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INFORMATION TECHNOLOGY SOLUTIONS

Solution to Question 1

Although the terms “data” and “information” are often used interchangeably, they do not mean the same thing. Data consists of facts about something that can be used in calculating, reasoning, or planning; it can be any character, text, word, or number. Information, on the other hand, is knowledge obtained from investigation, study, or instruction of data. Information is data transformed in such a way that it becomes useful to its users.

Solution to Question 2

The term “information system” captures the way in which an organization’s management uses IT (hardware, software, and data) to create and support systems that allow an organization to pursue and achieve its strategic goals. “Information systems” refers to an integrated set of components for collecting, storing, and processing data and for providing information, knowledge, and digital products. It is the merger of IT and business procedures and processes.

For a firm to realize the full value of these systems, the firm’s information systems strategy and its overall strategy must align with its IT governance. The key to developing a good strategy to achieve an organization’s goals is to have well-designed and well-managed systems available. When this happens, information systems can support the organization in achieving its competitive advantage and make impacts that can directly support the profitability of the organization.

Solution to Question 3

Information technology is changing the way companies operate. As technological capabilities have increased, organizations have more opportunities to use these capabilities beyond the accounting department.

The overarching objectives of information systems development typically fall into four broad categories: mandated changes, necessary changes, efficiency improvements, and effectiveness improvements.

To gain competitive advantage over its rivals, a company may focus on efficiency and effectiveness improvements.

Efficiency improvements typically come from development projects that reduce the need for people. They can also be upgrades to an already automated system to increase throughput. For example, the move to universal product codes and bar-coding meant that companies could eliminate most of the jobs that required inputting receiving reports

and shipping documents. As humans constantly make errors inputting data, eliminating data entry should also lead to increased effectiveness.

Systems development aimed at improving effectiveness addresses the quality of information. If the quality of the information can be improved, the company should be able to make better decisions, which should lead to increased profitability.

Management and the board of directors must be aware of the strategic importance of information systems. The “tone at the top” drives an innovative organizational culture that embraces technology and is constantly looking for new ways to leverage IT and information systems for competitive advantage.

Solution to Question 4

The board of directors is responsible for providing oversight of the strategic direction of the company. This responsibility for setting the strategic direction extends to the realm of information systems, which must be aligned with the company’s overall direction. The board is responsible for this alignment. Given IT’s increasing pervasiveness across all businesses, the board ignoring its oversight responsibilities in this area is a huge mistake that can lead to misalignment of a firm’s IT and general business strategy.

Solution to Question 5

The ISO 38500 framework sets out six principles for good corporate governance of IT. They are:

Responsibility: Groups and individuals within an organization understand and accept their responsibilities relating to both supply of and demand for IT. Those with responsibility for actions also have the authority to perform those actions.

Strategy: The organization’s business strategy takes into account the current and future capabilities of IT; the strategic plans for IT satisfy the current and ongoing needs of the organization’s business strategy.

Acquisition: IT acquisitions are made for valid reasons, on the basis of appropriate and ongoing analysis, with clear and transparent decision-making. There is appropriate balance between benefits, opportunities, costs, and risks, in both the short term and the long term.

Performance: Performance relates to IT demand and capability for supporting the organization, providing the services, levels of service, and service quality required to meet current and future business requirements.

Conformance: IT complies with all mandatory legislation and regulations. Policies and practices are clearly defined, implemented, and enforced.

Human behaviour: IT policies, practices, and decisions demonstrate respect for human behaviour, including the current and evolving needs of all the people involved the process.

Solution to Question 6

The following are among the most common decision-making structures:

- executive or senior management committees that provide ongoing business leadership and involvement in IT, often referred to as IT steering committees
- IT leadership committees composed of senior IT leaders from different areas of IT, such as infrastructure and development
- process teams made up of IT members and business-IT relationship managers
- IT councils composed of business and IT executives
- system architecture committees
- capital approval committees

Of these, chief information officers (CIOs) rate IT leadership committees and business/IT relationship managers as the most effective means of ensuring adequate decision-making. In both cases, IT expertise is matched with business knowledge so that decisions are more comprehensive than those made at the department level.

Solution to Question 7

It is important to include the financial manager in the selection process because they can add value in a number of ways:

- Identify user needs for information: users may include management, shareholders, creditors, suppliers, customers, government agencies, and stock exchanges. These needs will drive the development agenda of information systems.
- Participate in determining the costs and benefits of the systems being recommended.
- Participate in priority-setting committees to determine which of many opportunities should be pursued.
- Include the costs of information systems projects in departmental budgets.
- Verify the return on investment (ROI) of approved information system projects post-implementation.

Solution to Question 8

The following are challenges of putting an information systems plan into practice with respect to strategic alignment:

Business strategy is not always determined before information systems strategy. While the ideal view suggests that business plans come first, the organizational reality is more iterative than this. A partnership with information systems and IT specialists needs to be developed to achieve an information systems strategy that is aligned with that of the organization as a whole.

Solution to Question 9

The following are benefits to strategic information systems planning:

- There will be consistency with the strategic plan and appropriate systems in place to help achieve the organization's goals.
- Planning promotes efficiency by coordinating all the various subsystems throughout the organization and making sure that subsequent information systems development will enhance existing systems.
- When information systems are a strategic priority, it is more likely that the organization as a whole will remain aware of leading-edge information systems trends. The organization will thereby be able to assess and respond more quickly than it might have otherwise, possibly even gaining a competitive advantage that may end up being sustainable.
- Costs may be lower, as the coordinated effort by executives means there is less likelihood of duplicated effort and more likelihood of a streamlined approach.
- Considering what information systems support it may need to achieve the strategy, even as far as several years out, increases the company's ability to adapt to changes in information systems as they are occurring, rather than simply reacting and hoping for the best.

Solution to Question 10

There are four types of information system development:

a) Mandated changes require developing new systems, or making changes to existing systems, because of changes in legislation or regulations. One example is the implementation of HST.

b) Necessary changes are unavoidable changes in systems due to any number of issues not related to legislation or regulations. One example is the year 2000 systems fixes.

c) Efficiency improvements typically come from development projects that reduce the need for people. This can also refer to upgrading an already automated system to

provide increased throughput of information. For example, the move to universal product codes and bar-coding meant that companies could eliminate most of the jobs that required manually inputting receiving reports and shipping documents.

d) Effectiveness improvements include systems developments that address the quality of information. If the quality of the information can be improved, by extension the company should be able to make more informed decisions, which should lead to increased profitability.

Solution to Question 11

As part of the CEO/CFO certification process, executives must certify that they have "designed such internal controls over financial reporting, or caused it to be designed under their supervision, to provide reasonable assurance regarding the reliability of the financial reporting and preparation of the financial statements for external purposes in accordance with…GAAP."

IT controls are part of the environment that supports the preparation of financial statements for external purposes. Systems that connect the entire firm, like enterprise resource planning (ERP) systems, generate a lot of information that ultimately feeds into financial statements.

By certifying that the financial disclosures are accurate, the CEO and CFO are, by extension, certifying that their IT and information systems are operating as expected, as that is the only way the results will be free from material errors or omissions. IT systems provide much of the reporting data for complying with these laws, so strong controls over information systems are needed. Moreover, IT is a key source of operational risk in firms, and as such is subject to reporting rules as well. As a result, significant IT process changes have been required in many companies to support the reporting requirements of the legislation.

Solution to Question 12

a) IT governance has become a key topic in information systems in recent years for several reasons:

- the continuing need to align IT and business and ensure that IT provides appropriate business value to the organization
- the rise of concern over governance in general following the Enron and WorldCom accounting scandals in the early 2000s and the financial crisis of 2007-2008
- ethical considerations with respect to governance (for example, Cambridge Analytica misleading Facebook management with respect to a survey that, far from being just for research, was used to mine the personal information of millions of Facebook users)

- Multilateral Instrument MI 52-109 *Certification of Disclosure of Issuers' Annual and Interim Filings* requirement for CEOs and CFOs to certify all financial disclosures are accurate; IT systems support financial statement reporting

b) COBIT and COSO are control frameworks that help organizations implement IT governance and risk management. Each framework has five components or principles.

c) The focus of COBIT is to help organizations increase regulatory compliance and control over IT, integrate global IT standards, and reduce business risks. The focus of COSO is internal controls to improve risk management.

d) COBIT and COSO framework differences:

	COBIT principles	**COSO components**
IT governance	Guidelines on the integration of IT governance measures with other areas of governance	Information and communications policies developed to ensure governance compliance
Business process	Mapping of business process descriptions and templates; focus on practices by process and then link them to the actual business needs of the organization	Control activities are directives to ensure management policies and procedures are followed.
Control objectives	Support for effective security and control over IT processes	Control environment establishes the processes for managing and developing employees in an organization; continuous monitoring of control systems to assess deficiencies and the need for improvements
Continuous improvement	Maturity models to support process benchmarking and continuous improvement	Continuous monitoring of control systems to assess deficiencies and the need for improvements

Risk management	Guidelines to maintain focus on objectives, performance measures, and effective security and control over IT processes	Risk assessments from both internal and external sources, including objectives to manage the risks

Solution to Question 13

Porter's Five Forces is widely used to analyze the industry structure of a company as well as its corporate strategy. The impact of IT on those five forces is below:

Threat of new entrants

Established organizations today need to consider how they can use IT to mitigate the threat of new entrants in their markets. Established organizations should be using IT to their advantage in order to keep new entrants out of their market space.

Bargaining power of customers

IT has been used to address the price sensitivity aspect of buyer power as well as switching costs.

In the case of price sensitivity, companies that do business exclusively through the internet can often reduce their prices below those of similar bricks-and-mortar stores because they don't have the costs associated with operating a retail space (even considering the substantial investment in IT).

A consumer looking to buy an item they've found in store can instantly look online on their smartphone to see if the price is better elsewhere, before making a purchase. This technological advancement has put a lot of bargaining power into the hands of customers.

Businesses with robust websites that give detailed information on product specifications, pricing, and delivery times have a significant advantage over those businesses who either do not have a website or have not invested in the technology required to use a website to their advantage. Customers can use this information (or lack thereof) to their advantage to leverage their buying power.

Bargaining power of suppliers

Supplier bargaining power has increased due to switching costs associated with customers moving from one supplier to another.

The internet has given people and firms the ability to set up virtual storefronts on websites such as eBay and Amazon. This results in more suppliers in the market, reducing supplier power due to the increased choices available to consumers.

IT has allowed for mass customization. Mass customization is exactly as it implies: companies use scale efficiencies to mass produce products that meet individual customers' wants and needs.

Threat of substitutes

The threat of substitute products comes from the degree to which products in two different industries or markets are interchangeable. The internet has disrupted this area by making substitute products easier to find.

Rivalry among existing competitors

The rivalry among retailers is extremely intense, especially given the rise of the internet and online shopping. Many industries attempt to compete with sophisticated customer relationship management (CRM) systems so that they can provide the best value and retain their existing customers.

Being an early adopter of technology has given some retailers a competitive advantage. Walmart was a trendsetter with respect to understanding the power of information. It invested heavily in IT and information systems in order to track which products were most popular at each store, and then it priced these products at lower prices to gain customers.

Solution to Question 14

The four Vs of data are volume, velocity, variety, and veracity.

Volume is the amount of data available. Focusing on minimum storage units when planning is not practical because the total volume of data is growing exponentially every year.

Velocity is the frequency of incoming data that needs to be processed and converted into usable information as quickly as possible so that the information is available at the right time. Consider how many SMS messages, Facebook status updates, or credit card swipes are being sent on a particular telecom carrier every minute of every day — and how they have to be processed almost instantly.

Variety refers to the multiple sources of available information. Not all these sources are useful for every business, so it is important to understand the strategy and direction of your organization so you can make recommendations on which data to use.

Veracity is the accuracy of the data and is essentially equivalent to quality. This V is a product of the other three.

In order to achieve the optimal veracity of the data, IT and information systems strategy must address computational power and storage requirements to be able to analyze and store more and more data. Information system policies and procedures are needed to monitor the quality and deficiencies of the data the information system is collecting. The information the system is producing also needs to be analyzed to ensure it is the right information to assist in the strategic direction of IT and information systems.

Solution to Question 15

a) Porter's Five Forces

Threat of new entrants

The threat of new entrants obviously refers to new companies entering a market. However, sometimes the biggest competition does not come from brand new entrants, but rather from existing companies entering a different market segment/niche or a new geographic area. Typically, the degree of the threat posed by new entrants is based on how high the barriers of entry are for entering that market.

Barriers of entry include things such as required economies of scale, the resilience of industry networks, start-up capital requirements, R&D requirements, and availability of key resources or raw materials. For the restaurant industry, most of these are low. However, there are three barriers to entry that may discourage new entrants:

- Capital: Depending on the scale and type of restaurant proposed, capital need can vary widely.
- Location: Restaurants are very location sensitive, and a good (or bad) location can make (or break) the venture.
- Employees: Since customer service is paramount, the quality of the prepared food (the responsibility of the chef) and the way it is presented (the responsibility of the wait staff) can have a significant impact on success.

