

Introduction to Decision Support Systems

Chapter 1 - 1

DSS Defined

- *Common characteristics:* most DSS applications have certain attributes.
- There are many definitions of a DSS, but all have three themes: (1) applied to unstructured problems, (2) supports but does not replace the decision process, and (3) is under the user's control.

2

Common DSS Characteristics

- Employed in semistructured or unstructured decision contexts
- Intended to support decision makers rather than replace them
- Supports all phases of the decision-making process
- Focuses on effectiveness of the process rather than efficiency
- Is under control of the DSS user

Chapter 1 - 3

Common DSS Characteristics (cont.)

- Uses underlying data and models
- Facilitates learning on the part of the decision maker
- Is interactive and user-friendly
- Is generally developed using an evolutionary, iterative process
- Can support multiple independent or interdependent decisions
- Supports individual, group or team-based decision-making

Chapter 1 - 4

What A DSS Can and Cannot Do

- The DSS is expected to extend the decision maker's capacity to process information.
- The DSS solves the time-consuming portions of a problem, saving time for the user.
- Using the DSS can provide the user with alternatives that might go unnoticed.
- It is constrained, however, by the knowledge supplied to it.
- A DSS also has limited reasoning processes.
- Finally, a "universal DSS" does not exist.

Chapter 1 - 5

Ingredients of a DSS

- Alter classified DSS components into seven categories depending on how they impacted the decision.
- Another approach focused on the language provided by the DSS to work with data.
- Building on these, the basic components of a DSS can be stated as:
 1. The data management system
 2. The model management system
 3. The knowledge engine
 4. The user interface
 5. The users

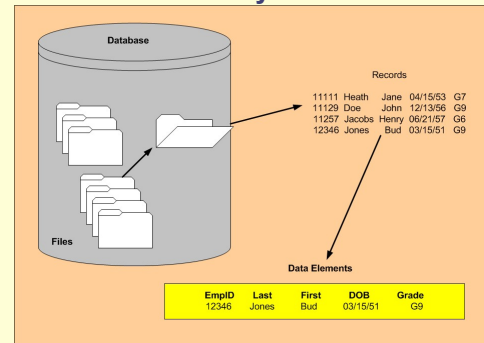
Chapter 1 - 6

Data and Model Management

- An increasing focus on the value of data to an organization pointed out that the quality and structure of the database largely determines the success of a DSS.
- A database organizes data into a logical hierarchy based on granularity of the data.
- The hierarchy contains four elements:
 1. Database
 2. Files
 3. Records
 4. Data elements

Chapter 1 - 7

Hierarchy of Data



Chapter 1 - 8

The Database Management System

- Even though the data within each file have a common structure (the record), the files themselves may be quite diverse.
- The important role of organizing the files and databases goes to the DBMS.
- The two main responsibilities of the DBMS are:
 1. Coordinating the tasks related to storing and accessing information.
 2. Maintenance of the logical independence between the data in the DSS database and the DSS application.

Chapter 1 - 9

General Functions of the DBMS

- Data definition** – providing a data definition language and allowing for interrelation of data
- Data manipulation** – providing a query language, allowing for capture and extraction
- Data integrity** – allows user to describe rules that maintain integrity and check for errors

Chapter 1 - 10

General Functions of the DBMS (cont.)

- Access control** – allows identification of users, controls access and tracks usage
- Concurrency control** – provides procedures for controlling the effects of simultaneous access
- Transaction recovery** – provides mechanisms for restart and reconciliation in the event of hardware failure

Chapter 1 - 11

The Model Base

- A model is a simplification of some event constructed to help study the event.
- The model base is the modeling counterpart to the database; it stores and organizes the various models the DSS uses in its analyses.
- The MBMS (or model base management system) is the counterpart to the DBMS.
- The model base is what differentiates a DSS from other information systems.

Chapter 1 - 12

General Functions of the MBMS

- **Modeling language** – allows for creation of decision models, provides a mechanism for linking multiple models
- **Model library** – stores and manages all models, provides a catalog and description.
- **Model manipulation** – allows for management and manipulation of the model base with functions (run, store, query, etc.) similar to those in a DBMS.

Chapter 1 - 13

DSS Knowledge Base

- Any true decision requires reasoning, which requires information.
- The knowledge base is where all of this information is stored by the DSS.
- Knowledge can just be raw information, or rules, heuristics, constraints or previous outcomes.
- This knowledge is different from information in either the database or model base in that it is problem-specific.

Chapter 1 - 14

Contents of the Knowledge Base

- Knowledge in the base can be categorized into two simple groups.
- **Facts** represent what we know to be true at a given time.
- **Hypotheses** represent the rules or relationships we believe to exist between the facts.

