1. Explain the potential value and the potential limitations of artificial intelligence.
2. Provide examples of the benefits, applications, and limitations of expert systems.
4. Provide examples of the use of fuzzy logic.
5. Describe the situations in which genetic algorithms would be most useful.
6. Describe the use case for several major types of intelligent agents.
Introduction to Intelligent Systems

This technology guide focuses on information systems that can make decisions by themselves. These systems are called **intelligent systems**. The major categories of intelligent systems are expert systems, neural networks, fuzzy logic, genetic algorithms, and intelligent agents. You will learn about each of these systems in the following sections.

The term *intelligent systems* describes the various commercial applications of artificial intelligence. **Artificial intelligence (AI)** is a subfield of computer science that studies the thought processes of humans and re-creates the effects of those processes via machines, such as computers and robots.

One well-publicized definition of AI is “behavior by a machine that, if performed by a human being, would be considered intelligent.” This definition raises the question, “What is **intelligent behavior**?” The following capabilities are considered to be signs of intelligence: learning or understanding from experience, making sense of ambiguous or contradictory messages, and responding quickly and successfully to new situations.

The ultimate goal of AI is to build machines that mimic human intelligence. A widely used test to determine whether a computer exhibits intelligent behavior was designed by Alan Turing, a British AI pioneer. The **Turing test** proposes a scenario in which a man and a computer both pretend to be women or men, and a human interviewer has to identify which is the real human. Based on this standard, the intelligent systems exemplified in commercial AI products are far from exhibiting any significant intelligence.

We can better understand the potential value of AI by contrasting it with natural (human) intelligence. AI has several important commercial advantages over natural intelligence, but it also displays some limitations, as outlined in Table TG 4.1.

Intelligent systems show up in a number of places, some of them surprising, as the following examples illustrate:

- A good session player is hard to find, but ujam (www.ujam.com) is always ready to rock. This Web app doubles as a studio band and a recording studio. It analyzes a melody and then produces sophisticated harmonies, bass lines, drum tracks, horn parts, and more.

  Before ujam can produce accompaniment, the app must figure out which notes the user is singing or playing. Once ujam recognizes these notes, its algorithms (an algorithm
is a problem-solving method expressed as a finite sequence of steps) use a mix of statistical
techniques and programmed musical rules to search for chords to match the tune.

- To the human eye, an x-ray is a murky puzzle. But to a machine, an x-ray—or a CT scan or
MRI scan—is a dense data field that can be assessed down to the pixel level. AI techniques
currently are being applied aggressively in the field of medical imaging.

New software gathers high-resolution image data from multiple sources—x-rays, MRI
scans, ultrasounds, CT scans—and then groups together biological structures that share
hard-to-detect similarities. For instance, the software can examine several images of the same
breast to measure tissue density. The software then color-codes tissues of similar densities so
humans can observe the pattern as well.

The software finds and indexes pixels that share certain properties, even pixels that are far
apart in one image or in a different image altogether. This process enables medical personnel
to identify hidden features of diffuse structures as well as features within a region of tissue.

- The human brain receives visual information from two eyes. Google’s AI system receives
visual information from billions of smartphone camera lenses. The company collects these
images from users of Google Goggles (www.google.com/mobile/goggles), a mobile service
that lets users run Web searches by taking pictures. Snap a barcode, and Goggles will shop
for the item’s best price. Take a picture of a book, and users will be linked to, for instance,
a Wikipedia page about the book’s author. Photograph the Eiffel Tower, and Goggles will
give you historical background on the landmark.