Bargaining power of customers

There is low bargaining power for customers. However, unless the restaurant is offering something extraordinary (like a celebrity chef or a 10-course tasting menu), it cannot set prices *too* high: buyers have a good knowledge of the market and will simply go to another restaurant.

Bargaining power of suppliers

The bargaining power of suppliers creates persistent difficulties for restaurants. Bargaining power refers to the ability to set higher prices for goods and services,

and restaurants face bargaining situations when buying food, paper goods, maintenance services, restaurant equipment and furnishings, and sanitary supplies.

Often, there are far fewer suppliers than independent restaurants. As a result, suppliers hold the upper hand in negotiations. Chain restaurants (where a supplier services multiple or many locations) have additional negotiating power with their suppliers. The relative size of the restaurant or chain to the supplier will impact overall purchasing power.

Threat of substitute products or services

Perhaps the greatest competitive challenge comes from substitute products and services. Meal delivery services such as Hello Fresh are a relatively new competitor for the restaurant market. Grocery and supermarket chains are a huge substitute to the restaurant industry, especially in economically hard times. Eating out is discretionary spending. In tough times, consumers can reduce their eating out budget or not eat out at all.

In addition, with apps, blogs, and websites cataloguing and reviewing the vast number of restaurants, it has never been easier for a customer to try a different restaurant every single day.

Rivalry among existing competitors

There is an enormous amount of competition in the restaurant industry at every level — from fast-food chains, cafés, food trucks, fast casual venues (deli and diners), and independent eateries all the way to Michelin-starred gastronomic temples. Restaurant chains with significant advertising budgets and volume purchasing discounts have a huge advantage over small businesses.

High levels of competition and rivalry exist between existing restaurant companies. There is low revenue growth potential. The product, “a meal out,” is homogenous, though the specifics of what and how it is consumed can vary widely. As a result, restaurants try to differentiate themselves by offering unique menus, loyalty programs, and higher levels of customer service.

Recommendation

The restaurant industry is a difficult industry to attempt to compete in because of the competitive nature of the industry, the availability of substitute products, the large number of participants and the low barriers to entry. In addition, independently owned restaurants may be reliant on much larger suppliers.

b) Competitive strategy

It’s been established that restaurant chains offer greater stability than independently owned restaurants. For chains with multiple brands, the basic starting point for competitive advantage is attempting to cater to every price point in the market by

bringing together restaurant chains that cater to different segments of the market. Consider Recipe Unlimited Corporation, which operates East Side Mario's, Harvey's, Kelsey's, Montana's, Milestones, The Keg, Swiss Chalet, and a dozen other brands.

Companies that are early adopters of technology, as evidenced by customer apps across all different brands, track detailed customer habits, interests, and experiences. Additionally, technology enhancements such as pre-orders and pre-pay are also ways to gain competitive advantage. Finally, customer loyalty programs help to ensure repeat visits at any of a company's restaurant brands. In the case of Recipe Unlimited, purchasing a gift card from the company gives customers the option of eating at any of their brands – thereby providing customers with choice while maintaining the overall revenue base.

An information system can support the mission of a customer-focused product-differentiation strategy by tracking customer habits, interests, and experiences in its company-wide CRM. Using a customer loyalty program or mobile technology is also customer focused, because any data captured can be mined for targeted customer information like frequency patterns and used to cluster customers by a set of specific variables (age, sex, location, spend level, and so on). All of these information systems innovations help to maintain a competitive advantage within the restaurant industry.

c) Application of case to models

The Nolan and McFarlan model developed four modes of IT governance: support mode, factory mode, turnaround mode, and strategic mode. Given the current trends in the restaurant industry (online ordering, and so on), they would likely be in the strategic IT governance mode. Firms in the strategic mode not only need the reliability of factory mode, but also view IT as a means to pursue competitive advantage through process improvements, increased customer responsiveness, and so on.

According to the Weill and Ross model, there are six dominant governance styles. The duopoly governance style may be the most effective in this industry, where decisions are made jointly by senior management and IT leaders, as this may align the goals of both IT and management.

Solution to Question 16

In general, users should look for the following four characteristics in DSS software.

Ease of use

Ease of use is the key to a successful DSS. If the software is difficult to use, managers will avoid using it. Whether it is presented in a command language, in on-screen menus, or in electronic form, the user interface should be intuitive to managers. DSS software packages that offer spreadsheet (column-and-row) structures to develop applications have been popular because this format (as in spreadsheet programs) is familiar to users on the managerial level. Query-by-example is another style that is favoured by managers.

Some DSS software uses English-like statements or formulas such as Revenue = Price × Quantity sold. They do not require statements to be sequenced in a strictly ordered fashion, thus making the problem formulation easier. For example, before issuing the Revenue formula, the user would not be required to define Quantity sold and Price. These variables can be defined at a later point in the model.

Most DSS software contains a host of forecasting, statistical analysis, and financial analysis capabilities. For example, financial routines such as net present value and internal rate of return calculations are usually provided in DSS software.

Flexibility

A successful DSS should be able to handle variations of the problem statement with relative ease. That is, it should be able to conduct what-if analyses with relative ease by changing a few parameters. A successful DSS should not require extensive problem specifications each time one or two parameters are changed for a new scenario.

Relevance

A successful DSS should provide relevant information for decision-making. In other words, it delivers the right information to the right person at the right time.

Functionality

There are many DSS software solutions on the market. Key functions to consider include:

- Handle large amounts of data from many sources
- Provide report and presentation flexibility
- Consolidate information
- Offer both textual and graphical orientation
- Support drill-down analysis

- Support optimization approaches
- Perform sensitivity analysis
- Use simulation
- Use goal-seeking

Solution to Question 17

a) Information systems help managers at various levels in an organization to plan, organize, lead, and control by providing the right information to the right person at the right time.

b) Management decision-making can be grouped into three levels:

Operational decisions

Front-line managers oversee the day-to-day operations, making routine **operational decisions** — for example, extending credit to customers and restocking inventory items from a supplier. Many traditional TPSs are designed for this level of management. Most accounting systems, inventory control systems, and payroll systems perform this function.

Tactical decisions

Middle managers, concerned with meeting short-term objectives, make **tactical decisions**. Most of the information and decision frameworks at this level of management are reasonably well structured. Examples of such management activities are reviewing back orders for inventory items, examining detailed expense schedules to track expenditures, and comparing actual sales to budget.

An MIS extends beyond the routine handling of operational information; it also provides a variety of reports to help managers make tactical decisions.

Strategic decisions

Top-level managers or executives are particularly concerned with **strategic decisions**. Reports from an MIS form only part of the total information requirements of senior management. Many of the issues dealt with at this level are semi-structured or unstructured and cannot be automated. Nevertheless, DSSs and executive support systems (ESSs) are computer-based tools that top-level management can use in its strategic planning and decision-making.

Solution to Question 18

The differences between DSSs, MISs, and TPSs are summarized in the following table:

	Nature	Who uses it	Type of reports	What it provides
DSS	unstructured, analytical decisions; helps identify alternatives	middle and senior management	output designed to help make specific decisions	support for unstructured or semi-structured problems
MIS	reports-oriented, for management; focuses on structured-type decisions	middle management	management reports focused on management functions	information for routine management decisions
TPS	process-oriented, for operations; uses batch or real-time processing; provides information for MIS and DSS	workers, front-line supervisors	routine, focused on operational results	preprogrammed decisions in accordance with established policies and procedures

Solution to Question 19

a) Operational employees are involved with daily decisions such as:

- processing sales orders
- paying invoices
- processing payroll
- generating financial statements

TPSs capture and process fundamental business transactions in either a real-time or a batch processing mode and are best suited for these types of decisions.

b) Middle managers try to improve the efficiency of operations, which includes tasks such as:

- reviewing inventory reports for optimal stock levels
- completing budget planning

- evaluating divisional performance
- comparing actual results to budget

MISs and DSSs support middle management decision-making and are best suited for these types of decisions.

c) Executives normally focus on strategic decisions and tasks such as:

- deciding what markets to compete in
- setting long-term goals for the company
- evaluating investment/expansion decisions
- evaluating organizational structure

EISs, ESSs, and DSSs support executive-level decision-making and are best suited for these types of decisions.

Solution to Question 20

The following are major characteristics of an MIS:

- *They provide reports with fixed and standard formats:* MIS characteristics can be described primarily in terms of the flexibility around the reports produced. The standardization makes reports understandable and easy to read by more than one user.
- *They use internal data stored in the computer system:* As stated earlier, the primary source of data for an MIS is data from the TPS and internal databases, because many decisions relate to internal operations. However, some use external sources such as the internet.
- *They allow end users to develop custom reports:* While it is important to allow end users to develop their own reports, it is equally important to exercise some form of control by checking requests to ensure that the reports wanted do not already exist, or to offer assistance in developing reports.
- *They require user requests for reports developed by systems personnel* — Most MIS organizations require a formal request for report development to be signed by a manager because reports require systems personnel's time and effort. The approval of the request also offers some form of control.

Solution to Question 21

Cryptocurrencies use blockchain technology, a digital public ledger of all cryptocurrency transactions, to record the transactions. The public ledger keeps track of the transactions between people, and the balance of cryptocurrency each person owns is based on the transactions they have completed. Encryption of each person's identity and balances ensures privacy. Once a transaction has been completed using an

electronic digital signature, it is confirmed in the public ledger by a process called "mining" — simply put, confirming transactions and adding them to a public ledger.

Mining is open source so that anyone can confirm the transaction. The first miner to solve the puzzle adds a "block" of transactions to the ledger. The way in which transactions, blocks, and the public blockchain ledger work together ensure that no one individual can easily add or change a block at will.

Solution to Question 22

Point	Meets DSS characteristics?	Why or why not?
1	Yes/No	This is a standard report focused on improving results. It can be used to support operational variance analysis or to guide more advanced decisions around optimal inventory levels.
2	No	This is a standard report describing transactional information. The report will likely be used in direct operations (for example, to support cleaning or catering services).
3	Yes/No	Depending on the algorithm, it could support everything from day-to-day operations (for example, figuring out how to lay out tables for Event ABC) to deciding whether to renovate or expand based on increased business opportunities.
4	Yes/No	Planning future office space requirements is a semi-structured problem. Systems that manage such problems (like master production scheduling systems) often have characteristics of both MISs and DSSs.
5	Yes/No	Inventory control systems are frequently characterized as MISs. Depending on the features allowed by the online interactivity, the system may also support advanced decision-making.
6	No	This functionality is focused on processing individual transactions and is characteristic of a TPS, not a DSS.
7	Yes	The interactive maintenance costs spreadsheet model is capable of answering what-if queries, which is a characteristic of a DSS.
8	Yes	Information on projected office space occupancy rates to assist in the decision to build a new office tower is typical of a DSS. The decision to build another office tower is an unstructured decision, and the information is forecast information.

Solution to Question 23

A **GDSS** consists of DSS elements plus GDSS software (sometimes called "*groupware*") and helps groups make decisions together.

Developers of a GDSS incorporate characteristics that go beyond the DSS by promoting new approaches for groups, including working with direct face-to-face interaction or meetings. These additional characteristics include the following:

- **Special design:** Special procedures are needed to promote creative thinking and group decision-making.
- **Ease of use:** This is even more important than in a DSS designed to suit an individual, because if a GDSS is not easy to use, some members of the group will not participate.
- **Flexibility:** Every manager in the group may have a somewhat different style that must be incorporated into the group process.
- **Decision-making support:** A GDSS supports several different approaches. Use of a GDSS encourages **brainstorming,** free thinking, and consideration of wide-ranging ideas. In the **group consensus approach**, a unanimous decision must be reached. In the **nominal group technique**, each member participates, then the group provides feedback and votes on a decision.
- **Anonymous input:** The advantage is that the group can concentrate on the ideas without being influenced by knowing who originated an idea.
- **Reduction of negative group behaviour:** A key element in a GDSS is the elimination of counterproductive or harmful behaviour, such as allowing a strong individual to dominate, getting sidetracked or losing focus, or not considering alternatives before coming to a conclusion, all of which waste time and prevent effective decision-making.
- **Parallel communication:** A GDSS allows anyone to comment on or address an issue when a thought occurs, rather than waiting for one or more people to finish addressing an issue and perhaps losing their own thought or idea.
- **Automated record-keeping:** Most GDSSs keep detailed records of comments automatically and anonymously, and they have automatic voting and ranking features.

Solution to Question 24

See the Excel file titled “Question 24 data and solution” for solutions.

a) The wine with the highest quantity on hand is Moscato, with 22 units.

b) See the Excel file.

c) Chile has the lowest average price of $12.52. The United States has the highest average price of $46.01.

d) The wines from Vineland Estates are Moscato, Riesling, and Sauvignon Blanc.

Solution to Question 25

See the Excel file titled “Question 25 data and solution.”

a)

i. This pivot table shows that the ratio of male to female employees is exactly 50/50 overall for the company.

