Accountant’s Guide to Computers and Information Technology

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Course Description

The course covers what every accountant should know about computers and information systems and technology. The practical and efficient use of computer technology is highlighted. Popular accounting, compliance, taxes, audit, write-up, forecasting and statistical, budgeting and planning, project management software are explained. The importance of information system and data protection, data bases, client/server computing, and cloud computing are discussed, with an emphasis on security issues. The course also teaches you how to make lease-purchase decisions and analyze and evaluate information technology (IT) investments.

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Chapter 1: Accounting Information Systems and Packages

Learning Objectives:

After completing this section, you should be able to:

1. Identify components of an accounting information system.
2. Recognize characteristics of accounting, tax, and audit software.
3. Recognize the purpose of extensible business reporting language (XBRL).

Accounting information systems record, report, and analyze business transactions and events for the management of the business enterprise. It encompasses six essential accounting systems including order processing, inventory control, accounts receivable, accounts payable, payroll, and general ledger. This chapter discusses several software applications of particular interest to accountants. The discussion includes the major players in the area and some important features to look for when considering a particular type of software.

Accounting Information Systems

Accounting information systems are the oldest and most widely used information systems in business.

Computer-based accounting information systems:

- Record and report the flow of funds through an organization on a historical basis and produce important financial statements such as balance sheets and income statements
- Produce forecasts of future conditions such as projected financial statements and financial budgets
• Operational accounting systems focus on transaction processing systems. They emphasize legal and historical record-keeping and the production of accurate financial statements.

• Typically, operational accounting systems include:
  1. Order Processing: Captures and processes customer orders and produces data for inventory control and accounts receivable.
  2. Inventory control: Processes data reflecting changes in inventory and provides shipping and reorder information.
  3. Accounts receivable: Records amounts owed by customers and produces customer invoices, monthly customer statements, and credit management reports.
  4. Accounts payable: Records purchases from, amounts owed to, and payments to suppliers, and produces cash management reports.
  5. Accounts payroll: Records employee work and compensation data and produces pay checks and other payroll documents and reports.
  6. General ledger systems: Consolidates data from other accounting systems and produces the periodic financial statements and reports of the business.

• Management accounting systems focus on the planning and control of business operations. They emphasize:
  1. Cost accounting reports
  2. Development of financial budgets and projected financial statements
  3. Analytical reports comparing actual to forecasted performance

Figure 1 illustrates the interrelationships of several important accounting information systems. Many accounting software packages are available for these applications.

Figure 1

Accounting Information Systems for Transaction Processing and Financial Reporting
**Online Accounting Systems**

Accounting information systems are being affected by Internet and client/server technologies. Using the Internet, intranets, extranets, cloud computing and other network changes how accounting information systems monitor and track business activity. The online, interactive nature of such networks calls for new forms of transaction documents, procedures, and controls. Many companies are using or developing network links to their trading partners through the use of the Internet or other networks for applications such as order processing inventory control, accounts receivable, and accounts payable.

**Accounting Software**

There are many factors that must be weighed when selecting a computer software package. Besides determining the software features currently needed and required in the future, the buyer must have a thorough understanding of the firm's existing system, and whether proposed software will integrate with all areas of that system and business.
Some of the basic considerations include: features and capabilities, compatibility and integration, ease of customization, ease of use, written documentation and technical support, price, and vendor's reputation and stability.

The fundamental task of accounting software is to automate the routine chore of entering and posting accounting transactions. This information is organized in an electronic format so as to produce financial statements and can be accessed immediately to assist in the management of the firm.

An accounting software package consists of a series of highly integrated modules. Each module corresponds to a specific accounting function (e.g., payroll, accounts receivable, and accounts payable). In an integrated system, after the details of the transaction are entered in one of the modules, the chart of accounts from the general ledger is "read." The transaction is then automatically posted to the accounts in the general ledger. For example, when a sale on account is entered in the accounts receivable module, a debit is automatically made to the accounts receivable account in the general ledger and an offsetting credit made to the general ledger sales account.

**Module Descriptions**

The basic features typically required by a firm and often integrated in an accounting software package include the following: general ledger, accounts receivable and invoicing accounts payable and purchase order processing, inventory, payroll, job costing, and fixed assets.

**General Ledger**

The general ledger is the heart of the accounting system. It contains the chart of accounts of the business. A general ledger module should contain a sample chart of accounts which can be customized to a particular business. In addition, it should contain predefined reports that support budget data and prior year comparisons which can be tailored to a firm's specific needs. Other essential features include the capability to generate automatic reversing and recurring journal entries, having at least 13 periods open at one time, and the ability to make prior period adjustments or post entries to another year without closing the current year.

**Accounts Receivable and Invoicing**

The accounts receivable and invoicing functions are often combined in the same module. This module allows you to enter sales data and permits extensive sales analysis. It provides customer receivables management by tracking customers' balances, generates invoices and/or monthly statements, as well as aging reports. It should allow for setting up credit limits for each customer, provide for flexible billing options, and the ability to apply partial payments to specific invoices or to the oldest balance. For faster processing, online inquiry should show the complete customer record at a glance including balances and unpaid invoices, and allow you to make changes "on the fly."
Accounts Payable and Purchase Order Processing

Accounts payable and purchase order processing can also be combined in a single module. The module tracks obligations to vendors and determines a best payments schedule, prints checks, and provides for the distribution to accounts. It should allow for enhanced management of order processing by tracking orders from the start to the receipt of goods. It should be able to detect supply problems and thus permit early planning for alternate sources. To analyze vendor performance, it must track the complete purchase and delivery history of vendors and allow for easy access to this information.

Inventory

This module automatically tracks inventory as purchases or sales are made, and maintains cost and price data for each inventory item. In an integrated system, the Inventory main file, which stores the product’s number, is checked when a sales invoice is created in the accounts receivable module. If sufficient inventory is on hand, the amount of the sale is reduced from the balance. Likewise when inventory is purchased, the inventory quantity is automatically increased. The module should help improve inventory management by alerting the user when to reorder, identifying slow moving items, and analyzing performance by item and category.

Payroll

The payroll module maintains default information for each employee (e.g., rate of pay and income tax withholding information). The module calculates the wages to be paid, prints checks, and keeps track of deductions, sick and vacation days, and other such information. It maintains information for government reporting (e.g., 941, W-2, unemployment, and state tax forms). For cost control, it should be able to provide for expense distribution or integrate with a costing module.

Job Costing

A job costing module allows you to track and report on the costs, income, and profitability of individual jobs or projects. This is done by assigning a job ID number to purchases, sales, and employee hours. A job cost module should provide for an accurate audit trail, detailed income, expenses and committed costs, as well as the tracking of other user-defined categories. For example, JAMIS is a job costing accounting package that tracks costs by project, contract, or organization over multiple years.

Fixed Assets

Fixed assets usually represent a significant investment by a firm, thus it is essential to keep track of them, but extremely tedious to do so. Tracking fixed assets and the repetitive calculation of depreciation is well suited for the computer. Most accounting software packages include the fixed asset module or capabilities to control fixed assets. It is also possible to purchase dedicated stand-alone fixed asset packages.

Fixed asset software can handle large amounts of data and a variety of depreciation methods for financial accounting and tax purposes. It should be able to maintain detailed information about each asset, including a description of the asset, its location, date placed in service, and estimated useful life. It should also be able to
track additions and disposal, as well as basis adjustments. An example of a fixed asset package is Bassets eDepreciation.

Before purchasing an accounting package, check if it has a fixed asset module, or capabilities sufficient for your needs. If not, ask if the vendor produces a stand-alone version, or would recommend a third party vendor. Before purchasing a stand-alone fixed asset software package, make sure that it allows for easy sharing of information with your general ledger, tax packages, and other data repositories.

**Market Leaders**

There are a number of accounting software products. They can conveniently be categorized as (a) low-end, (b) mid-level, and (c) high-end packages.

TechRepublic ([http://techrepublic.com](http://techrepublic.com)) provides a list of these packages.

**High-End**

High-end applications serve both midsize, regional companies and large, multinational corporations. They’re flexible, easy to implement, and can be modified to meet the users’ needs. Although this category of software isn’t inexpensive, they are appropriate for enterprise companies, and have increasing interaction with other company operations and provide cloud, mobile and international support.

**AccountMate Software**  
([www.accountmate.com](http://www.accountmate.com))  
Client/server software available to almost any size business.

**Sage ERP Options**  
([www.sage.com](http://www.sage.com))  
Multi-tier business management system, multi-currency and multilingual support, e-business and sales force automation capabilities, customization options.

**MS Dynamics AX**  
Designed for mid-size and larger companies, Microsoft® Dynamics AX (formerly Microsoft Axapta) is a multilanguage, multicurrency enterprise resource planning (ERP) solution. Its core strengths are in manufacturing and e-business, and it includes strong functionality for the wholesale and services industries.

**Epicor**
Integration between front office and back office applications, customization options.

Infor

Freestyle reporting capabilities; multinational, multi-currency processing of payments, invoices, and receivables; Web-enabled accounts receivable function.

Exact Software

Allows multiple budgets and prior year’s data to be maintained.

Oracle - JD Edwards Enterprise One

SAP

Mid-Level

Buyers of mid-range programs are tough to define by revenue, but they usually include four or five accounting users and have needs that are technically sophisticated. These buyers generally require more robust, multi-user features and management reporting while still retaining tools that are required for a small business. Essential features of a package include client/server architectures, custom report design, and Internet/intranet-enabled functions.

AccountMate Software—AccountMate

Client/server software available to almost any size business.

CheckMark Software—MultiLedger

Integrated, cross-platform accounting program combining general ledger, accounts receivable/payable, and inventory.

PC Accountant—ProBooks

Features integrated, point-and-click accounting.
Sage Software—BusinessWorks

http://na.sage.com/us/sage-businessworks
Features 10 fully integrated modules; can support up to 48 concurrent users.

VisionCore

http://www.comtechsolutions.com/
NET Accounting and ERP software that is connected, customizable and scalable.

Low-End

Products in the low-end category are not short on capabilities or features. Rather, they are made for sole proprietorships, partnerships, and corporations that are closely held with only a few employees. These users need a package that will help them balance checkbooks, prepare payroll reports and deposits, and keep track of bills and customer invoices. They want features including single points of entry for data, on-the-fly updating, tight integration with the Internet, sophisticated customized reporting, built-in job costing, and electronic payroll and bill paying services.

Sage 50 Accounting (formerly Peachtree Software)

Designed for small to medium-size businesses; features multi-user capabilities.

Intuit—QuickBooks

http://www.intuit.com/
Features include time tracking, job costing, and estimations; integrated with Microsoft Office

MYOB—Premier Accounting

www.myob.com
Features more than 100 accounting and financial management reports; supports multiple-currency accounting.

Selecting Accounting Software

In selecting accounting software, consider the following:

Customization: Can the package be customized? Can it be customized enough to meet user requirements? Items to be customized include reports, forms, input screens and source code.
**Vendor reliability**: Can we rely on the vendor? Do they have sufficient resources? Are they profitable and supported by sufficient, knowledgeable staff? Will they be around in 10 years?

**Reporting**: Can the package produce required financial statements in a timely and accurate manner? Do the reports include the required ratios? Do they include graphical output? Do they incorporate third-party products FRx (offers reporting capabilities for the general ledger module) and Crystal Reports (extracts and reports event data from all modules) into their packages?

**Database**: Do the databases available with the package match the user’s needs? Databases available include Btrieve, Microsoft SQL Server, Oracle, and IBM DB2. The user’s number of transactions is a typical determinant of the database required.

**Client/Server**: Does the package come with a client/server version? This version allows the user to save the bandwidth and time on the LAN and to distribute single processes across multiple computers throughout the organization.

**Account number structure**: Does the account number structure accommodate the number of segments—for subsidiaries, divisions, accounts, subaccounts, departments, programs, and funds—and total number of characters required by the user?

**Online**: Does the package include the following internet-related features?

- Publish web catalogs directly from, and made links to, the software’s inventory module.
- Retrieve orders directly from the web site and import them to the sales module.
- Print reports to a web page (HTML) format.
- Allow users access reports and accounting data across the web.
- Support remote data entry across the web.

**International**: Does the package process multiple currencies? Does the package support foreign languages?

**User friendliness**: Does the package contain user-friendly features such as graphical guidance; default-rich settings; and clear, simple, intuitive screens and labels.

**Other features**: Does the package include pivot tables and hotlinking? Does the package alert users when certain conditions, such as cash on hand, gross margin, and inventory balances, reach user-defined levels?

**Note**: For more in-depth analysis of various accounting packages, you may want to consult these professional organizations and manuals, some of which offer advice on purchasing software. They include:

- Institute of Management Accountants ([www.imanet.org](http://www.imanet.org))
- Family Firm Institute ([www.ffii.org](http://www.ffii.org))
- National Society of Accountants ([www.nsacct.org](http://www.nsacct.org))
- The American Institute of Certified Public Accountants ([www.aicpa.org](http://www.aicpa.org))
- CPA Practice Advisor ([www.cpapracticeadvisor.com](http://www.cpapracticeadvisor.com))
**Write-Up Software**

With the development of easy-to-use and inexpensive accounting software, many companies who previously relied on CPAs to keep their books are doing it themselves. CPA firms can counter this trend with dedicated Write-up software which is easy-to-use and provides more features so as to add value to their write-up services.

Write-up software should allow you to do more than just record transactions. One of the biggest features to look for is the ability to easily create an array of printouts and reports that a client might need. This includes being able to link and transfer data from other software packages and applications.

Another important feature is the ability to customize the input screen, so that it is consistent with the layout of the client’s source documents, thereby reducing unneeded keystrokes. Easy setup is another means to reduce the cost of write-up service. The package should contain sample company data, and the ability to copy common information and make changes to default information included in the setup “on the fly.” WebCPA ([www.accountingtoday.com](http://www.accountingtoday.com)) provides a complete review for write-up software.

Figure 2 lists some products included in both reviews.

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Compliance Software

In July 2002, the U.S. Congress passed the Sarbanes-Oxley Act, the most significant change to U.S. business regulations in 70 years. The Act creates tough new penalties for corporate fraud, prevents accounting firms from offering consulting services to audit clients and places restrictions on financial analysts. Section 404 (Management Assessment of Internal Controls) requires each annual report of an issuer to contain an "internal control report", which shall:

1. State the responsibility of management for establishing and maintaining an adequate internal control structure and procedures for financial reporting; and
2. Contain an assessment, as of the end of the issuer’s fiscal year, of the effectiveness of the internal control structure and procedures of the issuer for financial reporting.

Six Technologies That Can Assist with Compliance

Much of compliance is a matter of putting rules in place and ensuring that they are followed. Technology can provide the solutions to the corporate governance and compliance problem. It includes computer software for: business intelligence, business process management, document management, e-mail management, financial and accounting software, and enterprise resource planning (ERP).

Business intelligence Regulatory requirements for "real-time" disclosure of factors that affect financial performance mean that executives need access to timely, relevant data from all areas of the business. By drilling down into financial and company data and providing sophisticated reporting and analysis tools, business intelligence software can help ensure the accessibility of information.

Business process management (BPM) Businesses have traditionally been built around functional "silos", making it difficult to share information and obtain a consistent, enterprise-wide view. By extracting businesses processes from the underlying application code into an independent management layer, BPM software can help improve visibility.

Document management New corporate governance standards mean that companies need an efficient system for storing and retrieving important records and documents. Software packages that maintain audit trails of documents and set controls over how, where and for how long files are stored can help companies meet these obligations.

E-mail management As the volume of e-mail continues to soar, the logistics of storing essential e-mails and being able to retrieve them quickly become increasingly complex. And with new regulatory requirements around internal controls and disclosure obligations, the need for comprehensive e-mail management software becomes ever-more compelling.

Financial and accounting software To help comply with new standards such as Sarbanes-Oxley, many vendors are giving their traditional financing and accounting software a boost with additional modules that help with risk management, more accurate budgeting and forecasting, financial analysis and the establishment of internal financial controls.
**Enterprise resource planning (ERP)** ERP software can give organizations a consistent financial view across all divisions, thereby helping to maintain the accuracy of financial information. Many ERP providers are adding modules to their software to assist with compliance with Sarbanes-Oxley and other corporate governance standards. *Note: Appendix A provides a guide to compliance software.*

**Compliance Software**

Here is a list of some compliance software that can help.

1. *Trintech Cadency Compliance* ([www.trintech.com](http://www.trintech.com)) manages all SOX and other compliance initiatives across the enterprise, such as quality control, IT governance, and security, as well as corporate social responsibility (CSR) initiatives, such as green and sustainability projects.

2. *Agility™* ([www.businessport.net](http://www.businessport.net)) developed to include multi-standard compliance attempts to reduce S-Ox maintenance costs by controlling internally. *BusinessPort®* has the following features:
   - It offers a process-based solution.
   - The solution is deliverable on the corporate intranet and therefore easily distributed among the workforce.
   - The solution provides the client with a sustainable method for ongoing maintenance & compliance
   - Process maps, the core of the system, are easy to follow, much easier than text-based solutions

3. *Ethicspoint®* ([www.navexglobal.com](http://www.navexglobal.com)) offers management a tool that:
   - Effectively addresses issues of reporting compliance with the Sarbanes-Oxley and Foreign Corrupt Practices Acts
   - Reduces fraud, theft and abuse
   - Promotes safety
   - Identifies inappropriate behavior
   - Reinforce the organization's ethical values

**Tax Preparation Software**

Computer technology has had a significant impact on the way tax returns are prepared. Computerized tax return preparation lets the user prepare a return quickly and accurately, and allows the user to quickly analyze different tax planning strategies. Some software packages have built-in tools for tax research and permit for the electronic filing of tax returns. This software also lets the user easily do "what if" planning and then quickly makes all the necessary changes. Furthermore, data can be imported directly from accounting packages or electronic spreadsheets into tax preparation software.
While tax preparation software can help with tax planning, one should consider a dedicated tax research package for serious tax research. Most computer-based tax services have effectively replaced any printed version of tax services. They can greatly facilitate the tax research process, and make it much more efficient. In addition, it is easier to maintain and store all tax information on your computer or securely online. Most packages provide frequent online updates and additional tax information to assist with the preparation and filing process.

The industry is going through rapid and significant changes in terms of features and key players in the marketplace. As with other software, improvements are continuously being made.

The tax software industry is fiercely competitive and continues to go through consolidations and shakeouts. Thus it makes sense to deal with the larger, better-known vendors whose products are more likely to be supported in the future.

**Market Leaders**

The leading tax software packages can be categorized into segments:

*Lower-Cost Alternatives.* The price for this category is generally under $1,000. In spite of their low price, their features compare favorably with the higher priced products. The five products included in this category are listed in Figure 3.

*Mainstream.* These packages are suitable for mainstream tax practices. They are generally easy to use and learn, but are not intended to handle every situation that may arise. The packages in this category are generally more powerful than those in the lower-cost category.

*High-End.* This group is marketed for use by multistate regional and national firms. These packages are able to handle the most complex returns and track their progress through large offices.

![Figure 3: Tax Software](https://turbotax.intuit.com/)

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**Lower-Cost Alternatives**

- **Turbotax**  
  [https://turbotax.intuit.com/](https://turbotax.intuit.com/)
- **H&R Block Tax Software**  
- **ProSeries**  
- **Drake Tax Software**  
  [www.drakesoftware.com](http://www.drakesoftware.com)
- **TAXSIMPLE**  
  [www.taxsimple.com](http://www.taxsimple.com)
Audit software is used by accountants to perform audits efficiently and effectively. Software audit tools include automated workpapers, data extraction software, and trial balance software. The auditor can either access the client’s live data or obtain a copy of the company's data files. Data extraction software allows the auditor to audit "through the computer." The auditor can, for example, select a sample of accounts receivables for confirmations, or perform analytical reviews and do ratio analysis. Transactions may be compared to predetermined criteria.

Wolters Kluwer TeamMate is an electronic working paper system that helps automate the working paper preparation, review, reporting, and storage process. It includes standard and free form schedule templates, and automatic tick mark system and a powerful cross referencing capability. TeamMate also integrates popular spreadsheet, word processing and imaging software. It increases the efficiency and productivity of the entire internal audit process, including: risk assessment, scheduling, planning, execution, review, report generation, trend analysis, audit committee reporting and storage. By providing an integrated paperless strategy for managing audits, TeamMate’s audit software eliminates the barriers associated with paper-filled binders and disconnected electronic files, driving efficiencies into all facets of the internal audit workflow. The search, cross referencing, and retrieval capabilities allow the auditor to automatically correct errors in all affected documents. The working paper review features include automatic exception reporting, a working paper navigation system, and text and voice annotation. For example, the auditor can obtain a directory of all review notes pertaining to a document. The reporting features include key audit point summarization, report drafting, audit status reports, and time summaries. Financial data is quickly accessed by the sorting and filtering tools. A standard index provides a branch and node system for all papers. There is a simultaneous multi-user feature so auditors/reviewers can work with the same document set even if they are working in various locations. TeamMate improves the quality, productivity, and effectiveness of the auditor’s work. There are several complementary modules, including TeamRisk, TeamSchedule, TeamTEC, TeamEWP and Team Central.
CaseWare International (www.caseware.com), as the producer of engagement and reporting software, offers a software package supports you through all stages of client engagement (compilation, review, or full audit). This package features real-time updates, unrivalled flexibility, and also has its own integrated document-generator.

Thomson Reuters Engagement CS is a comprehensive tax workflow and accounting audit management software application. With the ability to build the whole package to your needs, you can organize any professional engagement, from planning and review to final document archiving, ensuring a complete, accurate, and cost-effective audit engagement. Engagement CS allows you to create trial balances, including the ability for multiple staff to make trial balance adjustments simultaneously, and create professional, customized financial statements and reports.

Figure 4 contains a number of audit software packages. They contain one or more features previously discussed.

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**Auditing Audit Software**

Recent corporate meltdowns are putting internal auditors under greater pressure. Internal auditors are under pressure to play an even greater role in strengthening internal control and governance by providing their companies with wider, deeper data analysis on a regular basis. Auditors need to spend quality time on solving exceptions, rather than finding them. This allows them to go beyond routine policing and take on more value-adding responsibilities, including risk management. One of the most striking changes to take place within internal auditing is the growing use of applications that fall under the banner of business intelligence. A number
of vendors specializing in business intelligence are now pushing their offerings into the auditing arena. Still, many businesses continue to rely on spreadsheet software to extract and analyze data.

**Spreadsheets**

More than any other product, the electronic spreadsheet has done more to make the capabilities of microcomputers evident to the business community. An electronic spreadsheet allows the user to work with data in a huge number of rows and columns. The user works with this data in a columnar spreadsheet, a format familiar to accountants. A big advantage of the spreadsheet is that it eliminates the need to perform manual calculations and can perform powerful computer-aided operations.

The spreadsheet has become a valuable tool in business planning, since it permits the user to perform "what if" scenarios. Inputs can be continuously changed, and the results will automatically be recalculated throughout the spreadsheet. Thus, the effect of alternative decisions is easily determined and planning greatly facilitated. The use of templates is another important feature of spreadsheets. Templates provide the format and contain the formulas which are used to repeatedly solve various business applications. Since one doesn't have to be a programmer to construct a template, all firms could now more easily use the vast power of the computer to help make better decisions in the management of a firm.

**Major Players**

The chief players in the spreadsheet field have been reduced to one software package, Microsoft Excel, with a growing use of free online software, such Google Spreadsheets. The advantage of the online software is the ability to share spreadsheets on the cloud, while avoiding licensing fees.

**Selection Considerations**

*Note: According to a University of Hawaii survey, between 78 and 97 per cent of spreadsheets contain “serious material errors” with a potential to devastate the bottom line. The evidence is as follows:*

- A number misrecorded in just one cell of a spreadsheet meant one company had to reduce drastically its fourth quarter outlook. Its shares lost more than 25 per cent of their value.
- A cut-and-paste error led to another company underbidding for an electricity supply contract.
- A missing minus sign caused a fund’s projected earnings to be overstated by $2.6bn.
- Falsely linked spreadsheets covered up a fraud totaling $700m at one bank.
- A faulty macro delayed the introduction of a drug, savaging a pharmaceutical company’s profits.
- A wrongly named spreadsheet led to the inflation of natural gas prices in the U.S. when one company submitted erroneous gas storage figures.

The key is the IT department should be responsible for spreadsheets so that experts can bring them under the same development, testing and control procedures as other computer applications.
Web-Based Accounting Systems

Web-based software packages are transforming business. Functions such as accounting, cash-flow management, customer relationship management (CRM), inventory control, and marketing can be performed electronically anytime and anywhere for a low monthly fee. For example, a small business can use Sage One, or QuickBooks Online (http://quickbooks.intuit.com/online) to process transactions for as little as $12.95 per month. Intuit offers payroll services on the Web, and a small business can outsource its payroll function. Not only can a business owner view and manage employee compensation via the Internet, but the outsourced services allow employees to access personal information, including earnings, income tax withholdings, retirement plans, and vacation days, without creating an added burden for the company.

Reliable and efficient access to information has become a must for business firms to stay competitive. To embrace web-based software and to stay competitive, small businesses must first set up a computer network. With networking technology, staff members or users at any location can share information simultaneously. The fast pace of information technology (IT) advances makes it difficult for accounting professionals to stay current

Implementing Web-based Accounting Systems

The following are easy-to-follow procedures to implement a web-based accounting system that will leverage current IT tools to improve profitability and efficiency.

Set up a system network.

A business must have the bandwidth capacity that broadband Internet provides in order to use web-based accounting packages effectively. The process of choosing the right ISP can be complicated, and a company must consider several factors, including price, performance, access, and technical support/services.

Select and subscribe to software

All web-based accounting packages listed in this section offer free trial periods of from 14 to 30 days. Businesses should make sure that the provider offers all the required features before subscribing to the service. A business should select a web-based accounting package based on the company’s information needs and the features offered by the software. For example, QuickBooks Online cannot provide detailed inventory information and thus is not suitable for most retailers. Neither QuickBooks Online nor Sage One can handle product costing, but the user can accumulate service or manufacturing costs by project. The Sidebar lists several important factors for a small business to consider when selecting web-based accounting software.