The software behind Goggles coordinates the efforts of multiple object-specific recognition
databases. There is a database for text, one for landmarks, one for corporate logos, and
so on. When an image arrives, Goggles transmits it to each of these databases, which in turn
use a variety of visual-recognition techniques to identify potential matches and compute
confidence scores (measures of how definitive the match is). Goggles then applies its own
algorithm to decide which result(s), if any, go back to the user. Goggles’ next category?
Identifying plants.
Building a model to run a major railroad is a complex task. One of the nation’s largest freight carriers, Norfolk Southern (www.nscorp.com), uses an intelligent system, the Princeton Locomotive and Shop Management System (PLASMA), to manage its huge operation. PLASMA uses algorithms to analyze the railroad’s operations by tracking thousands of variables to predict the impact of changes in fleet size, maintenance policies, transit time, and other factors. The key breakthrough was refining PLASMA so that it could mimic the complex behavior of the company’s dispatch center in Atlanta, Georgia. PLASMA examines vast amounts of historical data contained in the railroad’s databases. It then uses this analysis to model the dispatch center’s collective human decision making and suggest improvements.

before you go on...

1. What is artificial intelligence?
2. Differentiate between artificial and human intelligence.

Expert Systems

When an organization has to make a complex decision or solve a problem, it often turns to experts for advice. These experts possess specific knowledge and experience in the problem area. They can offer alternative solutions and predict whether the proposed solutions will succeed. At the same time, they can calculate the costs that the organization may incur if it doesn’t resolve the problem. Companies engage experts for advice on such matters as mergers and acquisitions, advertising strategy, and purchasing equipment. The more unstructured the situation, the more specialized and expensive is the advice.

Expertise refers to the extensive, task-specific knowledge acquired from training, reading, and experience. This knowledge enables experts to make better and faster decisions than non-experts in solving complex problems. Expertise takes a long time (often many years) to acquire, and it is distributed unevenly across organizations.

Expert systems (ESs) are computer systems that attempt to mimic human experts by applying expertise in a specific domain. Expert systems can either support decision makers or completely replace them. Expert systems are the most widely applied and commercially successful intelligent systems. A fascinating example of an expert system is IBM’s Watson (see the closing case of Chapter 2).

Human resources management uses expert systems to analyze applicants for available positions. These systems assign “scores” to candidates, lessening the workload for HR managers in the hiring process. Human HR managers still make the final decision, but the expert system provides useful information and recommendations.

An ES typically is decision-making software that can perform at a level comparable to a human expert in certain specialized problem areas. Essentially, an ES transfers expertise from a domain expert (or other source) to the computer. This knowledge is then stored in the computer, which users can call on for specific advice as needed. The computer can make inferences and arrive at conclusions. Then, like a human expert, it offers advice or recommendations. In addition, it can explain the logic behind the advice. Because ESs can integrate and manipulate enormous amounts of data, they sometimes perform better than any single expert can.

An often overlooked benefit of expert systems is that they can be embedded in larger systems. For example, credit card issuers use expert systems to process credit card applications.

The transfer of expertise from an expert to a computer and then to the user involves four activities:

1. Knowledge acquisition. Knowledge is acquired from domain experts or from documented sources.
2. **Knowledge representation.** Acquired knowledge is organized as rules or frames (object-oriented) and stored electronically in a knowledge base.

3. **Knowledge inferencing.** The computer is programmed so that it can make inferences based on the stored knowledge.

4. **Knowledge transfer.** The inferenced expertise is transferred to the user in the form of a recommendation.

The above examples demonstrate the usefulness of expert systems in a relatively narrow domain. Overall, however, expert systems may not be as useful as users would like. Consider the Microsoft® Windows troubleshooting software located in the Help section in the taskbar menu. Microsoft has designed this expert system to provide solutions, advice, and suggestions for common errors that users encounter in the operating system. We have all found however, that in some cases the Help section does not provide particularly useful advice.

**The Components of Expert Systems**

An expert system contains the following components: knowledge base, inference engine, user interface, blackboard (workplace), and explanation subsystem (justifier). In the future, ESs will include a knowledge-refining component as well. You will learn about all these components below. In addition, Figure TG 4.1 diagrams the relationships among these components.