Chapter 1 - 15

Knowledge Acquisition and Retrieval

- One or more people called **knowledge engineers** gather the information for the knowledge base. These people are specially trained in techniques for extracting this from experts in the domain.
- The **inference engine** is the part of knowledge base that applies the rules to pull the information out in the form the user desires.

Chapter 1 - 16

User Interfaces

- An interface is a component designed to allow the user to access internal components of a system.
- In general, the more common the interface, the less training need be provided to users. Think, how many Windows programs use the same menu structure as Microsoft Word?
- The general functions of a DSS interface are the **communication language** and the **presentation language**.

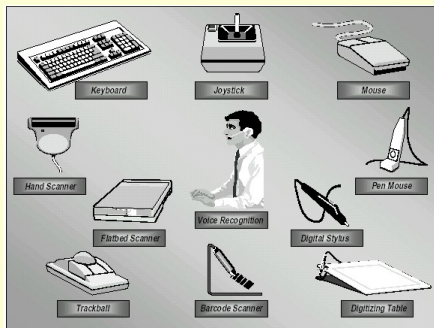
Chapter 1 - 17

General functions of the DSS Interface

- **Communication language** – allows for interaction with the DSS in a variety of ways, identifies form of input (see the next slide), provides support to DSS users, captures previous dialogues so future interactions can be improved.
- **Presentation language** – provides for presentation of data in a variety of formats, allows for detailed report generation, can provide multiple views of the data.

Chapter 1 - 18

Common Input Devices



Chapter 1 - 19

The DSS User

- In a DSS, the user is as much a part of the system as the hardware and software.
- User roles:** Alter classified users into five categories (decision maker, intermediary, maintainer, operator and feeder).
- Patterns of DSS use:** Alter further classifies the various user roles into one of four basic patterns of use. The next slide illustrates those patterns.

Chapter 1 - 20

Patterns of DSS Use

- Subscription mode** – the decision maker receives regularly scheduled reports.
- Terminal mode** – the decision maker interacts directly with the DSS.
- Clerk mode** – the decision maker uses the system directly, but not online. Output response may take some time.
- Intermediary mode** – the decision maker interacts through the use of one or more intermediaries.

Chapter 1 - 21

Categories and Classes of DSSs

A variety of methods attempt to categorize DSSs:

- Data-centric and model-centric
- Formal and ad hoc systems
- Directed versus nondirected DSSs
- Procedural and nonprocedural systems
- Hypertext systems
- Spreadsheet systems
- Individual and group DSSs

The unique characteristics of a particular scheme may be important in determining the best approach to the design of a new system.

Chapter 1 - 22

Let's assume we have a simple knowledge base that contains a selected number of variables deemed by experts to be the most important in evaluating a potential borrower's creditworthiness:

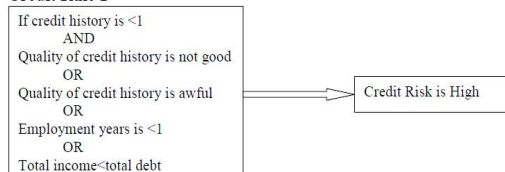
- Number of years of credit history (a numerical fact)
- Quality of the credit history (a ranking fact: perfect, almost perfect, very good, good, not good, awful)
- Job description of the borrower (a category fact: doctor, lawyer, computer operator, lecturer, etc)
- Number of years of employment in this job area (a numerical fact)
- Total income of the borrower (a numerical fact)
- Total debt obligations of the borrower (a numerical fact)
- Amount of money the borrower wants to borrow (a numerical fact)

Chapter 1 - 23

- In addition to these facts, the knowledge base should contain the relationships among them. The objective is to make a decision regarding whether we should lend money to a specific person.

Examples of Credit Rule Combinations (Relationships)

Credit Rule 1



Chapter 1 - 24

Credit Rule 2

If credit history is >1
AND NOT
Quality of credit history is not good
OR NOT
Quality of credit history is awful
AND
Total income > Total debt
AND
Employment years is >3
AND
Total income is >50,000
AND
Amount to borrow is <25,000

Credit Risk is Low
Make Loan

Note: The relationships between the facts are not focused on any particular person but rather are simply stated in the form of rules.

Chapter 1 - 25

EXERCISE

- Analyze a DSS application in the market. Describe its main components and summarize its functionalities
- The admissions office at JKUAT needs a DSS for evaluating applications. They need to build a database for the DSS. Specify the data sources and data that could be found for the admissions office to use.

Chapter 1 - 26