Customize the accounting system

Web-based accounting packages are general-purpose software, and a company needs to use and customize only the features required for its business. Working from the predefined chart of accounts, forms, and reports, a small business can set up and customize its accounting system in hours.
Prepare system documentation.

If the system is anything larger than the 1-5 person office, they need to prepare system documentation so that new staff can learn how to use the system and to ensure security in case the primary user is no longer available. System documentation should provide detailed procedures, including system activation and deactivation, chart of accounts, sales cycle, purchase cycle, employee and payroll cycle, cash receipts, cash disbursements, journal entries, inventory, financial reports and queries, and error corrections. The system designer should copy the predefined forms, screens, and reports and include them within the system documentation.

Good system documentation should be easy to read, make it easy for users to find specific information (i.e., include a table of contents, page numbers, and an index), and be well organized (i.e., by cycles or accounts). The procedures should be complete, in easy-to-follow steps (e.g., showing all relevant forms, screens, and reports). The overall presentation should be professional, and the system documentation should be kept in a safe place.

Web-based accounting makes the data easily accessible to multiple remote users at one time, and of course it offers the usual benefits of Web-based software: server-side upgrades, maintenance, and backups. For example, you can farm out your general ledger, accounts payable and receivable, invoicing, and reports functions to companies such as Sage Software (www.na.sage.com), and Intacct Corp. of Los Gatos, Calif. (http://us.intacct.com/).

Sage 300 Software

Sage 300 ERP (formerly ACCPAC accounting solutions) sells what it calls a complete business management system integrating an electronic storefront with a complete back-office system. It serves businesses doing e-commerce with a system connecting everything from inventory to invoicing. The system automates inventory control, purchase orders, Web site orders, credit checking, fraud protection, accounts payable and receivable, general ledger and even payroll.

Intacct

Intacct sees itself as "an accounting utility company." The company serves businesses employing up to 500 people with a full-function package--general ledger, financial reporting, budgeting, accounts payable and receivable, invoicing, expense reporting, human resources reporting and even a payroll service. If you're a small operation looking for low cost and ease of use, you want to pick something like Intuit Quickbooks. If you're a small or medium-size operation and you need functionality and scalability, you need something richer.

Intuit's Quickbooks

Quickbooks may be the market leader in small-business accounting software, but the company was late in developing a Web-based version. QuickBooks for the Web (http://quickbooks.intuit.com) and it's a different version than the desktop product.
Sage One

Formerly EPeachtree Accounting, the online offering from Sage (http://na.sage.com/us/sage-one), is a robust product for the Web. Quickly record your income and expenses into customizable account lists, then you'll be able to easily generate reports—P&L, balance sheets, aged invoices—whatever you need. After that, it's automatic; recurring transactions are matched and categorized, and payments that flow into your account can be applied against invoices you've created.

Advice and Caveats

A survey published by Financial Executives International (FEI)(www.financialexecutives.org) revealed that outsourcing would continue to be a solution for areas where management does not believe that in-house efforts can be cost-effective. The same survey also revealed that financial executives’ satisfaction levels with shared services are as high as 90%. Web-based accounting packages enable small businesses to outsource their accounting function at an affordable price, and web-based inventory control software allows small businesses to track their inventories in real time. Web-based software has the added bonus of always being up to date, because providers continuously provide incremental upgrades and new features.

To embrace web-based software, a small business must first develop a technology plan. This plan should be based on a thorough review of the company’s existing computing resources, and focus on what the business plans to do with technology. The plan should state the goals clearly, prioritize them, and tie them to a budget and a timetable. The firm must complete this prioritizing process before making any purchase decisions.

Once the company completes the technology plan, the second step is to match software products to the company’s goals and objectives. The business should be flexible with the technologies and should consider all available products in the market. At this point, the company can either handle the process with its own staff or use consultants to expedite the process.

Purchasing equipment can be overwhelming when facing all the choices in the market. Categorizing the available products can simplify this process. When evaluating competing services, the value-added features, such as unlimited free nationwide phone service, robust web-based e-mail, and hosting web content, can be extremely beneficial. For example, outsourcing the tasks of maintaining a web server, managing the associated traffic, and maintaining the continuous server uptime may result in savings of $2,000 to $3,000 per year.

Extensible Business Reporting Language (XBRL)

There exist too many data formats on the Internet preventing users from analyzing financial information without many labor intensive conversions. Excessive time is devoted to extracting useful information from available accounting and financial data. Further, time is wasted re-keying the same information into a spreadsheet. For example, data in the Securities and Exchange Commission’s (SEC) database referred to as Electronic Data Gathering, Analysis, and Retrieval System (EDGAR) cannot be imported directly into spreadsheets. EDGAR performs automated collection, validation, indexing, acceptance, and forwarding of submissions by companies.
and others who are required by law to file forms with the SEC. The comparison of numbers and ratios requires significant effort and very time consuming re-keying.

Extensible Business Reporting Language (XBRL) makes available financial information in an “easy to use” format on the Internet. It is a freely available electronic language for financial reporting, a XML-based framework that provides the financial community a standards-based method to prepare, publish in a variety of formats, reliably extract and automatically exchange financial statements of publicly held companies and the information they contain. XBRL is not about establishing new accounting standards but enhancing the usability of the ones that we have through the digital language of business. XBRL will not require additional disclosure from companies to outside audiences. This new language allows the financial community to communicate in a universal language. It is a language for the electronic communication of business information, providing major benefits in the preparation, analysis and communication of business information. It offers cost savings, greater efficiency and improved accuracy and reliability to all those involved in supplying or using business information.

XBRL is being developed by an international non-profit consortium of over 600 major companies, organizations and government agencies. It is an open standard, free of license fees. It is already being put to practical use in a number of countries and implementations of XBRL are growing rapidly around the world.

**How Companies Create XBRL Statements**

Accounting software vendors put XBRL tags in their accounting systems to allow users to cross-reference their accounts to this framework enabling a more efficient reporting process and a more meaningful experience for the users of financial information. Some of the most popular accounting software companies have already provided XBRL output in the financial statements. The list includes SAP, Oracle, Microsoft, and many others. There are thousands of companies globally involved in the development and adoption of XBRL.

**Applications of XBRL**

There are many accounting, financial, and business applications of XBRL including:

1. Automating business reporting.
2. Financial statement preparation and analysis. For example, XBRL financial statements on a company’s web site can go directly into Microsoft Excel so re-keying is not required.
3. Auditing of financial statements.
4. Managing and distributing accounting data.
5. Consolidating and reporting data to regulatory bodies.
6. Collecting and updating financial data on borrowers such as by accessing the borrower’s Web page.
7. Assessing credit risk.
8. Integrating investment information.
10. Internal management reporting such as cost control and analysis.
Chapter 1 Review Questions

1. Accounting information systems support accountants in decisions concerning the financing of a business and the allocation and control of financial resources within a business. True or False?

2. A typical accounting software package consists of a series of highly integrated modules including all of the following EXCEPT:
   A. Tax preparation
   B. Payroll
   C. Accounts receivable
   D. Accounts payable

3. Where is the chart of accounts of a business contained?
   A. Journal
   B. Balance sheet
   C. General ledger
   D. Income statement

4. What is a software module that allows you to track and report on the costs of individual jobs or projects?
   A. Inventory
   B. Payroll
   C. Accounts receivable
   D. Job costing

5. The deciding factor in selecting accounting software should be the price of the software. True or False?

6. What is the heart of the software accounting system that contains the chart of accounts of a business?
   A. Accounts receivable
   B. Invoicing
   C. General ledger
D. Accounts payable

7. What is the accounting software module that maintains default information for each employee?
   
   A. Inventory module
   B. Payroll module
   C. Job costing module
   D. Fixed assets module
Chapter 2:
Computer Software in Managerial Accounting

Learning Objectives:

After completing this section, you should be able to:

1. Recognize the function of Activity-Based Costing (ABC) systems.
2. Identify the value of managerial software and cash management software.

Computer software is available for most areas of managerial accounting, including cost systems, activity-based costing (ABC), forecasting, budgeting and planning, inventory evaluation, material requirement appraisal, project management, capital budgeting, risk analysis, linear programming, and flow-charting. There are stand-alone packages, templates, and spreadsheet add-ins. The purpose of this chapter is to alert you to software useful in managerial accounting, including their features, applications, and suitability to meet a particular company’s needs.

Activity-Based Costing (ABC) Software

An Activity-Based Costing (ABC) system accumulates costs on the basis of production or service activities at a firm. Basically it assigns costs by activity and links them to specific products. It is argued that the resulting cost data is much more realistic and precise as compared to the data obtained from a traditional costing system. ABC helps in determining what a product or process should cost, areas of possible cost reduction, and value-added vs. nonvalue-added aspects. Activity-based costing is beneficial in appraising value-chain functions. Further, costs are a function of their consumption factors such as number of employees, units produced, labor hours, etc.

Aided by computer software designed for ABC, the management accountant can more easily and accurately accumulate cost information and perform "what-if" testing. With this data, management is in a better position to evaluate and make decisions regarding its operations and products. There is a good deal of software that the
management accountant can use to aid in accumulating cost data. Some software are actually spreadsheet applications; others are modules of computer software packages.

## Cash Flow Forecasting Software

Computer software allows for day-to-day cash forecasting and management, determining cash balances, planning and analyzing cash flows, finding cash shortages, investing cash surpluses, accounting for cash transactions, automating accounts receivable and payable, and online banking. Computerization improves availability, accuracy, timeliness, and monitoring of cash information at minimal cost. Daily cash information aids in planning how to use cash balances. It enables the integration of different kinds of related cash information such as collections on customer accounts and cash balances, and the effect of cash payments on cash balances.

Spreadsheet program software such as Microsoft's Excel can assist you in developing cash budgets and answering a variety of "what-if" questions. For example, you can see the effect on cash flow from different scenarios (e.g., the purchase and sale of different product lines).

There are computer software packages specially designed for cash forecasting and management. These packages generally contain automatically prepared spreadsheets for profit/loss forecasts, cash flow budgets, projected balance sheet, payroll analysis, term loan amortization schedule, sales/cost of sales by product, ratio analysis, and graphs. You input data into different categories such as sales, cost of sales, general and administrative expenses, long-term debt, other cash receipts, inventory build-up/reduction, capital expenditures (acquisition of long-term assets such as store furniture), and income tax. The program allows changes in assumptions and scenarios providing a complete array of reports.

## Forecasting and Statistical Software

There are numerous computer software used for forecasting purposes. They are broadly divided into two major categories: forecasting software and general purpose statistical software. Some programs are templates, while others are spreadsheet add-ins. Still others are stand-alone. A brief summary of these three types of software follows.

### Templates

A template is a worksheet or computer program that includes the relevant formulas for a particular application but not the data. It is a blank worksheet that we save and fill in the data as needed for a future forecasting and budgeting application. Most templates are spreadsheet templates used in Excel or other spreadsheets that produces sales and financial forecasts, even for new products with limited historical data. They offer a variety of forecasting methods (such as moving averages, exponential smoothing, trend analysis, decomposition of time series, regressions, etc.) for accurate forecasts. You can use the built-in macros to enter data into your forecast
automatically. For example, enter values for the first and last months of a 12 month forecast. The compounded-growth-rate macro will automatically compute and enter values for the other ten months.

**Add-ins**

There are many add-ins that feature the following:

- Uses a variety of forecasting techniques and includes both automatic and manual modes
- Eliminates the need to export or reenter data

You can use it in either automatic or manual mode. In automatic mode, just highlight the historical data in your spreadsheet, such as sales, expenses, or net income; then the program tests several exponential-smoothing models and picks the one that best fits your data.

Forecast results can be transferred to your spreadsheet with upper and lower confidence limits. They generate a line graph showing the original data, the forecasted values, and confidence limits.

You can vary the type of trend (constant, linear, or dampened), as well as the seasonality (nonseasonal, additive, or multiplicative).

**Stand-Alone Programs**

There are an abundance of stand-alone packages that are much more powerful than templates or add-ins. Some business software use artificial intelligence. A built-in expert system examines your data. Then it guides you to exponential smoothing, Box-Jenkins, or regression - whichever method suits the data best. In addition to allowing the usage of all major forecasting methods, packages permit analysis of the data, suggests available forecasting methods, compares results, and provides several accuracy measures in such a way that it is easier for the user to select an appropriate method and forecast data under different economic and environmental conditions.

**Budgeting and Planning software**

The focus has been on moving away from spreadsheets to enterprise budgeting applications in order to make the planning and budgeting process more efficient and the data more reliable. However the underlying process remains fundamentally unchanged; it is still about capturing and consolidating line item expenses. Several popular ones are described briefly.

The new budgeting and planning (B&P) software represents a giant step forward for accountants. Finance managers can use these robust, Web-enabled programs to scan a wide range of data, radically speed up the planning process, and identify managers who have failed to submit budgets. More often known as *active financial planning software*, this software includes applications and the new level of functionality that combine budgeting, forecasting analytics, business intelligence, and collaboration.
Project Planning and Management

Most project management applications today use computers extensively. The management of projects is enhanced by tools such as Gantt charting, Fish-bone diagram, the Program Evaluation and Review Technique (PERT), and Critical Path Method (CPM). These tools are easily computerized and indeed there are dozens of commercial packages on the market. The user inputs activity time estimates and procedure information, program output slack for each activity, duration and variance for critical paths, and other useful project management information. Many project management software packages, such as Microsoft Project, let planners enter defined activities, events, and times only once, and then present either a Gantt or a PERT chart-or both-on the computer’s monitor. The project manager can then see how changing parameters will alter the charts and completion times. Some managers prefer using Gantt charts, some prefer PERT charts, and others use both, for the same projects. The preference depends on the personality of the manager and on presentation needs, rather than on the nature of the project.

The types of project management software are described below.

1. Project- and Resource-Tracking Software. With these applications, you enter each task and subtask of the project as well as each subproject, then define resources, such as employees and contractors, and assign them. Most of these tools let you define priorities and set the order in which subprojects or individual parts of the project must be done. Many good specialized project-tracking tools are available, but remember, spreadsheets and even text editors can do the job in a pinch. The quality of your project management depends more on your skill and attentiveness than on the tools you choose to use.

2. Time-Tracking Software. These applications let you track in detail the amount of time it takes to implement your project. Keeping abreast of this information over time will help you improve your estimating skills.

3. Bug-Tracking and Source-Code Version-Control Software. These applications are not just for software-development projects. You can use these products to control changes to documentation, keep on top of the versions of vendor software that are in your standard desktop image and track problems with every portion of your project.

Linear Programming

Linear programming is the allocation of limited capital and human resources to maximize gain or minimize cost. Linear Interactive and Discrete Optimization (LINDO) can be used to obtain optimal solutions. What’s Best! is a linear programming software aiding in determining the optimal allocation of limited capital, human, and financial resources. It considers time constraints and is ideal for management decision making. The objective of the software is to maximize revenue or minimize cost.
A Caveat

The tremendous power of project management software can lull you into a false sense of security. Although the tool can save you a significant amount of time, there are many things that it cannot do. You’ll have to rely upon your knowledge of project management rather than the tool. Here are some things that the tool cannot do:

- **Make decisions**: you’ll still have to determine the course to the project through the day-to-day decisions you make
- **Gather data**: you must still determine how much data you need and what forms are most useful to manage your project.
- **Find errors**: if you input bad data, you will get bad data out
- **Solve your most critical problems**: some of the biggest problems you encounter will relate to people. Obviously, project management software does not address this issue at all.

Selecting a Software Package

Here are specific recommendations for a software selection process.

1. **Plan the project.** Plan a software acquisition project to ensure you have overall agreement on the objectives, deliverables, scope, time frame, approach, etc., for choosing the software. This should include the background on what type of tool you will be considering, why it is needed, where it will fit in your technology architecture, etc. You should also build the work plan that you will use to manage the project. This planning step takes place just as it would for any projects that you manage.

2. **Gather and rank business requirements.** It's hard to select a tool or package if you are not sure what your requirements are. Again, this work is similar to the analysis you would do for any project. Ask questions such as the following:
   - What will people be using the package for?
   - What problem will the package solve?
   - What features and functions are required?

Many times, you will not be able to determine all the requirements by just asking the customers. You can also look for other potential requirements by reviewing prior research from industry analysts, reading magazines and
periodicals, and searching the Web. These searches can be used to generate potential requirements that can be validated by your customers. Each requirement should be weighted on a numeric scale, or high/medium/low, to reflect the relative importance of some requirements over others. (Other weighting scales can be utilized as well.) This total list of requirements and weightings needs to be reviewed and approved by your sponsor and major customers and stakeholders.

3. **Create package long list.** At this point, look for any and all packages that might meet your needs. This can be accomplished by searching the Web, looking at trade magazines, talking to other companies, etc. The purpose of the step is to gather a comprehensive, but not exhaustive, list of vendors and packages that you want to consider further. If you think you already know the particular packages you are interested in, this step can be skipped-moving you directly to the short list. But this step helps ensure that there is not an obvious candidate that you are overlooking.

4. **Create short list.** Perform an initial, high-level evaluation of the long list, looking for obvious reasons to eliminate some of the alternatives. For example, certain products may not fit within your technology architecture, some may be too new, or some may be obviously too expensive. In some cases, there may be a feature that you absolutely need that is not available. The purpose of this step is creating a short list of potential packages that look like they will have a reasonable chance to meet your needs. If the long list is not too large, you could send a Request for Proposal (RFP) to each candidate for feedback. You could also ask for product brochures and other literature. You can try out demo products. But, you must narrow down the packages to a small enough number that you can compare and contrast the remaining solutions during your final selection process.

5. **Evaluate package short list.** This step can be the most difficult part of package selection. You must map the package features and functions against your requirements and weighting factors to determine which package most closely meets your needs. Usually, some type of numerical calculation is made based on how well the package meets each requirement, multiplied by the weighting factor. The package with the highest score across all requirements should be the one that best meets your needs. When you have completed this step, you should have a first and second choice for the package that best meets your needs.

6. **Make final selection and negotiate contract.** In many organizations, a project team makes the final recommendation and then turns the process over to a formal purchasing or procurement organization. They are responsible for contract negotiation and legal details.

We have described an overall process that can be used to make a package or vendor selection. Of course, if the software is complex and expensive, these high-level processes might be broken down into 100 distinct activities. In fact, for large, strategic purchases, such as with the Department of Defense, the selection process could take months or years. On the other hand, for more simple, commonly used packages, the process might be streamlined and completed in a matter of days or weeks.

Still, you must understand your requirements first and then go through a process of finding and subsequently narrowing down the field of potential packages and vendors until you can make an intelligent decision on which one to purchase. Here are some of the factors you should consider, examine, and compare before selecting the “right” software for you.
Cost vs. Functionality. The costs and capabilities of project management software vary considerably. Systems can cost anywhere from a few hundred dollars to tens of thousands of dollars. Consider how much power you need with respect to the size of project the software can handle, the features you’re likely to need or benefit from. Make sure you keep an eye to the future: consider functionality not only in terms of what you need now, but for the terms as well.

Capability vs. Ease of Use: There’s general relationship between the capability of project management software and its ease of use. I once knew a company whose need for computing power in their project management software was not really that great. However, the decision-makers felt that they wanted maximum horsepower in their software, “just in case.” Unfortunately, proper use of the software required sending people off to a month-long, intensive training program and to periodic refresher courses thereafter. The company had difficulty breaking people free to take the training. After two years of hacking their way through the use of the tool, they abandoned it and bought something simpler.

Compatibility with other Systems: Consider how your project management software will have to interface with other communication, accounting, or reporting system already in use in your company.

Documentation, Startup Support and Ongoing Technical Support: How much support can you expect from the manufacturer and/or the company selling the software? Consider important issues, such as the documentation you’ll receive, the setup and startup support you can expect, and the long-term technical support you’ll get.

Consider using several sources of input, including the experiences of others and rating guides, before making your final selection of project management software.

Checklist

<table>
<thead>
<tr>
<th>Software Decision Checklist:</th>
<th>Answer</th>
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<tbody>
<tr>
<td>Which vendor’s product best meets your needs?</td>
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<tr>
<td>Which vendor’s products have more of the features and functionality you need?</td>
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<tr>
<td>Is the vendor’s product part of a robust, vibrant and flourishing ecosystem? In other words, are there third-party solution providers that can offer software solutions that fill the gaps the main product may not provide?</td>
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<tr>
<td>Does the vendor offer an API that is open to third-party integration?</td>
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<td>Can client data be saved, transferred, backed up, and easily exported to another vendor’s system?</td>
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<tr>
<td>Does the vendor employ generally accepted universal open data formats, standards and architecture?</td>
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<tr>
<td>Have independent consumer organizations positively reviewed and/or tested the product?</td>
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<tr>
<td>Can the vendor direct you to real users who are using the product?</td>
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<tr>
<td>Does the vendor offer a free trial or demo version of the software, so you can try before you buy?</td>
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<tr>
<td>Does the vendor offer robust and comprehensive support via telephone, email, online support forums and more?</td>
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<td>Does the product have a solid reputation within the tax and accounting community?</td>
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<td>Which product boasts a lower expected total cost of ownership?</td>
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<td>Are there stats to back up the vendors’ claims?</td>
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<tr>
<td>What kind of return on investment do the vendors state you can expect to see in one month, one year and beyond?</td>
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<tr>
<td>Are there stats to back up the vendors’ claims?</td>
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<tr>
<td>Is the software vendor financially sound?</td>
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<td>Will the vendor be here in the months and years to come?</td>
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<tr>
<td>Or, will you be the owner of an orphaned software product?</td>
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<tr>
<td>Does the vendor maintain the software with regular updates and upgrades?</td>
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<tr>
<td>Does the vendor have an R&amp;D department to make sure their products are continually cutting edge and best in class?</td>
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<tr>
<td>Is the pricing structure simple and straightforward? Or will the vendor nickel-and-dime you for every additional feature or service?</td>
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<tr>
<td>Can you check online forums to hear what current users say? For example, is the product as good as it is advertised? Or, does the vendor spend more on marketing hype than product development? And according to these forums, does the product perform as expected?</td>
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<tr>
<td>Is the vendor responsive to customer issues and requests?</td>
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<tr>
<td>Integration of the application’s modules: If the product offers additional modules for various accounting or industry-specific functions, are all modules well integrated and as easy to learn and use as the core product?</td>
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<tr>
<td>Are industry-specific templates and other customized modules available either through the core product or through third-party vendors in its cloud ecosystem?</td>
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<tr>
<td>Software Updates: Does the vendor update its product regularly without impacting your workflow?</td>
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<tr>
<td>What is the up time for the vendor? Are there frequent periods when access to the program is closed for maintenance?</td>
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</tbody>
</table>
A well-run vendor should perform most updates and maintenance during non-business hours.

<table>
<thead>
<tr>
<th>Secure backup of client data: Is your data secure and regularly backed up in multiple locations or data centers?</th>
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<tbody>
<tr>
<td>Is the vendor compliant with SOC I, II or III requirements?</td>
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<tr>
<td>Does the vendor undergo regular compliance testing to ensure the integrity of its system and your data?</td>
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<tr>
<td>Does the vendor offer a guarantee and/or warranty?</td>
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<tr>
<td>Insert your own questions:</td>
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</tbody>
</table>

Source: Modified from CPA.com white paper “The Match of the Century”.
Chapter 2 Review Questions

1. What do you call a worksheet or computer program that includes the relevant formulas for particular applications but not the data?
   
   A. Spreadsheet add-ins
   B. Templates
   C. Stand-alone
   D. SPSS

2. The allocation of limited capital and human resources to maximize gain or minimize cost is called __________.
   
   A. Executive Management Game
   B. Risk Analysis
   C. Flow Charting
   D. Linear Programming
Chapter 3:
Information Security and Data Protection

Learning Objectives:

After completing this section, you should be able to:

1. Identify the steps in managing computer security.
2. Recognize failure points for a computer system.
3. Recognize appropriate protective steps for software modification.

Security concerns have heightened in recent years including computer-related data errors, thefts, burglaries, fires, and sabotage. The increased use of networked computers, including the Internet, intranets, and the extranets, has had a profound effect on computer security. The nature of the computing environment has changed significantly. The greatest advantage of remote access via networks is convenience. This convenience, however, makes the system more vulnerable to loss. As the number of points from which the computer can be accessed increases, so does the threat of attack. More caution is clearly needed to counter such threats.

The first step in managing computer security is to identify the resources that need to be protected. For example, the resource to be protected might be CPU cycles or computer time. This is unlikely to be the objective of most attackers or hackers. Frequently, hackers are interested in obtaining access to private or confidential information. Sometimes, the organization may not even consider the information to be “valuable” to anyone else and may not be willing to take security precautions. This is a serious mistake. Hackers often steal or destroy data or information simply because it is there! Other hackers may delete or destroy files in an attempt to cover their illegal activity. This leads to just one conclusion. A casual attitude towards computer security is never justified.

The second step in managing computer security is to determine against whom you want to protect your system. The security needs of a military computer system are likely to be significantly different from the security needs of a corporation. Are you trying to protect your computer system from teenagers “playing around” or corporate spies or industrial espionage?
The third step in managing computer security is balancing the costs and benefits of various security safeguards. In other words, how much are you willing to spend on security? Clearly, it is prudent to spend more on protecting resources that are of greater value to the organization. The cost of security safeguards include not only the direct cost of the safeguards, such as equipment and installation costs, but also indirect costs such as employee morale and productivity. It is important to recognize that increasing security typically results in reduced convenience. Employees for example, may resent the inconvenience that results from implementing security safeguards. Too much security can be just as detrimental as too little security; a balance must be maintained.