   Each location has a different distribution of male to female employees. The largest offices, in Montreal and Toronto, have close to an equal representation of male and female employees. Vancouver and Winnipeg offices are small by comparison to the larger offices and have different distributions by gender.

   The distribution is an indication only of count, not of salary distribution, and therefore does not assist in determining if there are salary discrepancies.

ii. This pivot table shows the difference in average salaries between men and women by location.

   Women are paid significantly less ($59,360.27) than the men ($104,805.52) in each location and in the company overall.

iii. This pivot table shows us that men earn more than women in every Years Service category except for seven years of service. Even there, the difference is small overall.

iv. This pivot table shows that women are paid less in each Job Status category compared to men.

b) Additional analysis is required to confirm why women’s salaries are lower than men’s. Because the company has a 50/50 ratio of men to women, additional analysis should be based on location, years of service, and job status. One reason may be that men are in more senior roles compared to women and as a result get paid higher salaries. The employee data does not provide any information on job type or level within the organization.

   It would be helpful to be able to compare similar job positions in each location and across the company to confirm if there is a pay equity issue. For example, are clerical staff, middle management, and senior management paid similar wages in each location and across the company? Are women in more junior positions compared to men, which would explain the salary gap? Is there a bias to promote men over women?

Solution to Question 26

When management sets objectives for a mission-critical system, the key success factors by which they measure functional areas must be translated into systems objectives and form part of the system's functional requirements. In addition to these requirements, specific performance objectives and cost objectives must be defined at the outset. These objectives should be quantified in measurable terms.

Performance objectives include such factors as:

- the quality or usefulness of the output
- the speed at which output is generated
- the scalability of the system

Cost factors include:

- development costs
- costs related to the uniqueness of the application (customization costs)
- investments in hardware and other equipment
- ongoing operating costs

Solution to Question 27

A *systems analyst* is the coordinator, communicator, and architect who interacts with the various technical and non-technical participants.

A *business analyst* is responsible for analyzing the existing and proposed systems based on their knowledge of the business and its processes.

When these two roles work together on a development project, most user needs will be considered and addressed in the new information system.

Solution to Question 28

Most systems development methodologies require some form of management approval before development can proceed to the next stage. Management usually requires a report for this purpose. The following are typical reports that are useful for management's review:

- analysis
- design specifications document
- programs and status
- acquisition proposal

- project completion
- post-implementation review
- request for maintenance

Solution to Question 29

Common stages in the waterfall model

The waterfall model used here contains seven stages:

1. Planning
   - Create a high-level plan of the project and determine project or systems goals.
   - Determine the feasibility of the system by asking “Does this project make sense?”
   - Because of the sequential nature of this method, if something is missed, the repercussions later on in the process can be substantial and, therefore, costly.
2. Requirements analysis
   - Determine end-user business requirements and information needs, and start defining functions and operations of the intended system.
3. Design
   - Broadly decide how to meet user needs, beginning with conceptual design.
   - Feed this conceptual design into the physical design, in which detailed features and operations such as process diagrams, screen layouts, and reports are described.
4. Development
   - Transform the detailed design information into the actual system.
   - Determine the hardware and software specifications, database design, procedures to follow, and job definitions.
   - Program parts (developed internally) and/or purchase parts.
5. Testing
   - Create a testing environment to test for bugs, errors, and interoperability, and of course for the users to determine if the system meets their needs.
6. Implementation
   - Place the new system into production and carry out actual business operations using the new system.
7. Maintenance
   - Add to, change, and upgrade the system.

Solution to Question 30

Dissatisfaction with the waterfall model and the high rate of IT project failures led to a proliferation in alternative SDLC methodologies, described on a spectrum of Agile methods (flexible), iterative methods (working to get each piece complete), and sequential methods (more rigid). Some of these methods include:

- Extreme Programming and Scrum are two Agile methodologies. Their focus is on allowing for rapid changes along the development cycle.
- Rational Unified Process and dynamic systems development method are two iterative methodologies. The project scope is often limited, and each iteration focuses on improving design or expanding capabilities.

Solution to Question 31

Various issues factor into the decision to make or buy software. Customization and control trade off against cost, speed of implementation, internal politics, developer skills, strategic value, and risk — all these play a role in the decision. Organizations that have opted to refine their in-house development according to the principles of a service-oriented architecture (SOA) have the advantage of reusable code and may find the build option more feasible. Regardless, integration represents a challenge if you must link in-house systems to external systems.

Deciding whether to build a custom system (internally or using consultants) or acquire an existing system (commercial software or a custom system made available to partners) is one of the biggest challenges in developing new systems. There are advantages and disadvantages to each approach. The trend in organizations is toward buying (which includes subscribing) instead of building. To make the buy decision more complicated, organizations also have the option of using open-source software with customization. Despite the complexities of the solutions available, the choice of whether to make or buy must be made for each new system considered.

Solution to Question 32

Regular systems maintenance helps to avoid major problems in the future. Reasons for systems maintenance include:

- changes in business processes
- new requests from stakeholders, users, and managers
- bugs or errors in programs
- technical and hardware problems or changes
- corporate mergers and acquisitions
- government regulations

Sometimes maintenance occurs because the IT group sees how systems can be improved, the development of a new application affects other applications, or a new direction for software development occurs.

Solution to Question 33

Advantages to using systems development methodologies:

- Methodologies impose discipline on the project team, which must perform tasks, comply with standards, and adhere to a project schedule. This discipline is required for both new and experienced team members. Projects place a great stress on the people involved. A methodology will help keep them focused and help them see past the unavoidable glitches along the way. While some methodologies place a greater emphasis on controls and schedules, all provide the basic discipline needed to complete the complex tasks of systems development.
- Methodologies can be used to ensure that the important aspects of a project have been taken into account. A methodology prescribes the way to accomplish something. It ensures focus and adherence to a process, and it provides a way to validate that all important aspects of the project are covered.
- Methodologies enable management to coordinate and manage the systems development process. Outlining the activities that occur and the logic governing the process makes it easier to measure progress.

Disadvantages to using systems development methodologies:

The underlying assumption of many methodologies is that a standard process can be imposed on any systems development process. Unfortunately, no two projects are alike. Sometimes, systems analysts may hide behind the systems development methodology as an excuse for not thinking in new directions, and they go through projects according to the steps outlined in the methodology in the same order every time.

Solution to Question 34

Prototyping works well in situations where it is difficult to articulate or identify the needs and requirements of the system — where requirements are “fuzzy,” or not clearly defined.

Prototyping’s principal advantages come from the fact that a working system is built in incremental stages that the users can see and use. In this way, it is often easier to identify requirements accurately and avoid costly changes late in the development cycle — such as those that occur in the waterfall approach. The users know what the system will look like and how it will function because they are testing the developments regularly in increments.

Two major drawbacks of prototyping are weak internal controls and lack of data integrity safeguards (for example, input edit procedures, access control to sensitive information, error checking, and backup and recovery procedures). These controls and safeguards are ignored for a variety of reasons, the most common being that the focus of prototyping is to develop a working system, not to ensure security and data integrity.

Solution to Question 35

The seven principles that should guide re-engineering efforts are:

- Organize around outcomes, not tasks.
- Have those who use the output of the process perform the process.
- Subsume information-processing work into the real work that produces the information.
- Treat geographically dispersed resources as if they were centralized.
- Link parallel activities rather than integrate them.
- Put the decision point where the work is performed, and build control into the process.
- Capture information once, at the source.

Solution to Question 36

1. Involvement and communication: User involvement in the change has been identified as a key success factor for information systems projects. Convincing users of the benefits of the change (through constant and consistent true communications using a variety of methods such as electronic postings, Facebook pages, Twitter feeds, posters, and meetings) can counter resistance.
2. Regular progress updates: Regular updates can help make users feel more connected and interested, which can help counter resistance.
3. Communication methods: Various methods of communication can be used. For large projects, many organizations create newsletters that are produced throughout the duration of the project and provide updates on progress, provide explanations of the goals of the system, seek input, and celebrate successes as the system is rolled out. Having regular meetings with users who are affected by the system, especially during critical periods, is a good way for users to air their concerns and to get answers to lingering questions. Parties to celebrate small wins, and bigger parties to celebrate big wins, are also good ways to communicate the importance of the system to users and other stakeholders.
4. Education and training: Education and training can also improve adaption rates. Education focuses more on the conceptual level of the system (its key goals, functions, and expected performance) and the overall process. Training is much more system focused. It is aimed at people who will use the system. Training helps

to counter users' fears that they may be incapable of using the new system, and it provides another way to counter the forces of social inertia and lack of confidence.

5. Appointing champions: Appointing champions can also help manage change. Champions are people who actively and enthusiastically promote the progress of an innovation through its critical stages. The best champions are not appointed to a championship role but emerge to fill the role because of their own convictions about the benefits of the proposed change.
6. Hiring to promote a culture of change: A person's openness to change is influenced by, or may even be a part of, their core personality. Therefore, firms that work in high-change environments would be well served by screening potential employees for traits such as comfort with ambiguity and openness to new experiences, or perhaps even a desire to embrace change. Over time, this will result in an organization whose employees are naturally less resistant to change.
7. Alignment of organization and individual goals: Goal alignment throughout the organization is a key determinant of the organization's success, and this extends to change initiatives. The more individual goals are aligned with organizational goals, the higher the chances of success.

Could also discuss providing support and building commitment, developing positive relationships to establish trust, and change management.

Solution to Question 37

In a **parallel conversion**, the old system continues to be used at the same time as the new system is introduced. Both systems run in parallel for a predetermined amount of time; when the new system can be trusted, the old one is discontinued.

The parallel approach is considered the least risky conversion approach. Nevertheless, the cost and potential confusion of running two systems at once makes it a poor choice for large, complex systems.

In a **pilot conversion**, the new system is introduced in a single unit or location for a set period before it is installed in other parts of the organization. The pilot conversion allows an organization to test out a new system in a controlled environment. It limits the amount of disruption and harm a new system can produce in an organization. By concentrating on one site or department, you can work out all of the details and potential problems before the new system is fully introduced to the organization.

The pilot approach to systems conversion is a middle-of-the-road method designed to minimize risk. The pilot approach is adopted in situations where the risk of direct cutover is too high and parallel conversion is either impossible or unaffordable. Pilot installations work well when there is some uncertainty regarding how the system will work and when there is time to work out any potential problems without jeopardizing the benefits to the company.

In a **phased conversion**, a new information system is broken down into smaller functional components that can be brought into operation one at a time, with each one adding more improvements and functionality to the overall system. Only when one module is working properly is another introduced. This approach is often used when the new system has a wide scope and many modules. A phased installation is gradual, incremental, and easier to manage than the other installation approaches. A phased approach keeps the risk fairly low by spreading the conversion out over time.

In a **direct cutover conversion**, the old system is discarded, and the new system takes over all at once. Also known as the “plunge,” “abrupt cutover,” or “big bang” approach, it is essentially turning the old system off and turning the new system on. Compared with the other approaches, this method presents the most risk. To mitigate this increased risk, a complete and thorough dress rehearsal should be conducted well in advance to ensure that the new system will work when the cutover occurs. If possible, risk mitigation strategies should be identified and put into place in case the new system fails. These include retaining the old system (hardware and software) to switch back to if the new system does not work properly or designing manual procedures to take over if necessary.

Solution to Question 38

Feasibility analysis is concerned with the likelihood that a system will be completed in a way that will be valuable to the firm. Its main areas of focus are technical feasibility, organizational feasibility, economic feasibility (or cost-benefit), and schedule feasibility.

Technical feasibility

Technical feasibility considers whether the system’s goals can be achieved with currently available technology. It is based on the system requirements, and its goal is to determine whether the company has the capability (resources, software, hardware) to complete the project.

Organizational feasibility

Organizational feasibility considers the capabilities of the company that is adopting the new system and whether it is possible for the company to do so successfully. It asks questions such as “Does the organization have the right culture, legal requirements, or customs to undertake this project?”

Schedule feasibility

Schedule feasibility considers whether the system can be completed in the amount of time available. Every project has a payback period, a time frame in which the project must be completed for it to be useful. Some possible options for system redesign will be rejected if they can’t meet the necessary schedule. Another time-based study to consider is measuring the future value of the project investment against the time required to complete the project.

Economic feasibility

Economic feasibility considers whether the project is cost-effective. At the beginning of most major projects, the costs are relatively difficult to estimate with any accuracy. As the project progresses, however, the project manager and the project team are better able to put dollar values on specific system requirements. These values must be weighed against the perceived benefits of the requirements.

