**Study Guide: DSS, ESS and Intelligent Systems**

Define an expert system, describe how it works, and explain its value to business.

Expert systems are an intelligent technique for capturing tacit knowledge in a very specific and limited domain of human expertise. These systems capture the knowledge of skilled employees in the form of a set of rules in a software system that can be used by others in the organization.

Expert systems model human knowledge as a set of rules that collectively are called the knowledge base. The strategy used to search through the collection of rules and formulate conclusions is called the inference engine. The inference engine works by searching through the rules and “firing” those rules that are triggered by facts gathered and entered by the user.

Expert systems help organizations make high-quality decisions with fewer people. They are used in discrete, highly structured, decision-making situations where expertise is expensive or in short supply.

Define case-based reasoning and explain how it differs from an expert system.

Case-based reasoning (CBR) uses descriptions of past experiences of human specialists, representing them as “cases” and storing them in a database for later retrieval when the user encounters a new case with similar parameters. The system searches for stored cases similar to the new one, locates the closest fit, and offers the solution to the old case for use with the new case. If the new case fits the solution, it is added to the case database. If not, the case will be added with a new solution or explanations as to why the solution did not work. CBR differs from expert systems in that it captures the knowledge of the organization rather than a single expert, and the knowledge is captured as cases rather than if-then rules. Also, expert systems work by applying IF-THEN-ELSE rules against a knowledge base whereas CBR represents knowledge as a series of cases. With case-based reasoning, the knowledge base is continuously updated by the users.

Define a neural network and describe how it works and how it benefits businesses.

Neural networks are usually physical devices (although they can be simulated with software) that emulate the physiology of animal brains. Neural networks are used for solving complex, poorly understood problems for which large amounts of data have been collected. They find patterns and relationships in massive amounts of data that would be too complicated and difficult for a human being to analyze. Neural networks “learn” patterns from large quantities of data by sifting through data, searching for relationships, building models, and correcting over and over again the model’s own mistakes.

In a neural network, the resistors in the circuits are variable, and can be used to teach the network. When the network makes a mistake, i.e., chooses the wrong pathway through the network and arrives at a false conclusion, resistance can be raised on some circuits, forcing other neurons to fire. Used after a false conclusion, intervention teaches the machine the correct response. If this learning process continues for thousands of cycles, the machine learns the correct response. The simple neurons or switches are highly interconnected and operate in parallel so they can all work simultaneously on parts of a problem. Neural networks are very different from expert systems where human expertise has to be modeled with rules and frames. In neural networks, the physical machine emulates a human brain and can be taught from experience.

Define and describe fuzzy logic, genetic algorithms, and intelligent agents. Explain how each works and the kinds of problems for which each is suited.

Fuzzy logic is a rule-based AI technology that tolerates imprecision by creating rules that use approximate or subjective values and incomplete or ambiguous data. Fuzzy logic represents more closely the way people actually think than traditional IF-THEN rules. For example, if we all agree that 120 degrees is hot and -40 degrees is cold, then is 75 degrees hot, warm, comfortable, or cool? The answer is fuzzy at best and cannot be programmed in an IF-THEN manner. Japan’s Sendai subway system uses a fuzzy logic system to control acceleration so it will operate more smoothly.

Genetic algorithms (adaptive computation) are a variety of problem-solving methods that are conceptually based on the method that living organisms use to adapt to their environment (process of evolution.) Genetic algorithms control the generation, variation, adaptation, and selection of possible problem solutions using genetically-based processes. As solutions alter and combine, the worst ones are discarded and the better ones survive to go on and produce even better solutions. Genetic algorithms are particularly suited to the areas of optimization, product design, and the monitoring of industrial systems. Organizations can use genetic algorithms to minimize costs and maximize profits and schedule and use resources efficiently. Genetic algorithms are ideal when problems are dynamic and complex and involve hundreds of variables or formulas. For example, General Electric used a genetic algorithm to help them design a jet turbine aircraft engine that required the use of about 100 variables and 50 constraint equations.

Intelligent agents are software programs that use a built-in or learned knowledge base to carry out specific, repetitive tasks for an individual user, business process, or software application. By watching the user of a program or system, an intelligent agent may customize the software system to meet the user’s needs, reducing software support costs. Intelligent agents can be used as wizards to help users do or learn how to perform a given task. Intelligent agents can be used to carry out “smart” searches of the database, data warehouse, or the Internet, reducing search costs and avoiding the problems of misdirected searches. Agent-based modeling applications model consumer, stock market, and supply chain behavior.

Define a geographic information system (GIS) and explain how it supports decision making.