The last step in managing computer security is contingency planning. Assuming that security is violated, how do you recover? What are the data backup policies? What are the legal consequences? What will be the financial impact? A risk analysis should be performed in planning computer security policies and financial support. Computer security risks fall into one of three major categories: destruction, modification, and disclosure. Each of these may be further classified into intentional, unintentional and environmental attacks. The threat comes from computer criminals and disgruntled employees who intend to defraud, sabotage, and “hack.” It also comes from computer users who are careless or negligent. Lastly, the threat comes from the environment; an organization must protect itself from disasters such as fire, flood, and earthquakes. An effective security plan must consider all three types of threats: intentional attacks, unintentional attacks, and environmental attacks. What is the company’s degree of risk exposure? Insurance policies should be taken out to cover such risks as theft, fraud, intentional destruction, and forgery. Business interruption insurance covers lost profits during downtime.

Computer System Failures

A computer system can fail for several reasons, including:

- Operator mistakes
- User mistakes
- Malicious acts
- Hardware malfunction
- Software bugs
- Environmental factors, such as lightning, fire, earthquake, or power outage

When discussing computer reliability, it is useful to distinguish between errors, failures and faults in a computer system. An error occurs when there is a deviation from expectations. Some errors are acceptable because they can be overcome, others are not. An unacceptable error is a failure. If the failure can have serious consequences, it is considered a critical failure. A fault is a condition that results in a failure.

System reliability is distinct from system security. Security is designed to protect against intentional misuse and does not consider malfunction. Improving one factor often enhances the other factor. Both factors need to be considered in managing risk.
Establishing a Security Policy

Every organization should have a security policy that defines the limits of acceptable behavior and the organization’s response to violations of such behavior. Its purpose is to assign accountability and delegate authority across the organization. The security policy will naturally differ from organization to organization, based on its own unique needs. For example:

- There may be an edict barring the playing of computer games on corporate computers.
- There may be a policy against visiting adult web sites on the Internet using corporate Internet accounts or computers.
- Some organizations may wish to restrict the use of a specific protocol because it cannot be administered securely.
- Employees may be prohibited from taking copies of certain corporate data out of office premises.
- There may be a policy prohibiting use of pirated software.

The security policy should not only define acceptable behavior, but it should also contain the organization’s response to violations. How will the violators be reprimanded? Will the organization reprimand violators inside the organization differently from violators outside the organization? What type of civil or criminal actions might be taken against violators?

The security policy should be a broad statement that guides individuals and departments in achieving certain goals. The specific actions needed to realize the goals are contained in supporting standards rather than in the policy document. The security policy should be concise and to the point, generally not exceeding ten pages. It should be easy to understand. Its focus should be on emphasizing the role of individuals and departments in achieving the objectives. It is not the purpose of the security policy to educate or train individuals. Such an objective is better served through training seminars.

The background for developing a security policy should be discussed. It should explain the purpose of security, including why data integrity must be maintained. The importance of maintaining confidentiality and privacy of information resources should be emphasized. The continuous availability of information is important for the organization and any interruption can have serious financial consequences.

Employees should understand computer security is everyone’s responsibility. The scope of the computer security policy should encompass all locations of the company and all of its subsidiaries. Security is only as strong as its weakest link and therefore the same set of standards should be used throughout the organization. This means that the standards should be flexible enough so they can be used in a wide variety of circumstances and conditions, yet they should provide consistency and quality across the organization.

The security policies apply to all computer facilities and the data they contain, including stand-alone computers, Internet and intranet sites, local area networks (LANS), and wide area networks (WANS). All forms of electronic
communication, including email and internet usage are covered by the security policy. Other printed material, such as documentation and technical specifications, should be included in the security policy.

Computer security should be viewed as a means to an end and not an end itself. Computer security is an integral component of an organization’s overall risk management strategy. The responsibilities of various departments and individuals should be identified in the security policy. The policy established should be evaluated on a periodic basis to incorporate changes in technology or circumstances. The authority for issuing and amending the security policy should rest with a committee such as the Information Technology Management Committee. This committee should be responsible for determining when circumstances justify departure from the policy; all exemptions and exceptions should be approved by the committee.

Active participation by individuals and departments is needed for a security policy to succeed. It is well established that individuals are more likely to accept the security policy if they have had input during its creation. The real benefit of participation is that employees or departments will make a positive contribution to the policy by imparting their knowledge. Senior management’s support and cooperation is critical in implementing the policy.

The relationship between the computer security policy and other corporate policies should be described. For example, the computer security policy should be used in conjunction with the firm’s policies for:

- the internal control structure
- contingency plans, including business resumption planning
- privacy and confidentiality
- compliance with local and federal laws and regulations

A process should be in place to ensure compliance with laws and regulations. Privacy and confidentiality issues have a serious effect on computer security. Increased governmental regulation should be expected in the future. The legal department should assist department heads in complying with laws and regulations.

The Information Systems department’s and its security personnel’s responsibilities should be defined in the security policy document. These responsibilities include:

- ensuring that security personnel have the training and skill needed to perform duties required by the security policy.
- provide computer security assistance to other departments. Be responsible for all computer networks and communications.
- providing systems development methodology for security needs. Be responsible for all cryptographic methods and keys.
- provide and manage virus detection software for networked and stand-alone computers.
- be responsible for acquiring hardware or operating systems that are not currently part of the organization’s architecture.
- authorizing the use of the network, including the Internet and Intranet.
- review, evaluate and approve all contracts with third parties concerning information systems.
For personal computer systems, additional precautions are needed and should be addressed in the security policy. Some points to consider include:

- all original data should be backed up on a periodic basis.
- personal computers connected to a network may be a source of viruses; virus detection software should always be used, especially before copying data or programs on to the network. Confidentiality and privacy of data may be compromised.
- certain types of confidential or important data should never be stored on a local hard drive; instead such data should be stored on the network, or on floppy or compact disks or removable hard drive so that it may be removed and stored in a secure place.
- standards should be established for remote access.
- personal computers on the network should not be directly connected to the Internet since the Internet is a source of virus infections and hackers may be able to gain access through it; Internet access should be only through the company’s Internet server and firewall which is capable of protecting itself.

Below is a list that Pricewaterhousecooper developed suggesting the fundamental safeguards that any company should follow for an effective security program:

1. A written security policy
2. Back-up and recovery/business continuity plans
3. Minimum collection and retention of personal information, with physical access restrictions to records containing personal data
4. Strong technology safeguards for prevention, detection, and encryption
5. Accurate inventory of where personal data of employees and customers is collected, transmitted, and stored, including third parties that handle that data
6. Internal and external risk assessments of privacy, security, confidentiality, and integrity of electronic and paper records
7. Ongoing monitoring of the data-privacy program
8. Personnel background checks
9. An employee security awareness training program
10. Require employees and third parties to comply with privacy policies

(source [www.pwc.com](http://www.pwc.com) 9/2013)

**Physical Security and Data Security**

Physical and data security considerations are equally important. An effective security system should prevent a security breach. However, if in spite of proper protection, a system is successfully attacked, the system should create an audit trail to allow prompt investigation.
Unauthorized access to the computer facilities should be restricted and sensing and surveillance devices should be installed. Computer environment, including heating, cooling, dehumidifying, ventilating, lighting, and power should be protected. Appropriate care must be taken to protect the plant from harm and accidents and disasters such as fire and floods. Adequate emergency lighting should be available for safe evacuation in case of fire or other disaster. Consideration must be given to loss or damage to computer equipment and peripherals. Media, such as disks, tapes, and output should be protected. User manuals for equipment and software must be protected to maintain continuity of proper operations. Surge protectors should be used to protect the computer system against power line disturbances. Of course, the organization must consider loss of or injury to its personnel.

The layout of computer facilities is important in planning for computer security as well as achieving cost savings. As computers become smaller, they can be housed in smaller areas and this changes the way facilities are designed and planned. For example, it is no longer necessary to have raised floors in the computer room. If wiring is a concern, cables can generally be along the walls. If flooding is a concern, aluminum channels or I-beams can be used to raise components and cabinets. Cabling costs can be saved by placing the network equipment inside, next to the processing equipment. Smaller components may be stacked vertically to conserve floor space and reduce cable costs.

The computer facilities should be housed in a building’s core area near wire distribution centers. Care should be taken to avoid a location where water or steam pipes cross either vertically or horizontally. The room should be sealed to keep out smoke and dust.

Only one door should be used for access into a secured area. The door should be self-closing and it should not have a hold-open feature. A combination or programmable lock may be sufficient. An alarm system should be installed. There should not be any direct access from public places.

**Wires and Cables**

With the increase in distributed computing, it is even more essential to protect the wiring system. Wires and cables are generally made of either copper or optical fiber. Fiber optics offer significant performance and security advantages. However, they cost more to install. Still, if considerable data needs to be transferred, the cost disadvantage of fiber optics rapidly diminishes.

Cables and wires are fragile. They can be easily damaged. It is not possible to repair damaged wires; they must be replaced. The electrical properties of cables may also be affected and the data may become unreliable. Alternate paths should be provided for cables linking important or critical paths.

Fiber optics offer better security protection. It is relatively easy for someone to wiretap copper lines if they can obtain access anywhere along its length. Such wiretaps are very difficult to detect. In contrast, it is difficult and expensive to wiretap fiber optics. Moreover, normal operations are disturbed in a fiber optics tap and can therefore be detected more easily. Even with fiber optics, it is possible that a skilled individual with proper equipment can tap the system undetected. Fiber optics provide a deterrent, but should not be viewed as being perfectly secure. Of course, the best way to protect sensitive data is to use some type of encryption.
Fiber optics is not affected by electrical or magnetic interference. Copper wires have to be shielded with cabling and grounded metal conduits have to be provided.

Data wiring should be certified by a knowledgeable and experienced individual. Such an individual should

- Perform a visual inspection.
- Check that each cable is connected correctly.
- Check that there are no crossed pairs.
- Use a reflectometer to detect if there are any constrictions, bad terminations, or external interference.

Purchase orders for any wiring should specify:

- Who will certify the wiring?
- What equipment will be used to test the wiring?
- What standards will be followed?

**Destroying Data**

Once data is no longer needed, it must be properly destroyed. Information on magnetic media is typically “destroyed” by over-writing on it. While the information appears to have been destroyed, there are many subtleties to consider. For example, if the new file is shorter than the old file, information may remain on the magnetic media beyond the new file’s end-of-file marker. Any information beyond the end-of-file can be easily retrieved. A safe method is to overwrite the entire media. However, overwriting the entire media is time consuming and other methods, such as de-gaussing should be used. Degaussers are essentially bulk erasure devices that when used within their specification provide adequate protection.

Formatting a disk does not safely destroy all information. It is important to note that magnet media may retain a latent image of the preceding bit value after the write insertion of a new bit value. This occurs due to the inability to completely saturate the magnetization. While normal read/write operations are not affected by this limitation, it does pose a security threat and anyone with sophisticated equipment could exploit it.

For papers and other soft materials, such as microfiche and floppy disks, it is possible to shred them. Some shredders cut in straight lines or strips. Others offer cross-cutting and particle producing. Some shredders disintegrate by repeatedly cutting and passing the material through a fine screen. Shredders may also grind the material and make pulp out of it.

Burning is still another way to destroy sensitive data that is no longer needed. As with shredding, burning means that the storage media can no longer be reused. Even when burning, one needs to exercise caution. It is possible, for example, to retrieve printed information using special techniques from intact paper ashes, even though the information may no longer be visible to the human eye.
Environmental Considerations

Computer facilities are susceptible to damage from environmental factors. Fire security is especially important and is discussed in detail in a separate section. Other important factors include heat, water, humidity, dust, and power failure.

- **Heat** and high temperature can cause electronic components to fail. Air conditioning is generally essential for reliable operation. Simple precautions should be taken to ensure that air vents are not blocked and that the air is allowed to circulate freely. Backup power should be available for air conditioning if the computer system will be used even if the primary power fails.
- **Water** is an obvious enemy of computer hardware. Hoods, rain, sprinkler system, burst pipes, etc. could do significant damage. Attention should be given to the design of routing water pipes and the location of the computer facilities. Instead of a traditional sprinkler system, consider using an alternate fire-extinguishing agent that will not damage the hardware.
- **Humidity** at either extreme is harmful to the hardware. High humidity is likely to lead to condensation which can corrode metal contacts or cause electrical shorts. Low humidity is likely to permit the buildup of static electricity. Computer facilities should either be housed on bare floors or floors covered with anti-static carpeting. Humidity should be continuously monitored and kept at acceptable levels.
- **Dust**, dirt, and other foreign particles can ruin computer hardware. For example, dust can interfere with proper reading and writing on magnetic media. Personnel should not be permitted to eat or drink near the computer facilities. Air should be filtered and filters replaced at appropriate intervals.
- **Power failure** can render all equipment useless. Brownouts and blackouts are the most visible sign of power failure. However, voltage spikes are much more common and can cause serious damage. Spikes may be produced by lightning and such spikes may either damage equipment or randomly alter or destroy the data. A drop in line voltage can also lead to malfunction of computer equipment and peripherals. Voltage regulators and line conditioners should be used if electrical fluctuations occur. Use of uninterruptible power supplies should be considered.

Maintenance and Preventive Care

Facilities should be protected against adverse effects of the weather and other environmental factors. Regular maintenance can help prevent unexpected downtime. Diagnostic programs should be run as part of regular maintenance. Maintenance logs should be kept. Recurring problems can be quickly identified by scanning the logs. The maintenance log should include, at a minimum, the following information:

- Description of equipment serviced.
- Company Identification number of equipment serviced.
- Date of service.
- Services performed, including the results of diagnostic tests.
- A note indicating whether the service was scheduled or unexpected.
Computer areas should be properly cleaned and dusted. Eating, drinking, and smoking should be prohibited in computer areas. Personnel should be trained in proper handling of computer equipment and peripherals. Personnel should be trained in proper handling of magnetic media and CD-ROMs. For example, magnetic media should not be placed on top of or near telephones, radios, and other electric equipment. Labels should be prepared prior to placing them on disk; many untrained personnel will affix the label to the disk and then write on the label using a ball point pen.

Computers and peripheral equipment should be cleaned on a regular basis using cleaning products recommended by the manufacturer. Electrical equipment should never be sprayed directly with cleaning liquids. Keyboard surfaces should be cleaned with a damp cloth and vacuumed using special computer vacuums.

Magnetic media devices, especially the read/write heads and transport rollers, should be cleaned using commercially available cleaning products for such purpose. Dust, smoke, finger prints, and grease can build up on recording surfaces and lead to crashes or permanent damage to the equipment and magnetic media. Printers may need to be cleaned to remove fibers, dust particles and lint.

Simple precautions, such as using static-resistant dust covers protect the computer equipment and peripherals. Such covers should only be used when the equipment is not in use. Otherwise, the equipment may overheat and be damaged.

**Water Alert Systems**

Water alert systems should be installed in locations where water might damage computer equipment. Generally, water alert systems should be installed in the basement or in floors above the computer systems. Water sensing systems are especially useful in protecting electrical cables under the floor. Water sensors should be installed within suspended ceilings and inside water cooled computer cabinets and process cooling equipment. The water sensors should activate an alarm as well as some type of a drainage pump.

**Static Electricity**

Static electricity results from an excess or deficiency of electrons. An individual could easily become charged to several thousands of volts. While the current from electrostatic discharges is too low to harm humans, electronic equipment could easily be damaged. Protective measures against electrostatic discharges include grounding, shielding, filtering and limiting voltage. Vinyl flooring is generally better than carpeting to avoid a buildup of static electricity. Simple precautions can minimize the dangers from static electricity; these include:

- Using anti-static spray.
- Grounding computer equipment.
- Using anti-static floor and table mats.
- Maintaining the proper level of humidity.
Humidity Control

Humidity should be tightly controlled and maintained at an optimal level. When the air is too dry, static electricity is generated. When humidity is too high, generally at levels above 80% relative humidity, there may be problems with electric connections, as a process similar to electroplating starts to occur. Silver particles start to migrate from connectors onto copper circuits, thus destroying electrical efficiency. A similar process affects the gold particles used to bond chips to circuit boards. Generally, an optimal relative humidity level is about 40 to 60 percent.

Fire Protection

According to insurance companies, fire is the most frequent cause of damage to computer centers. No combustible material should be allowed in the computer room. This means special care should be taken in selecting office furniture. Waste receptacles should not be in the computer room. Instead, waste receptacles should be located nearby, just outside the computer room.

Fire detectors should be installed in appropriate locations and connected to an automatic fire alarm system. Fire detectors sense either changes in temperature or thermal combustion and its byproducts. Fire detectors may be activated by smoke, heat, or flame.

Smoke activated devices provide early warning for slowly developing fires. Smoke detectors should be installed in air conditioning and ventilating systems. Smoke detectors typically rely upon either photoelectric devices or radioactive devices.

- **Photoelectric Smoke Detectors**: Variations in the intensity of light cause changes in electric current in the photoelectric cell. Photoelectric smoke detectors are generally of three types:
  - Area-sampling photoelectric devices draw in air from the area to be protected, and if smoke is present in the sampled air, the light reflections on the photoelectric cell will trigger the alarm.
  - **Beam photoelectric** devices focus a beam of light on to a photoelectric cell from across the protected area. The smoke causes an obstruction in the light and activates the alarm.
  - **Spot photoelectric devices**, unlike beam photoelectric devices, contain the light source and the receiver in one unit. Light is not projected across the protected area. Instead, smoke entering the detector causes the light to reflect onto the photoelectric cell hence activating the alarm.

- **Radioactive Smoke Detectors**: These smoke detectors contain a minute amount of radioactive material in a special housing. Smoke interacts with the radioactive material and changes its ionization which activates the alarm. Radioactive detectors are most commonly the spot type. The response time for radioactive smoke detectors is affected by several variables, including the stratification of air currents and the nature of products of combustion. Generally, the heavier the particles resulting from combustion, the longer it takes for them to reach the ceiling where the smoke detectors are usually attached and the longer the response time of the unit. Incidentally, the danger from radiation from such detectors is minimal and all detectors must meet or exceed government standards.
Heat activated detectors can be of two types. The first type will activate the alarm when the temperature reaches a fixed predetermined value. The second type of detector senses the rate of change in temperature. Typically when the rate of rise in temperature exceeds 150 to 200 F, the alarm is activated.

For highly combustible areas, the rate of rise temperature detectors are recommended due to their faster response time. However, fixed temperature detectors tend to be more reliable and are not as prone to false alarms. Some heat activated detectors contain both types of sensors.

Heat activated detectors are available in line or spot coverage styles. Line type detectors usually rely upon heat sensitive cables or a pneumatic tube. Spot type detectors are placed at fixed intervals in each zone.

Flame activated detectors are of two types: Flame-Radiation-Frequency and Flame-Energy. Radiation-frequency detectors sense the flame related flicker caused by combustion. These sensors tend to be expensive and are therefore suitable under limited circumstances. Flame-energy detectors sense the infrared energy of the flame. These are also expensive and tend to be suitable for protecting expensive equipment. The principal advantage of flame-energy detectors is their super-fast detection of infrared energy of flame. These detectors are also capable of producing enough voltage to trigger the release of an extinguishing agent.

Different types of fires require different types of extinguishing agents. Using the wrong extinguishing agent can do more harm than good.

- Fires involving ordinary combustible materials, such as wood, paper, plastics, and fabric can be safely extinguished using water or tri-class (ABC) dry chemical.
- Fires involving flammable liquids and gases, such as oil, grease, gasoline, and paint can generally be safely extinguished using tri-class (ABC) and dry chemical, Halon, FM-200, and carbon dioxide.
- Fires involving live electrical equipment should be extinguished using a non-conducting extinguishing agent, such as tri-class (ABC), regular dry chemical, Halon, or carbon dioxide.

Most computer room fires will be electrical, caused by overheating of wire insulation or other components. Smoke from an electrical fire may be toxic and it should be avoided in even small quantities. Generally electrical fires cannot be extinguished till the heat source is eliminated.

A power panel with circuit breakers for the major pieces of equipment should be placed at an easily accessible location, preferably inside the computer room. The circuits should be clearly labeled so equipment can be shut down quickly in an emergency. Redundant devices should be on separate circuits. There should be one emergency switch to shut down everything in the event of a fire.

In the event of a major fire or explosion, the only concern should be the safety of human life. Computer equipment and wiring is likely to be destroyed by the intense heat. Backup copies of disks and data should always be kept at off-site locations. Not only will this help when attempting to recover from a fire, but it can also help during the fire since the personnel will not attempt to save backup data by risking their lives.

Halon has the potential of depleting the ozone layer. While Halon is still in use, an international agreement was reached to stop its manufacture as of January 1, 1994. FM-200 is now available as a Halon substitute. Both Halon and FM-200 systems tend to be expensive and governmental approval is often required. These systems
are also not very effective against electrical fires. In an electrical fire, it is essential that the power be shut off because a fire extinguishing system will only suppress the fire till power is stopped.

Water sprinkler systems are simple and a relatively inexpensive protection against fire. Most new buildings are required by code to have a sprinkler system. Accidental activation of the sprinkler system can cause substantial damage and it may take a long time before normal operations are resumed. In an electrical fire, water may even intensify the fire and cause greater damage. Sensors should be installed to cut off electrical power before sprinklers are turned on. It should be possible to activate sprinkler heads individually to prevent damage to a wide area. There should be a shutoff valve inside the computer room so that water can be shut off when it is no longer needed. This will minimize damage in the event of accidental activation.

Carbon dioxide, Halon, and FM-200 extinguishers do not require any clean-up after discharge. However, carbon dioxide discharge can suffocate humans. Foam or dry chemicals can be hard to remove. Hand-held fire extinguishers should be mounted on walls. Self-contained breathing apparatus should also be mounted on the wall.

Quick removal of smoke should be a priority. Special fans and blowers should automatically be activated by the smoke or fire alarm.

If computer equipment starts smoking, the first step should be to cut off the equipment’s electrical power. This is frequently sufficient and the fire will probably extinguish by itself. If there are visible signs of fire, or if you can feel the heat, an appropriate fire extinguisher should be used. Carbon dioxide extinguishers are often recommended for microcomputer related fires. When using a carbon dioxide extinguisher, do not spray the extinguishing agent directly onto the glass surface of the CRT, since it will lead to a sudden drop in temperature and shatter the glass.

Personnel should be trained for fire emergency. Company policy should state exactly what action should be taken in the event of a fire or smoke alarm. Personnel should be strictly forbidden from risking injury or loss of life to protect data or equipment. The following steps can reduce the damage caused by fire, and in the process, reduce insurance premiums:

- Safes for storage of documents should have a minimum four-hour fire rating.
- Walls, floors, and ceilings of computer facilities should have a minimum two-hour fire rating.
- Fire alarm should ring simultaneously at the computer facility and the nearest fire department. In addition, fire alarm signals should be located where prompt response is assured.
- Vaults used for storing backup tapes and records should be located in a separate building at a sufficient distance.
- Smoke and ionization detection systems should be installed throughout the ceiling of the computer facilities. Water detection systems should be installed under the floor of computer facilities.
- Halon, FM-200, or a similar fire extinguishing system should be installed throughout the computer facilities. Automatic sprinkler systems can be used in the supply and support areas. In case of destruction, there should be a disaster recovery plan.
- Building code and fire marshal regulations must be adhered to strictly.
Access controls guard against improper use of equipment, data files, and software. The oldest method of restricting physical access is by using some type of lock. Locks may be classified into two types: preset locks and programmable locks.

With preset locks, it is not possible to change the access requirements short of physically modifying the locking mechanism. Programmable locks may be either mechanical or electronic. The combination on the programmable locks can be more easily changed, as security needs change. A basic problem with such locks is that the entry codes are frequently easy to obtain by an observer. Some types of electronic locks overcome this problem by using a touch screen that randomly varies the digit locations for each user and by restricting directional visibility to basically perpendicular angle.

Security guards and security dogs are another way to restrict access in a wide variety of situations. The physical presence of guards and dogs serve as a deterrent. In the event of a problem, the guard is able to respond appropriately. Preemployment screening and bonding are essential when hiring security guards. Certain states, such as New York, have mandatory training requirements for guards.

Limitations with such methods are well known. Guards can become easily bored with the routine work and may not fulfill their duties as expected. It is easy for someone to forge identification and be let in by a guard. Another limitation of guards is that they may not be informed and through procedural error allow unauthorized individuals access to restricted areas.

Guard dogs are also very useful and act as deterrents. Dogs have excellent hearing and a keen sense of smell. Guard dogs can be trained to “hold” intruders till security personnel arrive. One disadvantage of security dogs is that additional liability insurance must be purchased. Training and maintaining dogs is expensive. Finally, guard dogs generally cannot differentiate between authorized and unauthorized visitors.

Still, security is enhanced if guards and/or dogs patrol the facilities frequently and at random intervals. The use of guards and dogs contribute to psychological deterrence. It lets a potential attacker or intruder know that he might be caught. A determined attacker, of course, is unlikely to be deterred by psychological deterrents and security should always be supplemented through other means.

Something as simple as lights greatly enhances security. Lights improve the ability of security personnel to carry out surveillance. Lights also deter intruders from entering the facilities. Lights may be left on all the time, on timer control, on ambient control, activated by motion detectors, or manually operated.

Computer and terminal access controls include:

- **Automatic Shut-Off** The system signs off the user if the user fails to sign off after the transmission is completed.
- **Call Back**: A phone call is made to the terminal site to verify the user’s identity before access is granted to the system.
- **Time Lock**: Access is denied to the system during specified hours, such as after normal business hours.

Within the plant, areas containing sensitive data should be accessible only to authorized personnel. These areas, including the computer room should have only a single entry door which can be operated by an appropriate
encoded magnetic-strip ID card. Physical controls include having a librarian keeping a log. A lockout should occur with repeated errors. Logs should automatically be kept of the ID number, time of access, and function performed. Further, data dictionary software provides an automated log of access to software and file information. Intrusion detection devices such as cameras and motion detectors should be used to monitor sensitive and high-risk areas against unauthorized individuals.