Solution to Question 39

John P. Kotter developed an eight-step model for maximizing the likelihood of a successful change initiative. The eight steps are as follows:

1. Increase urgency: By creating compelling reasons for change, such as getting a new system (be it a new system or a replacement of an old one), you can establish a sense of urgency. This sense of urgency will help sustain the change effort.
2. Build a guiding team: Forming a coalition of supporters with enough power to lead the change and the conviction to do so will help maintain the sense of urgency, overcome resistance, and address and solve unforeseen problems as they inevitably arise.
3. Get the right vision: Create not only the vision that gets you to the end goal, but also strategies, plans, and the appropriate budget to help ensure success in attaining that vision.
4. Communicate for buy-in: Complete transparency is required. This means that open and honest communication is key to ensuring the appropriate vision exists throughout the organization. While the overall vision must be aligned, from a tactical or operational perspective this means that strategies must be customized for each department and job role as appropriate.
5. Empower action: In order to help ensure employees feel empowered, it is up to management to remove barriers to change and encourage risk-taking and creative problem-solving.
6. Create short-term wins: Too often, long-term projects are celebrated only upon completion. If this is years away, it is difficult for anyone to maintain the required motivation and energy over this extended period of time. As such, it is imperative to plan for, create, and reward short-term “wins” that move the project and organization forward. Short-term wins serve four purposes: 1) provide feedback as to validity of vision and strategies, 2) give recognition to those working hard on the project, 3) build momentum and support by attracting the attention of those not already actively involved, and 4) limit the impact of cynics.

7. Don't let up: This step, to a certain degree, uses the information from step 6 (create short-term wins) to make sure the change project remains a priority for the entire organization. Point 1 in step 6, feedback, allows the organization to reassess the changes and make any necessary adjustments to the new strategy or vision. Points 2 to 4 help consolidate improvements, make those already on board even bigger "champions," and help change the attitude of the naysayers. In order to help maintain this momentum, the organization must be certain to ensure that bottom-up feedback loops (from frontline employees to managers and executive decision-makers) are in place and functioning properly.
8. Make it stick: In order to make the changes "stick," managers must reinforce the changes by openly tying results to the new behaviours, thereby emphasizing what is important to the organization. Other tactics include coaching and training to reinforce the new culture and giving people who embrace the changes visible, prominent positions.

Solution to Question 40

The most common forms that resistance may take (and how management can address them) are as follows:

Public debate

Public debate, as during town-hall meetings, is where people challenge the value of the system openly and loudly, and it is the most obvious form of resistance. Because it is open, it is often the easiest form of resistance to counter. Of course, its public nature also means that the resistor has an audience to convince of the negative viewpoint, and this can be dangerous from the perspective of those advocating change.

To address public debate, management should acknowledge the employees' concerns. Management can meet with the concerned employees privately after the public meeting, and the results of the meeting and actions to be taken can be communicated to the entire company via an official communication.

Benign neglect

Simply ignoring the problem and hoping it will go away can also be an effective form of resistance to change. It may not work for everyone, but for people who have input into the system or who control resources for the system, simply ignoring the process can hold things up considerably. This is a very passive-aggressive form of resistance. It can be difficult to detect: Is the person delaying because they are busy with other things or because they are trying to resist what you are doing?

To address benign neglect, management can meet with the unresponsive employee to highlight the importance of the project and confirm that the employee has enough time and personnel to complete the task. Once everyone has agreed to the terms and

workload required, timelines and deliverables can be documented. These timelines and deliverables can then form part of the employee's performance evaluation.

Resource diversions

Refusing to commit money or staff time can stall the entire systems development process. Similarly, inappropriate staffing, such as sending someone with inadequate skills to work with a design team, can hurt the process and delay the system. Again, both of these means are subtle. There is no overt statement that the person is resisting. Perhaps resources have been diverted to activities that are a more immediate priority, which is certainly what the person will tell you if you ask. Or perhaps they were unaware that the person they sent to work with the project team lacked certain project development skills. Because they are not systems specialists, they may not know what skills are preferred.

To address resource diversions, management should meet with the employee responsible for resource allocation. Management can state its preference for the team members it wishes to have involved in the project and offer to accommodate the preferred team members' schedules by altering meeting times.

Problem expansion

Problem expansion as a form of resistance to change involves tying up the aims of the system with other, even larger goals, to the point where nothing can be accomplished because the problem is too broad. For example, a new order entry system may be challenged on the grounds that what really needs to be done is a complete rethink of the customer strategy. To build a new system before the customer strategy is in place is dangerous because the system may not support the new strategy. By expanding the problem to one of customer strategy, the person has, in the guise of being supportive, managed to make change virtually impossible. Essentially, the person is trying to build resistance to change by creating the perception that the change is too broad — regardless of the reality.

Problem expansion can be addressed by acknowledging the employee's suggestion for greater scope, but then re-emphasizing the limited budget and tight time frames for the project. Management can agree to look at the additional scope requests during the next planning phase and encourage the employee to prepare the initial background report outlining the possibilities and issues the organization would face in implementing such a system.

Sabotage

The most extreme form of resistance is sabotage, a deliberate and calculated attempt to ensure that the new system cannot be successfully implemented. This may bring to mind images of employees intentionally breaking hardware or corrupting data files, but sabotage can be subtler as well. Users may give incorrect information to designers about how they do their job, or they may not explain the errors in data that will need to be cleaned up if the new system is to work.

To address sabotage, management must first determine whether errors are being intentionally introduced in the system and should meet with the responsible employee to make them aware of the ongoing errors. Management should discuss the employee's attitude and dislike of the new system and attempt to understand what is motivating the dislike. Management may offer the employee additional training on the system to ensure there are no knowledge gaps. When the errors persist after retraining and several follow-up meetings, management may have to terminate the employee.

Solution to Question 41

Data integrity ensures that information remains useful to organizations. To do this, the data must be:

- presented in a meaningful format
- available to the people who will need it
- at the appropriate level of detail for the decision at hand
- accurate (most importantly)

When data can be used in many formats, and many functions can be performed with the data in such a way that the characteristics (type, size, usage, metadata, ownership) are maintained, then you have data integrity. It's not just about information being accurate. For information systems, it is important to prove that the collection, storage, and relationships of the data are sound.

Solution to Question 42

a) The two characteristics of SSBI that make it most relevant to big data analysis are:
   - It provides extended capabilities for extracting, profiling, cleaning, and analyzing data. It aims at facilitating integration and improving veracity.
   - It is easy to use. No degree in computer science is required.

b) Some specific features of SSBI software that makes it useful are:
   - It is flexible. SSBI uses a relational data model that is scalable and extensible.
   - It has the ability to process massive amounts of data, in excess of one million rows. Contrast this with Excel, which has a limit of approximately one million rows.
   - It has an advanced, optimized data engine (the part of the software that manages the data).
   - It has strong capabilities to extract, transform, and load data.
   - It has the ability to integrate data using a data model.

Solution to Question 43

a) The data process chain summarizes the different phases of the data-to-insight cycle. The data process has five distinct phases:

Phase	Description
Data discovery	Explore what data is available, its relevance, and its affordability.
Data collection	Extract, transform, and load data (the ETL process). Transformation includes activities such as profiling, cleaning, restructuring, and integrating.
Information model building	Determine the information needed for decision-making purposes and build the information model.
Analytics	Identify insights useful for decision-making.
Problem solving	Use the insights as part of the decision-making process.

b) Data structure refers to how data is organized.

Unstructured data lacks an underlying data model, which makes processing and therefore analysis challenging. The typical example of unstructured data is text, but other examples are audio, video, and images.

Structured data has been organized into a formatted repository (such as a database) using an underlying data model. Technologies have been available for decades to analyze structured data. The use of structured query language (SQL) for building information models starting from data stored in a relational database is a good example.

Solution to Question 44

a) The data life cycle describes the different steps in the life of a single piece of data, through six steps:

Step	Description
Start	The data is created.
Recognize value	It is recognized that the data might have value to make decisions.
Transform	The data's form or content is changed: cleaned, restructured, aggregated, and so on.
Use	The data is used for analytical purposes — to support decision-making.
Store	The data is stored (that is, preserved) and can be further processed at any time. There are different reasons why data is stored, including archiving and analysis.
End	The data is no longer needed and is therefore destroyed.

b) “Dark data” refers to data that businesses have access to but choose not to use for the following reasons:
   - The data adds little or no value.
   - Extracting the data is too complex.
   - The business cannot process all available data (lack of capacity).

Solution to Question 45

A number of solutions, both technological and human, can be used to improve data integrity, security and integration:

Technological solutions could include information systems design. Moving toward more integrated views of organizational data and using a database management system to create more integrated systems will help immensely. Another technological solution is the design of user-input programs, for example a data entry program that flags duplicate inputs or incomplete inputs.

Human solutions, mostly involving training and education, are an essential part of any plan to improve data integrity, security, and integration.
Educating users about the importance of data quality, and the meaning of data quality, is an essential first step. Training in how to use applications and how to maintain data integrity is also a critical factor. Many organizations often neglect the training and education components of a well-designed information systems plan. Large multi-million dollar implementations have failed in part because staff did not receive technical training and so were unable to adapt to the new system.

Solution to Question 46

a) A database is an organized collection of electronically stored data. A relational database is a type of database that organizes the data using tables that are linked together, which makes information retrieval across tables easy. Databases are built to store current transactions and enable fast access for ongoing business purposes.

   A data warehouse is a type of database that integrates and organizes transactional data from different source systems and provisions them for analytical use. Therefore, they support the data-to-insight cycle for the organization. A main objective of data warehouses is to support data structures that are optimal for analytical purposes by extracting, transforming, and loading the data.

   Therefore, the main difference between a relational database and a data warehouse is that the purpose of a database use is for transactional use, whereas the purpose of a data warehouse is for analytical use.

b) The following are four main advantages of relational databases:

- Data is stored once. Any change to field data occurs only once, and all linked tables will show the change.
- Complex queries can be created. Creating, inserting, updating, and deleting table records is done in a query language called SQL.
- Security is improved. The concept of data residing in tables means that data can be split across many tables. This is a security benefit. Restricting access to certain data is easier. A payables clerk will have access to a vendor name and address but may be restricted from setting up terms or from viewing the year-to-date purchases incurred.
- They are flexible. The relational model is naturally scalable and extensible, which means that it can easily meet changing or increasing data requirements.

Solution to Question 47

Information models are used to take raw data and make it into useful information. There are four types of model-building methodologies, which are all designed to help achieve better business decisions and outcomes.

Model	Focus	Approach
Descriptive analytics	Looks at historical data and events for insights into what has happened	Looks for patterns within historical data to try to find the reason for a particular outcome
Predictive analytics	Uses statistical techniques to determine the probability of a future outcome or event	Looks for patterns found in historical data and current data to identify risks and opportunities
Diagnostic analytics	Examines data to answer the question “Why did it happen?”	Attempts to understand underlying cause of the issue
Prescriptive analytics	Combines descriptive, predictive, and diagnostic analytics to provide recommendations and to identify implications of these various recommendations	Looks beyond the *what* and the *when* to also incorporate the *why* (*Why will this happen?*)

Solution to Question 48

a) Predictive expectations are stakeholders’ opinions on what they think is likely to happen when a system is introduced, and they are based on past experiences. The following are examples in this case from the perspective of the federal government employees:

- They may believe the replacement systems will continue to make errors and will not pay them the correct amounts.

- They may believe the project will take longer than expected to implement.
- They may believe the project will cost more than budgeted to complete.

With normative expectations, stakeholders may also have an opinion about what the new system should do. The following are examples in this case:

- Employees expect the new system will pay them the correct amount.
- The new system will be more efficient than the previous system.
- Employees will be able to update personal information themselves.

Other examples may be provided.

b) The expectation gap is the difference between what a user expects to happen and what actually happens. The expectation gap occurs with both normative and predictive expectations. The following are problems arising from the expectation gap:

- Uncertainty: Federal government employees are never sure whether they will be paid, which could lead to a loss of motivation — if I am unsure whether I am going to be paid, why should I do my job well?
- Credibility: The failure of the Phoenix system has led to a loss of credibility for the federal government and the IT departments that worked on the project. Staff and stakeholders alike are skeptical that the new system will be better than Phoenix.
- Dissatisfaction: There is a high level of dissatisfaction with the Phoenix system from federal government employees who were not paid correctly. There is also a level of dissatisfaction from taxpayers, who believe their contributions to running the country are being wasted.

c) There are several steps the federal government and the IT department can take to reduce the problems that can arise from the expectation gap and thereby increase the success of the replacement system:

- Establish realistic expectations by having a clearly articulated vision and goals for the new system.
- Communicate which features will be included in the new system and justify why certain features have been excluded.
- Set realistic expectations about the project process and timelines.
- Perform due diligence when checking the system — that is, ensuring the system worked as intended, delivered on schedule, and met other objectives of the organization before the system was selected.