The **knowledge base** contains knowledge necessary for understanding, formulating, and solving problems. It comprises two basic elements: (1) facts, such as the problem situation, and (2) rules that direct the use of knowledge to solve specific problems in a particular domain.

The **inference engine** is essentially a computer program that provides a methodology for reasoning and formulating conclusions. It enables the system to make inferences based on the stored knowledge. The inference engine is considered the “brain” of the ES.

Here is an example of the inference engine for a medical expert system for lung cancer treatment:

**IF** lung capacity is high
**AND** X-ray results are positive

**Recommended action**

---

**FIGURE TG 4.1** Structure and process of an expert system.
AND patient has fever
AND patient has coughing
THEN surgery is necessary.
IF tumor has spread
OR contraindications to surgery exist
THEN surgery cannot be performed.

The user interface enables users to communicate with the computer. The communication is carried out in a natural language, usually a question-and-answer format, and in some cases is supplemented by graphics. The dialogue between the user and the computer triggers the inference engine to match the problem symptoms with the knowledge contained in the knowledge base and then generate advice.

The blackboard is an area of working memory set aside for the description of a current problem, as specified by the input data. Thus, it is a kind of database.

Unique to an ES is its ability to explain its recommendations. This function is performed in a subsystem called the explanation subsystem or justifier. The explanation subsystem interactively answers questions such as the following: Why did the ES ask a certain question? How did the ES reach a particular conclusion? What is the plan to reach the solution?

Human experts have a knowledge-refining system; that is, they can analyze their own performance, learn from it, and improve it for future consultations. This type of evaluation is necessary in computerized learning as well so that the program can be improved by analyzing the reasons for its success or failure. Unfortunately, such a component is not available in commercial expert systems at the moment; however, it is being developed in experimental systems.

Applications, Benefits, and Limitations of Expert Systems

Today, expert systems are found in all types of organizations. They are especially useful in the ten generic categories shown in Table TG 4.2.

During the past few years, thousands of organizations worldwide have successfully applied ES technology to problems ranging from researching AIDS to analyzing dust in mines. Why have ESs become so popular? The answer is, because they provide such a large number of capabilities and benefits. Table TG 4.3 lists the major benefits of ESs.

<table>
<thead>
<tr>
<th>Category</th>
<th>Problem Addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interpretation</td>
<td>Inferring situation descriptions from observations</td>
</tr>
<tr>
<td>Prediction</td>
<td>Inferring likely consequences of given situations</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>Inferring system malfunctions from observations</td>
</tr>
<tr>
<td>Design</td>
<td>Configuring objects under constraints</td>
</tr>
<tr>
<td>Planning</td>
<td>Developing plans to achieve goal(s)</td>
</tr>
<tr>
<td>Monitoring</td>
<td>Comparing observations to plans, flagging exceptions</td>
</tr>
<tr>
<td>Debugging</td>
<td>Prescribing remedies for malfunctions</td>
</tr>
<tr>
<td>Repair</td>
<td>Executing a plan to administer a prescribed remedy</td>
</tr>
<tr>
<td>Instruction</td>
<td>Diagnosing, debugging, and correcting student performance</td>
</tr>
<tr>
<td>Control</td>
<td>Interpreting, predicting, repairing, and monitoring systems behavior</td>
</tr>
</tbody>
</table>

Table TG 4.2
Ten Generic Categories of Expert Systems
Despite all of these benefits, expert systems present some problems as well. The difficulties involved with using expert systems include the following:

- Transferring domain expertise from human experts to the expert system can be difficult because people cannot always explain how they know what they know. Often they are not aware of their complete reasoning process.
- Even if the domain experts can explain their entire reasoning process, automating that process may not be possible. The process might be either too complex or too vague, or it might require too many rules.
- In some contexts, there is a potential liability from the use of expert systems. Humans make errors occasionally, but they are generally “let off the hook” if they took reasonable care and applied generally accepted methods. An organization that uses an expert system, however, may lack this legal protection if problems arise later. The usual example of this issue is medical treatment, but it can also arise if a business decision driven by an expert system harms someone financially.