Are controls being diligently followed over processing, maintaining records, and file or software modification? Each individual function (e.g., accounts receivable, payroll) may have its own password so that users have access to limited areas of their authorization. The computer can keep an internal record of the date and time each file was last updated. This internal record should be compared against the log. The hours to access “key” microcomputer files should be limited. This prevents unauthorized access after normal working hours. Files should be expressed in terms of different levels of confidentiality and security such as top secret, confidential, internal use only, and unrestricted. Confidential information should not be displayed on the screen. To control access to sensitive data, there should be a mapping of access requirements to the system components. Access rights should be based on job function, and there should exist an appropriate segregation of duties. Temporary employees should be restricted to a specific project, activity, system, and time period.

**Hardware Security**

Computer hardware has improved in reliability and speed tremendously. These technological advances have not always had a beneficial impact on computer security and data integrity. Most integrated circuit chips on hardware equipment appear to be inscrutable to a lay person. There are millions of transistors on a small semiconductor. Still, it is possible for a bug to be planted into electronic equipment and it may be very difficult to detect. Several techniques may be used to seal the hardware against tampering.

Records should always be kept of hardware failure and computer down times. Regular maintenance should be performed on periodic intervals and records should be maintained. If computer equipment frequently requires servicing, personnel might be tempted to bypass controls and take shortcuts. The possibility of human errors therefore increases considerably. Records should be analyzed to determine if an unfavorable trend is observed for the downtime or if the equipment frequently requires unscheduled service.

Records should be kept of all computer equipment and peripherals. The hardware inventory logs should contain at least the following information:

- a description of the hardware
- manufacturer’s name
- model number
- serial number
- company identification number
- date of purchase
- name, address and phone number of stores from where the item was purchased
Software Development Security

Segregation of duties is essential in protecting computer programs during the development and modification stages. When software is developed and maintained internally, changes are frequently made to meet changing requirements. The source code is generally stored in the source library, while the compiled and executable version of the program is stored in the production library. The source library is under the control of the programmer, whereas the production library should be under the control of computer operations or a similar entity that does not have programming responsibilities.

All programs and data files should have date and time stamps, including both production and test versions. Date and time stamps make it possible to determine the current version of the program in the event of an error or malfunction.

The transfer from test status to production status of programs should be accompanied by authorization by management. The quality assurance department should do a formal review before releasing the final production version.

Whenever modification to a program is required, the reasons and requirement must be documented to prevent fraudulent modification. Requests for modification should include at least the following information:

- description of change
- why is the change needed
- how will the change benefit the department or organization
- name, title, and department of individual requesting the change
- approval of department head or another authorized individual
- date of request
- date of desired completion (time by which modifications should be made)

Once the Information Systems department receives the request to modify a program, it should determine:
• the priority of modification and the estimated date of completion
• the cost to make the modifications and the charge to the user department

The user department should be notified of the budgeted cost and the estimated completion time. The user department should approve the estimated completion time and budgeted cost.

A control sequence number should be assigned to the modification. Change requests should be tracked from the time they are initially submitted to the time the changes are completed. A programmer or analyst should be assigned the primary responsibility for making the changes. A determination should be made as to how the modified program will be tested. This generally requires the cooperation of the user department.

Small changes or emergency modifications should be possible without going through the full formal control procedure. Such changes should be carefully monitored. At a minimum, the following information about the modification should be documented:

• description of modification
• approval of the user department
• review of source code changes by a supervisor

**Password Security**

Passwords are subject to attack using several techniques. One technique, which relies on brute force, was frequently used in the past. All possible combinations were tried till the attacker was successful. To prevent such unauthorized access, the number of unsuccessful tries should be limited. Moreover, unsuccessful login attempts should be audited.

A hacker is often able to guess the correct password because many individuals select words or strings of characters that have a logical association with the individual under attack. For example, individuals often select the following easily guessable words:

• spouse’s or girlfriend’s/boyfriend’s name
• children’s name
• pet’s name
• social security number
• phone number
• own birthday, or a loved one’s birthday
• words like “password” or “code”

It is best to select a password that does not appear in a dictionary. It is also a good idea to include numbers or characters, such as a question mark or a percentage or a dollar sign in the password.

It is sometimes possible for a hacker to edit the password file and insert bogus user names and passwords. To protect against such an attack, the password file should be properly protected against unauthorized writing.
The passwords should always be kept in an encrypted format. Otherwise, it is easy for someone to scan for commands that are followed by passwords such as logins to capture passwords either from storage, or as they are being typed or routed in transit.

A serious design flaw can sometimes result in the creation of a “universal password.” Such a password satisfies the requirements of the login program without the hacker actually knowing the true and correct password. In one case, for example, a hacker could enter an overly long password. The overly long password would end up overwriting the actual password, thus allowing the hacker unauthorized access.

Audit Trail

Audit trails contain adequate information regarding any additions, deletions or modifications to the system. They provide evidence concerning transactions. An effective audit trail allows the data to be retrieved and certified. Audit trails will give information regarding the date and time of the transaction, who processed it, and at which terminal.

Computer-related risks affect the company’s internal control structure and thereby affect the company’s auditability. Electronic Data Interchange (EDI) systems are on-line systems where computers automatically perform transactions such as order processing and generating invoices. Although this can reduce costs, it can adversely affect a company’s auditability because of the lessened audit trail.

The AICPA has issued control techniques to ensure the integrity of an EDI system. The AICPA recommends controls over accuracy and completeness at the application level of an EDI system to include: checks on performance to determine compliance with industry standards, checks on sequence numbering for transactions, reporting irregularities on a timely basis, verifying adequacy of audit trails, and checking of embedded headers and trailers at interchange, functional group, and transaction set level. Control techniques at the environmental level include: review quality assurance of vendor software, segregation of duties, ensuring that software is virus-free, procuring an audit report from the vendor’s auditors, and evidence of testing. To ensure that all the EDT transactions are authorized, the AICPA provides these authorization controls: operator identification code, operator profile, trading partner identifier, maintenance of user access variables, and regular changing of passwords.

The Security Administrator

The size and needs of the company will dictate the size of the security administration department. This department is responsible for the planning and execution of a computer security system. They make sure that the information system’s data is reliable and accurate. The security administrator should possess a high level of computer technical knowledge as well as having management skills and a general understanding of the organization’s internal control structure.
A security administrator should interact with other departments to learn of the organization’s changing needs and be able to maintain and update the security system efficiently. The security administrator is responsible for enacting and customizing policies and standards for the organization based on specific needs. Checks on performance and monitoring of staff should be done to ensure that these policies and standards are being complied with. In developing these policies and procedures, as well as the overall information computer security system, the security administrator must perform a risk assessment.

**Disaster Recovery**

Tsunamis, hurricanes, earthquakes, fires, floods, criminal and terrorist acts, and human error can all severely damage an organization's computing resources, and thus the health of the organization itself. Many companies, especially online e-commerce retailers and wholesalers, airlines, banks, and Internet service providers, for example, are crippled by losing even a few hours of computing power. That is why it is important for organizations to develop disaster recovery procedures and formalize them in a disaster recovery plan. It specifies which employees will participate in disaster recovery, and what their duties will be; what hardware, software, and facilities will be used; and the priority of applications that will be processed. Arrangements with other companies or services for use of alternative facilities as a disaster recovery site and offsite storage of an organization's databases are also part of an effective recovery effort. The purpose of computer security is to protect the information services of the organization as a whole. Information should not be lost, damaged, or modified. It should be readily available to authorized users. It should not be possible to accidentally or intentionally disable the computer system. Contingency planning is a must to minimize a variety of business risks a business may encounter.

**Contingency Planning**

Many man-made and natural disasters can strike a company. A disaster may be defined as anything that will create a significant disruption in an organization’s ongoing activities for a considerable period of time. Proper contingency planning can help minimize the loss of human life, data, and capital. Preparedness is the key to recovering from disaster.

The primary focus of computer security should always be to take preventive action, not corrective action. Nonetheless, it is impossible to prevent every security breach. It is virtually impossible to anticipate every problem and even if a problem can be anticipated, the cost/benefit criterion may not justify taking any preventive action. Sometimes the precautionary measures may prove to be ineffective because of human or other error. Productivity and efficiency may also be sacrificed if precautionary measures are taken too far.

Emergency procedures should be established for each type of disaster that may occur. For each type of disaster, a determination should be made about the effect of the disaster on data processing and business operations. In other words, how long will the service be interrupted and at what level would the company be able to operate.
Legal Issues

Legal issues are important in considering computer security. Substantial liability may be incurred by a company for violating legal requirements. Sometimes management may even be held personally liable.

Privacy and other personal rights may be violated due to lack of computer security. The public is very concerned about privacy and this is reflected in the ever increasing legal requirements and regulations.

The general rule at the federal level is that all government files are open to the public unless there is a specific reason, enacted by the legislature, to keep the information secret. The Freedom of Information Act makes it possible for citizens and organizations to obtain access to most government records.

The federal government has passed legislation to protect private information. The Financial Privacy Act of 1978 was one step in this direction. The 1987 Computer Security Act showed further commitment toward computer security. This act states that, “improving the security and privacy of sensitive information in the federal computer systems is in the public interest.” This by no means should be limited to the federal government. The private sector also has to play their part in ensuring that private information is kept private. The public is very concerned about information getting into the wrong hands, and is concerned when asked to provide sensitive information.

With the 1987 Computer Security Act, the National Institute of Standards and Technology (NIST) was assigned the responsibility to develop cost-effective standards and guidelines to protect sensitive information in the federal databases. The Act also created a twelve-member panel to help NIST in performing their role. The private sector and the corporate world as a whole should not rely entirely on the government to take the steps towards improving security. To ensure that the individual privacy is protected, the following needs to be considered.

- Classification of Information
- Accuracy
- Protection of Sensitive Information

Once the information is determined to be sensitive, it should be verified for accuracy before being put into a database. Such information should be afforded the necessary protection to keep it confidential and adequately protected.

The Federal Privacy Act applies to records maintained by certain branches of the federal government. When contracting with agencies subject to the Federal Privacy Act, the act applies to the contract. The contractor and its employees are subject to the same requirements. Agency and criminal penalties may result from failure to comply.
Most states have Public Records Acts similar to the federal Freedom of Information Act. Several states have also enacted Fair Information Practices Acts which regulate the information state agencies, and those contracting with the state agencies, may maintain about individuals.

At the international level, especially in Europe, there are laws covering both governmental and private records. Computerized data banks must be licensed and certain laws apply only to them. Rules concerning disclosure are generally strict. There are frequently prohibitions against transferring information across national boundaries.

Email communications may be a source of claims of privacy violations. The organization should have a clearly stated policy about using computer systems for personal communications. For example, the organization may want to clearly state that the organization has the right to read all email communications. Courts have generally held that the employer has the right to view employee email; still it is prudent to have a written policy on this issue.

The Computer Fraud and Abuse Act is a federal law making it a crime for any unauthorized use (copying, damaging, obtaining database information, etc.) of computer hardware or software across state lines. Offenders can be sentenced to up to 20 years in prison and fined up to $100,000.

The Foreign Corrupt Practices Act (FCPA) of 1977 applies to all companies whose securities are registered or filed under the Securities Exchange Act of 1934. This Act requires the companies to keep accurate accounting records and to maintain a system of internal control. In other words, this Act mandates that these companies maintain appropriate computer security of its accounting records. Criminal prosecution can result from willful violations.

Computer security related legal liability may be incurred in a variety of situations, ranging from programming errors to civil or criminal violations. A company is expected to exercise due care and violation of the due care standard could result in liability. Consider a computer program that was originally designed properly, bug-free and operating effectively. However, due to lack of appropriate security, an attacker is able to place a logic bomb that causes the system to crash at a specified time in the future. The organization and its senior management may be held personally liable for any damages arising from the crash of the program. Such damages may include, for example, loss in market price of stock shares. Human life might also be affected if the program that crashed performed critical functions, such as a medical diagnosis system.

Consider another scenario where the attacker is able to modify the database of a construction company. Assume the database contains information about the strength of various types of steel that will be used to construct an office building. Engineers may rely upon the modified database and use steel that is not strong enough. The building eventually collapses and human life is lost. The liability that may result in such circumstances is likely to be astronomical, especially if it is proven that appropriate security could have prevented modification of the database.

The National Institute of Standards and Technology (NIST) has published several national standards in the area of computer security. Some of the standards include:

- password usage
• physical security and risk management
• data encryption standards
• user authentication techniques
• contingency planning
• electrical power for computer facilities
• key management
• automated password generators
• digital signature standard

It is prudent to consider using these standards in managing computer security. In a lawsuit alleging breach of security, failure to follow these standards may be used by plaintiffs to prove negligence, even if your organization was not required to follow these standards.
Chapter 3 Review Questions

1. What is the first step to managing computer security?
   A. Identify resources needing protection
   B. Determine who the attackers may be
   C. Measure costs and benefits
   D. Develop a contingency plan.

2. What are brownouts and blackouts the most visible sign of?
   A. Heat
   B. Water
   C. Humidity
   D. Power failure

3. What is a computer access control that denies access to the system during specific hours?
   A. Automatic shut-off
   B. Time lock
   C. Call back
   D. Photo electric device

4. The Federal Privacy Act applies to records used by Federal government users. True or False?
Chapter 4:

The Accountant and the Networked Environment

Learning Objectives:

After completing this section, you should be able to:

1. Recognize technical advantages of cloud computing.
2. Identify business benefits from cloud computing.
3. Identify protective steps for network environments.

Client/Servers

The client/server relationship describes a network whereby a server provides a function or service to one or more clients, and the client may have a relationship with one or more server. The accountant should have some basic familiarity with the client/server environment because client-server is the backbone of the Internet.

Servers are classified by the services they provide. For instance, a web server serves up web pages using HTML and a file server serves (or distributes) computer files. A shared resource may be any of the server computer’s software and electronic components, from programs and data to processors and storage devices. The sharing of resources of a server constitutes a service.

A network should be designed to meet corporate goals and purposes. In a client/server arrangement, computers are connected by a network in which some computers (clients) process applications while other computers (servers) provide services (e.g., Internet hosting, file storage) to the clients. In client-server environments, change control must also ensure synchronization of programs across the network so that each client and each server run the same versions of the programs.
As an example, think of when a bank customer accesses online banking services with a web browser (the client) from their home computer or smartphone. The client initiates a request to the bank's web server, using the web protocol. The customer's login credentials may be stored in a database at the bank, and the web server accesses the database server as a client. Then, an application server (which may or may not be the same computer as the web server) interprets the data by applying the bank's business logic, checking for security first, and provides the output to the web server. The output, for instance, could be the top level information about the user’s account (profile, balances, etc.). Finally, the web server returns the result to the client web browser for display.

In each step of this sequence of client–server message exchanges, a computer processes a request and returns data, following a very specific ‘handshake’ routine. This is the request-response messaging pattern. When all the requests are met and verified, the sequence is complete and the web browser presents the data to the customer. The routine is similar whether it is data going across the Internet or data staying within an network inside a company.

A client-server system divides processing of an application between a client machine on a network and a file server. This division depends on which tasks each is best suited to perform. However, user interaction is ordinarily restricted to the client part of the application. This portion normally consists of the user interface, data entry, queries, and receipt of reports. The file server customarily manages peripheral hardware and controls access to shared databases. Thus, a client-server application must be designed as separate software components that run on different machines but appear to be one application.

Think of all the interactions that are required to make any online transaction occur. The client must process all of the user’s interaction. The client, say a smartphone, must determine whether interaction is required across a single network or multiple networks. Location of the targeted server must occur (using domain addresses), followed by authentication and security procedures. The client-server systems may or may not require use of a database, which may process millions of records of data as it seeks client verification. Vast amounts of data must be sent, retrieved, transmitted, double-checked and returned. And, of course, all of this must happen almost instantaneously or else the user will simply give up.
In a client/server environment, the accountant is primarily concerned with issues of functioning, decision-making, and security.

**Changing Technology**

The current technology, client server installations, is in the early phases of being phased out in favor of a Cloud environment. Each of these migrations took about a decade. Today, firms choose the method of deployment that they believe fits their culture best, and viable options exist for on-premises installation, hosted desktops and servers, Software as a Service (SaaS), as well as hybrid cloud environments, which are a combination of these methods. On-premises systems create islands of data isolation, and may be the root cause of some of the current issues in firms that need attention. Many of these systems require staff to spend more time inputting, manipulating, and outputting data rather than using and analyzing the resulting information. Common issues include the cost, availability, and time to receive on-going technical support, complex remote access procedures, and security lapses.

This model of working with client data is inefficient, and frequently requires reconciliation of the client’s records to those maintained by the accounting firm. There are barriers which hinder a firm’s ability to provide certain types of services, and compliance with privacy regulations is a significant challenge as well.

**Cloud Computing**

We have all been through many technology shifts—mainframes, minicomputers, PCs, client/server and, now, the cloud. In every single technology shift, one thing has stayed true. Customers want all the functionality they’ve enjoyed before, they want more of it, they want it faster, they want it cheaper, and they want it easier to use. This is the driving force behind cloud computing.

Cloud computing is a rapidly growing new area of the technology industry. The easiest way to envision cloud computing is to think of it as doing all of your computing and business on the Internet, eliminating the need for any in-house technology infrastructure or staff. All of the servers and software you need are ‘rented’ from service providers, allowing you to focus on running the business instead of running a hardware center. Amazon, for instance, a company must people think of strictly a retailer, actually has a quickly expanding business that focuses on providing computer resources for other companies. Instead of spending large amounts on processing power, new startups can quickly sign up with Amazon and allocate computing resources around the world. Similar services are provided by Google, Microsoft, IBM, and countless others, employing cutting edge technology at extremely competitive prices.

Unlike regular software packages, cloud applications are specifically designed for deployment on the Internet. They use standard Web-based interfaces to enable access by hundreds, or hundreds of thousands, of users. The vendors allow you to log in from anywhere, and all of their processing power is performed by powerful servers.
No longer do users install specific software packages on local machines, requiring annual updates. Instead, users simply rent the software, and the vendors handle all software updates, security, and customer support. Software services are available from tax software, to accounting, to payroll and human resource management.

**Technology Benefits**

- **Rapid implementation.** In many cases, a simple online registration form can get you up and running in minutes, allowing you to configure and setup your specific software requirements using simple forms.
- **100% uptime.** Software runs on service providers secure servers. It is always up and running, and ready to be accessed at any time of the day from any location. Because cloud computing relies on multiple servers, using backup and redundant technologies, users can access the system at any time.
- **Data is located in a central location, accessible in real-time from around the world, from multiple devices.** Users can sign in using a desktop from the office, a laptop from the coffee house, a tablet from home or a smart phone when traveling.
- **No need to install and maintain software at your location or to purchase upgrades.** The service providers handles all the headaches and expenses of new software updates, and it very common that bugs are fixed and implemented immediately.
- **Systems will scale and grow with your needs.** To expand the number of users, or add new modules or more computing power, is usually as easy as a few changes in the online configuration panel.
- **Lower upfront costs for systems and software.** Hardware and software expenses can be significantly reduced because you rent the services, and the service provider updates and upgrades everything. Expenses are spread out across multiple customers, allowing them to charge less than a single user setup.
- **Security is improved in many ways.** First, your data is stored remotely and backed up regularly – having a system crash is no longer a major concern. One of the major problems users face is running, frequent, secure backups, and making sure the data is stored off-site for added protection. This is a standard feature of using cloud-based services. Second, theft of a computer or loss of a laptop will not cause loss of vital data as all data is stored remotely. Third, service providers utilize the latest security protocols, requiring higher grade passwords and other verification routines.

**Business Benefits**

- **Ability to access and manage all of your data securely from any Internet enabled device.** This makes the accountant more responsive and valuable to their clients.
- **Because the software is web-based, you can collaborate with your clients in real-time using the latest data.** Many cloud-based packages have accountant and client views so that you can discuss the data simultaneously from different locations.
- **Can reduce any reliance on paper or physical data from your client.** Instead of the client sending you the data, they can enter it themselves, or they can email it to you securely.
- **Your staffing requirements decline from reduced need for internal IT people.**
• Your staffing and workplace become more flexible. CPAs can work from home as needed, or remotely from another office, or at the client’s premise as needed because everything they need is available online.

It is important to remember, though, the change to any new technology platform will hold some risks; however, the risk may be less than avoiding the change altogether. Legacy applications and hardware create many problems, including compatibility, obsolescence, reliability, and inefficiencies. Also, it is important to also weigh the soft costs of refusing to change. These include the damage to a firm’s reputation from appearing behind the times, the difficulty to recruit new employees, and the difficulty in keeping employees. In a world filled with virtual offices and mobile phones and instant data access, no one wants to be in the firm relying on outdated systems and inflexibility. In the end, avoiding a change can be far more costly than embracing change.

Cloud computing is here to stay, as the business case and usage scenarios are too compelling to ignore. It is a very important business trend and it will significantly change the way that business is conducted in the coming years. Business leaders must realize that cloud computing is not just a superior IT solution. It is a superior way of conducting many aspects of business. It is based on the underlying on making the business more efficient and more agile. Cloud computing makes business more flexible and more responsive to customer demands. It changes the way a workforce operates, allowing greater mobility and more workplace options.

**Things to Consider Before Moving to Cloud-Based Services**

Changing a work environment style is a large commitment, with long-lasting implications, and many different options need to be considered before taking the plunge into cloud-based services:

• Bandwidth. Does your office, home, or mobile environment provide enough bandwidth so that you can quickly access everything online. Remember that as you move online, your reliance on high-speed connections are critical. The fear of not being able to access records instantly is one of the reasons that has slowed down the acceptance of cloud-based services in the accounting world. CPAs are worried that during critical work periods, their internet access may be interrupted. However, with each year, this issue becomes less and less of a problem as internet providers become faster and more reliable, and alternative methods of accessing the Internet develop. (see next bullet)

• Multiple access technologies. Think of sitting at your office, and all of a sudden your electricity is cut off due to power equipment maintenance down the street. What will you do? You may have a backup battery for your desktop, or your laptop, but will you have Internet access? It makes sense to have redundant technologies to access your vital cloud-based software. In this case, you could perhaps use your mobile phone as a wireless access point, having your laptop connect via WiFi to your smart phone and reaching the Internet via the mobile phone data connection. Or perhaps there is a local coffee house or library where you can easily connect.

• Data migration and access. Once you lock in with a service provider, how does this affect future compatibility and data access? Are there easy ways to convert from one provider to another? Can the data be saved in a standard database or other format? This problem is not very different from an in-house computer setup using standalone software, but it present itself as more of a problem if you
become unhappy with a new service provider. It is always a good idea to think through data migration issues.

- Security and uptime. Always test a new system thoroughly before making the change. Most vendors will provide at least 30-days free to evaluate their system. Use the time to implement the system and run test cases. Make sure that the service provider has been tested by a third-party monitor, like McAfee Secure.

**Specific applications and examples**

**Audit Confirmation**

- Capital Confirmation

**Bill Management and Payment for Businesses**

- Bill.com
- Billing Boss/Payment Boss (SageSpark)

**Customer Relationship Management (CRM)**

- NetSuite
- SageCRM.com
- SalesForce.com

**Document Management**

- CNG Online (Cabinet NG)
- GoFileRoom (Thomson Reuters)
- SmartVault
- Dropbox

**ERP**

- Intacct
- NetSuite
- QuickBooks Online

**Financial Statements**

- BlackLine Systems
- ProfitCents (Sageworks)

**Payroll**

- Intuit Online Payroll (formerly Paycycle)
- Paychex
Future Trends

The transition from premise-based hardware and software is accelerating and it is expected that most software providers will move to cloud-based systems within 10 years. The business case is just too strong for both the accountants and the service providers. The world and all devices are becoming more connected, and cloud based services and systems are a natural way to embrace new technologies, new work-styles and greater...
convenience. It is wise for any business professional to thoroughly analyze how to incorporate this inevitable trend into their work environment.

Network and Internet Security Concerns

Security is more difficult to achieve in a client-server system cloud-based system than a single dedicated environment. The system has numerous access points, and users have many chances to alter data. Thus, application controls must be combined with general access controls to protect the system.

Network Security

Computer networks play a dominant role in transmitting information within and between firms. A network is simply a set of computers (or servers, smartphones, etc) interconnected by transmission paths. These paths usually take the form of cable, fiber optic, or telephone lines; however, other media, such as wireless and infrared transmission, radio waves, and satellite are possible. The network serves one purpose: exchange of data between the computers, servers, tablets or other mobile devices. The considerations in selecting a network medium are:

- Technical reliability
- Type of business involved
- The number of individuals who will need to access or update accounting data simultaneously
- Physical layout of existing equipment
- The frequency of updating
- Number of micros involved
- Compatibility
- Cost
- Geographic dispersion
- Type of network operating software available and support
- Availability of application software
- Expandability in adding additional workstations
- Restriction to PCs (or can cheaper terminals be used?)
- Ease of access in sharing equipment and data
- Need to access disparate equipment like other networks and main frames
- Processing needs
- Speed
- Data storage ability
- Maintenance
- Noise
- Connectivity mechanism
- Capability of network to conduct tasks without corrupting data moving through it
Backup capability is an especially important feature of networks. For instance, if one computer fails, another computer in the network can take over the load. This might be critical in certain industries such as financial institutions.

Data switching equipment is used to route data through the network to its final destinations. For instance, data switching equipment is used to route data around failed or busy devices or channels.

The financial manager should be assured that protective steps have been taken to protect the computer system such as financial database files. It may be possible to restrict access to information on the network by having a nonprivileged mode.

Encryption equipment can be used to assure proper security during transmission. Encryption safeguards a message so it cannot be comprehended except if the receiver has a “key” to decipher it. A private key is a shared confidential key used to encrypt or decrypt a message or transmission. Encryption may begin with an initial unencoded message and scramble the plain text with an algorithm that has a key to derive unintelligible ciphertext. Further, checksums should be used to provide confidence that data has not been improperly changed while being processed over the network.