Solution to Question 49

a) XML is a tool designed to make a document readable by both a human and a machine. XML is commonly used because it is an international standard. If data elements within your web page are developed using XML, there is a very high likelihood that your document can be read by people worldwide. XML has two additional important characteristics:

- You can create personalized descriptive tags that are appropriate for your purposes.
- It is a language for storing, rather than presenting, data.

b)

	Correction (errors in bold)	**Error**
<xml version = “2.0	<**?**xml version = “2.0**”?>**	Missing both question marks (?), closing quotation marks (”) for the attribute value of 2.0, and closing triangle bracket (>)
<bookname CPA Standards and Guidance Collection </Bookname>	<bookname**>** CPA Standards and Guidance Collection </**b**ookname>	Missing closing triangle bracket (>) “Bookname” needs to be in lower case
<pages>600<pages>	<pages>600**</**pages>	Missing end tag — the forward slash (/)
	</book>	Missing </book>

Solution to Question 50

a) Artificial intelligence and machine learning are closely linked. Artificial intelligence can be seen as acquiring and applying knowledge, whereas machine learning can be seen as acquiring knowledge or a skill.

The following table can help to differentiate between the two:

Artificial intelligence	Machine learning
Attempts to make a computer do something better than a human	Learns from past experiences
Aims to increase chance of success	Aims to increase accuracy; does not worry about success

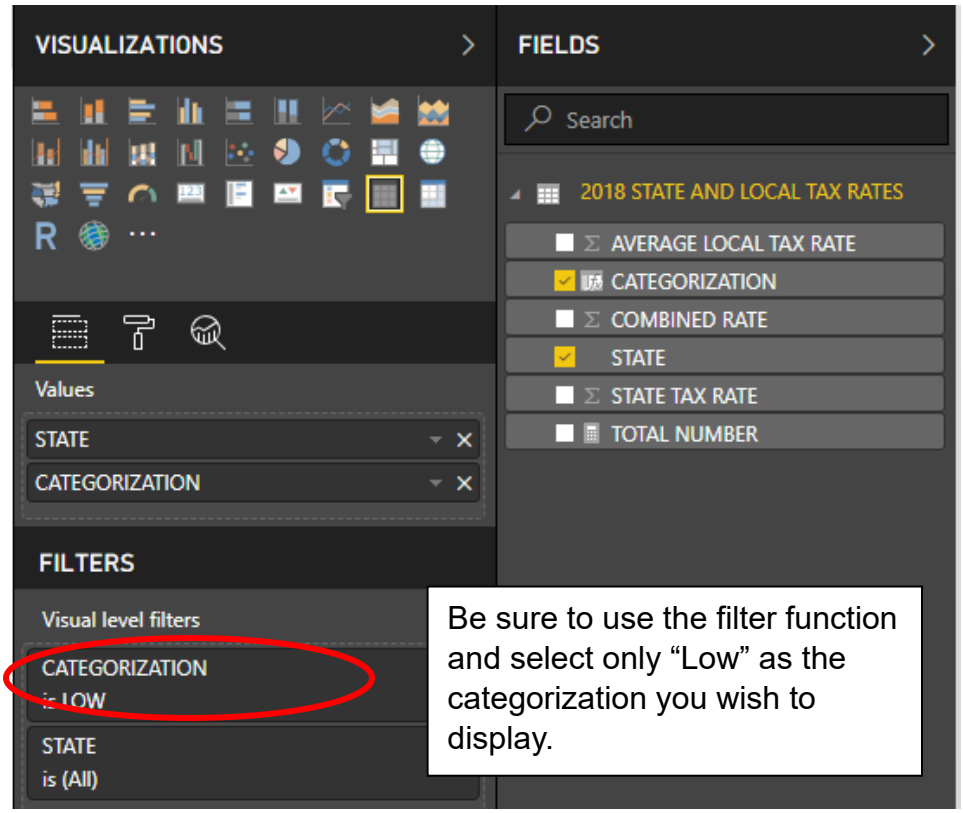
Artificial intelligence	Machine learning
Improves intelligence to solve complicated problems	Works to maximize performance on a task
Makes decisions	Learns new things from data
Mimics how a human would react in a given situation	Creates self-learning algorithms

b)

Example	Classification
Amazon predicts what you are interested in purchasing based on past behaviour, web searches, and website interactions.	AI
The bank uses a system to assess the riskiness of an individual defaulting on a loan by analyzing separate databases on credit scores, spending patterns, and financial data quarterly.	ML
A website offers a customer recommendations based on previous purchases or website activity.	ML
You use Google Maps for travel directions and real-time traffic data.	AI
A social network uses face recognition to identify your friends in other pictures posted on its platform.	ML
You talk to a smart assistant like Siri or Alexa on your smartphone.	AI

Solution to Question 51

a) Check the boxes for STATE and CATEGORIZATION:

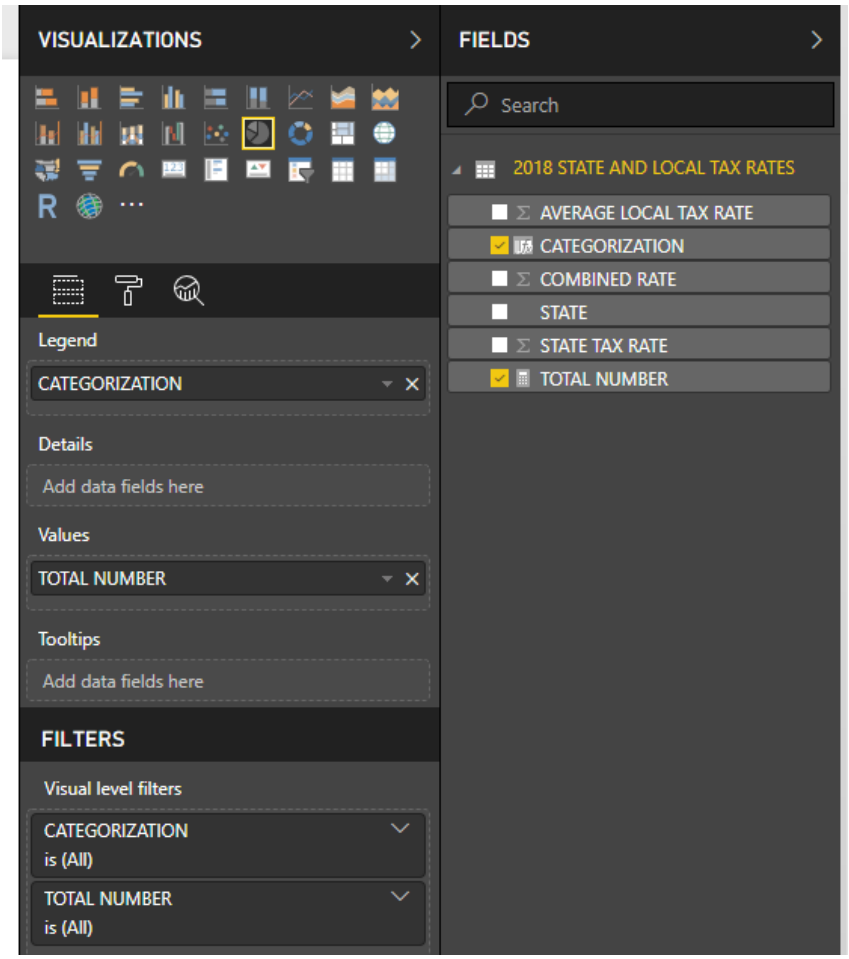


Your table should resemble the following:

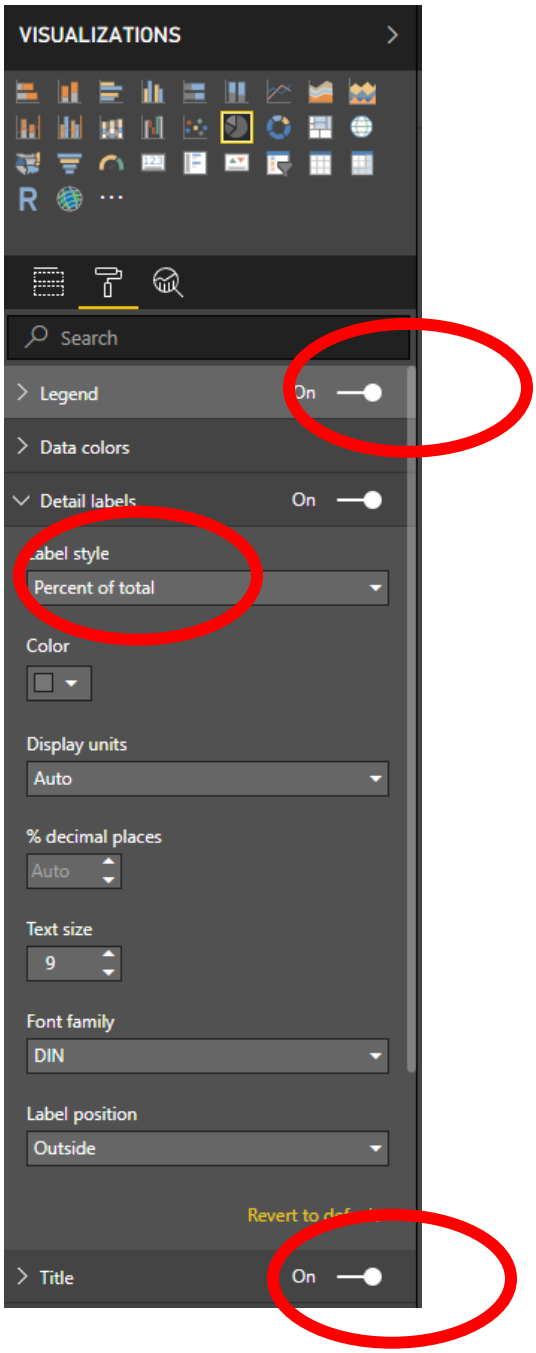
STATE	CATEGORIZATION
Alaska	LOW
Delaware	LOW
Hawaii (c)	LOW
Montana (d)	LOW
New Hampshire	LOW
Oregon	LOW

You can see that only six states are considered to have “LOW” tax rates.

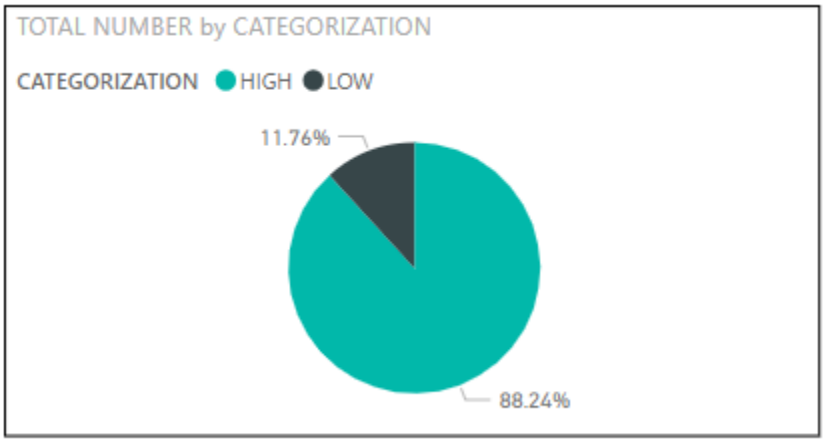
b) Select CATEGORIZATION as well as TOTAL NUMBER in the FIELDS column:



Additional formatting will help you convey all the information you need:

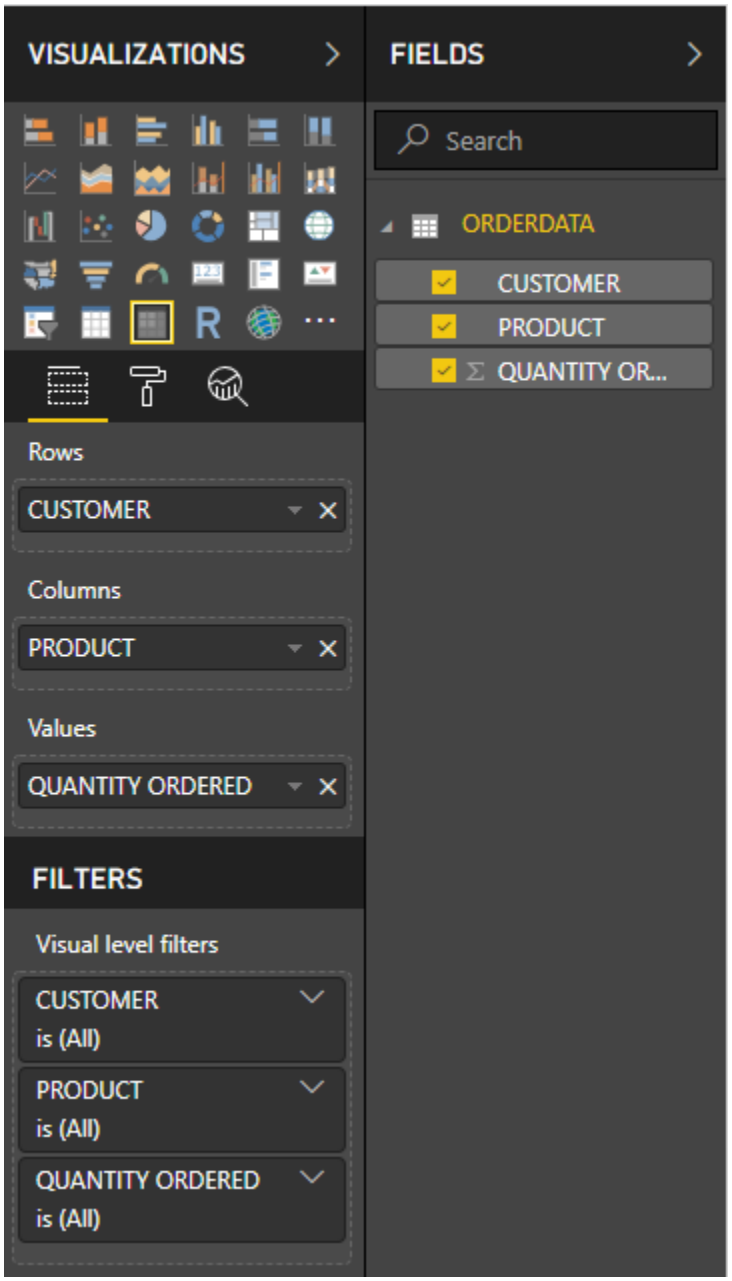


Your pie chart should resemble the following:



Solution to Question 52

Select the matrix visualization and all three fields indicated below:



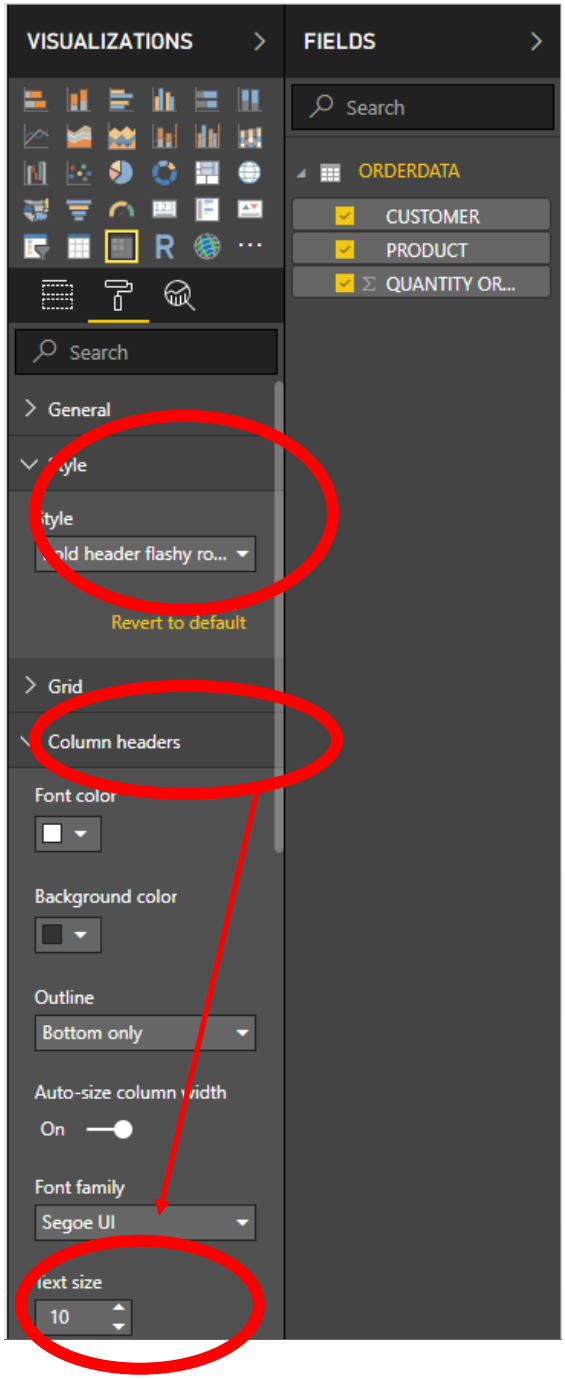
There is no need to modify any of the filters to create the table as illustrated.

Depending on how you have formatted your visualization, it may look something like this:

CUSTOMER	BELGIAN LION	CARAMEL	CHERRY CLUSTERS	GIANT SMORES	PRETZEL BITES	RAISIN CLUSTER	SPARTY	Total
Stacy's Card Shop		4						4
Lansing City Zoo	12							12
Student Supplies							44	44
Jane's Jello								45
Pennies Only		45						45
Billy Bonka Candies		11						48
ABC Greenery							56	56
Pierre Legume							66	66
Brenda's Bakery		34	22		16	1		73
Collegiate Clothes							76	76
Aunt Patsy's Pastries	22				34	22		78
Flintstones Bakery		52			29			81
Lion Country Safari	99							99
Myers		12			34		56	102
Dusty's Kitchen	23	34	17			10	23	107
Time For Tea			93			21		114
The Coffee Garden		76	32			29		137
Hubsons		34	54			66		154
Muskegon Deli		23	45	98				166
Jason's Candy Bar		31		123	21			175
Grandiose Gourmet		87	23	43	39		15	207
Country Cricket Candies		88		111	23			222
Broke & Sons Candy Store		198	22		23	54		297
Holland Cookies			99		109	91		299
My-Joy Munchies			55	75	199	3		332
Kristin's Kandies		155	56	201	23	34		469
Total	**156**	**884**	**518**	**721**	**562**	**331**	**336**	**3508**

Using the embedded arrow to sort total orders will help you easily identify the customer with the most orders.

Formatting choices for the above are:



a) The most popular product is “Caramel” with 884 orders.

b) The customer with the highest volume of purchases is “Kristin’s Kandies” with 469 orders.

Solution to Question 53

The factors that drive the need for technological change in organizations are:

1. Application demands: Technology decisions are often driven by application requirements. An analysis of business requirements may determine that new information is required to maintain existing or future business relationships. If the current information system does not support this information, new applications may need to be adopted.
2. Infrastructure life cycles: Sometimes technology decisions are driven by the need to maintain an appropriate basic level of technology as a foundation on which to build applications. Every computer has a finite life. To avoid system failures, organizations must upgrade their systems before reliability and performance are compromised. Similarly, networking equipment must be replaced to avoid failures that will hurt the ability of the business to communicate.
3. Customer and supplier demands and other external forces: Some technology decisions are made in response to the demands of customers or suppliers. For example, if your business partners make changes in their technology, you may need to make changes to continue to communicate with them. Also, if technology suppliers stop supporting particular pieces of hardware or software, you may need to upgrade, not because what you have no longer performs adequately, but because you cannot obtain replacement parts or additional components or because they no longer interface with newer applications.

Solution to Question 54

Information systems planning needs to involve a range of stakeholders from across the firm, including information systems staff, users, and managers. In some cases, information systems planning may also include consultation with customers, suppliers, and other external stakeholders. Depending on the governance model, different levels of involvement will be required for different units regarding different decisions. Departmental needs can best be articulated by people from within those departments. Users and managers — from finance to production to marketing — need to be consulted, and their input must be included in the planning process. This consultation may be formal or informal, and it may focus at one point in time or be ongoing. A combination is likely the most effective. Informal, ongoing relationships allow for easier communication, but formal and more intense consultations may identify issues that could be missed with an informal planning process.

Involving a range of stakeholders promotes success, as it ensures that they are engaged and that different perspectives are considered, which can decrease implementation issues. For example, senior management provides broad strategic direction and support to the planning effort. A primary tenet of project management success is to obtain senior management support. It is no different with information systems planning. The finance team is an important consumer of information systems

products and services. Financial managers also play a role in determining the costs and likely benefits of an information systems opportunity and in identifying where the funds to undertake different projects will come from. Senior information systems management must take the lead in this planning process. Other information systems staff may be involved as facilitators of the process, gathering information (working with departmental management and users to determine priorities), researching new technologies and their potential applications, and preparing cost-benefit analyses (with help from the financial team and the departmental representatives) for different proposals. Greater involvement helps with department buy-in when the approved plan is presented to the staff, because everyone feels included in the process.

Solution to Question 55

A number of factors contribute to successful systems development projects:

- clearly defined and understood goals
- open and continuous communication
- management involvement and support
- definitive timelines
- strong project management skills

Systems development projects can fail for the following reasons:

- Lack of understanding of the desired results (imprecise targets): Results must be clearly defined, roles clearly understood, and tasks connected to results. The stakeholder group that will benefit as well as the benefit itself should be clearly documented.
- Poor estimating techniques for budgeting and scheduling: Information must be gathered to accurately estimate costs to define the cost/benefit relationship of the project.
- Small, unadjusted schedule slippage, which cumulatively results in a major delivery delay: With the dependency of some tasks, small slippages in key tasks can lead to major delays in delivering the new product on time.
- Lack of project management skills or leadership: It takes time to develop leadership skills, and having the wrong person in charge of the project can lead to failure.
- Poorly trained analysts and programmers: This can cause delays in projects because of the time needed to train these people on different project management tools.
- Conflicting goals and objectives among the project team members and users: If individual team members have goals that are not aligned with the project, this can cause the project to fail.

- Use of inappropriate software or hardware tools: Each project must be treated individually, and the right project management tool must be used to deploy it. Using something simple like an Access database when a fully integrated web-based solution is needed will lead to project failure.
- Difficulty coordinating personnel, phases, and tasks: Deploying extra resources to a project could lead to slowing it down, rather than speeding it up, if the optimal number of resources is not known.

Note: Only two reasons were required, but the others given above can assist in understanding the subject.

Solution to Question 56

In the software as a service (SaaS) model, applications are hosted remotely (typically by the software vendor), and the customer pays a monthly fee to use the software — sometimes including upfront licence costs. SaaS models have a number of benefits and limitations:

Benefits	Limitations
• less internal IT infrastructure (typically housed at an outside firm) • typically accessed via the internet • version upgrades are made by the vendor on a regular basis, giving the latest functionality, and ensuring minimal disruption to end-users • lower upfront investment required	• less control, therefore higher reliance on vendor • typically doesn't allow a lot of customization • security risks of hosting data remotely and accessing it via the public internet

Solution to Question 57

These are the six major hardware components of a typical computer:

- central processing unit (CPU), consisting of the control unit, the arithmetic/logic unit (ALU), and registers; also commonly known as the "processor"[1]
- memory (primary storage)
- communications devices
- secondary storage (permanent storage)

[1] The CPU performs almost all the data processing operations for the computer. Processors are able to execute millions of simple tasks per second, and their speed of execution is measured in MIPS (millions of instructions per second) for machine cycle time and megahertz (MHz, millions of cycles per second) or gigahertz (GHz, billions of cycles per second) for clock speed.

- input devices
- output devices

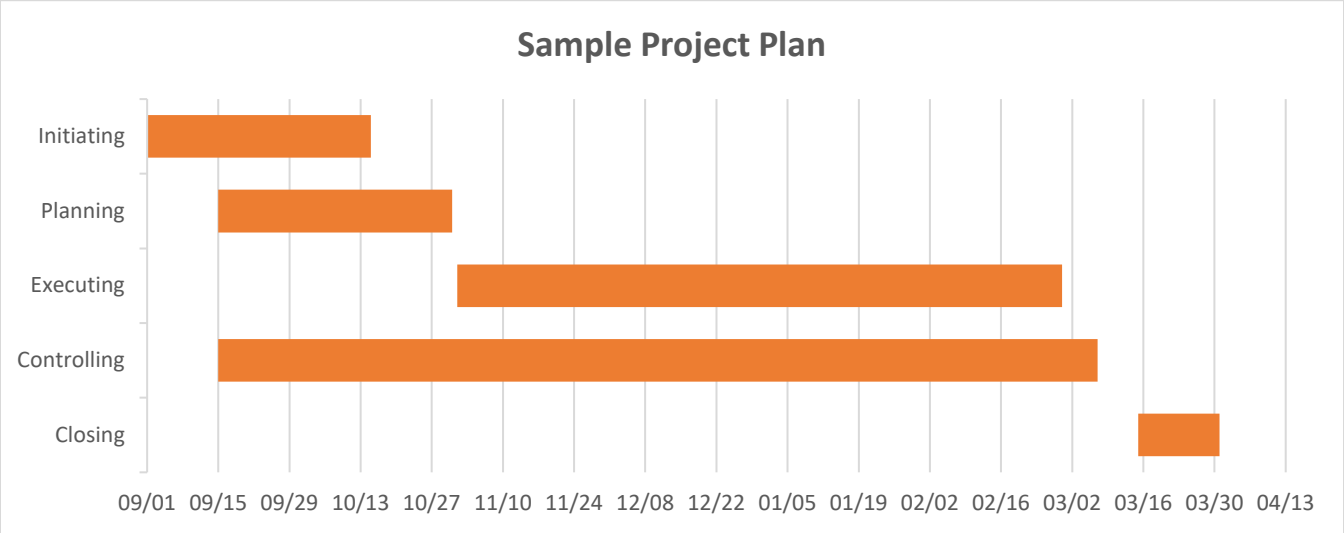
Solution to Question 58

Biometrics, one of the newest forms of input technology, is used for personal identification, taking advantage of the unique biological characteristics of the human user. Biometric systems are becoming affordable and are used in day-to-day systems, such as ATMs, entrance control systems, and access control to computer networks or smartphones. The following is an overview of the types of input used for biometric systems:

- Voiceprint: Voice-recognition devices can be used to secure programs and files on PCs and notebook computers. This technology can confirm the identity of the user on the basis of voice characteristics. Voice-recognition devices are also used in industrial situations so that workers are free to use their hands while speaking into the computer, in medical systems whereby doctors can quickly update records, and even in cars where drivers can activate devices like smartphones without removing their hands from the wheel.
- Iris scanning: Each individual has unique iris patterns. Iris recognition is a biometric technology that can be used in many situations to replace a password or PIN. Examples of such applications include replacing the password for logging on to networks, the security card for opening doors, and the PIN for ATMs. Iris scanning is replacing retina scanning as the preferred technology because retina scanning is very intrusive, requiring a high-intensity light to be shone into the back of the user's eye.
- Fingerprint: The human fingerprint is unique, and computer devices have been designed to inexpensively record and recognize fingerprints. Fingerprint identification can be used on Apple and Android mobile devices instead of a PIN or password and is also available on a number of laptop and personal computer products.