In the case of medical treatment, consider a physician who consults with a medical expert system when treating a patient. If the patient's care goes poorly, then the question arises, who is liable? The physician? The expert system? The vendor of the expert system?
Neural Networks

A neural network is a system of programs and data structures that simulates the underlying functions of the biological brain. A neural network usually involves a large number of processors operating in parallel, each with its own small sphere of knowledge and access to data in its local memory (see Figure TG 4.2). Typically, a neural network is initially “trained” or fed large amounts of data and rules about data relationships.

Neural networks are particularly adept at recognizing subtle, hidden, and newly emerging patterns within complex data, as well as interpreting incomplete inputs. Neural networks can help users solve a wide range of problems, from airline security to infectious disease control. They are the standard for combating fraud in the credit card, healthcare, and telecom industries, and they are becoming increasingly important in today's stepped-up international efforts to prevent money laundering.

Neural networks are used in a variety of ways, as illustrated by the following examples.

- The Bruce nuclear facility in Ontario, Canada, has eight nuclear reactors, making it the largest facility in North America and the second largest in the world. The plant uses a neural network in its checkpoint x-ray screening system to detect weapons concealed in personal belongings. The system also identifies biologically dangerous liquids.
- Neural networks are used in research into diseases like Alzheimer’s, Parkinson’s, and epilepsy. Researchers build robots with simulated rat brains that mimic the rats’ neural activity. The researchers then can study the brain’s function and its reaction to stimuli.
- Investors employ neural networks to forecast the performance of stock index futures, currencies, natural gas and oil stocks, T-bond futures, gold stocks, and other major investments.
- In banking systems, neural networks help detect fraud in credit card transactions and insurance claims, fight crime, and gauge customer satisfaction.

Figure TG 4.2 illustrates how a neural network might process a typical mortgage application. Note that the network has three levels of interconnected nodes (similar to the human brain): an input layer; a middle, or hidden, layer; and an output layer. When the neural network is

![Neural network diagram]

**FIGURE TG 4.2** Neural network.
trained, the strengths, or weights, of its connections change. In our example, the input nodes are age, income, occupation, marital status, employer, length of time with that employer, the desired amount of the mortgage, and the current interest rate. The neural network has already been trained with data input from many mortgage applications, successful and unsuccessful. That is, the neural network has established a pattern as to which input variables are necessary for a successful mortgage application. Interestingly, the neural network can adjust as both mortgage amounts and interest rates increase or decrease.

before you go on...

1. What are neural networks?

TG 4.4 Fuzzy Logic

Fuzzy logic is a branch of mathematics that deals with uncertainties by simulating the processes of human reasoning. The rationale behind fuzzy logic is that decision making is not always a matter of black or white, or true or false. Rather, it frequently involves gray areas where the term maybe is more appropriate.

A computer programmed to use fuzzy logic precisely defines subjective concepts that humans do not define precisely. For example, for the concept “income,” descriptive terms such as “high” and “moderate” are subjective and imprecise. Using fuzzy logic, however, a computer could define “high” incomes as those exceeding $200,000 per year, and “moderate” incomes as those ranging from $150,000 to $200,000 per year. A loan officer at a bank might then use these values when considering a loan application.

Fuzzy logic has also been used in financial analysis and Internet searches. In accounting and finance, fuzzy logic allows you to analyze assets expressed in imprecise values (e.g., intangible ones like goodwill). As an example, Google uses fuzzy logic to locate answers to your search terms, based on your perception of the topic as reflected in how you phrase your query, which determines the relevance of the Web pages that Google delivers to you.

before you go on...