There should be a security server keeping security data such as names and passwords. A password authentication protocol repeatedly transmits user identifications and passwords for authentication reasons. A digital signature (electronic identification) assures the author’s authenticity and the integrity of the communication or message. A digital signature is attached to documents being transferred electronically for security to guarantee that a sender is actually who he or she purports to be. This signature gives assurance that the document has not been changed improperly. Digital signature encryption is public key encryption in reverse. Before a server acts on an important client request, the server must substantiate the appropriateness of the request. Further, security can be enhanced by using network auditing tools that highlight which users accessed which network files.

There is network-filtering software that examines source and destination addresses to determine access. Internal firewalls are filters on the network to ascertain if corporate transmissions on the internal network are authorized. Filter tables list those individuals authorized to proceed through the firewall server into the entity’s network. Filter tables may have different levels of access to different file types. With application-level filters, there is additional security by evaluating the whole data request rather than just the source and destination addresses.

There should be computer-based security software. To monitor suspicious behavior of employees and outside users, use intrusion detection software. The financial manager should make use of performance monitoring software in which limits are set for which an overage over such limits indicate a problem to be appraised and corrected for. There is usually an audit trail.

The financial manager should note the proper values applicable to various data fields. We may use and allow decoy files to be infected so as to identify, monitor, and control viruses. In pre-emptive monitoring, there is a problem test set run on a recurring basis to diagnostically test network traffic to alert the financial manager if a malfunction is detected. We must be on guard against polymorphic viruses, which are viruses that change their
appearance each time infected software is run to make detection more difficult. A Trojan horse is a virus hidden in a legitimate program. We can identify unknown viruses via running an emulation program. Antivirus software must be used to safeguard data files and programs.

Any out-of-the-ordinary occurrences should be investigated. We can use event detection software to identify and filter data for such unexpected events.

Security penetration/vulnerability analysis should be conducted periodically to uncover any possible problems. Penetration tools should be used to try to break into a system to uncover weaknesses in the firewall and router configurations. Automated tools exist to audit the computer system and report potential security weaknesses. Vulnerabilities are identified such as poor passwords or failure to update software with security patches. Vulnerability testing tools search for potential weaknesses that may allow an attacker to gain unauthorized access.

Vulnerability testing tools may audit the system or launch a mock attack. Vulnerability testing programs may be classified according to scope. Their focus may be narrow and they may examine just a single vulnerability or their emphasis may be broad and they may appraise the whole system.

Access controls should exist to use a specific computers or applications. Data and time constraints along with file usage should be enumerated. Unauthorized use should deactivate or log out of any computer access points.

Communication security over the network may be in the form of:

- **Access control.** Guards against improper use of the network. Authentication software is added to an existing security system to verify a user’s existence to assure the person is not an imposter, and provides password control and user authentication devices.

- **Data confidentiality.** In place protection of confidential information during transmission.

- **Routing control.** Inhibits data flow to insecure network elements such as identified unsecured relays, links, or sub-networks.

- **Identification.** Identifies the origin of a communication within the network by digital signals or notarization.

- **Authentication.** Substantiates the identity of an originating user or user entity within the network. Examples of security controls are time stamping, passwords, synchronized checks, non-repudiation, and multiple-way handshakes. Biometric authentication methods measure body characteristics with the use of equipment attached to the workstation. Keystroke dynamics is another form of identification.

- **Digital signature.** Messages are signed with a private key.

- **Traffic padding.** A traffic analysis of data for reasonableness.

- **Data integrity.** Steps exist to guard against unauthorized changes of information at the receiving and sending points.
Security should exist in different layers. Security needs to be provided over networking facilities and telecommunication elements. Controls must be placed over both host computers and sub-networks.

Network traffic may be over many sub-networks, each having their own security levels, depending on confidentiality and importance. Hence, different security controls may be needed.

A firewall is used to control access between two networks. Its objective is to restrict unauthorized traffic. A firewall performs the following two functions:

- Restricts or blocks certain traffic.
- Permits certain traffic.

Firewalls provide logging and auditing functions for security purposes. Firewalls work by blocking unwanted and unauthorized people from viewing company databases. For example, security data may be gathered about the number of login attempts and password failures.

Digital signatures can be used when the content of the message is not secret, but the sender wants to authenticate his or her identity and confirm that he or she wrote the message.

**Internet Security Threats**

Most people are aware of the huge number of security vulnerabilities associated with the Internet, and the difficulty of trying to stop everyone. It seems that daily is another story about large data loss or security breach caused by hackers.

Below are the top 10 Internet security tips for small business, as provided by the security experts at the FCC (http://www.fcc.gov/cyberforsmallbiz), to help business protect their business, their customers and their data from growing cybersecurity threats:

1. **Train employees in security principles**
   Establish basic security practices and policies for employees, such as requiring strong passwords, and establish appropriate Internet use guidelines that detail penalties for violating company cybersecurity policies. Establish rules of behavior describing how to handle and protect customer information and other vital data.

2. **Protect information, computers and networks from cyber attacks**
   Keep clean machines: having the latest security software, web browser, and operating system are the best defenses against viruses, malware, and other online threats. Set antivirus software to run a scan after each update. Install other key software updates as soon as they are available.

3. **Provide firewall security for your Internet connection**
   A firewall is a set of related programs that prevent outsiders from accessing data on a private network. Make sure the operating system’s firewall is enabled or install free firewall software available online. If employees work from home, ensure that their home system(s) are protected by a firewall.

4. **Create a mobile device action plan**
Mobile devices can create significant security and management challenges, especially if they hold confidential information or can access the corporate network. Require users to password protect their devices, encrypt their data, and install security apps to prevent criminals from stealing information while the phone is on public networks. Be sure to set reporting procedures for lost or stolen equipment.

5. Make backup copies of important business data and information
Regularly backup the data on all computers. Critical data includes word processing documents, electronic spreadsheets, databases, financial files, human resources files, and accounts receivable/payable files. Backup data automatically if possible, or at least weekly and store the copies either offsite or in the cloud.

6. Control physical access to your computers and create user accounts for each employee
Prevent access or use of business computers by unauthorized individuals. Laptops can be particularly easy targets for theft or can be lost, so lock them up when unattended. Make sure a separate user account is created for each employee and require strong passwords. Administrative privileges should only be given to trusted IT staff and key personnel.

7. Secure your Wi-Fi networks
If you have a Wi-Fi network for your workplace, make sure it is secure, encrypted, and hidden. To hide your Wi-Fi network, set up your wireless access point or router so it does not broadcast the network name, known as the Service Set Identifier (SSID). Password protect access to the router.

8. Employ best practices on payment cards
Work with banks or processors to ensure the most trusted and validated tools and anti-fraud services are being used. You may also have additional security obligations pursuant to agreements with your bank or processor. Isolate payment systems from other, less secure programs and don’t use the same computer to process payments and surf the Internet.

9. Limit employee access to data and information, limit authority to install software
Do not provide any one employee with access to all data systems. Employees should only be given access to the specific data systems that they need for their jobs, and should not be able to install any software without permission.

10. Passwords and authentication
Require employees to use unique passwords and change passwords every three months. Consider implementing multi-factor authentication that requires additional information beyond a password to gain entry. Check with your vendors that handle sensitive data, especially financial institutions, to see if they offer multi-factor authentication for your account.

Different Types of Internet Threats

The language used to describe the types of threats that your computer may be vulnerable to can often get confusing. Here’s a quick list of the types of threats that Norton monitors in their Norton Safe Web reports.
Drive-by Downloads
A drive-by download is computer code that takes advantage of a software bug in a Web browser to make it do something that the attacker wants—such as run malicious code, crash the browser, or read data from the computer. Software bugs that are open to browser attacks are also known as vulnerabilities.

Phishing Attacks
A phishing attack occurs when an attacker displays Web pages or sends emails that claim to be from a trusted company. These pages or emails solicit sensitive information from an unwitting customer.

Spyware
Spyware is any software package that tracks and sends personally identifiable information or confidential information to third parties.

Viruses
Viruses are a type of malicious code, or malware, typically spread by other computers through email, downloads, and Web sites that are not safe.

Heuristically-Detected Virus
A heuristically-detected virus is found based on the malicious behaviors that it exhibits. These behaviors may include attempts to steal a person's sensitive information such as passwords or credit card numbers.

Worms
A worm is another type of malicious code, or malware, that focuses primarily on spreading to other vulnerable computer systems. It typically spreads by sending out copies of itself to other computers, either via email, instant messages, or some other service.

Unsolicited Browser Changes
An unsolicited browser change occurs when a Web site or program changes the behavior or settings of the Web browser without the user's consent. This may result in the home page or search page changing to another Web site, often one that is designed to serve ads or other unwanted content to the user.

Suspicious Browser Changes
A suspicious browser change occurs when a Web site attempts to modify the list of trusted Web sites. A Web site may be trying to get your Web browser to automatically download and install suspicious applications without your consent.

Dialers
A dialer is any software package that changes modem settings in order to dial a high cost toll number, or requests payment for access to particular content. The result of this attack is that the owner of the phone line is charged for services were never authorized.

Trackware
Trackware is any software package that tracks system activity, gathers system information, or tracks customer habits and relays this information to third-party organizations. The information gathered by such programs is neither personally identifiable nor confidential.
Hacking Tools
Hacking tools are programs used by a hacker or unauthorized user to attack, gain unwelcome access to, or perform identification or fingerprinting of your PC. Some hacking tools are used by system or network administrators for legitimate purposes, but the power they provide can also be misused by unauthorized users.

Joke Programs
A joke program is one that alters or interrupts the normal behavior of your computer, creating a general distraction or nuisance. Joke programs are programmed to perform various actions like causing the CD or DVD drive of your PC to open at random.

Security Risk
A security risk is a condition in which a computer is more vulnerable to an attack. This condition can be created when an otherwise innocent program contains an error that reduces the security of your computer. These errors are usually unintentional. Using such a program could increase the risk that your PC will be attacked.

Suspicious Application
A suspicious application is one with behavior that represents a potential risk to a computer. The behavior of such a program has been examined and determined to be unwanted and malicious.

Cybersquatting
Cybersquatting is the practice of acquiring a site name to attempt to deceive people about the identity of the organization running the site. Cybersquatting makes use of deceptive practices to mimic trusted brands or otherwise confuse users. Typosquatting is one form of cybersquatting in which name spelling variants are used.

Computer threats
Items such as viruses and worms that load directly on your computer, with the potential to do harm to your computer.

Identity threats
Items such as spyware or keyloggers that attempt to steal personal information from your computer.

Ecommerce safety threats
Suspicious ecommerce activities, such as selling counterfeit goods.

Annoyance factors
Items that don't necessarily do harm, but are a nuisance, such as joke programs or a site that isn't what it seems.
Chapter 4 Review Questions

1. Securing client-server systems is a complex task because of all of the following factors EXCEPT
   A. The use of relational databases.
   B. The number of access points.
   C. Concurrent operation of multiple-user sessions.
   D. Widespread data access and update capabilities.

2. Client-server architecture may potentially involve a variety of hardware, systems software, and application software from many vendors. What is the best way to protect a client-server system from unauthorized access?
   A. A combination of application and general access control techniques.
   B. Use of a commercially available authentication system.
   C. Encryption of all network traffic.
   D. Thorough testing and evaluation of remote procedure calls (RPCs).

3. Security concerns will NOT include which of the following items?
   A. Encryption
   B. Expert systems
   C. Passwords
   D. Internal firewalls or filters

4. Physical access controls used to prevent unauthorized access to equipment, data files, and software include all of the following EXCEPT:
   A. Identification
   B. User’s name and password
   C. Cards and keys
   D. Firewalls

5. Computer security software offered on the network that substantiates the identity of an originating user or user entity within the network such as time stamping, passwords, or methods measuring body characteristics is:
   A. Traffic padding
B. Authentication
C. Routing control
D. Digital signature
Chapter 5:
The Accountant and Database Management Systems

Learning Objectives:

After completing this section, you should be able to:

1. Identify responsibilities for accountants on a database management system.
2. Recognize database types and terminology.

The accountant needs to access a database because it includes accumulated interrelated records of different types and files. The stored information is used by the accountant to have enough data to make an informed decision. Use should be made of clustering the database in which there is a logical order to the stored information. For example, revenue and cost data may be kept and retrieved in sequential order in department and division order. In database concurrency, there is simultaneous accessing of the database by more than one financial person or application. In looking at the database file, the accountant sees an accumulation of related records explaining a subject by using a field set.

A database management system (DBMS) involves an integrated set of computer programs that create the database, maintain the elements, safeguard the data from loss or destruction, and make the data available to application programs and inquiries. In a database system, the data and programs are maintained separately except during processing. The DBMS constrains a description of the logical and physical structure of the database called the schema. The schema is the description of the structure of organization of the database using data description (definition) language. A primary goal of a DBMS is to minimize data redundancy, and user interface is enhanced through increased accessibility and flexibility. The system is administered by a database administration (DBA) who is a person with overall responsibility for developing and maintaining the database.

A database management system refers to software managing and controlling the database. Typically, the database is on a server. Accountants can define, create, modify, and maintain the database, but they should not be the DBA in charge of developing the system. The standard query language (SQL) is usually used to create and maintain the relational databases including its accessing and updating.
A system catalog lists the data contained in a database. The data may be kept in a text file or dictionary-like document. The accountant should be concerned with administering financial information such as managing information resources, developing, designing, planning, keeping standards, and maintaining policies and procedures.

A network database model is one comprised of interrelated records and data items. The database should furnish a wide range of data to users. It should range from easy questioning to report writing based on different desired specifications to very complex solutions related to decision support systems. A network database model fosters many relationships such as the association between a vendor’s database and the stocking of particular merchandise. The merchandise may be bought from different vendors, and each vendor can sell many different types of merchandise. As another example, below is a graphical representation of the database that might be used for a store selling digital music.

The accountant should schedule in sequential order database functions or transactions to accomplish a task in the most efficient way. In sequential access, the accountant selects all records of a particular type.
In a leap file, financial records are in the identical order of insertion. Database files may be subdivided (fragmented) over a number of documents. In replication, there is a duplicating of key elements of the database in different locations and assuring that copies of the information are updated simultaneously.

In a computer-aided manufacturing database we store manufacturing-related data for example, as data for the production of goods such as appliances.

We can use sensitivity analysis to determine how output is affected by inputs. Input variables may be modified at the same time to see the impact on outcome. Sensitivity analysis allows us to determine the relative importance of the various inputs. A model may be constructed to forecast multiple variables. An experimentation with different combinations of input variables may lead to better overall results. Further, the accountant should rank variables in the order of importance.

It is possible that data on a particular topic of interest is obtained from different sources. In such cases, the controller should be careful that erroneous conclusions are not drawn when the various sources present similar data in different manners. If data is missing, the controller must be careful if he or she decides to guess at the data left out or use mean, median, or common value figures.

Data conversion tool software extracts information from heterogeneous sources and transfers the source information to target data and then derives the programming codes to process it. Data must be carefully checked for consistency to ensure successful processing.

The accountant should split the database into segments of similar financial records. An example is sales territories having a particular range of sales. In segmentation, the accountant may want to break down a larger project into smaller ones for analysis purposes.

In hypothesis testing, the accountant attempts to prove or disprove an assumption. The hypothesis is proven or not by evaluating information via observation and testing.

This chapter discusses database security, classification of data, object databases, distributed databases, hierarchical databases, multidimensional databases, multimedia databases, meta-data, data warehousing, data marts, data modeling, link analysis, knowledge-based systems, market basket analysis, memory-based reasoning, data mining, fuzzy searches, neural networks, online analytical processing, online transaction processing, genetic algorithms, decision trees, and personal information assistants.

**Database Security**

It may be advisable to have a secure single login in which users log into the network rather than each specific server or application. Access is permitted only to authorized resources.

Security of the database may be aided by referential integrity checks, which compare data among tables for appropriateness and logical relationship order. For security, we should match the database to the transaction
log file. A transaction log is a listing of database transactions including updates for managing and control purposes.

The security analyzer tool for analyzing networks (SATAN) reviews the network to spot security weak points. System fault tolerances are networking aspects that safeguard the network from faults. An analytical report is prepared indicating problem areas and possible solutions.

The accountant should hide sensitive financial information in the database so it is not revealed to unauthorized individuals. To access a database, proper identification such as a password is required. In a database lock, database data cannot be accessed or altered until a transaction has been finalized. A shared lock is a database lock that allows users to read data but not update it.

A time bomb is a virus activated at a particular date or time. Antivirus software must be used.

To assure staff are familiar with the security procedures and policies to be adhered to in a database management system, a control plan should exist. Control related statements should provide detailed directions to conduct procedures and explain the needs of the security system. Any policy statements should not be subject to short-term modifications. The control plan should be distributed and consistent throughout the company. The plan should have some flexibility so it may be successfully adapted to different parts of the entity that may differ to some degree from one another. The control plan should be periodically reviewed to ensure that any changes in the company’s circumstances or improvements in technologies are responded to.

Databases containing sensitive information must be restricted only to authorized individuals. Database access should be assigned different levels of confidentiality and security such as generally accessible data (unrestricted), internal use only, and top secret. Confidential information should not be displayed on computer screens without the appropriate access codes. Employee compliance should be periodically reviewed to ensure that individuals are honoring the controls that have been established. Each database function (e.g., payroll) should require its own password so that employees only have access to the areas that they have been approved and authorized for. Segregation of duties should also exist. For example, a programmer who modifies or patches a program should not have access to the computer database area or library to assure the prevention of data manipulation. Thus, segregation of duties should exist between programmers, installation librarians, operators, data processing personnel, users, and control employees.

The Information Technology Internal Auditor should be concerned with the following areas when reviewing the company’s database system:

- Monitoring and appraising the company’s computer policy and security standards applying to the database and network.
- Supporting internal auditing functions during operational and compliance audits.

In auditing a typical database system, the IT auditor will review and analyze the following areas of the company’s information system:

- Personnel practices applying to the installation.
- Contingency planning and disaster recovery.
• Data center structure.
• Backup controls of the data center.
• Effectiveness and efficiency of operating and administrative procedures.
• Standards of developing the installation.
• Specific control practices.
• Control procedures of the database information library.

The Information Technology auditor is responsible to assure that the company’s database system controls are in place and properly functioning. To achieve this, the following specific control functions should be watched and appraised by the IT auditor.

• Errors and omissions are identified and corrected. However, the emphasis should be on preventing these problems in the first place.
• Assurance that jobs are performed in a timely manner.
• Transactions are properly approved and authorized by the appropriate level of management.
• Transactions are correctly processed.
• Functions should be reviewed periodically and incompatible activities should be segregated.

Transaction trails should exist for additions, deletions, or modifications of data processed by the database. Audit trails should be created or made available to provide the IT auditor information regarding (1) the date and time of the transactions, (2) who processed the transactions, and (3) where the transaction was initiated (e.g., terminal). Most database software has the ability to track database transactions.

### Database Types and Terminology

#### Classification

Data may be classified from the population in similar groups. The classification may be based on a training model. The classes of information are periodically appraised and updated. For example, we can classify potential clients as low, medium, or high risk. In some cases, the accountant may start with a training set and build a predictor model on the grouping of new records. For example, credit card customers may be segmented into predefined classes to ascertain whom to send promotional mailings.

#### Object Databases

In an object database management system, objects are stored in a multi-user client/server form. We can have concurrent access to objects. Objects can be protected from threats and transactions can be safeguarded. The object database management system adds to the traditional database management system the functions of questioning, concurrency, locking, and protection.
Distributed Database Management Systems

A distributed database is a collection of tables spread over at least two servers in the company at different locations. With distributed transactions, one transaction gives a sequence of database requests to different remote database servers. This allows for database update on various servers.

A transaction consists of SQL statements, each allowing for the access of data at different locations. In distributed transactions processing, transactions are processed over multiple distributed linked computers in multiple geographically situated locations.

Hierarchical Databases

In a hierarchical database, there is a family tree of related record types. Lower-level records are subordinate to higher-level ones.

Multimedia Databases

In a multimedia database, we have abstract unstructured data such as audio, graphics, video, animation, hypertext, and hypermedia.

Multidimensional Databases

With multidimensional databases, we handle multiple dimensions that include product, service, geographic locality, customer, client, guest, order, salesperson, and time period. A multidimensional database for a company’s products may include time, territory, sales volume, customer, price, vendor, store, and total sales. Data may be appraised using alternative dimensions.

Data Warehousing

A data warehouse enhances productivity within the controller’s department. It provides timely and accurate financial information. The data warehouse organizes and classifies information.

In data warehousing, there is a voluminous database of summarized and detailed interrelated information that may be extracted and analyzed in making financial management decisions. Detailed information may relate to sales, purchases, payables, and receivables. There is a vast accumulation of past and current data. It is updated continuously because data is reliable for a specified time period. This updating may be via planned batch processing to foster comparative analysis. (However, in some cases, a data warehouse may not be designed to update data immediately and repetitively.) The database is subject-oriented and timely. Complex, analytical, and investigative questioning of the data warehouse may solve financial problems.

Data warehousing includes data regarding payroll, accounting, finance, marketing, and management. Information stored is usually classified by type such as by product/service line, department, division, sales territory, marketing survey data, suppliers, customers, orders, transactions, physical resources, personnel, or
financial resources. A major purpose of data warehousing is to question a database spread over a multinational company.

The data warehouse allows the company to integrate its cumulative operational information into an accessible means so that forecasts, trends, and strategic decisions may be derived.

The financial data of all departments of the company is put into a database that can be managed, controlled and evaluated.

In data warehousing, there should be integration of extraction, retrieval, cleansing, questioning, and summarizing. For this purpose, meta-data integration software is available.

Data transformation from these data sources to the data warehouse should be well documented. Data going into the data warehouse are from numerous operational databases inside and outside the company. Thus, information is accumulated from sources in different locations. The accountant should be abreast of where information came from and how it was modified and transformed. Merged information should be put into a standardized and consistent format to enhance decision making and support. Therefore, there should be a derived commonality in data definition, structure, and relationships. Errors and inconsistencies in the data must be rectified to assure information quality. A data warehouse may be used for training purposes.

Data warehousing may be used in internal audits by providing information and analysis to appraise corporate activities and control operations. It fosters the examination of the company’s efficiency. Inefficiencies may be indicated by comparing estimated to actual amounts. Areas of fraud, irregularities, and errors may readily be identified. Areas of sensitivity are highlighted.

Marketers may use a customer or guest database to profile individuals who are apt to respond to special incentives. Further, the company may accumulate information regarding buying patterns of their major customers to stimulate purchases by them.

Problems with the quality of goods may be identified by looking at the trend in product returns or allowances due to defective merchandise. An analysis may also be made of buying schedules to ascertain the appropriate times to buy merchandise to take advantage of lower prices and quantity discounts.

Data warehousing can be used by insurance companies to ascertain prospective policy holders who may be underwriting risks.

Divisions doing poorly may be identified. Then either corrective action may be taken or those divisions may be liquidated or sold.

Applications of data warehousing include:

- Measuring the impact of changing prices on product demand
- Detailing credit standing of a new customer
- Pricing based on inventory patterns and demand
- Detecting insurance and warranty claims fraud
Meta-data describes data included in the data warehouse including where it came from, content, and importance. Information flow in and out of the data warehouse is indicated. Therefore, the history of any data may be reconstructed. Meta-data reveals what data are available in the system and its location. As such, meta-data enable accountants to comprehend the logical data model of the data warehouse. Meta-data enables us to track the data components of the data warehouse, data content, integration and transformation of data, and from where the data was derived. Meta-data involves a review and analysis of where information was extracted, indexing process, statistical analysis, data aggregations, and patterns. For control purposes, meta-data should be well defined, updated, secured, integrated, comprehensible, and documented. Retrieval policies should be specified.

Data Marts

A data mart is a data file consisting of logical records. It is an element of a data warehouse furnishing summarized information that can be used in decision making by a department or division manager. The data mart is a subset of the data warehouse that is usually oriented to a specific business line or team. Data marts are small slices of the data warehouse. Whereas data warehouses have an enterprise-wide depth, the information in data marts pertains to a single department. The data mart may be either tied to or separated from the entity’s centralized data warehouse. Because data marts have much less data than a data warehouse, a data mart is simpler to understand and utilize.

Data marts service the data requirements of particular departments within the organization. Data marts are of benefit and use to specific departments. A data mart is a subset of a data warehouse that accumulates the information required by a particular department or other responsibility unit such as a product or service line. Also, a given data mart might be used solely by two or more departments on a shared basis for common requirements.

Information for the data mart is directly obtained from the data warehouse of the overall company. (However, it is possible to construct a data mart as an independent unit with departmental information accumulated just for it.) With a data mart, information may be available more quickly because of substantially less transaction volume. Further, the information may be better customized to meet the department’s needs. Another benefit of a data mart is that its cost is much lower than that data of a data warehouse.

Data marts may be transportable personal warehouses on a laptop or tablet to be used by internal auditing staff with auditing branches.

Data Modeling

A data model involves designing and planning a database. In an entity’s data model there is shown important financial information, key relationships between financial data, and the impact of the information on the firm. The accountant should make use of the data model in explaining information, its interrelations, and limitations. The accountant wants to fully understand accountants’ database. Noted are cases in which data is shared.

In modeling, an output(s) is derived from inputs. In a time series model, we see the effect of a factor over time such as the market price of the company’s stock base based on various changes associated with the company’s
financial health. In a clustering model, financial records are grouped in terms of similarity. An example is finding what similar financial characteristics divisions of the company have in common. In a classification model, we classify a record based on some predetermined criteria. New classifications may emerge in addition to old classifications. A prediction model forecasts future results based on past and current information. The correctness of the model as a predictor should be assessed by comparing what is expected to what actually happens. What is the degree of deviation? The model should be tested over time. Any changes should be incorporated as needed.

**Link Analysis**

The financial manager should engage in link analysis looking at the relationship between fields such as relating departmental profit to departmental assets. In link appraisal, the financial manager looks at how financial records are related to see what patterns exist. For example, the financial manager may want to know the likelihood that merchandise or services will be purchased together. Also, how are vendors associated and what effect will that have on the company if there is a shortage of raw materials? What is the link between customers, lenders, and employee unions?