Solution to Question 59

Excel was used to develop this Gantt chart. You can use Excel or hand draw a Gantt chart. The important part of creating the Gantt chart is being able to visualize the amount of time, as well as dependencies and overlaps in each stage of the project.



Solution to Question 60

a) Controlling (173 days)

b) 211 days

c) Three: Initiating, Planning, and Controlling

d) Two: Executing and Controlling

e) Four: Initiating (44 days), Planning (46 days), Executing (119 days), and Controlling (173 days)

Solution to Question 61

Networking is essential in organizations for a number of reasons. With the increased popularity of the internet and the web since the mid-1990s, companies have integrated them into their strategies. There are solely internet-based businesses, and there are “clicks-and-mortar” companies, such as retail stores that have branched out onto the internet through their existing physical enterprises. Marketing that promotes one-to-one advertising, customized to a particular customer’s interest, and social media have provided new ways to reach communities of potential customers. Wired, wireless, mobile — the options for staying connected are greater than ever.

The ability to provide shared communications, such as through email, blogs, Twitter, and Facebook, is one key benefit of networking. Sharing data is also a critical benefit. With a network, users in different locations can access the same customer database to

provide, for example, better data integration. Sharing data also reduces organizations' cost of storage because only one copy of the data needs to be kept, and in many cases this too is now stored online.

Sharing network resources, such as printers and scanners, allows organizations to buy fewer of these devices than computers. With printers, this can mean users have access to a faster, higher-quality printer as part of a workgroup than they would have if the organization bought one printer to go with each computer.

Centralized administration is also a key benefit to networking. On corporate networks, software programs check each time a user logs on to make sure the user has the most up-to-date virus-checking programs. If not, the updates can be automatically installed on the user's machine. When files are stored centrally, backup can become the responsibility of the information systems department, increasing the likelihood that regular backups will be made.

Networking has also provided virtualization, or the ability to connect and run remote devices as if they were a part of a local area network (LAN). This can allow users to connect to their company's programs and files from anywhere they have an internet connection. Applications like Citrix on desktop computers and VMware on servers and end-user client computers extend the life and functionality of existing machines, reducing the need to constantly update hardware. In addition, cloud computing can virtualize both the platform and the infrastructure of network resources by providing connectivity outside the operating business.

Solution to Question 62

The three approaches used to structure the IT and information system planning process are:

1. Portfolio analysis: Portfolio analysis looks at risk management, strategic alignment of IT investments, cost-benefit, and investment management along with standardization of investment procedures, rules, and plans within the IT area. Infrastructure and IT replacement planning normally follows a portfolio analysis approach, while information systems planning and strategic information systems planning benefit from using both approaches. The combination of a top-down (strategic analysis) and risk-benefit evaluation (portfolio analysis) of information systems projects results in complementary information that may yield superior plans by highlighting any strategic disconnects within the company.

2. Strategic analysis: Strategic analysis, using critical success factors, takes a top-down approach. Using tools such as Porter's Five Forces model or the value chain, managers determine the processes that deliver the greatest value to the organization and the opportunities to use information systems to support these processes. They then become the priorities for systems development.

3. Scenario planning: Scenario planning attempts to go beyond present-focused thinking. This approach involves looking at a small number of future possibilities and examining their implications for the current information systems plan. Scenario planning makes use of open creative thinking around the possibilities of future business by challenging assumptions that restrict thinking to the present, enabling a more open-minded consideration of various outcomes.

Solution to Question 63

Most software on the market today follows proprietary (not free) standards. Packages are built and sold that will benefit many adopters at a reasonable cost. There are those who argue that the proprietary model is inappropriate. This model discourages information sharing and application integration, since different proprietary systems don't generally communicate with each other. For the same reason, it makes it difficult for users to adopt the best software to meet specific needs.

Open-source software is software with source code that anyone can inspect, modify, and enhance.

Source code is the part of software that most computer users don't ever see; it's the code computer programmers can manipulate to change how a piece of software — a "program" or "application" — works. Programmers who have access to a computer program's source code can improve that program by adding features to it or fixing parts that don't always work correctly.

Some argue that open-source software cannot be sustained as a business model because you can receive the software for free. Yet the open-source movement continues to gain momentum. Linux is now one of the most commonly used operating systems (OSs) in IT department servers, and Apache (an open-source web server) is the most commonly used web server. What open-source solutions offer organizations today is choice. From OSs (Ubuntu, openSUSE), to browsers (Firefox), to business applications (Compiere, Openbravo), open-source software solutions are offering organizations more choice beyond the traditional vendors.

Solution to Question 64

You may use search terms like “technology drivers” or “technology changes business,” but these are likely to lead to general discussions. More specific searches for “CIO concerns 20XX” or “what are 20XX technology trends” may generate more diverse results (and typically lead to more specific answers). Including the year in the search will help filter out old or obsolete results.

Answers to this question will vary. The following table provides some trends in IT decisions:

Driver/trend	Impacts/explanation
Rethinking privacy	Many mandated changes to information systems are being driven by changing attitudes to privacy and ever-increasing threats to information security. Just about every large website in the world now displays a message about how it uses cookies — this was brought about by 2018’s General Data Protection Regulation (GDPR), which came into force on May 25, 2018, in the European Union. This regulation modernizes laws that protect the personal information of individuals. It will fundamentally reshape the way data is handled in every sector, from health care to banking and beyond.
Information security	Increasingly, business leaders outside the IT department — like chief executive officers (CEOs) — are being held more accountable for cybersecurity at their firms. Security events like ransomware, viruses, and leaked or stolen data cause real economic impact. Addressing these through technology upgrades and user education is a priority for most chief information officers (CIOs).
The internet of things (IoT)	Cheap, reliable data networks create opportunities for continual communication. Standard interfaces and protocols now mean that virtually any device can be internet connected. Combining these opens up a world of new business opportunities and drives incredible technological change. Companies are racing to add digital integration to their products, and at the same time there is a need to grow the technology infrastructure to support millions more networked devices.
Cloud computing	In the simplest terms, cloud computing means storing and accessing data and programs over the internet instead of from your company’s network or from your computer’s hard drive. But this simple concept is revolutionizing IT. Think about SaaS and your favourite website (Amazon, Spotify, eBay, Salesforce, and so on). None of these is possible without cloud computing.
Edge computing	The use of cloud computing is still growing, as more and more businesses migrate to a cloud solution. But it’s no longer an *emerging* technology. Edge computing is. As the quantity of data we’re dealing with continues to increase, we’ve realized the shortcomings of cloud computing in some situations. Edge computing is designed to help solve some of those problems as a

	way to bypass the latency caused by cloud computing and getting data to a data centre for processing. It can exist “on the edge,” if you will, closer to where computing needs to happen. For this reason, edge computing can be used to process time-sensitive data in remote locations with limited or no connectivity to a centralized location. As with any growing market, this will create job demand, primarily for software engineers.
Individualization of IT	The days of corporate owned-and-managed devices may be coming to an end. Smartphones, bring your own device (BYOD), work from home, work anywhere/anytime, and other trends are driving incredible change in the workplace. Users are demanding more flexibility, a wider range of device choices, and new ways to connect with the work world. Changes in devices are also driving changes in applications — screens designed for 27” desktop computer monitors must be refactored for use on a 5” phone.
Virtual reality and augmented reality	Virtual reality (VR) immerses the user in an environment, while augmented reality (AR) enhances their environment. Although VR has primarily been used for gaming thus far, it has also been used for training, as with VirtualShip, a simulation software used to train U.S. Navy, Army, and Coast Guard ship captains. The popular Pokémon Go game is an example of AR. Both have enormous potential in training, entertainment, education, marketing, and even rehabilitation after an injury. Either could be used to train doctors to do surgery, offer museum-goers a deeper experience, enhance theme parks, or enhance marketing endeavours.

Solution to Question 65

For e-commerce to be successful, the company must have a site that attracts customers and is easy to use. It is also important that the service be reliable and accurate, and provide rapid response. In e-commerce, it is easy for the potential customer to go elsewhere if the process is slow or if they encounter problems with the order itself. Therefore, it is essential to build a good working e-commerce system with a complete and sound technological infrastructure.

The key infrastructure components are:

- the organization’s internal technology, in the form of networks linked to the internet by high-speed equipment
- e-commerce software working in conjunction with the server software and OS on the server hardware platform

These infrastructure components must be carefully chosen and integrated to support a large number of customers, suppliers, and business partners around the world.

Solution to Question 66

Today's businesses generate more data than ever before. And therefore, IT has never been more critical to the success of a small business.

For many small businesses, though, their backup and storage strategy hasn't caught up with their more pervasive use of computers. This could be due to confusion about the various storage options, or a failure to understand that the old paradigm of the occasional batch backup is no longer adequate.

Offline solutions:

Offline solutions do not require a connection to the internet to work.

Flash drives (or USBs) are one of the most popular external storage media. They are rewritable solid-state drives (SSDs) and can store from 1 GB to 2 TB of data, although these large flash drives can be expensive.

Tape drives (a data storage device that reads and writes data on a magnetic tape) are commonly used in corporate settings, but optical media such as DVD and Blu-Ray discs are also occasionally used for the purpose of offline data backup.

This technology may seem outdated, but it shouldn't be dismissed! Tape backups have saved Google in at least one Gmail outage, and Facebook is experimenting with Blu-Ray discs for data backup.

Online solutions:

Some online (or cloud) services are designed specifically to serve businesses for data backup.

Cloud storage can work very well if backing up data incrementally, and it requires no upfront capital investments. The downside, though, is that data retrieval may take an unacceptably long time should you require full data recovery.

For critical data, businesses should make two full copies, maintained on separate physical devices. In addition, a third copy should be kept offline, preferably secured at another location.

Having two complete copies offers some measure of business continuity, allowing organizations to continue with their business as usual even with the complete loss of one set of data.

Solution to Question 67

The following are common risk management strategies:

- Avoid: Redesign the process to avoid particular risks and thus reduce overall risk (for example, not using untested third-party software).
- Diversify: Spread the risk among numerous assets or processes to reduce the overall risk of loss or impairment (for example, having redundant backups for critical databases).
- Control: Design activities to prevent, detect, or contain adverse events or to promote positive outcomes (for example, having different individuals handle cash receipts, record the bank deposit, and complete the bank reconciliation to minimize the opportunity for one person to steal cash from the company).
- Share: Distribute a portion of the risk through a contract with another party (for example, purchasing insurance).
- Transfer: Distribute all of the risk through a contract with another party (for example, outsourcing).
- Accept: Tolerate risks when the cost of managing them is greater than the potential harm (for example, not obtaining earthquake insurance when you don't live in an earthquake zone).

Solution to Question 68

Enterprise-level controls are used throughout the company. They are internal controls that cover all the objectives of an organization, including financial reporting, operations, and information technology (IT). Common enterprise controls include the following:

- policies and procedures manuals
- risk assessment methodology
- change management
- hiring and retention methods
- governance
- management systems triggered within IT systems

Such controls are designed to give an organization's board of directors, managers, and other personnel confidence that those objectives will be achieved. Without adequate general controls, application controls may not function properly, affecting the content and value of the information created.

Solution to Question 69

To mitigate the risk of fraud, responsibilities must always be structured so that no single employee can authorize financial transactions, record financial transactions, and hold custody of the assets for transactions they have processed. Control systems require that checks and balances be built into an authorization or verification process. Managers should assign tasks to separate employees to avoid, or at least minimize, concentration of too much financial authority for one person.

In IT departments, developers and administrators often have authorized access to both enterprise systems and individual modules. For example, the developer who modifies or tests program fixes in a test environment should not also update the live environment. Similar to financial audit trails, IT must run system audit trails logging what programs and files were updated, by whom, and with whose authority. Separating testing from live environment changes and implementation is an important segregation of IT duties.

Transaction processing and authorization in automated transactions (such as those performed in e-commerce) are usually handled by software. Knowing who has change and modification access to that software is a requirement for those charged with oversight of the accounting function.