1. What is fuzzy logic?
2. Give some examples where fuzzy logic is used.

TG 4.5 Genetic Algorithms

Recall that an algorithm is a problem-solving method expressed as a finite sequence of steps. A genetic algorithm mimics the evolutionary, “survival-of-the-fittest” process to generate increasingly better solutions to a problem. That is, a genetic algorithm is an optimizing method that finds the combination of inputs that produces the best outputs. Genetic algorithms have three functional characteristics:

- Selection (survival of the fittest): The key to selection is to give preference to better and better outcomes.
- Crossover: Combining portions of good outcomes in the hope of creating an even better outcome.
- Mutation: Randomly trying combinations and evaluating the success (or failure) of an outcome.
Genetic algorithms are best suited to decision-making environments in which thousands or millions of solutions are possible. Genetic algorithms can find and evaluate solutions intelligently, and they can process many more possibilities more thoroughly and quickly than a human can. (Users do have to tell the genetic algorithm what constitutes a “good” solution, which could be low cost or high return, or any number of other results.) Let’s look at some examples:

- Boeing uses genetic algorithms to design aircraft parts such as the fan blades on its 777 jet. Rolls Royce and Honda also use genetic algorithms in their design processes.
- Retailers such as Marks and Spencer, a British chain with 320 stores, use genetic algorithms to manage their inventories more effectively and to optimize their store displays.
- Air Liquide, a producer of industrial gases, uses genetic algorithms to find optimal production schedules and distribution points in its supply chain. The company, which has 40 plants and 8,000 client sites, must consider factors such as power prices and projections of customer demand, as well as the power costs and efficiency of each plant.

before you go on...

1. What is a genetic algorithm?
2. Give examples of the use of genetic algorithms.

Intelligent Agents

An intelligent agent is a software program that assists you, or acts on your behalf, in performing repetitive computer-related tasks. Intelligent agents often use expert systems and fuzzy logic behind the scenes to create their seemingly intelligent behavior.

You may be familiar with an early type of intelligent agent—the paper clip (“Clippy”) that popped up in early versions of Microsoft® Word. For example, if your document appeared as though it was going to be a business letter—that is, if you typed in a date, name, and address—the animated paper clip would offer helpful suggestions on how to proceed. Users objected so strenuously to this primitive intelligent agent that Microsoft eliminated it from subsequent versions.

There are many intelligent agents (also called bots), used for a wide variety of tasks. You can view the many different types of available agents by visiting BotSpot (www.botspot.com) and SmartBot (www.smartbot.com). The following sections examine three types of agents: information agents, monitoring-and-surveillance agents, and user or personal agents.

Information Agents

Information agents search for information and display it to users. The best known information agents are buyer agents. A buyer agent, also called a shopping bot, helps customers find the products and services they need on a Web site. There are many examples of information agents. We present a few illustrative cases below.

- The information agents for Amazon.com display lists of books and other products that customers might like, based on past purchases.
- Google and Ask.com use information agents to find information, and not just when you request it. Google, for example, sends out Googlebots to surf all the Web sites in Google’s index. These bots copy individual pages to Google’s repository, where Google’s software indexes them. Therefore, whenever you perform a Google search, the search engine builds a list of all the pages that have the keywords you specify, and it presents them to you in PageRank order. Google’s PageRank algorithm sorts Web pages based on the number of links on the Web that point to each page. That is, the more Web links that point to a particular page, the higher that page will be on the list.
• The Federal Electronic Research and Review Extraction Tool, or FERRET, was developed jointly by the Census Bureau and the Bureau of Labor Statistics. You can use FERRET to find information on employment, healthcare, education, race and ethnicity, health insurance, housing, income and poverty, aging, and marriage and the family.

**Monitoring-and-Surveillance Agents**

Monitoring-and-surveillance agents, also called predictive agents, constantly observe and report on some item of interest. There are many examples of predictive agents. Consider the following:

• Allstate uses monitoring-and-surveillance agents to manage its large computer networks 24/7/365. Every 5 seconds, the agent measures 1,200 data points. It can predict a system crash 45 minutes before it happens. The agent also watches to detect electronic attacks early so that they can be prevented.