In link analysis, the accountant may find new characteristics associated with financial data. However, the controller should note that link analysis is not as reliable with large data sets as with smaller ones.

**Knowledge Discovery**

Knowledge discovery does not involve prior assumptions. The financial manager searches database information so as to draw new views or management conclusions. A knowledge base is a set of information to answer queries and solve business problems. What patterns are evident?

There is an emphasis on finding meaningful information. Data is chosen, refined, and put into a useful form. The data is then evaluated to see what should be investigated further. Based on the results, management will undertake steps to control a problem situation or eliminate a problem. For example, is there a way to attract additional business? Special attention should be given to unusual associations. However, when files are marked, “secure,” they may not be transferred.

Knowledge discovery helps us determine who is apt to purchase certain kinds of merchandise.

**Market Based Analysis**

The market based analysis (MBA) method classifies item groupings that take place together in a transaction. MBA is particularly appropriate for numeric and categorical data. The accountant should examine the likelihood of different goods or services being brought together in some logical order. Thus, we can use MBA to examine multiple buys by a customer or a sales catalog of numerous types of merchandise. Guidelines for this process should be enumerated. Why do customers purchase certain products? Which customers buy multiple products simultaneously and why? MBA also aids in establishing a good advertising and promotion plan.
With MBA, we can better compare sales derived from different geographic areas like urban versus suburban. Seasonal differences may be taken into account.

If there is an unexpected combination of insurance claims over a short time period, it may point to fraud.

**Memory-Based Reasoning**

Under memory-based reasoning (MBR), we use cases of known events or occurrences to predict unknown events or instances. We look at similar events (neighbors) in prior years to predict what will happen now. The number of neighbors to use for analysis depends on information distribution and the nature of the problem being evaluated. What was an insurance company’s historical experiences with the types of claims being submitted now? Did fraud occur in prior years? Were the claims legitimate and immediately paid? MBR can also be used to predict how customers will react to a particular advertisement.

The degree of similarity or dissimilarity between the historical records and current records must be ascertained. What is the distance between the two? The less distance, the more reliable will be the conclusions drawn.

The training set is the historical records that enable us to find the nearest neighbors to an unknown (current) record. For useful results to occur, an adequate amount of records by category is necessary. The more the neighbors used, the more accurate will be the conclusions.

The training set should include a sufficient number of occurrences for all possible classifications. We should also include for analytical purposes rare instances such as fraud so we have a good balance of usual and unusual occurrences for all categories. Better results are achieved when the training set is voluminous and representative.

**Data Mining**

Data mining involves software examining a database to identify patterns, relationships, and trends to assist in financial management decision making. We extract past and current information from a voluminous database for analysis. Are there any problem areas requiring corrective action? To be effective, data mining relies on the source data to be accurate, consistent, and integrated. Data mining looks both to confirm anticipated patterns and to uncover new patterns. Anything unusual, hidden, or unexpected should be investigated.

Data mining allows accountants to evaluate integrated consistent information for future strategic decisions. However, over time, data mining results may change due to, say, changing economic and political factors. Data mining results should be reviewed by the controller for common sense and reasonableness. The controller may be able to come up with new ideas, guidelines, yardsticks, and rules. Data mining assists in improving corporate operations and the resulting bottom line.

A data warehouse stores data while data mining extracts, cleanses, and appraises the information for management decision making. Data mining provides intelligence to a database.

In deciding on the appropriate data mining method suitable in a given situation, the accountant should take into account the circumstances, tasks to be performed, nature of input in terms of quality and amount, reliability
required, type of output, importance, training desired, available software and data, scalability, and accuracy and understandability of the model.

In data mining, we go through large databases to search for useful patterns, relationships, and trends. Some of the ensuing results will be expected, others will be unexpected. The accountant will continually question the database until a complete financial picture emerges. Any unanticipated patterns should be verified through repeated questioning and evaluation. The controller can refine his or her search by only extracting key information. In actuality, data mining is most advantageous when there is a vast amount of sophisticated and complex information.

We may use artificial intelligence or statistical methods when searching and evaluating the data warehouse or data marts. Data mining involves clusters, segmentation, grouping, linking, predicting, explaining, and highlighting variances between expected and actual financial figures.

Managerial and financial applications for which data mining may be applied include determining whether a bank should grant a loan to a particular borrower (and, if so, how much), spotting insurance fraud, noting fraudulent warranty claims and credit card fraud, creating advertising and promotional efforts to maximize sales (including gauging how prospective customers will react best to a specified promotion, or which products or services are most favored by customers in a particular geographic area), evaluating and selecting vendors, financial statement analysis, including the appraisal of profitability and liquidity, customer profiling based on such factors as buying behavior, selection of stocks and bonds in portfolio management, establishing a credit rating for a loan applicant or customer, pricing of products and/or services, ascertaining risk level for a new project or proposal, predicting sales, inventory control, production management, detecting questionable patterns of internal funds transfers, ascertaining the degree of customer confidence and commitment, customer service, determining which products or services to cross-sell, marketing research and planning, and finding the reasons why products or services sell better in certain markets or to certain customer types.

Other applications include appraising seasonality issues, deciding on which products to push and when, arranging merchandise in a branch store or sales catalog to generate the most orders, deciding how to best package merchandise, profiling clients and hotel guests, uncovering forgeries in documents, quality control including identifying defective goods bought from a supplier, determining products a particular class of customer is likely to buy (e.g., young people are more apt to buy sporting merchandise than older individuals), predicting future prices in commodities, forecasting foreign currency exchange rates, direct marketing, predicting employee theft, deriving optimal selling techniques, credit approval, employee or customer development and retention, deciding on whether to offer discounts for certain products to promote sales, planning store layout to promote business, assessing the possibility of a product or service line failing, new product or service, forecasting expected profit from a new customer, predicting trading patterns of securities, estimating which hotel guests are likely to return, grouping and classifying customers, picking the best location for a new store, improving product design, determining customer retention, appraising suppliers, deciding which customers should receive incentives so they do not switch to competitors, efficiently allocating resources, deciding on advertising approaches to maximize orders, determining the best piggyback products, risk reduction, and demographic analysis.
There are many considerations to take into account when selecting data mining software. These include how many data records exist, database access, reporting aspects and requirements, network functioning, simplicity, documentation, operating systems, data compatibility, scalability in product and users, technical support, interfaces supported, and organizational fit.

**Fuzzy Search**

In a fuzzy search, user direction is absent or minimal. If-then rules may also be derived. The controller may in fact not know beforehand what he or she is looking for. As far as the search process is concerned, in market basket analysis, the controller tries to identify patterns where the occurrence of something implies something else will happen. In a sequential search, there is a chronological time order to events or patterns. In a search clutter, the controller looks to classify items in homogenous groupings. Think of a standard Google search where a user may enter a phrase or word, and the results ultimately help the user refine the search in order to find the most meaningful result.

**Online Analytical Processing**

Online analytical processing (OLAP) assists financial executives in gaining a clear and consistent perspective on financial information so as to facilitate decision making. OLAP enables controllers to gain perception on information quickly and consistently in an interactive way. What patterns and trends are evident in the financial data?

Information can be modified depending on need. The controller may use OLAP for data reporting purposes. OLAP techniques are used in accessing voluminous databases. It includes data stored in a centralized data warehouse, operational system, or virtual distributed warehouse. Many OLAP tools have drill-down capabilities into the initial database. The controller is able to get interactive access to a large variety of data views.

OLAP is an approach to original and condensed historical multidimensional data to assist accountants in better understanding the information and reaching sound decisions. As the financial environment changes, an updating of the information will be necessary. The result will be comprehensive, current, and reliable data.

In OLAP, why and what-if questions can be asked and answered to improve financial decision making. For instance, the financial manager may wish to find out how the entity’s new products have affected its sales over the past three years by a major geographic region. There are significant analytical attributes. Data may be evaluated by some predetermined criteria. Further, OLAP gives the financial manager the opportunity to probe and appraise corporate data in bits and pieces.

OLAP is mostly a decision support technique with such beneficial characteristics as links, dimensions, and formulas. The specifics of each feature are evaluated. With OLAP, the controller is provided with the records answering his queries as well as with scenario settings.

There are several factors that need to be considered in choosing a suitable OLAP tool for a given application. Factors include type of software used, conformity to the company’s environment, future needs, scalability,
questioning capabilities and evaluative techniques, operations to be conducted, performance, and ability to add, delete, or modify data.

In OLAP, we have multidimensional aggregate data providing fast access to key financial information so it can be properly appraised by the accountant. In most cases, accountants examine financial information by product or service line, scenario, geographic area, and time. It is essential that the financial executive can appraise data by dimension, function, or aggregation level. Multidimensional online analytical processing is suitable for financial applications where detailed computations are needed for different products, services, business segments, responsibility units, divisions, and departments of the company. With multidimensional information, financial executives may obtain budgeted compared to actual amounts as well as summarized financial data by product/service line, time, and organization. Sales may be noted by time, product, service, sales price, geographic area, distribution channel, and customer. A typical query in OLAP is “What are the sales by product, service, customer, quarter, and store?” OLAP can go across various domains—for example, presenting sales in stores and credit card charges.

Financial applications of OLAP include financial forecasting (e.g., sales), retrieval of relevant financial information for decision making from large data sets, budgeting, operating performance analysis, financial modeling, and activity-based costing. In production, OLAP assists in manufacturing planning and uncovering assembly line problem areas. In marketing, OLAP assists with marketing research, market segmentation, customer appraisals, and advertising and promotion.

In evaluating the company compared to competitors, OLAP can be helpful to accountants by looking at the percentage growth in accounts such as revenue, costs, and assets. We can model complex and sophisticated relationships.

Advantages of OLAP include fast computation and response time, flexibility, interactivity and easy application. Also, it considers multidimensional data, supplies timely information, and is sound in analyzing time series. Unfortunately, continuous variables are not handled well.

### Online Transaction Processing

With online transaction processing (OLTP), transactions are immediately entered. Information has to be accurate and consistent. The nature of processing is repetitive with continual updates. Database integrity should have proper controls. Numerous applications exist such as inventory control, management control, and collections. OLTP is mostly structured for transactional, repetitive processing instead of unstructured investigative processing. By using OLTP, the financial manager can optimize his or her transaction processing capability associated with such applications as manufacturing, accounting, marketing, and sales. OLTP is application and event driven. Data in OLTP is changing and volatile.

In OLTP, the nature of questioning involves day-to-day operations such as the updating of inventory for buys and sells. At a certain inventory level, a reorder occurs.
Genetic Algorithms

Genetic algorithms (GAs) may be used in scheduling physical and human resources subject to limitations (e.g., budget). There is an allocation of limited resources taking into account relationships among resources and users. GAs can help find optimal values such as the best selling price, optimal number of units to produce, and correct number of staff to service customer/client needs. Disadvantages of GAs involve encoding and high cost.

Decision Trees

A decision tree breaks down records into subsets. They are easy to understand because the flow of the financial decision process is shown such as:

```
Is Internal Control Weak?
Yes
  ↓
  Take Steps to Improve
  ↓
  Steps Deficient
  ↓
  Make Note in Audit Report

No
  ↓
  No Audit Qualification
  ↓
  Steps Adequate
  ↓
  Audit Reliance Justified
```

A decision tree asks questions in sequential order. This method is feasible when you can derive comprehensible and explainable rules.

Personal Information Agents

Personal information agents are mobile applications on data warehouses to perform questioning or uncover data patterns. Many agents are rule-based such as “if A occurs, do Y.” Agents should be able to note unexpected occurrences or events within a data warehouse. The typical personal information agent can specify the particular subject or event based on a specified time frame. Any changes in the subject area are updated.
Chapter 5 Review Questions

1. The database approach to systems and the resulting concept of database management systems have several unique characteristics not found in traditional systems, specifically file-oriented systems. A primary goal of database management systems (DBMS) is to minimize data redundancy. True or False?

2. Transaction trails should exist for modifications of data processed by the database. True or False?

3. What is an example of data that is classified in a family tree of related record types where lower-level records are subordinate to higher-level-ones?
   A. Object-database
   B. Multimedia database
   C. Hierarchical database
   D. Distributed database management system

4. A data file consisting of logical records that furnish summarized information that can be used in decision-making is ____________.
   A. Link analysis
   B. Data mart
   C. Data modeling
   D. Knowledge discovery

5. What is the software process used to examine a database that identifies patterns, relationships and trends to assist financial management decision-making?
   A. Market based analysis
   B. Memory-based reasoning
   C. Data mining
   D. Fuzzy search
Chapter 6: 
Information Systems and Financial Analysis

Learning Objectives:

After completing this section, you should be able to:

1. Recognize several capital budgeting techniques.

2. Recognize the effect of taxes and Modified Accelerated Cost Recovery Systems (MACRS) on capital budgeting decisions.

Capital budgeting is the process of making long-term planning decisions for alternative investment opportunities. There are many investment decisions that the company may have to make in order to grow. Examples of capital budgeting applications are installation of a new information system (IS), lease or purchase, new product development, product line selection, keep or sell a business segment, and which asset to invest in. A careful cost-benefit analysis must be performed to determine a project’s economic feasibility of a capital expenditure project. These need to be weighed against other options such as the outsourcing of IT or the greater use of cloud-based resources.

Evaluating Technical Investments

What are the Types of Investment Projects?

There are typically two types of long-term capital expenditure decisions:

1. Selection decisions in terms of obtaining new facilities or expanding existing ones: Examples include:
   a. Investments in property, plant, and equipment as well as other types of assets.
b. Resource commitments in the form of new product development, market research, introduction of an IS system, refunding of long-term debt, and so on.

c. Mergers and acquisitions in the form of buying another company to add a new product line.

2. *Replacement decisions* in terms of replacing existing facilities with new ones. Examples include replacing an old machine with a high-tech machine.

**What are the Features of Investment Projects?**

Long-term investments have three important features:

1. They typically involve a large amount of initial cash outlays which tend to have a long-term impact on the firm’s future profitability. Therefore, this initial cash outlay needs to be justified on a cost-benefit basis.

2. There are expected recurring cash inflows (for example, increased revenues, savings in cash operating expenses, etc.) over the life of the investment project. This frequently requires considering the time value of money.

3. Income taxes could make a difference in the accept-or-reject decision. Therefore, income tax factors must be taken into account in every capital budgeting decision.

**Understanding the Concept of Time Value of Money**

A dollar now is worth more than a dollar to be received later. This statement sums up an important principle: money has a time value. The truth of this principle is not that inflation might make the dollar received at a later time worth less in buying power. The reason is that you could invest the dollar now and have more than a dollar at the specified later date.

Time value of money is a critical consideration in financial and investment decisions. For example, compound interest calculations are needed to determine future sums of money resulting from an investment. Discounting, or the calculation of present value, is inversely related to compounding, is used to evaluate the future cash flow associated with capital budgeting projects. There are plenty of applications of time value of money in accounting and finance.

**How Do You Measure Investments in Technology?**

Several methods of evaluating investment projects are as follows:

1. Payback period
2. Net present value (NPV)
3. Internal rate of return (IRR)
The NPV method and the IRR method are called *discounted cash flow (DCF)* methods. Each of these methods is discussed below.

### 1. Payback Period

The payback period measures the length of time required to recover the amount of initial investment. It is computed by dividing the initial investment by the cash inflows through increased revenues or cost savings.

**Example**

Assume:

- Cost of investment = $18,000
- Annual after-tax cash savings = $3,000

Then, the payback period is:

\[
\text{Payback period} = \frac{\text{Initial investment}}{\text{Cost savings}} = \frac{18,000}{3,000} = 6 \text{ years}
\]

**Decision rule:** Choose the project with the shorter payback period. The rationale behind this choice is: The shorter the payback period, the less risky the project and the greater the liquidity.

### 2. Net Present Value

Net present value (NPV) is the excess of the present value (PV) of cash inflows generated by the project over the amount of the initial investment (I):

\[
\text{NPV} = \text{PV} - I
\]

The present value of future cash flows is computed using the so-called cost of capital (or minimum required rate of return) as the discount rate. When the NPV of the investment is positive, the investment should be accepted.

The advantages of the NPV method are that it obviously recognizes the time value of money and it is easy to compute whether the cash flows form an annuity or vary from period to period.

### 3. Internal Rate of Return

Internal rate of return (IRR), also called *time adjusted rate of return*, is defined as the rate of interest that equates I with the PV of future cash inflows. In other words,

\[
\text{at IRR } I = \text{PV or } \text{NPV} = 0
\]

**Decision rule:** Accept the project if the IRR exceeds the cost of capital. Otherwise, reject it.

The advantage of using the IRR method is that it does consider the time value of money.
The shortcomings of this method are that (1) it is time-consuming to compute, especially when the cash inflows are not even, although most financial calculators and PCs have a key to calculate IRR, and (2) it fails to recognize the varying sizes of investment in competing projects.

**How Do Income Taxes Affect Investment Decisions?**

Income taxes make a difference in many capital budgeting decisions. The project which is attractive on a before-tax basis may have to be rejected on an after-tax basis and vice versa. Income taxes typically affect both the amount and the timing of cash flows. Since net income, not cash inflows, is subject to tax, after-tax cash inflows are not usually the same as after-tax net income.

**How to Calculate After-Tax Cash Flows**

Let us define:

- \( S \) = Sales
- \( E \) = Cash operating expenses
- \( d \) = Depreciation
- \( t \) = Tax rate

Then, before-tax cash inflows (or cash savings) = \( S - E \) and net income = \( S - E - d \)

By definition,

\[
\text{After-tax cash inflows} = \text{Before-tax cash inflows} - \text{Taxes} = (S - E) - (S - E - d) \cdot t
\]

Rearranging gives the short-cut formula:

\[
\text{After-tax cash inflows} = (S - E) \cdot (1 - t) + (d) \cdot t \] or \\
\[
= (S - E - d) \cdot (1 - t) + d
\]

The deductibility of depreciation from sales in arriving at taxable net income reduces income tax payments and thus serves as a *tax shield*.

\[
\text{Tax shield} = \text{Tax savings on depreciation} = (d) \cdot t
\]

**Example**

Assume:

- \( S = \$12,000 \)
- \( E = \$10,000 \)
- \( d = \$500 \) per year using the straight line method
- \( t = 30\% \)

Then,
After-tax cash inflow = \((\$12,000 - \$10,000)(1 - .3) + (\$500)(.3)\)  
= \((\$2,000)(.7) + (\$500)(.3)\)  
= \$1,400 + \$150 = \$1,550  

Note that a tax shield = tax savings on depreciation = \((d)(t)\)  
= (\$500)(.3)  
= \$150

Since the tax shield is \(dt\), the higher the depreciation deduction, the higher the tax savings on depreciation. Therefore, an accelerated depreciation method (such as double-declining balance) produces higher tax savings than the straight-line method. Accelerated methods produce higher present values for the tax savings which may make a given investment more attractive.

Example

Shalimar Corporation has provided its revenues and cash operating costs (excluding depreciation) for the old and the new machine as follows:

<table>
<thead>
<tr>
<th></th>
<th>Annual Revenue</th>
<th>Annual Cash Operating Costs</th>
<th>Net Profit before Depreciation and Taxes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Old machine</td>
<td>$150,000</td>
<td>$70,000</td>
<td>$80,000</td>
</tr>
<tr>
<td>New machine</td>
<td>$180,000</td>
<td>$60,000</td>
<td>$120,000</td>
</tr>
</tbody>
</table>

Assume that the annual depreciation of the old machine and the new machine will be \$30,000 and \$50,000, respectively. Assume further that the tax rate is 46%.

To arrive at net profit after taxes, we first have to deduct depreciation expense from the net profit before depreciation and taxes, as follows:

<table>
<thead>
<tr>
<th>Add</th>
<th>After-Tax Cash Inflows</th>
</tr>
</thead>
<tbody>
<tr>
<td>Old machine (($80,000-$30,000)(1-0.46)=$27,000)</td>
<td>$57,000</td>
</tr>
<tr>
<td>New machine (($120,000-$50,000)(1-0.46)=$37,800)</td>
<td>$87,800</td>
</tr>
</tbody>
</table>

Subtracting the after-tax cash inflows of the old machine from the cash inflows of the new machine results in the relevant, or incremental, cash inflows for each year.

Therefore, in this example, the relevant or incremental cash inflows for each year are \$87,800 - \$57,000 = \$30,800.

Alternatively, the incremental cash inflows after taxes can be computed, using the following simple formula:

\[
\text{After-tax incremental cash inflows} = (\text{increase in revenues})(1-\text{tax rate})
\]
- (increase in cash charges)(1-t-x rate)
+ (increase in depreciation expenses)(tax rate)

**Example**

Using the data in Example the above, after-tax incremental cash inflows for each year are:

<table>
<thead>
<tr>
<th>Description</th>
<th>Calculation</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase in revenue x (1-t-x rate):</td>
<td>($180,000-$150,000)(1-0.46)</td>
<td>$16,200</td>
</tr>
<tr>
<td>Increase in cash charges x (1-t-x rate):</td>
<td>($60,000-$70,000)(1-0.46)</td>
<td>-5,400</td>
</tr>
<tr>
<td>Increase in depreciation expense x tax rate:</td>
<td>($50,000-$30,000)(0.46)</td>
<td>9,200</td>
</tr>
</tbody>
</table>

**How Does MACRS Affect Investment Decisions?**

Although the traditional depreciation methods can be used for computing depreciation for book purposes, 1981 saw a new way of computing depreciation deductions for tax purposes. The current rule is called the *Modified Accelerated Cost Recovery System* (MACRS) rule, as enacted by Congress in 1981 and then modified somewhat in 1986 under the Tax Reform Act of 1986. This rule is characterized as follows:

1. It abandons the concept of useful life and accelerates depreciation deductions by placing all depreciable assets into one of eight age property classes. It calculates deductions, based on an allowable percentage of the asset's original cost (See Tables 1 and 2).

With a shorter asset tax life than useful life, the company would be able to deduct depreciation more quickly and save more in income taxes in the earlier years, thereby making an investment more attractive. The rationale behind the system is that this way the government encourages the company to invest in facilities and increase its productive capacity and efficiency. (Remember that the higher d, the larger the tax shield (d)(t)).

2. Since the allowable percentages in Table 1 add up to 100%, there is no need to consider the salvage value of an asset in computing depreciation.

3. The company may elect the straight line method. The straight-line convention must follow what is called the *half-year convention*. This means that the company can deduct only half of the regular straight-line depreciation amount in the first year.

The reason for electing to use the MACRS optional straight-line method is that some firms may prefer to stretch out depreciation deductions using the straight-line method rather than to accelerate them. Those firms are the ones that just start out or have little or no income and wish to show more income on their income statements.
Example

Assume that a machine falls under a 3-year property class and costs $3,000 initially. The straight line option under MACRS differs from the traditional straight line method in that under this method the company would deduct only $500 depreciation in the first year and the fourth year ($3,000/3 years = $1,000; $1,000/2 = $500). The table below compares the straight line with half-year convention with the MACRS.

<table>
<thead>
<tr>
<th>Year</th>
<th>Straight line Depreciation</th>
<th>Cost</th>
<th>MACRS %</th>
<th>MACRS Deduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$ 500</td>
<td>$3,000</td>
<td>33.3%</td>
<td>$ 999</td>
</tr>
<tr>
<td>2</td>
<td>1,000</td>
<td>3,000</td>
<td>44.5</td>
<td>1,335</td>
</tr>
<tr>
<td>3</td>
<td>1,000</td>
<td>3,000</td>
<td>14.8</td>
<td>444</td>
</tr>
<tr>
<td>4</td>
<td>500</td>
<td>3,000</td>
<td>7.4</td>
<td>222</td>
</tr>
<tr>
<td></td>
<td>$3,000</td>
<td>$3,000</td>
<td></td>
<td>$3,000</td>
</tr>
</tbody>
</table>
### Table 1

**Modified Accelerated Cost Recovery System**

**Classification of Assets**

*Property class*

<table>
<thead>
<tr>
<th>Year</th>
<th>3-year</th>
<th>5-year</th>
<th>7-year</th>
<th>10-year</th>
<th>15-year</th>
<th>20-year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>33.3%</td>
<td>20.0%</td>
<td>14.3%</td>
<td>10.0%</td>
<td>5.0%</td>
<td>3.8%</td>
</tr>
<tr>
<td>2</td>
<td>44.5</td>
<td>32.0</td>
<td>24.5</td>
<td>18.0</td>
<td>9.5</td>
<td>7.2</td>
</tr>
<tr>
<td>3</td>
<td>14.8a</td>
<td>19.2</td>
<td>17.5</td>
<td>14.4</td>
<td>8.6</td>
<td>6.7</td>
</tr>
<tr>
<td>4</td>
<td>7.4</td>
<td>11.5a</td>
<td>12.5</td>
<td>11.5</td>
<td>7.7</td>
<td>6.2</td>
</tr>
<tr>
<td>5</td>
<td>11.5</td>
<td>8.9a</td>
<td>9.2</td>
<td>6.9</td>
<td>5.7</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>5.8</td>
<td>8.9</td>
<td>7.4</td>
<td>6.2</td>
<td>5.3</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>8.9</td>
<td>6.6a</td>
<td>5.9a</td>
<td>4.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>4.5</td>
<td>6.6</td>
<td>5.9</td>
<td>4.5a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>6.5</td>
<td>5.9</td>
<td>4.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>6.5</td>
<td>5.9</td>
<td>4.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>3.3</td>
<td>5.9</td>
<td>4.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>5.9</td>
<td>4.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>5.9</td>
<td>4.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>5.9</td>
<td>4.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>5.9</td>
<td>4.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>3.0</td>
<td>4.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>4.4</td>
<td>4.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>4.4</td>
<td>4.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>4.4</td>
<td>4.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>4.4</td>
<td>4.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>2.2</td>
<td>2.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

a. Denotes the year of changeover to straight-line depreciation.
Table 2
MACRS Tables by Property Class

<table>
<thead>
<tr>
<th>MACRS Property Class &amp; Depreciation Method</th>
<th>Useful Life (ADR Midpoint Life) “a”</th>
<th>Examples of Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-year property 200% declining balance</td>
<td>4 years or less</td>
<td>Most small tools are included; the law specifically excludes autos and light trucks from this property class.</td>
</tr>
<tr>
<td>5-year property 200% computers, declining balance</td>
<td>More than 4 years to Less than 10 years</td>
<td>Autos and light trucks Computers, copiers, duplicating equipment, heavy general-purpose trucks, and research and experimentation equipment are included.</td>
</tr>
<tr>
<td>7-year property 200% and declining balance</td>
<td>10 years or more to less than 16 years</td>
<td>Office furniture and fixtures most items of machinery and equipment used in production are included.</td>
</tr>
<tr>
<td>10-year property 200% declining balance</td>
<td>16 years or more to less than 20 years</td>
<td>Various machinery and equipment, such as that used in petroleum distilling and refining and in the milling of grain, are included.</td>
</tr>
<tr>
<td>15-year property 150% declining balance</td>
<td>20 years or more to less than 25 years</td>
<td>Sewage treatment plants telephone and electrical distribution facilities, and land improvements are included.</td>
</tr>
<tr>
<td>20-year property 150% declining balance</td>
<td>25 years or more</td>
<td>Service stations and other real property with an ADR midpoint life of less than 27.5 years are included.</td>
</tr>
<tr>
<td>27.5-year property Straight-line</td>
<td>Not applicable</td>
<td>All residential rental property is included.</td>
</tr>
<tr>
<td>31.5-year property Straight-line</td>
<td>Not applicable</td>
<td>All nonresidential property is included.</td>
</tr>
</tbody>
</table>

“a” The term ADR midpoint life means the “useful life” of an asset in a business sense; the appropriate ADR midpoint lives for assets are designated in the tax Regulations.
What to Know About the Cost of Capital

The cost of capital is defined as the rate of return that is necessary to maintain the market value of the firm (or price of the firm's stock). Project managers must know the cost of capital, often called the minimum required rate of return, used either as a discount rate under the NPV method or as a hurdle rate under the IRR method. The cost of capital is computed as a weighted average of the various capital components, which are items on the right-hand side of the balance sheet such as debt, preferred stock, common stock, and retained earnings.