Solution to Question 70

Information systems fraud against companies may be committed by an employee or an external party. Former and current employees are much more likely than non-employees to perpetrate frauds against companies because they understand the company's systems and weaknesses. This enables them to commit the fraud and cover their tracks. Perpetrators of computer fraud tend to possess computer knowledge, experience, and skills. Hackers and people committing computer fraud may be motivated by curiosity, profit, the challenge of beating the system, unhappiness with their jobs, or a desire to get revenge on the employer.

Computer systems are particularly vulnerable to computer crimes for several reasons:

- People can steal, destroy, or alter massive amounts of data in very little time.
- Access is often provided to customers and vendors, creating added vulnerability.
- Computer programs need to be altered only once, and they will operate that way until the system is no longer in use or someone notices.

- Modern systems are accessed by personal computers and mobile devices over the internet. This makes them inherently more vulnerable to security risks and difficult to control compared to mainframe systems running on dedicated (closed) networks.

Solution to Question 71

Malware (malicious software) is designed to infiltrate and damage a computer system without the owner's consent. Malware is a general term for various forms of hostile, intrusive, or annoying software or program code. Hackers are moving beyond attaching viruses as email attachments to using newer technologies to spread malware.

The following are some of the top security threats:

- websites using phishing or fake sign-in pages to capture a user's ID and password
- mobile phone and tablet attacks; the use of smartphone technology and increased connectivity through Bluetooth, instant messaging, email, and third-party apps increases the potential for device contamination
- identity theft and unauthorized access to and use of private or customer data
- geolocation data captured via mobile devices and sold without the owner's knowledge to third-party vendors

To stay protected from threats and malware, companies and individuals should ensure that their antivirus programs are kept up to date. They should install the latest software patches and implement a multi-layered approach to detecting and blocking attacks, such as using firewalls.

Solution to Question 72

Goal	Control(s)	Risk management strategy	Explanation
Prevent malware from being installed	Use and regularly update antivirus software or programs	Control	Antivirus software protects a computer, thereby preventing virus infection across the company.
Prevent data loss due to fire	Run daily backups and store at an off-site location	Diversify	Fire is something that can cause a large amount of damage very quickly, with the resulting cost rising quickly. Maintaining backups at separate locations can increase the speed with which operations can resume.
Prevent data loss due to hardware failure	Manage service contract *and* run daily backups	Transfer *and* Diversify	In a managed service contract, the vendor assumes responsibility for maintaining hardware and service continuity. If hardware fails, the provider must fix or replace it. Maintaining backups can increase the speed with which operations can resume.
Protect cardholder data	Encrypt transmission of cardholder data across open public networks	Control	Encryption can help protect sensitive information as it basically scrambles data and requires authorization to view it normally (such as a password, PIN code).
Prevent unauthorized access to data	Firewall systems (not making system available outside the enterprise)	Avoid *and* Control	Not making the system available outside the enterprise avoids most casual hacking attempts. The physical firewall adds an additional layer of protection by further controlling access by blocking unsolicited incoming traffic.
Recover corrupted files	Run daily backups	Diversify	Daily backups reduce the potential loss in the event of failure, since several backups can be checked to restore the data to a point before the file was corrupted.

Other controls are possible for each of these risks. Those controls may result in different classifications of the risk management strategy.

Solution to Question 73

Authentication is the process that confirms a user's identity.

Procedures for user authentication are one of the most important aspects of security. When someone tries to log on to a network, it is important to be able to determine if they are who they purport to be.

Passwords are the most common security mechanism for user authentication. The basic rules of secure passwords are:

- They should include both upper and lower case letters, numbers, and symbols in seemingly random patterns. Longer passwords are also more secure.
- They should be changed frequently (every 30 days or so), and repetition of recently used passwords should not be allowed.
- They should not be words found in the dictionary because one password-cracking technique is simply to try every word in the dictionary.
- They should not be names or other things that are easily guessed (important dates, phone numbers, and so on).

Another alternative is the use of **passphrases**. These are short phrases of normal words that are assembled in a seemingly nonsensical way, such as "sHEcLiMbEd5.Ten." The advantage of these passphrases is that they can be easier to remember than a completely random string of characters and symbols, but they are still difficult to crack.

Single sign-on involves creating programs that can pass sign-on information from one system to the next so that once a user is authenticated on the network, their access privileges and password information can be automatically given to the other systems they access.

Access cards can also be an important tool for security. Access cards can be required to access places, providing physical security, but they can also be used with systems. In addition to a card or dongle, users also have to give a password to access the system. This means that even if a password is guessed, it is unusable without the access card, or if an access card is stolen, it is unusable without the password. Such overlapping schemes enhance the security of authentication tools.

Biometric identification techniques are becoming more popular and less expensive, focusing more directly on authentication based on something you are. Because they measure physical characteristics (for example, facial features, fingerprints, hand scans, retinal scans, and handwriting), biometric identification techniques tend to be more secure.

Solution to Question 74

Business continuity planning deals with what happens when things do go wrong. For example, what do you do if your website is subjected to a denial of service attack? Who is notified of the problem? What steps do they take, in what order, to end the attack, resume services when the attack has ended, and identify the source of the attack to undertake legal action?

Disaster planning is what you do when a catastrophic event, like a tornado or earthquake, affects your business.

Continuity planning and disaster planning are not mutually exclusive. The documentation, procedures, and processes created for one are equally valuable for the other. It is a matter of degree. A power outage in one section of the plant requires continuity planning. A machine room flooded with water requires disaster planning. Continuity means that some things are down but the company can still function as a business; disaster usually means that the company cannot function as a business until the problem is solved.

Solution to Question 75

The four categories of integrity controls that are designed to foster a reliable system are:

Source data controls: Companies must establish control procedures to ensure that all source documents are authorized, validated, accurate, complete, properly accounted for, and entered into the system or sent to their intended destination in a timely manner. Source data controls include the design of forms, pre-numbered forms sequence tests, turnaround documents (such as the payment remittance slip attached to invoices), cancellation and storage of documents, authorization, visual scanning, check digit verification, and radio-frequency identification (RFID) security.

Data-entry controls: Once data is collected, data-entry control procedures are needed to ensure that the data is entered correctly. Common tests to validate input include field checks, sign checks, limit checks, range checks, size checks, completeness checks, validity checks, and reasonableness tests. In addition to these controls, when using batch processing, the following data-entry controls should be used: sequence checks, error logs, and batch totals. Online data-entry controls include automatic entry of data, prompting, pre-formatted input forms, transaction logs, and error messages.

Processing controls: Controls that ensure data is processed correctly include using external and internal file labels to ensure that the correct and most current files are being updated, recalculating batch totals, and implementing data conversion controls and data transmission controls to minimize the risk of data transmission errors.

Output controls: Careful checking of system output provides additional control over processing integrity. Output controls are user reviews that make sure output is reasonable and complete, and that the intended recipient is correct. The reviews may

include reconciling all transactions and system updates to control reports and so on, reconciling control account balances to totals of subsidiary accounts, and reviewing external data reconciliation such as bank reconciliations.

Solution to Question 76

The goal of AI is to develop information systems that can react to the environment and function like human beings, meaning they can perform physical functions such as seeing, walking, talking, and listening, and intellectual functions such as thinking and reasoning. The ultimate objective for AI development is to give machines the ability to learn and to solve problems. This can result is more efficient decision-making and help organizations achieve their goals.

Some of the risks of AI are that the criteria used to make the decision can be incorrect or incomplete and that incorrect decisions can be more likely without human intervention. The implementation of AI can be costly, as can repairs. There are also ethical and moral concerns related to the use of AI.

Solution to Question 77

Canada's Personal Information Protection and Electronic Documents Act (PIPEDA) requires that privacy breaches that "pose a real risk of significant harm" be reported to the Office of the Privacy Commissioner (OPC) and to the affected individuals. PIPEDA defines "significant harm" as including humiliation, damage to reputation or relationships, and identity theft (among other harms).

If the nature of the computer crime materially affects the company's financial statements, and the company fails to disclose this information to its shareholders, auditors who discover the crime must issue a qualified audit report. (Note that auditors are not legally obligated to report the crime.)

Apart from these exceptions, there is no *legal* duty to report non-privacy-related computer crimes (for example, loss of intellectual property through theft of documents). Every individual must consider their own *moral* duties to report crimes. Moral arguments for reporting a computer crime include the following:

- Crime and corruption threaten political stability, and citizens have a moral duty to report these to the government to help law enforcement efforts.
- Innocent third parties may be affected by the crime without their knowledge.
- Reporting the crime may lead to finding the criminal who is responsible and thus prevent future crimes from occurring.

Solution to Question 78

Traditionally, the term “privacy” expresses space, decision, and information: the right not to be interfered with, the control over matters that affect you, and the ownership of things that are yours. All aspects of this definition come under pressure in the online world.

For example, a person relaxing in their backyard usually believes they are in a private space. Even if passersby can see over the fence, they are likely to be few and easily observed. (Information feedback is direct and immediate.) Upon discovering that the space is no longer private, the person can easily take remedial measures — cover up, go inside, and so on. (Decision-making control is also direct and immediate.)

Now, consider what happens when people post pictures of themselves in their backyard on social media. Even if the pictures are visible only to friends, they can be stored, recalled, and revisited at any time. (The notion of space is now greatly expanded, both over time and by the number of potential viewers.) Typically, the original poster does not know when or how the pictures are viewed. (Feedback information is greatly muted.) And, once posted, the pictures can be retransmitted, copied, and posted elsewhere, or even manipulated — all without the poster’s consent. (Decision-making control is lost.)

Perceptions of privacy are strongly affected by cultural values. For example, notions of space, decision, and information in Southeast Asia are very different from those in North America. Thus, the question of what is “private” or “personal” online is open to interpretation. Furthermore, the technical perils of posting pictures are now widely known, yet users continue to post, suggesting they knowingly accept the restrictions on their space, decision, and ownership — and thus privacy online no longer exists.

On the other hand, some people desire much stronger privacy. Even when people are careful with what they post online, they still discover that their personal information has been collected, analyzed, and linked to without their consent. The Cambridge Analytica scandal highlighted how supposedly private, secure information from online social media sites could be mined to develop detailed user profiles. The underlying concern from the general public is that unethical use of such profiles enables identity theft and other privacy violations. These violations go well beyond embarrassing Facebook posts and controversial Snapchat photos. Protecting innocent third parties is a foundation of ethical behaviour that should be respected everywhere.

In response to these and other concerns, governments are attempting to regulate online privacy. In Canada, PIPEDA requires that certain privacy breaches be reported to the OPC and to the affected individuals. In Europe, the General Data Protection Regulation (GPDR) protects internet users from clandestine tracking and unauthorized personal data usage.

Despite the increased privacy risks, some fear government intervention and any efforts made in gathering and tracking internet users’ information. On the other hand, many

believe such measures are needed for law enforcement to keep pace with online terrorism and rapidly changing communications technology.

There is no right answer in this debate. Internet privacy concerns arise because we surrender personal information in many ways online, from shopping to posting pictures on social media. Protecting against online privacy invasion requires that users inform and protect themselves through active measures.

Solution to Question 79

In large organizations, an internal control issue is created by the wide access to computer information available to a large user community, including non–information systems professionals. Problems or risks may arise from an incomplete understanding of information systems control concepts. For example, non–information systems professionals often do not understand the need for access control to prevent unauthorized access to sensitive data.

Many small organizations, due to their limited financial resources and fewer staff, have to strike a balance between the ideal and the practical in their choice of internal controls. For example, it is often not economically viable for a small organization to implement complete segregation of duties, a standard technique that is used in larger organizations.

Instead of the more elaborate controls used for larger organizations, small businesses may rely on:

- **Administrative (management) controls**: it may be impossible to segregate or rotate the duties of data preparation, computer operation, and the control function, given that one person may be performing all of these functions. However, controls that can be implemented include the use of manuals to guide operators, detailed and up-to-date operating instructions for each type of software, and frequent review by senior administrators to ensure that the control procedures are followed. Management supervision and review procedures are the most important controls in most small businesses.
- **Systems development controls:** systems development in small businesses is usually very different from that in larger businesses. Off-the-shelf software for accounting, word processing, and spreadsheets is often included with computers. Small businesses rarely develop their own applications software. However, management still needs to develop appropriate internal controls for how the business should use the off-the-shelf applications.

  These controls include standardized procedures to guide the system, starting from planning and acquisition, through to testing, purchasing, and implementation. Documentation of the system must be developed to show the appropriate inputs, outputs, and files to be used. Complete and comprehensive documentation,

including effective user manuals, should accompany the systems. Last but not least, the business has to develop authorization procedures to assign access rights.

- **Procedural controls:** the third element of internal control for small businesses is in the area of procedures. Management must set up a procedural control structure that will apply to all data in the business, from initiation of a typical transaction to the output of financial statements for each processing cycle. The procedural controls determine the data-processing work schedule for performing the inputs, processing, storage, and outputs. Control over the business's master files and transaction files should also be included.