• Monitoring-and-surveillance agents can watch your competitors and notify you of price changes and special offers.

• Predictive agents can monitor Internet sites, discussion groups, and mailing lists for stock manipulations, insider trading, and rumors that might affect stock prices.

• These agents can search Web sites for updated information on topics of your choice, such as price changes on desired products (e.g., airline tickets).

**User Agents**

User agents, also called personal agents, take action on your behalf. Let’s look at what these agents can do (or will be able to do shortly).

• Check your e-mail, sort it according to your priority rules, and alert you when high-value e-mails appear in your in-box.

• Automatically fill out forms on the Web for you. They also will store your information for future use.

**before you go on...**

1. Define intelligent agents, information agents, monitoring-and-surveillance agents, and user agents.

2. Explain the uses of each type of intelligent agent.

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**What’s In IT For Me?**

**For the Accounting Major**

Intelligent systems are used extensively in auditing to uncover irregularities. They also are used to uncover and prevent fraud. Today’s CPAs use intelligent systems for many of their duties, ranging from risk analysis to cost control. Accounting personnel also use intelligent agents for mundane tasks such as managing accounts and monitoring employees’ Internet use.

**For the Finance Major**

People have been using computers for decades to solve financial problems. Innovative intelligent applications have been developed for activities such as making stock market decisions, refinancing bonds, assessing debt risks, analyzing financial conditions, predicting business failures, forecasting financial trends, and investing in global markets. Often, intelligent systems can facilitate the use of spreadsheets and other computerized systems used in finance. Finally, intelligent systems can help reduce fraud in credit cards, stocks, and other financial services.
1. Explain the potential value and the potential limitations of artificial intelligence.
   Table TG 4.1 differentiates between artificial and human intelligence on a number of characteristics.

2. Provide examples of the benefits, applications, and limitations of expert systems.
   Expert systems are computer systems that attempt to mimic human experts by applying expertise in a specific domain. Tables TG 4.2 and TG 4.3 offer examples of expert systems.

   A neural network is a system of programs and data structures that simulate the underlying concepts of the human brain. Neural networks are used to detect weapons concealed in personal belongings, in research on various diseases, for financial forecasting, to detect fraud in credit card transactions, to fight crime, and many other applications.

4. Provide examples of the use of fuzzy logic.
   Fuzzy logic is a branch of mathematics that deals with uncertainties by simulating the process of human reasoning. Fuzzy logic is used in financial analysis, the manufacture of...
antilock brakes, measuring intangible assets like goodwill, and finding responses to search terms in Google.

5. **Describe the situations in which genetic algorithms would be most useful.**

A genetic algorithm is an intelligent system that mimics the evolutionary, survival-of-the-fittest process to generate increasingly better solutions to a problem. Genetic algorithms are used to design aircraft parts such as fan blades, to manage inventories more effectively, to optimize store displays, and to find optimal production schedules and distribution points.

6. **Describe the use case for several major types of intelligent agents.**

An intelligent agent is a software program that assists you, or acts on your behalf, in performing repetitive, computer-related tasks. Intelligent agents are used to display lists of books or other products that customers might like, based on past purchases; to find information; to manage and monitor large computer networks 24/7/365; to detect electronic attacks early so they can be stopped; to watch competitors and send notices of price changes and special offers; to monitor Internet sites, discussion groups, and mailing lists for stock manipulations, insider trading, and rumors that might impact stock prices; to check e-mail, sort it according to established priority rules, and alert recipients when high-value e-mails appear in their inbox; and to automatically fill out forms on the Web.