Cost of Debt

The cost of debt is stated on an after-tax basis, since the interest on the debt is tax deductible. However, the cost of preferred stock is the stated annual dividend rate. This rate is not adjusted for income taxes because the preferred dividend, unlike debt interest, is not a deductible expense in computing corporate income taxes.

Example

Assume that the Hume Company issues a $1,000, 8 percent, 20-year bond whose net proceeds are $940. The tax rate is 40 percent. Then, the after-tax cost of debt is:

\[
8.00\% \times (1 - 0.4) = 4.8\%
\]

Example

Suppose that the Hume company has preferred stock that pays a $12 dividend per share and sells for $100 per share in the market. Then the cost of preferred stock is:

\[
\frac{\text{Dividend per share}}{\text{Price per share}} = \frac{12}{100} = 12\%
\]

Cost of Common Stock

The cost of common stock is generally viewed as the rate of return investors require on a firm's common stock. One way to measure the cost of common stock is to use the Gordon's growth model. The model is

\[
P_o = \frac{D_1}{r - g}
\]

where \( P_o \) = value (or market price) of common stock
\( D_1 \) = dividend to be received in 1 year
\( r \) = investor’s required rate of return
\( g \) = rate of growth (assumed to be constant over time)

Solving the model for \( r \) results in the formula for the cost of common stock:

\[
r = \frac{D_1}{P_o} + g
\]
Example

Assume that the market price of the Hume Company's stock is $40. The dividend to be paid at the end of the coming year is $4 per share and is expected to grow at a constant annual rate of 6 percent. Then the cost of this common stock is:

\[
\frac{D_1}{P_0} + g = \frac{$4}{$40} + 6\% = 16\%
\]

Cost of Retained Earnings

The cost of retained earnings is closely related to the cost of existing common stock, since the cost of equity obtained by retained earnings is the same as the rate of return investors require on the firm's common stock.

Measuring the Overall Cost of Capital

The firm's overall cost of capital is the weighted average of the individual capital costs, with the weights being the proportions of each type of capital used.

\[ \sum (\text{Percentage of the total capital structure supplied by each source} \times \text{cost of capital for each source}) \]

The computation of overall cost of capital is illustrated in the following example.

Example

Assume that the capital structure at the latest statement date is indicative of the proportions of financing that the company intends to use over time:

<table>
<thead>
<tr>
<th>Source</th>
<th>Weights</th>
<th>Cost</th>
<th>Weighted Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortgage bonds ($1,000 par)</td>
<td>$20,000,000</td>
<td>4.80% (from Example 17)</td>
<td></td>
</tr>
<tr>
<td>Preferred stock ($100 par)</td>
<td>5,000,000</td>
<td>12.00% (from Example 18)</td>
<td></td>
</tr>
<tr>
<td>Common stock ($40 par)</td>
<td>20,000,000</td>
<td>16.00% (from Example 19)</td>
<td></td>
</tr>
<tr>
<td>Retained earnings</td>
<td>5,000,000</td>
<td>16.00%</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>$50,000,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

These proportions would be applied to the assumed individual explicit after-tax costs below:

<table>
<thead>
<tr>
<th>Source</th>
<th>Weights</th>
<th>Cost</th>
<th>Weighted Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Debt</td>
<td>40% (a)</td>
<td>4.80%</td>
<td>1.92% (b)</td>
</tr>
<tr>
<td>Preferred stock</td>
<td>10</td>
<td>12.00%</td>
<td>1.20</td>
</tr>
<tr>
<td>Common stock</td>
<td>40</td>
<td>16.00%</td>
<td>6.40</td>
</tr>
<tr>
<td>Retained earnings</td>
<td>10</td>
<td>16.00%</td>
<td>1.60</td>
</tr>
</tbody>
</table>
Overall cost of capital is 11.12%

By computing a company's cost of capital, we can determine its minimum rate of return, which is used as the discount rate in present value calculations. A company's cost of capital is also an indicator of risk. For example, if your company’s cost of financing increases, it is being viewed as more risky by investors and creditors, who are demanding higher return on their investments in the form of higher dividend and interest rates.

**Lease-Purchase Decisions**

The lease-purchase decision is one commonly confronting firms considering the acquisition of new assets. It is a hybrid capital budgeting decision which forces a company to compare the leasing and financing (purchasing) alternatives.

There are tax benefits of leasing equipment rather than financing it with a term loan. Depending upon your needs and the nature of your business, the entire lease payment may be fully deductible as a business expense, thereby reducing your taxable income. With a loan, only the interest and depreciation can be used for deductions. Another benefit a lease offers is 100% financing plus an additional 10% of the equipment’s costs to cover “soft costs,” such as taxes, shipping and installation. Some term loans offer 100% financing but, typically, they cover the cost of equipment only.

A lease can help you manage your cash flow. The payments are usually lower than for a term loan. Since a lease payment requires no down payment or deposit, you can get the equipment you need without depleting your reserve capital. The types of business that most often lease equipment to generate revenue are manufacturing, transportation, printing, and professional corporations, such as medical, law, or accounting firms. Leasing works well for such companies since they can keep their equipment current without having to dip into capital to do it. Since the business' capital is not being used for equipment, they can use it for business development and expansion.

A loan is your best choice, however, if you wish to keep the equipment and build equity quickly. Loans can be structured so you can own the equipment outright at the end of the term. Note: If you are sure you want to retain your equipment beyond the lease term and prefer to know the full cost of the financing up front, you may choose a Lease Purchase option. As its name implies, this option requires no additional payment to own the equipment at the end of the lease.

To make an intelligent financial decision on a lease-purchase, an after-tax, cash outflow, present value comparison is needed.
1. Find the annual lease payment.
2. Find the after-tax cash outflows.
3. Find the present value of the after-tax cash outflows.

When considering a purchase, take the following steps:

1. Find the annual loan amortization
2. Calculate the interest. The interest is segregated from the principal in each of the annual loan payments because only the interest is tax-deductible.
3. Find the cash outflows by adding interest and depreciation (plus any maintenance costs), and then compute the after-tax outflows.

The table below shows a lease vs. purchase decision

**Table 3**
Lease versus Purchase Evaluation Report

<table>
<thead>
<tr>
<th>Year</th>
<th>Lease Net After-Tax Cash Flow</th>
<th>Purchase Net After-Tax Cash Flow</th>
<th>Present Value Factor</th>
<th>Discounted Cash Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>23,216</td>
<td>23,216</td>
<td>1</td>
<td>23,216</td>
</tr>
<tr>
<td>1</td>
<td>23,216</td>
<td>11,608</td>
<td>0.9259</td>
<td>10,748</td>
</tr>
<tr>
<td>2</td>
<td>23,216</td>
<td>11,608</td>
<td>0.8573</td>
<td>9,952</td>
</tr>
<tr>
<td>3</td>
<td>23,216</td>
<td>11,608</td>
<td>0.7938</td>
<td>9,214</td>
</tr>
<tr>
<td>4</td>
<td>23,216</td>
<td>11,608</td>
<td>0.735</td>
<td>8,532</td>
</tr>
<tr>
<td>5</td>
<td>(11,608)</td>
<td>23,216</td>
<td>0.6806</td>
<td>(7,900)</td>
</tr>
<tr>
<td></td>
<td>($92,864)</td>
<td>($58,040)</td>
<td></td>
<td>($53,824)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lease Proposal</th>
<th>Purchase Proposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of machine</td>
<td>$100,000</td>
</tr>
<tr>
<td>Terms of payment</td>
<td>5 years</td>
</tr>
<tr>
<td>Interest rate</td>
<td>12%</td>
</tr>
<tr>
<td>Down payment</td>
<td></td>
</tr>
<tr>
<td>Monthly lease payment at the end of the year</td>
<td>$23,216</td>
</tr>
<tr>
<td>Monthly loan payment</td>
<td>$26,381</td>
</tr>
<tr>
<td>Depreciation</td>
<td>Straight line</td>
</tr>
<tr>
<td>Residual purchase price</td>
<td>0%</td>
</tr>
<tr>
<td>Corporate tax bracket</td>
<td>50%</td>
</tr>
<tr>
<td>After-tax cost of capital</td>
<td>8%</td>
</tr>
</tbody>
</table>
Economic Feasibility Study for a New Information System

Determining economic feasibility requires a careful investigation of the costs and benefits of a proposed information system. The basic framework for feasibility analysis is the Capital Budgeting Model in which cost savings and other benefits, as well as initial outlay costs, operating costs, and other cash outflows, are translated into dollar estimates. These must be weighed against other options such as relying on cloud-based services.

The estimated benefits are compared with the costs to determine whether the system is cost beneficial. Where possible, benefits and costs that are not easily quantifiable should be estimated and included in the feasibility analysis. If they cannot be accurately estimated, they should be listed and the likelihood of their occurring and the expected impact on the organization evaluated. Some of the tangible and intangible benefits a company might obtain from a new system are cost savings: improved customer service, productivity, decision making, and data processing; better management control; and increased job satisfaction and employee morale.

Equipment costs are an initial outlay cost if the system is purchased and an operating cost if rented or leased. Equipment costs vary from a few thousands for personal computer systems to millions of dollars for enormous server setups. Equipment costs are usually less than the cost of acquiring software and maintaining, supporting, and operating the system. Software acquisition costs include the purchase price of software as well as the time and effort required to design, program, test, and document software. The personnel costs associated with hiring, training, and relocating staff can be substantial. Site preparation costs may be incurred for large computer systems. There are costs involved in installing the new system and converting files to the appropriate format and storage media.

The primary operating cost is maintaining the system. There may be significant annual cash outflows for equipment replacement and expansion and software updates. Human resource costs include the salaries of systems analysts, programmers, operators, data entry operators, and management. Costs are also incurred for supplies, overhead, and other operating costs. Initial cash outlay and operating costs are summarized in Table 8.

<table>
<thead>
<tr>
<th>Table 4</th>
<th>Initial Cash Outlay and Operating Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware</td>
<td></td>
</tr>
<tr>
<td>Servers</td>
<td>Peripherals</td>
</tr>
<tr>
<td>Special input/output devices</td>
<td>Communications hardware</td>
</tr>
<tr>
<td>Upgrade and expansion costs</td>
<td></td>
</tr>
<tr>
<td>Software</td>
<td></td>
</tr>
<tr>
<td>Application, system, general-purpose, utility, and communications software</td>
<td></td>
</tr>
<tr>
<td>Updated versions of software</td>
<td></td>
</tr>
<tr>
<td>Application software design, programming, modification, and testing</td>
<td></td>
</tr>
<tr>
<td>Installation</td>
<td></td>
</tr>
<tr>
<td>Freight and delivery charges</td>
<td>Setup and connection fees</td>
</tr>
</tbody>
</table>

99
Conversion
- Systems testing
- File and data conversions
- Parallel operations

Documentation
- Systems documentation
- Training program documentation
- Operating standards and procedures

Site preparation
- Air-conditioning, humidity, and dust controls
- Physical security (access)
- Fire and water protection
- Cabling, wiring, and outlets
- Furnishing and fixtures

Staff
- Supervisors
- Analysts and programmers
- Computer operators
- Input (data conversion) personnel
- Recruitment and staff training

Maintenance/backup
- Hardware/software maintenance
- Backup and recovery operations
- Power supply protection

Supplies and overhead
- Preprinted forms
- Data storage devices
- Supplies (paper, ribbons, toner)
- Utilities and power

Others
- Legal and consulting fees
- Insurance

During systems design, several alternative approaches to meeting system requirements are developed. Various feasibility measures such as technical, operational, legal, and scheduling feasibility are then used to narrow the list of alternatives. Economic feasibility and capital budgeting techniques, which were discussed earlier, are used to evaluate the benefit-cost aspects of the alternatives.

Example

Sophie, an information systems (IS) project manager for the HYY chain of discount stores, is contemplating installation of a new IS system that is flexible, efficient, timely, and responsive to user and customer needs. The new system aims at improving the company's business processes. After the analysis Sophie's IS project team decided they wanted the corporate office to gather daily sales data from each store. Analyzing the prior day's sales will help the company adapt quickly to customer needs. Providing sales data to suppliers will help avoid stockouts and overstocking.

Coordinating buying at the corporate office will help HYY to minimize inventory levels and negotiate lower wholesale prices. Stores will send orders electronically the day they are prepared. Based on store orders, the previous day's sales figures, and warehouse inventory, HYY will send purchase orders to suppliers. Suppliers will process orders and ship goods to regional warehouses or directly to the stores the day orders are received. Each
store will have the flexibility to respond to local sales trends and conditions by placing local orders. Accounts payable will be centralized so the firm can make payments electronically.

Sophie's team conducted an economic feasibility study and determined that the project makes excellent use of funds. As shown in the table below, they estimated that initial outlay costs for the system are $4.32 million (initial systems design and new hardware $1.8 million each, software $375,000. and training, site preparation, and conversion $250,000 each).

The team estimated what it would cost to operate the system for its estimated six-year life, as well as, what the system would save the company. The following recurring costs were identified: hardware expansion, additional software and software updates, systems maintenance, added personnel to operate the system, communication charges, and overhead. The system will also save the company money by eliminating clerical jobs, generating working capital savings, increasing sales and profits, and decreasing warehouse costs. The costs and savings for years 1 through 6, which are expected to rise from year to year, are shown in the table.

Sophie calculated the annual savings minus the recurring additional costs and then calculated the annual after-tax cash savings under the MACRS tax rule. The $4.66 million system can be depreciated over the six-year period. For example, the depreciation in year 1 of $932,000 reduces net income by that amount. Since the company does not have to pay taxes on the $1 million, at their tax rate of 34% they end up saving an additional $316,880 in year 1. Finally, Sophie calculated the net savings for each year.

Sophie used HYY’s cost of capital of 10% to calculate the net present value (NPV) of the investment, which is over $3 million. The internal rate of return (IRR) is a respectable 26%. Sophie realized how advantageous it would be for the company to borrow the money (at 10% interest rates) in order to produce a 26% return on that borrowed money. In addition, payback (the point at which the initial cost is recovered) occurs in the fourth year. NPV and IRR are calculated as shown in the table.

Sophie presented the system and its cost-benefit calculations to top management. Challenges to her estimates (various "what-if" scenarios) were plugged into the Excel model so that management could see the effect of the changed assumptions. This spreadsheet analysis was intended to ensure a positive return of the new system under future uncertainty.

The table on the next page shows an Economic Feasibility Study for a New Information System.
### Initial outlay costs

<table>
<thead>
<tr>
<th>Item</th>
<th>Year 0</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Year 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial system design</td>
<td>$1,800,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hardware</td>
<td>$1,800,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Software</td>
<td>$375,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Training</td>
<td>$185,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site preparation</td>
<td>$250,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conversion</td>
<td>$250,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total Initial Outlay Costs:** $4,660,000

### Recurring costs

<table>
<thead>
<tr>
<th>Item</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Year 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware expansion</td>
<td>$250,000</td>
<td>$290,000</td>
<td>$330,000</td>
<td>$370,000</td>
<td>$390,000</td>
<td></td>
</tr>
<tr>
<td>Software</td>
<td>$160,000</td>
<td>$210,000</td>
<td>$230,000</td>
<td>$245,000</td>
<td>$260,000</td>
<td></td>
</tr>
<tr>
<td>Systems maintenance</td>
<td>$70,000</td>
<td>$120,000</td>
<td>$130,000</td>
<td>$140,000</td>
<td>$150,000</td>
<td></td>
</tr>
<tr>
<td>Personnel costs</td>
<td>$485,000</td>
<td>$800,000</td>
<td>$900,000</td>
<td>$1,000,000</td>
<td>$1,100,000</td>
<td>$1,300,000</td>
</tr>
<tr>
<td>Communication charges</td>
<td>$99,000</td>
<td>$160,000</td>
<td>$180,000</td>
<td>$200,000</td>
<td>$220,000</td>
<td>$250,000</td>
</tr>
<tr>
<td>Overhead</td>
<td>$310,000</td>
<td>$420,000</td>
<td>$490,000</td>
<td>$560,000</td>
<td>$600,000</td>
<td>$640,000</td>
</tr>
</tbody>
</table>

**Total Recurring Costs:** $964,000

### Cash savings

<table>
<thead>
<tr>
<th>Item</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Year 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clerical cost savings</td>
<td>$500,000</td>
<td>$1,110,000</td>
<td>$1,350,000</td>
<td>$1,500,000</td>
<td>$1,700,000</td>
<td>$1,950,000</td>
</tr>
<tr>
<td>Working capital savings</td>
<td>$1,000,000</td>
<td>$1,200,000</td>
<td>$1,500,000</td>
<td>$1,500,000</td>
<td>$1,500,000</td>
<td>$1,500,000</td>
</tr>
<tr>
<td>Increased sales and profits</td>
<td>$500,000</td>
<td>$900,000</td>
<td>$1,200,000</td>
<td>$1,500,000</td>
<td>$1,800,000</td>
<td></td>
</tr>
<tr>
<td>Reduced warehouse costs</td>
<td>$400,000</td>
<td>$800,000</td>
<td>$1,200,000</td>
<td>$1,600,000</td>
<td>$2,000,000</td>
<td></td>
</tr>
</tbody>
</table>

**Total Cash Savings:** $1,500,000

### Cash savings minus recurring costs

<table>
<thead>
<tr>
<th>Item</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Year 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less income taxes (34%)</td>
<td>(182,240)</td>
<td>(442,000)</td>
<td>(799,000)</td>
<td>(999,600)</td>
<td>(1,229,100)</td>
<td>(1,445,000)</td>
</tr>
<tr>
<td>Cash savings (net of tax)</td>
<td>$353,760</td>
<td>$858,000</td>
<td>$1,551,000</td>
<td>$1,940,400</td>
<td>$2,385,900</td>
<td>$2,805,000</td>
</tr>
</tbody>
</table>

**Tax savings from depreciation deduction**

<table>
<thead>
<tr>
<th>Year</th>
<th>MACRS</th>
<th>Depreciation</th>
<th>Tax savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20.00%</td>
<td>$932,000</td>
<td>$316,880</td>
</tr>
<tr>
<td>2</td>
<td>32.00%</td>
<td>$1,491,200</td>
<td>$507,008</td>
</tr>
<tr>
<td>3</td>
<td>19.20%</td>
<td>$894,720</td>
<td>$304,205</td>
</tr>
<tr>
<td>4</td>
<td>11.50%</td>
<td>$535,900</td>
<td>$182,206</td>
</tr>
<tr>
<td>5</td>
<td>11.50%</td>
<td>$535,900</td>
<td>$182,206</td>
</tr>
<tr>
<td>6</td>
<td>5.80%</td>
<td>$270,280</td>
<td>$91,895</td>
</tr>
</tbody>
</table>

**Net cash inflows (net savings) after taxes:** $(4,660,000)

<table>
<thead>
<tr>
<th>Year</th>
<th>Cash inflows</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$(4,660,000)</td>
</tr>
<tr>
<td>1</td>
<td>670,640</td>
</tr>
<tr>
<td>2</td>
<td>1,365,008</td>
</tr>
<tr>
<td>3</td>
<td>1,855,205</td>
</tr>
<tr>
<td>4</td>
<td>2,122,606</td>
</tr>
<tr>
<td>5</td>
<td>2,568,106</td>
</tr>
<tr>
<td>6</td>
<td>2,896,895</td>
</tr>
</tbody>
</table>

**NPV:** $3,151,248

**IRR:** 26.26%

---

### Net present value calculations @ a cost of capital of 10%

<table>
<thead>
<tr>
<th>Year</th>
<th>Net savings</th>
<th>PV factor</th>
<th>PV</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$(4,660,000)</td>
<td>1.0000</td>
<td>$(4,660,000)</td>
</tr>
<tr>
<td>1</td>
<td>670,640</td>
<td>0.9091</td>
<td>609,679</td>
</tr>
<tr>
<td>2</td>
<td>1,365,008</td>
<td>0.8265</td>
<td>1,128,179</td>
</tr>
<tr>
<td>3</td>
<td>1,855,205</td>
<td>0.7513</td>
<td>1,393,815</td>
</tr>
<tr>
<td>4</td>
<td>2,122,606</td>
<td>0.6830</td>
<td>1,449,740</td>
</tr>
<tr>
<td>5</td>
<td>2,568,106</td>
<td>0.6209</td>
<td>1,594,537</td>
</tr>
<tr>
<td>6</td>
<td>2,896,895</td>
<td>0.5645</td>
<td>1,635,297</td>
</tr>
</tbody>
</table>

**NPV:** $3,151,248

**IRR:** 26.26%
Summary

We have examined the process of evaluating capital expenditure projects. We have also discussed several commonly used criteria for evaluating capital budgeting projects, including the NPV and IRR methods. Since income taxes could make a difference in the accept or reject decision, tax factors must be taken into account in every decision. Although the traditional depreciation methods still can be used for computing depreciation for book purposes, 1986 saw a new way of computing depreciation deductions for tax purposes. The rule is called the modified accelerated cost recovery system (MACRS). Lease-purchase decisions were also treated on an after-tax basis. Also presented is an example of economic feasibility study for a new information system.
Chapter 6 Review Questions

1. Examples of capital budgeting applications include installation of a new information system (IS) and information technology (IT). True or False?

2. The technique that recognizes the time value of money by discounting the cash flows for a project over its life to time period zero using the company’s minimum required rate of return is the:
   
   A. Net present value method.
   B. Capital rationing method.
   C. Payback method.
   D. Accounting rate of return method.

3. Flex Corporation is studying a capital acquisition proposal in which newly acquired IT assets will be depreciated using the straight-line method. Which one of the following statements about the proposal would be incorrect if a switch is made to accelerated methods such as the Modified Accelerated Cost Recovery System (MACRS)?
   
   A. The net present value will increase.
   B. The internal rate of return will increase.
   C. The payback period will be shortened.
   D. The profitability index will decrease.

4. What is the rate of return necessary to maintain the market value of the firm (or price of stock)?
   
   A. Internal Rate of Return (IRR)
   B. Net Present Value (NPV)
   C. Cost of Capital
   D. Payback Period
Glossary

ACTIVE FINANCIAL PLANNING SOFTWARE new-breed, Web-enabled software that includes applications and the new level of functionality that combine budgeting, forecasting analytics, business intelligence, and collaboration.

ACTIVITY-BASED COSTING (ABC) system that accumulates costs on the basis of production or service activities at a firm. Basically it assigns costs by activity and links them to specific products.

APPLICATION SERVER server running application programs. It is a network server performing applications requested by a client.

APPLICATION SOFTWARE has two prime subcategories comprising of resource management software (provides access to shared network resources and services) and productivity software (aids user productivity).

ARTIFICIAL INTELLIGENCE (AI) application of human reasoning techniques to machines. Artificial intelligence systems use sophisticated computer hardware and software to simulate the functions of the human mind including that of reasoning, sensation, perception, learning, and communicating. It gives computers the ability to think and solve complex business problems. Computers are made to act intelligently. Artificial intelligence applications include forecasting stock market prices via sequence prediction plannings. Plans describe many alternative sequences of actions with specification of conditions based on what different sequences were followed. In planning we can use program-like structures such as fuzzy algorithms to represent plans. Pattern recognition applications also exist. Further, applications are aided by long chains of "if-then" rules.

AUTHENTICATION mechanism used to ascertain if a user is who he or she purports to be.

CAPITAL BUDGET a budget or plan of proposed acquisitions and replacements of long-term assets and their financing. A capital budget is developed using a variety of capital budgeting techniques such as the discount cash flow method.
CLIENT/SERVER NETWORK OPERATING SYSTEMS supports voluminous users and enables interaction with other network operating systems through gateways. Client/server networks are much more complex and costly than peer-to-peer network operating systems.