Geographic information systems (GIS) are a special category of DSS that use data visualization technology to analyze and display data for planning and decision making in the form of digitized maps. The software can assemble, store, manipulate, and display geographically referenced information, tying data to points, lines, and areas on a map. GIS can thus be used to support decisions that require knowledge about the geographic distribution of people or other resources in scientific research, resource management, and development planning. For example, GIS might be used to help state and local governments calculate emergency response times to natural disasters or to help banks identify the best locations for installing new branches or ATM terminals. GIS tools have become affordable even for small businesses and some can be used on the Web.

**Define Executive Support Systems (ESS) and the Balanced Scorecard Framework.**

Executive support systems (ESS) help managers and executives focus on performance information that maximizes resources within the organization to improve the profitability and success of the company. There are two parts to developing an ESS: understand exactly what the most important performance information is and develop systems capable of delivering that information to the right people in an easy-to-use format. What are key performance indicators (KPI) should be for Furman? Obvious suggestions are enrollment numbers and the number of students in each academic discipline. Less obvious KPI might be drop-out rates or the number of students switching majors. Before you can develop an ESS, you need to understand exactly what data you should track.

ESS allow managers to increase their span of control by pushing decisions further down the management chain and decentralize many decisions. Conversely, ESS can centralize decision-making even more because managers have a wider range of information readily available.

**A balanced scorecard** focuses on measurable outcomes on four dimensions of a business’s performance: financial, business process, customer, and learning and growth. Each dimension uses key performance indicators (KPIs) to understand how well an organization is performing on any of the dimensions at any time. The framework of a balanced scorecard requires managers to focus on more than just financial performance. They must focus on things they are able to influence at the present time like customer satisfaction, business process efficiency, or employee training. The KPIs are developed by senior executives and are automatically provided to users through an executive support systems

**Management Decision Examples**

**1. Applebee’s:** the largest casual dining chain in the world wants to develop menus that are tastier and contain more items that customers want and are willing to pay for. How might information systems help management implement this strategy? What pieces of data would Applebee’s need to collect? What kinds of reports would be useful to help management make decisions on how to improve menus and profitability?

Applebee’s can use data from transaction processing systems and point-of-sale systems to track which menu items sell the best. The company can use external demographic data to understand potential customers by accessing data about ages, income levels, and the number of children per family. The company can also use external weather data to track which menu items should be advertised. For instance, if the weather prediction calls for a snowstorm, the company can feature hot soups and sandwiches. Managers can use trend reports to determine which menu items are selling the best at any particular time. Reports broken into regions may be helpful since tastes differ based on geographic location. Grits sell well in the South but poorly in the Northwest. Reports on how well individual items sell during specific times of the day or week may be helpful to adjust marketing campaigns.

**2. Canadian Pacific Railway:** The company used a tonnage-based operating model that focused on minimizing the total number of freight trains in service and maximizing the size of each train. It did not necessarily use crews, locomotives, and equipment efficiently, resulting in inconsistent transit times and delivery schedules. How could a DSS help Canadian Pacific and other railroads compete with trucking firms more effectively?

The railroad company can use a geographic information system to analyze and display data for planning and decision making in the form of digitized maps. The software assembles, stores, manipulates, and displays geographically referenced information, typing data to points, lines, and areas on a map. The GIS have modeling capabilities, enabling managers to change data and automatically revise business scenarios to find better solutions. The company can use external data from chambers of commerce, industries, and government agencies to determine product shipping metrics. Couple that with data from its internal database to decide optimal delivery times. Transaction processing data fed into the DSS could help make decisions about the best crew scheduling. OLAP and multidimensional DSS could mix the right crews, locomotives and delivery schedules to meet customer demands.

1. **How do executive support systems (ESS) help senior managers make better decisions?**

**Define and describe the capabilities of an ESS.**

Executive support systems help senior managers with unstructured problems that occur at the strategic level of the firm. ESSs provide data from both internal and external sources, including data from the Web and provide a generalized computing and communications environment that can be focused and applied to a changing array of problems. ESSs provide easy-to-use analytical tools and online displays to help users select and tailor the data as needed.

**Describe how the balanced scorecard helps managers identify important information requirements.**

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**Explain how ESS enhance managerial decisions making and provide value for a business.**

ESSs help senior executives monitor firm performance, spot problems, identify opportunities, and forecast trends. These systems can filter out extraneous details for high-level overviews or drill down to provide senior managers with detailed transaction data if required. Some display a high-level view of firm performance in the form of a digital dashboard. ESS help executives monitor key performance indicators and to measure performance against external environmental changes. ESS expand executives’ span of control because information is readily available and easy to access.