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**[ Chapter Glossary ]**

- **algorithm** A problem-solving method expressed as a finite sequence of steps.
- **artificial intelligence (AI)** A subfield of computer science that is concerned with studying the thought processes of humans and re-creating the effects of those processes via machines, such as computers.
- **buyer agent (or shopping bot)** An intelligent agent on a Web site that helps customers find products and services that they need.
- **expert systems (ESs)** Computer systems that attempt to mimic human experts by applying expertise in a specific domain.
- **fuzzy logic** A branch of mathematics that deals with uncertainties by simulating the processes of human reasoning.
- **genetic algorithm** An approach that mimics the evolutionary, “survival-of-the-fittest” process to generate increasingly better solutions to a problem.
- **information agent** A type of intelligent agent that searches for information and displays it to users.
- **intelligent agent** A software program that assists you, or acts on your behalf, in performing repetitive, computer-related tasks.
- **intelligent systems** A term that describes the various commercial applications of artificial intelligence.
- **monitoring-and-surveillance agents (or predictive agents)** Intelligent agents that constantly observe and report on some item of interest.
- **neural network** A system of programs and data structures that simulates the underlying concepts of the human brain.
- **personal agents** (see **user agents**)
- **predictive agents** (see **monitoring-and-surveillance agents**)
- **shopping bot** (see **buyer agent**)
- **Turing test** A test in which a man and a computer both pretend to be women (or men), and the human interviewer has to decide which is the real human.
- **user agents (or personal agents)** Intelligent agents that take action on your behalf.

**[ Discussion Questions ]**

1. Explain how your university could employ an expert system in its admission process. Could it use a neural network?
   
   What might happen if a student were denied admission to the university and his parents discovered that an expert system was involved in the admissions process?

2. One difference between a conventional business intelligence system and an expert system is that the former can explain **how** questions, whereas the latter can explain both **how** and **why** questions. Discuss the implications of this statement.
[Problem-Solving Activities]

1. You have decided to purchase a new video camcorder. To purchase it as inexpensively as possible and still get the features you want, you use a shopping bot. Visit several of the shopping bot Web sites that perform price comparisons for you. Begin with MySimon (www.mysimon.com), BizRate.com (www.bizrate.com), and Google Product Search.

   Compare these shopping bots in terms of ease of use, number of product offerings, speed in obtaining information, thoroughness of information offered about products and sellers, and price selection. Which site or sites would you use, and why? Which camcorder would you select and buy? How helpful were these sites in making your decision?

2. Access the MyMajors Web site (www.mymajors.com). This site contains a rule-based expert system to help students find majors. The expert system has more than 300 rules and 15,000 possible conclusions. The site ranks majors according to the likelihood that a student will succeed in them, and it provides six possible majors from among 60 alternative majors that a student might consider.

   Take the quiz, and see if you are in the “right major” as defined by the expert system. You must register to take the quiz.

3. Access Exsys (www.exsys.com), and click on the Corvid Demo (www.exsyssoftware.com/CORVID52/corvidsr?KBNAME=../Download2/DownloadForm.cvR). Provide your e-mail address, and click on the link for “Student—Needed for Class.” Try the various demos, and report your results to the class.

[Internship Activity]

Retail Industry

Amazon has huge advantage over bricks and mortar retailers with the intelligent systems they employ. All you have to do is get somewhere close to a product category and their intelligent systems will provide links to products other customers shopped for or bought after they viewed that particular item. Often, in a few clicks you have found a top rated product that you were not aware of a few minutes earlier.

For Harrison Kirby (owner of the golf shop from the Internship Activity from Chapter 7) this causes a real problem. He has a tough time competing with online golf stores because he is not able to carry their amount of inventory nor does he have the amount of data necessary to create these intelligent systems. Harrison is interested in creating a system that would allow his customers to tap into the intelligent systems that are available online but keep his customers in his store for purchases.

Please visit the Book Companion Site to receive the full set of instructions and learn how you can help Harrison develop a plan that would help him compete in such a highly competitive market.