CLIENT/SERVER sharing and interaction of data between server and client computers connected by a network.

CLIENT-SERVER SYSTEM computers connected by a network in which some computers (clients) process applications while other computers (servers) provide services (e.g., file storage, Internet hosting) to the clients.

COMMON GATEWAY INTERFACE (CGI) means of programming Web sites. Script programs are run on the server. (This is different from Java which runs on the client). CGI is primarily used to handle online forms. CGI allows Web applications to be written and executed on multiple different Web servers.

COMPUTER-AIDED DESIGN (CAD) DATABASE stores information applicable to engineering or mechanical design such as for buildings, ships, and aircraft.

COMPUTER-AIDED MANUFACTURING (CAM) DATABASE stores production-related information such as for manufacturing products (e.g., automobiles, trucks, equipment).

COMPUTER-AIDED SOFTWARE ENGINEERING (CASE) DATABASE stores information associated with software development including planning, designing, analyzing, testing, implementing, and maintaining.

CONCEPTUAL DATABASE DESIGN building a data model for the company irrespective of any physical aspect.

COOKIES information stored in the client on behalf of a server for a specified time period. Servers usually use cookies to store user identifications, user habits, and buying tastes. The cookie is sent back to the server in later requests from the client. Cookies are, by default, communicated only to the server that created them.

CORPORATE DATA MODEL presents key data, relationships between that data, and how it effects and is used by different areas of the entity. Areas of data sharing are indicated.
DATA ADMINISTRATION managing data resources including planning, designing, developing, and maintaining standards, procedures and policies.

DATA DEFINITION LANGUAGE (DDL) language allowing users to define the database as well as specify data types and nature along with constraints associated with the database. The DDL allows users to describe the entities needed for the application and their interrelated relationships.

DATA DICTIONARY (CATALOG) description and explanation of all data objects stored and managed by the system. The information can be stored in a dictionary-like document or a text file.

DATA FILE file of logical records.

DATA MARTS mobile personal warehouses on a laptop or tablet used on the road such as by salespeople and real estate brokers.

DATA MARTS subset of a data warehouse providing business information, usually in summarized fashion, to a specific department or division within the company. The data mart can be independent or linked to the company's centralized data warehouse (containing large amounts of detailed information). Since data marts contain less information relative to the data warehouse it is more readily comprehensible and easier to use.

DATA MINING process of going through voluminous databases to find meaningful trends, relationships, correlations, and patterns. We accumulate and analyze significant information stored in data warehouses or data marts by using artificial intelligence, and mathematical and statistical tools. Data mining is used to make business decisions. The major activities related to data mining are prediction, segmentation, linking, and identifying deviations. Examples of data mining applications are to determine whether to give a loan to an applicant based on his/her application, uncovering fraud, advertising approaches to maximize orders, analyzing liquidity or solvency, earnings quality, portfolio selection, profiling customers, and appraising suppliers. Data mining looks at data trends and patterns based on a stipulated model of classification and/or clustering.

DATA WAREHOUSING subject-oriented, timely integrated database providing important information to management in making business decisions.
DATABASE ADMINISTRATOR (DBA) individual in-charge of managing and monitoring all database activities including design, implementation, security, and maintenance of operations.

DATABASE collection of interrelated records of different types, and may be consisting of a collection of interrelated files. The stored information is used to satisfy the requirements of multiple users within the company and/or other companies accessing it.

DATABASE FILE collection of related records describing a subject by using a set of fields.

DATABASE MANAGEMENT SYSTEM (DBMS) generalized software used to manage databases. The software system allows users to define, create, alter, and maintain the database and provides controlled access to the database. The DBMS is the software enabling interaction of the user’s application programs and the database. Information is organized in a specified way so that accurate, reliable, and timely data can be retrieved.

DATABASE organized collection of information.

DECISION SUPPORT SYSTEM (DSS) computer-based software that assists decision makers by providing data and models. It conducts primarily semistructured tasks. DSS do not make decisions but merely attempt to improve and enhance decisions by providing indirect support without automating the entire decision process.

DISTRIBUTED DATABASE MANAGEMENT SYSTEM (DDBMS) software allowing for managing the distributed database to users. The DDBMS is comprised of one logical database split into fragments. Each site can independently process user requests where local data (local applications) may be accessed and the site can also process data stored on other computers (global applications) in the network. The sites are linked by a communications network where interrelated data is shared.

ECONOMIC FEASIBILITY requires a careful investigation of the costs and benefits of a proposed information technology (IT) system. The basic framework for feasibility analysis is the capital budgeting model in which cost savings and other benefits, as well as initial outlay costs, operating costs, and other cash outflows, are translated into dollar estimates.
ENCRYPTION data coding making one unable to read the information without having the decryption key.

EXECUTIVE INFORMATION SYSTEM (EIS) provides information on how the company is currently performing in its operating and financial activities. The EIS provides detailed information as needed to bring management up-to-date in executive decision making.

EXECUTIVE MANAGEMENT GAME a type of mathematical model and simulation. Simulation is designed to simulate a system and to generate a series of quantitative and financial results regarding system operations.

EXPERT SYSTEM (ES) reasoning, inference, logical, or if-then functions to solve a business problem such as how to reduce a specific cost and/or and improve productivity. The expert system is a program that functions as an expert in solving problems via a body of knowledge. The expert system not only assists in decision making but also provides the user with the logic it used to reach its decision.

EXPERT SYSTEM DATABASE stores knowledge and rule bases for artificial intelligence applications.

EXTENSIBLE BUSINESS REPORTING LANGUAGE (XBRL) formerly code named XFRML, a freely available electronic language for financial reporting. It is an XML-based framework that provides the financial community a standards-based method to prepare, publish in a variety of formats, reliably extract and automatically exchange financial statements of publicly held companies and the information they contain.

EXTRANET intranet partly accessible at different levels by authorized parties dealing with a company such as suppliers and customers.

EXTRANET network using Internet technology to link a company to outside related parties such as suppliers and customers.

FILE collection of records of a similar type.
FILE SERVER server holding the files needed for the DBMS and applications.

FILE TRANSFER PROTOCOL (FTP) protocol allowing for transferring data files and software over the Internet.

FILE TRANSFER PROTOCOL TCP/IP protocol allowing users to download data to their client PC.

FIREWALL system to prevent unauthorized access to or from a private network. A firewall examines the propriety of messages and blocks those that violate security criteria.

FUZZY SYSTEMS a kind of expert system because they also store knowledge as rules in the form of fuzzy rules or patches. Expert systems work with logic or symbols. Fuzzy systems work with fuzzy sets and have a numerical or math basis facilitating math analysis and simple chip design.

GOPHER menu-based client/server structure having search engines obtaining requested data from information servers. Gopher client software is usually on a client PC interacting with software on a specified Gopher server. This Gopher server searches many FTP sites to find the needed data to send to the Gopher client.

GROUPWARE type of client/server software facilitating collaborative work. It enables individuals to communicate and accomplish activities together electronically.

GROUPWARE SERVERS manages data such as text, image, mail, and work flow. This client/server has people interacting with each other.

HOTLINKING linking between two applications such that changes in one affect the other. For example, some desktop publishing systems let you establish hot links between documents and databases or spreadsheets. When data in the spreadsheet changes, the corresponding charts and graphs in the document change accordingly.

HYPERTEXT MARKUP LANGUAGE (HTML) presentation language to format data for WWW browsers. It is a protocol allowing one to embed formatting information in a Web document.
HYPERTEXT TRANSFER PROTOCOL (HTTP) client/server protocol on the WWW. HTTP is a request/response model for messages between client and server. Web servers run software supporting HTTP to service the multiple Web client requests for Web pages. It is the protocol to transmit HTML documents over the Internet.

INTERNAL RATE OF RETURN (IRR) the rate of interest that equates the initial investment with the present value of future cash inflows.

INTERNET international network of networks. It is a wide area network linking vast amounts of host computers.

INTRANET local area Web which is a single network within the company. It is a private network of a company accessible only internally by staff and employees, or others having authorization.

LEASE-PURCHASE DECISION a decision commonly confronting firms considering the acquisition of new assets. It is a hybrid capital budgeting decision which forces a company to compare the leasing and financing (purchasing) alternatives.

LOCAL AREA NETWORK (LAN) serves as the infrastructure for client/server applications. The LAN relays service requests from the client to server and carries the resulting information back to the client. LAN is a computer network situated near each other such as in the same building.

MALWARE viruses, worms, Trojan horses, spyware, and adware.

NET PRESENT VALUE (NPV) the difference between the present value of cash inflows generated by the project and the amount of the initial investment.

NETWORK connection of computers to share files, data, hardware, and software. There is architecture switching and transmission equipment.
NEURAL NETWORKS software programs that simulate human intelligence. Neural networks make the computer a "thinking problem solver." They are designed to learn from experience.

ON-LINE ANALYTICAL PROCESSING (OLAP) creation and summarization of historical, multidimensional data to aid users in decision making. OLAP database servers use multi-dimensional structures in data storage and relationships. OLAP is concerned with extracting information from a DATA WAREHOUSE that is useful, relevant, comprehensible, timely, and accurate.

OUTSOURCING retaining outside experts to handle network issues.

PEER-TO-PEER NETWORK any computer on the network can act as a server. An example is Windows for Workgroups.

PEER-TO-PEER two sides of a communication link use the identical protocol interface to carry out the network transmission.

QUERY LANGUAGE an English-like language that allows database users to specify what information they want to retrieve or examine.

REAL-TIME 1. conferencing in which individuals work together using real-time technologies.

RELATIONAL DATABASE data is represented in two-dimensional tables comprising of rows and columns. The tables are referred to as "relations". The relational database relates or connects data in different files through the use of a key field, or common data elements.

RISK ANALYSIS analyzing questions like, “what’s the chance of a negative result?”, “What’s the chance of a result over one million?” At a glance you'll know if your risk is acceptable, or if you need to make a contingency plan.
SERVER network computer sharing resources and information with network users. A dedicated server is only used to provide service for network users. A nondedicated server may be used as a client as well.

SMART CARDS smart identifications which may have a numeric keypad. It is used in token authentication systems.

STRUCTURED QUERY LANGUAGE (SQL) standard language used in a relational database management system to create, retrieve, modify, and secure data. With SQL, a database user can insert and delete information held in relations, and enforce relational integrity rules. SQL has a high level interface to a relational system. SQL provides a description of information to be retrieved via a command. SQL carries out questioning of the database to obtain relevant information from it. SQL is a transform-oriented language structured to use relations to transform inputs into required outputs. It is a declarative language not a procedural one.

TEMPLATE a worksheet or computer program that includes the relevant formulas for a particular application but not the data.

TROJAN HORSE virus is hidden in a legitimate program. It infects the network or system as intended unless identified and corrected for.

UNIFORM RESOURCE LOCATOR (URL) address of a Web site. Web pages may be indexed and linked. In other words, URL is a name used to identify and access a file on the Internet regardless of its format or the protocol needed for retrieval.

WEB-BASED ACCOUNTING makes the data easily accessible to multiple remote users at one time, and of course it offers the usual benefits of Web-based software: server-side upgrades, maintenance, and backups.

WEB SERVER provides services and information to Web clients asking for Web pages. It is a server (hardware) equipped with software allowing it to run Web applications. It is a server storing HTML documents accessible on the Web.

WEB SITE information posted on the Internet to attract user interest.

WIDE AREA NETWORK links two or more LANs. The connected LANs to derive a WAN may be in the same building, or different buildings near each other or distantly apart. WANs are essential in the client/server environment because the applications in client/server usually apply to accessing data stored in separate locations.

WORLD WIDE WEB browsing of information on the Internet using hyperlinks. Data on the Web is in the form of Web pages appearing as text, graphics, sound, video, and pictures. The network of computers on the Web consists of servers (providing information) and clients (receiving information). Data on the Web is stored in documents using Hyper Text Markup Language (HTML). HTML is the document formatting language in designing Web pages. Browsers must comprehend and interpret HTML to display the documents.

XBRL see EXTENSIBLE BUSINESS REPORTING LANGUAGE (XBRL)
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Chapter 1 Review Questions

1. Accounting information systems support accountants in decisions concerning the financing of a business and the allocation and control of financial resources within a business. True or False?

   True is incorrect. Accounting information systems record, report, and analyze business transactions and events for the management of the business enterprise.

   False is correct. Financial management systems support financial managers in decisions concerning (a) the financing of a business and (b) the allocation and control of financial resources within a business.

2. A typical accounting software package consists of a series of highly integrated modules including all of the following EXCEPT:

   A. **Correct.** A tax preparation software package typically stands alone.
   B. Incorrect. A typical accounting software package consists of a series of highly integrated modules. Each module corresponds to a specific accounting function, including payroll.
   C. Incorrect. In an integrated system, after the details of the transaction are entered in one of the modules, the chart of accounts from the general ledger is "read." The transaction is then automatically posted to the accounts in the general ledger. For example, when a sale on account is entered in the accounts receivable module, a debit is automatically made to the accounts receivable account in the general ledger and an offsetting credit made to the general ledger sales account.
   D. Incorrect. A typical accounting software package contains highly integrated modules. Accounts payable is one module integrated into a package.

3. Where is the chart of accounts of a business contained?

   A. Incorrect. The journal is the one in which the daily transactions are listed. The journal uses the chart of accounts of a business as a building block. The chart of accounts is contained in the general ledger.
   B. Incorrect. The chart of accounts of a business is not in the balance sheet where assets, liabilities and owner's equity are listed.
   C. **Correct.** The chart of accounts of a business is contained in the general ledger. In accounting information, after the details of the transaction are entered in one of the modules, the chart of accounts from the general ledger is "read."
D. Incorrect. The chart of accounts of a business is a listing of account names and not in the income statement where profits and losses are listed.

4. What is a software module that allows you to track and report on the costs of individual jobs or projects?

A. Incorrect. An inventory module tracks purchases and sales.
B. Incorrect. A payroll module maintains default information for each employee.
C. Incorrect. An accounts receivable software module is used to enter sales data and permits sales analysis.
D. Correct. A job costing software module allows you to track and report on the costs, income, and profitability of individual jobs or projects. A job cost module should provide for an accurate audit trail, detailed income, expenses and committed costs, as well as the tracking of other user-defined categories.

5. The deciding factor in selecting accounting software should be the price of the software. True or False?

True is incorrect. The deciding factors in selecting accounting software include customization, reporting capabilities, account number structure, and user friendliness.

False is correct. The price should never be the deciding factor in selecting accounting software. Inexpensive software may make an accounting job harder and cost more in the long run.

6. What is the heart of the software accounting system that contains the chart of accounts of a business?

A. Incorrect. Accounts receivable functions allow you to enter sales data and permits extensive sales analysis.
B. Incorrect. Invoicing provides customer tracking and generates monthly statements and aging reports.
C. Correct. The general ledger is the heart of the accounting system. It contains the chart of accounts of the business.
D. Incorrect. Accounts payable tracks obligations to vendors and determines a best payment schedule, prints checks and provides for distribution to each account.

7. What is the accounting software module that maintains default information for each employee?

A. Incorrect. The inventory module automatically tracks purchases and sales, maintains price data, and keeps an updated inventory file.
B. Correct. Payroll module maintains default information for each employee (rate of pay, income tax withheld, etc).
C. Incorrect. The job costing module tracks and reports on the material, labor, and other indirect costs of individual jobs or projects.
D. Incorrect. The fixed assets module keeps track of significant investments made by a firm and computes depreciation of assets.

**Chapter 2 Review Questions**

1. What do you call a worksheet or computer program that includes the relevant formulas for particular applications but not the data?

   A. Incorrect. Spreadsheet add-ins are separate program modules that are used in a variety of business applications such as forecasting.
   
   B. **Correct.** A template program includes the relevant formulas for particular applications. To activate you just enter the data to obtain the solution.
   
   C. Incorrect. Stand-alone software is generally a more powerful package with a built in expert system.
   
   D. Incorrect. SPSS is a comprehensive statistical package used for various statistical analyses.

2. The allocation of limited capital and human resources to maximize gain or minimize cost is called _________.

   A. Incorrect. Executive Management Game is a learning and simulation tool.
   
   B. Incorrect. Risk Analysis calculates the likelihood of changes and events that affect the bottom line.
   
   C. Incorrect. Flow-charting diagrams complex procedures and data flow through visual representation.
   
   D. **Correct.** Linear Programming aids in determining the optimal allocation of limited capital, human, and financial resources. It considers time constraints and is ideal for management decision making. The objective of the software is to maximize revenue or minimize cost.

**Chapter 3 Review Questions**

1. What is the first step to managing computer security?

   A. **Correct.** The first step to managing computer security is to identify the resources that need to be protected.
   
   B. Incorrect. Determining against whom you want to protect your system is the second step.
   
   C. Incorrect. Measuring costs and benefits of different security safeguards would be the third step.
   
   D. Incorrect. To develop a contingency plan is the last step in managing computer security.

2. What are brownouts and blackouts the most visible sign of?
A. Incorrect. Heat can cause electronic components to fail.
B. Incorrect. Water can do significant damage to computers.
C. Incorrect. Humidity can cause metal contacts to corrode or cause electrical shorts.
D. Correct. Power failure can render all equipment useless. Brownouts and blackouts are the most visible sign of power failure.

3. What is a computer access control that denies access to the system during specific hours?
   A. Incorrect. Automatic shut-off signs off the user if the user fails to sign-off after transmission is completed.
   B. Correct. With a time lock, access is denied to the system during specified hours, such as after normal business hours.
   C. Incorrect. Call back by the telephone to the computer user verifies a user’s identity before granting access to the system.
   D. Incorrect. A photo electric device is usually used for smoke detection.

4. The Federal Privacy Act applies to records used by Federal government users. True or False?
   True is incorrect. When contracting with agencies subject to the Federal Privacy Act, the act applies to the contract. The contractor and its employees are subject to the same requirements. Agency and criminal penalties may result from failure to comply.
   False is correct. This act states that, “improving the security and privacy of sensitive information in the federal computer systems is in the public interest.” This by no means should be limited to the federal government.

Chapter 4 Review Questions

1. Securing client-server systems is a complex task because of all of the following factors EXCEPT
   A. Correct. A client-server system divides processing of an application between a client machine on a network and a file server. This division depends on which tasks each is best suited to perform. However, user interaction is ordinarily restricted to the client part of the application. This portion normally consists of the user interface, data entry, queries, and receipt of reports. The file server customarily manages peripheral hardware and controls access to shared databases. Thus, a client-server application must be designed as separate software components that run on different machines but appear to be one application. Client-server systems do not necessarily use relational databases.
B. Incorrect. The existence of multiple access points makes security more complicated in client-server environments.
C. Incorrect. Users may access the network at the same time.
D. Incorrect. Client-server security becomes complex when many users can update information.

2. Client-server architecture may potentially involve a variety of hardware, systems software, and application software from many vendors. What is the best way to protect a client-server system from unauthorized access?
   A. Correct. Security is more difficult to achieve in a client-server system than in a single computer environment. The system has numerous access points, and many users have many chances to alter data. Thus, application controls must be combined with general access controls to protect the system.
   B. Incorrect. Authentication systems are only a part of the solution.
   C. Incorrect. Encryption affects only general access control techniques.
   D. Incorrect. Testing and evaluation of RPCs may be only a small part of an overall security review.

3. Security concerns will NOT include which of the following items?
   A. Incorrect. Encryption equipment can be used to assure proper security during transmission.
   B. Correct. An expert system is an interactive system that asks a series of questions and uses knowledge gained from a human expert to analyze answers and come to a decision, that is, to exercise judgment.
   C. Incorrect. Security concern includes passwords used in authentication protocol transmits for user identification.
   D. Incorrect. Security concern includes internal firewalls or filters to ascertain if corporate transmissions on the internet network are authorized.

4. Physical access controls used to prevent unauthorized access to equipment, data files, and software include all of the following EXCEPT:
   A. Incorrect. Identification uses physical characteristics to identify approved users.
   B. Incorrect. A user’s name and passwords allow access to authorized personnel.
   C. Incorrect. Cards and keys limit access to their holders.
   D. Correct. Firewalls work by blocking unwanted and unauthorized people from viewing company databases.

5. Computer security software offered on the network that substantiates the identity of an originating user or user entity within the network such as time stamping, passwords, or methods measuring body characteristics is:
   A. Incorrect. Traffic padding is a traffic analyzer of data for reasonableness.
B. **Correct.** Authentication substantiates the identity of an originating or user entity within the network. Examples of security controls are time stamping, passwords, synchronized checks, non-repudiation, and multiple-way handshakes. Biometric authentication methods measure body characteristics with the use of equipment attached to the workstation. Keystroke dynamics is another form of identification.

C. Incorrect. Routing control inhibits data flow to insure network elements.

D. Incorrect. A digital signature is used to sign messages with a private key.

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**Chapter 5 Review Questions**

1. The database approach to systems and the resulting concept of database management systems have several unique characteristics not found in traditional systems, specifically file-oriented systems. A primary goal of database management systems (DBMS) is to minimize data redundancy. True or False?

   True is correct. A database management system (DBMS) involves an integrated set of computer programs that create the database, maintain the elements, safeguard the data from loss or destruction, and make the data available to application programs and inquiries. A primary goal of a DBMS is to minimize data redundancy, and user interface is enhanced through increased accessibility and flexibility.

   False is incorrect. A database management system refers to software managing and controlling the database. Data redundancy is minimized by constraining a description of the logical and physical structure of the database called the schema.

2. Transaction trails should exist for modifications of data processed by the database. True or False?

   True is correct. Transaction trails should exist for additions, deletions, or modifications of data processed by the database.

   False is incorrect. Audit trails should be created or made available to provide the IT auditor information regarding (1) the date and time of the transactions, (2) who processed the transactions, and (3) where the transaction was initiated (e.g., terminal). Most database software has the ability to track database transactions.

3. What is an example of data that is classified in a family tree of related record types where lower-level records are subordinate to higher-level-ones?

   A. Incorrect. An object-database is where objects are stored in a multi-user client/server form.

   B. Incorrect. A multimedia database stores unstructured data such as audio, graphics, video and animation.
C. Correct. In a hierarchical database, there is a family tree of related record types. Lower-level records are subordinate to higher-level ones. Hierarchical systems are as popular in computer systems as they are in other walks of life. The most obvious example of a hierarchical system in computers is a file system, in which directories have files and subdirectories beneath them. Such a file organization is, in fact, called a hierarchical file system.

D. Incorrect. A distributed database management system is a collection of tables spread over at least two servers in the company at different locations.

4. A data file consisting of logical records that furnish summarized information that can be used in decision-making is _____________.

A. Incorrect. A link analysis looks at relationships between fields relating to department profit and department assets.
B. Correct. A data mart is a data file consisting of logical records. It is an element of a data warehouse furnishing summarized information that can be used in decision making by a department or division manager.
C. Incorrect. Data modeling involves planning and designing a database to explain interrelations and limitations.
D. Incorrect. Knowledge discovery is a set of information to answer queries and solve business problems.

5. What is the software process used to examine a database that identifies patterns, relationships and trends to assist financial management decision-making?

A. Incorrect. Market based analysis a method used to classify item groupings that take place together in a transaction.
B. Incorrect. Memory-based reasoning uses cases of known events or occurrences to predict unknown events or instances.
C. Correct. Data mining involves software examining a database to identify patterns, relationships, and trends to assist in financial management decision making. We extract past and current information from a voluminous database for analysis.
D. Incorrect. Fuzzy research occurs when the controller tries to identify patterns where the occurrence of something implies that something else will happen.

Chapter 6 Review Questions

1. Examples of capital budgeting applications include installation of a new information system (IS) and information technology (IT). True or False?
True is correct. Capital budgeting is the process of making long-term planning decisions for alternative investment opportunities. It includes IT investments that the company may have to make in order to grow and be more efficient.

False is incorrect. Examples of capital budgeting applications are installation of a new information system (IS), lease or purchase, new product development, product line selection, and keep or sell a business segment.

2. The technique that recognizes the time value of money by discounting the cash flows for a project over its life to time period zero using the company’s minimum required rate of return is the:

- A. Correct. The net present value method discounts future cash flows to the present value using the firm’s cost of capital. The initial cost of the project is then deducted from the present value. If the present value of the future cash flows exceeds the cost, the investment is considered to be acceptable.
- B. Incorrect. Capital rationing is not a technique but rather a condition that characterizes capital budgeting when the limited amount of capital available is insufficient to fund all profitable investments.
- C. Incorrect. The payback method does not discount cash flows.
- D. Incorrect. The accounting rate of return method does not consider the time value of money.

3. Flex Corporation is studying a capital acquisition proposal in which newly acquired IT assets will be depreciated using the straight-line method. Which one of the following statements about the proposal would be incorrect if a switch is made to accelerated methods such as the Modified Accelerated Cost Recovery System (MACRS)?

- A. Incorrect. The present value of the net inflows will increase with no change in the investment, since MACRS tend to make after-tax cash inflows bigger than under the straight-line depreciation method. Hence, the NPV will be larger.
- B. Incorrect. Deferring expenses to later years increases the discount rate needed to reduce the NPV to $0.
- C. Incorrect. Switching to MACRS defers expenses and increases cash flows early in the project’s life.
- D. Correct. MACRS is an accelerated method of depreciation under which depreciation expense will be greater during the early years of an asset’s life. Thus, the outflows for income taxes will be less in the early years, but greater in the later years, and the NPV (present value of net cash inflows-investment) will be increased. The profitability index (present value of net cash inflows / the investment) must increase if the NPV increases.

4. What is the rate of return necessary to maintain the market value of the firm (or price of stock)?

- A. Incorrect. The Internal Rate of Return (IRR) is a method of evaluating investment projects.
- B. Incorrect. The Net Present Value (NPV) is the present value minus the initial cost of the project.
C. **Correct.** The cost of capital is the rate of return necessary to keep the market value of the company. It is often called the minimum required rate of return, hurdle rate, cutoff, or discount rate.

D. Incorrect. Payback Period is the time a project takes to recover the initial investment.