/unit), but there will also be additional variable costs of \$360,000 (30,000 units @ \$12/unit). This gives a contribution margin of \$240,000 per year, from which we need to subtract taxes. Taxes are 40% and this reduces the contribution margin to \$144,000. We then multiply this by the present value of an annuity factor for 4 years. The factor is 3.04 and this gives a discounted value of \$437,760 ( $\$144,000 \times 3.04$ ). To answer this question correctly, you need to know that “contribution margin” equals sales minus variable costs. The increase in fixed costs is not included in this calculation.
- 69 b** – The working capital investment is an outflow investment of \$50,000 at the beginning and an inflow of the same amount at the end. The PV of the inflow is \$32,000 ( $\$50,000 \times .64$  PV of \$1 factor for 4 years). These netted together gives a total discounted cash outflow of \$18,000 related to the required working capital investment.
- 70 d** – Because there are 4 payments, we will take the present value of these 4 future payments to determine the present value of the note. The present value of an ordinary annuity factor for 4 years at 6% is 3.465; multiplying this by the \$1,000 payment gives a present value for the note of \$3,465.
- 71 a** – Because we are given a future lump sum but only the present value of an annuity table, we will need to make one calculation using the PV of an annuity table to determine the factor to multiply the one lump sum payment by to calculate the present value of that payment. If we subtract the PV factor of an annuity for 3 years (one year less than the period of the payment) from the PV factor of an annuity for 4 years we will be able to calculate the PV factor of \$1. This is  $3.312 - 2.577 = .735$ . This is the PV of \$1 for four periods at 8%. We multiply this by \$4,000 to get the PV of \$2,940.
- 72 b** – The amount borrowed will be only \$450,000 because there is a 10% down payment that will need to be made. This \$450,000 needs to be divided by the present value of an annuity factor for 25 years at 10% to determine how much each individual payment will be. The factor is given to us as 9.8226.  $\$450,000 \div 9.8226 = \$45,813$ . This is the amount of each payment over the life of the loan.
- 73 d** – The \$4,000 deposited at the end of each of the next 3 years is a 3-year annuity. The future value of an ordinary annuity factor for 3 years at 8% is 3.25. We multiply the \$4,000 that will be deposited each year by 3.25 to calculate the future value of the \$4,000 deposits. This is \$13,000. This needs to be added to the future value of the \$75,000 that is already in the bank account. The future value of \$1 factor for 3 years at 8% is 1.26.  $\$75,000 \times 1.26 = \$94,500$ . Adding this to the \$13,000, we get a total cash value of \$107,500.