Chapter 12
Analyzing Semi-structured Decision Support Systems

Systems Analysis and Design

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Major Topics

- Decision support systems
- Decision-making style
- Analytic and heuristic decision making
- Intelligence, choice, and design
- Semistructured decisions
- Decision support system methods

Decision Support Systems

- Decision support systems are a class of information systems that emphasize the process of decision making and changing users through their interaction with the system
- Decision support systems are well suited for addressing semistructured problems where human judgment is still desired or required

Decision Support Systems

- Decision support systems function to
  - Organize information for decision situations
  - Interact with decision makers
  - Expand the decision maker's horizons
  - Present information for decision-maker understanding
  - Add structure to decisions
  - Use multiple-criteria decision-making models

Decision Support System Users

- Decision support systems support the decision-making process by helping the user explore and analyze alternatives through different modeling techniques

Decision Making Under Risk

- Decisions are made under three' sets of conditions:
  - Certainty
    - The decision makers know everything in advance of making the decision
  - Uncertainty
    - The decision makers know nothing about the probabilities or the consequences of decisions
  - Risk

Decision-Making Style

- Decision-making styles of users are categorized as either
  - Analytic or
  - Heuristic

Analytic Decision Making

- Relies on information that is systematically acquired and systematically evaluated to narrow alternatives and make a choice
- Use methodical, step-by-step procedures to make decisions
- Value quantitative information and the models that generate and use it

Analytic Decision Making

- Use mathematics to model problems and algorithms to solve them
- They seek optimal rather than completely satisfying solutions
- They use decision techniques such as graphing, probability models, and mathematical techniques to ensure a sound decision-making process

Heuristic Decision Making

- A heuristic decision maker makes decisions with the aid of guidelines which are not necessarily applied consistently or systematically
- It is experienced-based
- Learn by acting, use trial and error to find solutions, and rely on common sense to guide them

Analytic and Heuristic Decision Making

Analytic Decision Maker	Heuristic Decision Maker
Learns by analyzing	Learns by acting
Uses step-by-step procedure	Uses trial and error
Values quantitative information and models	Values experience
Builds mathematical models and algorithms	Relies on common sense
Seeks optimal solution	Seeks completely satisfying solution

Intelligence, Choice, and Design

- The decision-making process is divided into
  - Intelligence
  - Choice, and
  - Design phases

Intelligence Phase

- The intelligence phase involves the decision maker
  - Searching the external and internal business environment
  - Checking for
    - Decisions to make
    - Problems to solve
    - Opportunities to examine

Intelligence Phase

- A DSS can support this phase by having mechanisms for
  - Recognizing problems
  - Defining problems
  - Determining the scope of problems
  - Assigning priorities to problems

Choice Phase

- In the choice phase the decision maker chooses a solution to the problem or opportunity
- A DSS can help by reminding the decision maker what methods of choice are appropriate for the problem and by helping to organize and present the information

Design Phase

- In the design phase
  - The decision maker formulates the problem
  - Generates alternatives
  - Analyzes the alternatives

Design Phase

- A DSS can supports this phase by
  - Generating alternatives that might not occur to the decision maker
  - Quantifying or describing data, retrieving data, collecting new data, and manipulating data

Semistructured Decisions

- Structured decisions are those for which all or nearly all the variables are known and can be totally programmed
- A semistructured decision is one which is partially programmable, but still requires human judgment
- "Deep structure" is structure which is present but not yet apparent

Dimensions of Semistructured Decisions

- Three dimensions of a semistructured or unstructured decision
  - Degree of decision-making skill required
  - Degree of problem complexity
  - Number of criteria considered

Semistructured Decisions in Intelligence, Design, Choice

Intelligence	Design	Choice
Unable to identify the problem	Unable to generate alternatives	Unable to identify a choice method
Unable to define the problem	Unable to quantify or describe alternatives	Unable to organize and present information
Unable to prioritize the problem	Unable to assign criteria, values, weights, and rankings	Unable to select alternatives

Decision Support System

- A decision support system should be able to support multiple-criteria decision making

Decision Support System Methods

- Weighing method
- Sequential elimination by lexicography
- Sequential elimination by conjunctive constraints
- Goal programming
- Analytic Hierarchy Processing (AHP)
- Expert systems
- Neural nets
- Recommendation systems

Weighing Method

- The weighing method entails assigning various components of the alternatives a certain percentage and multiplying numerical scores for the components by the percentages

Sequential Elimination by Lexicography

- With the technique of sequential elimination by lexicography, attributes are ranked in order of importance rather than assigned weights
- Intra-attribute values are specified as with the weighing method

Sequential Elimination by Conjunctive Constraints

- With sequential elimination by conjunctive constraints, the decision maker sets constraints and eliminates alternatives that do not satisfy the set of all constraints

Goal Programming

- The goal-programming model contains
  - Decision and deviational variables
  - Priorities and sometimes weights
- Goals are set for each of the goal equations
- Is of limited use as a DSS tool because sensitivity analysis for goal programming is not yet well developed

Analytic Hierarchy Processing (AHP)

- Analytic Hierarchy Processing requires decision makers to judge the relative importance of each criteria and indicate their preference regarding the importance of each alternative criteria
- A disadvantage of AHP stems from the use of the pairwise method used to evaluate alternatives

Advantage of Analytic Hierarchy Processing

- AHP has an ease-of-use advantage over goal programming
  - The decision maker does not have to be skilled at formulating goal equations
  - The decision maker does not have to be knowledgeable about goals and priorities

Analytic Hierarchy Processing

- The three steps in AHP are
  - Determine which alternative is preferred over another and by how much, called a pairwise comparison
    - Comparing two alternatives to determine which is preferred and by how much
  - Repeat the process for each criteria
  - Rate each of the criteria according to its importance

Expert Systems

- Expert systems are rule-based reasoning systems developed around an expert in the field

Neural Nets

- Neural nets are developed by solving a number of a specific type of problems and getting feedback on the decisions, then observing what was involved in successful decisions

Recommendation Systems

- Recommendation systems are software and database systems that reduce the number of alternatives by ranking, counting, or some other method
- A recommendation system that does not use weights
- It simply counts the number of occurrences

World Wide Web and Decision Making - Push and Pull

- The World Wide Web may be used to extract decision-making information
- Push technologies automatically deliver new Internet information to a desktop
- Intelligent agents learn your personality and behavior and track topics that you might be interested in based on what it has learned

Simulations

- Simulations may be used to make decisions
- The user constructs a simulation and interacts with it to analyze situations