

Decision Support and Business Intelligence Systems

(9th Ed., Prentice Hall)



Chapter 2:

**Decision Making, Systems,
Modeling, and Support**



Learning Objectives

- Understand the conceptual foundations of decision making
- Understand the need for and the nature of models in decision making
- Understand Simon's four phases of decision making:
 - intelligence,
 - design,
 - choice, and
 - implementation



Learning Objectives

- Recognize the concepts of rationality and bounded rationality and how they relate to decision making
- Differentiate between the concepts of making a choice and establishing a principle of choice
- Learn how DSS provide support for decision making in practice
- Understand the systems approach



Opening Vignette:

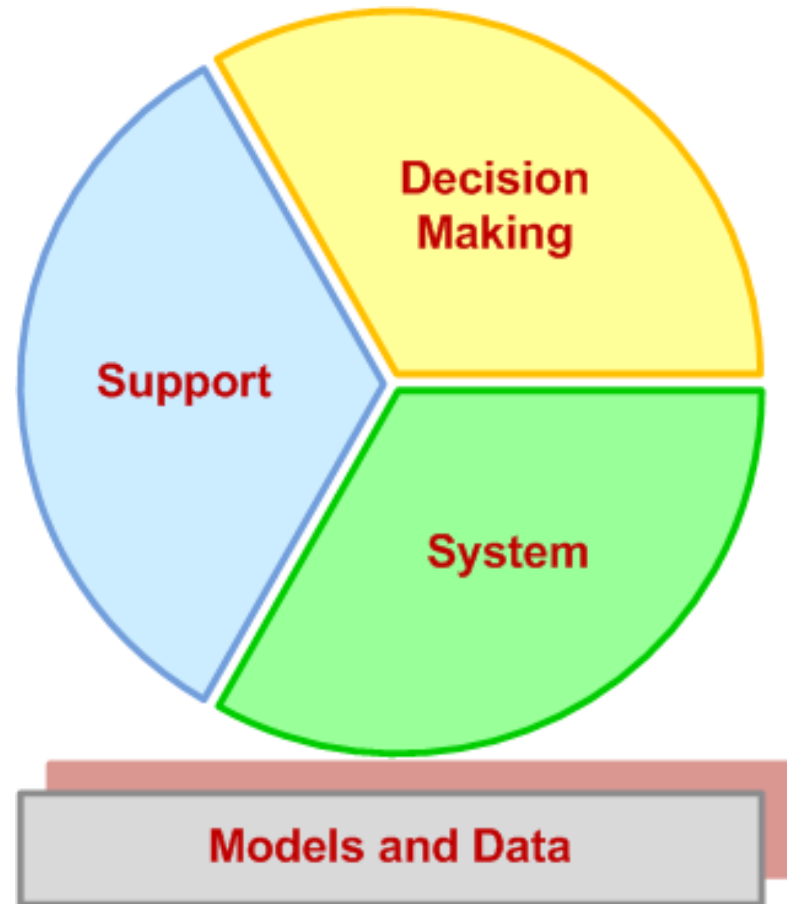
“Decision Modeling at HP Using Spreadsheets”

- Company background
- Problem
- Proposed solution
- Results
- Answer and discuss the case questions

Decision Support Systems (DSS)

Dissecting DSS into
its main concepts

Building successful DSS
requires a thorough
understanding of these
concepts





Characteristics of Decision Making

- Groupthink
- Evaluating what-if scenarios
- Experimentation with a real system!
- Changes in the decision-making environment may occur continuously
- Time pressure on the decision maker
- Analyzing a problem takes time/money
- Insufficient or too much information



Characteristics of Decision Making

- Better decisions
 - Tradeoff: accuracy versus speed
- Fast decision may be detrimental
- Areas suffering most from fast decisions
 - personnel/human resources (27%)
 - budgeting/finance (24%)
 - organizational structuring (22%)
 - quality/productivity (20%)
 - IT selection and installation (17%)
 - process improvement (17%)



Decision Making

- A process of choosing among two or more alternative courses of action for the purpose of attaining a goal(s)
- Managerial decision making is synonymous with the entire management process - *Simon (1977)*
- e.g., Planning
 - What should be done? When? Where? Why? How? By whom?



Decision Making and Problem Solving

- A problem occurs when a system
 - does not meet its established goals
 - does not yield the predicted results, or
 - does not work as planned
- Problem is the difference between the desired and actual outcome
- Problem solving also involves identification of new opportunities



Decision Making and Problem Solving

- Are problem solving and decision making different?
Or, are they the same thing?
- Consider phases of the decision process
 - Phase (1) Intelligence
 - Phase (2) Design
 - Phase (3) Choice, and
 - Phase (4) Implementation
- Some consider the entire phases (1-4) as problem solving with the choice phase (3) as decision making.
- Others view phases (1-3) as decision making and implementation phase (4) as problem solving
- This book: decision making \cong problem solving



Decision-Making Disciplines

- **Behavioral:** anthropology, law, philosophy, political science, psychology, social psychology, and sociology
- **Scientific:** computer science, decision analysis, economics, engineering, the hard sciences (e.g., biology, chemistry, physics), management science/operations research, mathematics, and statistics
- Each discipline has its own set of assumptions and each contributes a unique, valid view of how people make decisions



Decision Style

- The manner by which decision makers think and react to problems. This includes:
 - The way they perceive a problem
 - Their cognitive response
 - How values and beliefs vary from individual to individual and from situation to situation.
- When making decisions, people...
 - follow different steps/sequence
 - give different emphasis, time allotment, and priority to each steps



Decision Style

- Personality temperament tests are often used to determine decision styles
- There are many such tests
 - Meyers/Briggs,
 - True Colors (Birkman),
 - Keirsey Temperament Theory, ...
- Various tests measure somewhat different aspects of personality
- They cannot be equated!



Decision Style

- Decision-making styles
 - Heuristic versus Analytic
 - Autocratic versus Democratic
 - Consultative (with individuals or groups)
- A successful computerized system should fit the decision style and the decision situation
 - Should be flexible and adaptable to different users (individuals vs. groups)



Decision Makers

- Small organizations
 - Individuals
 - Conflicting objectives
- Medium-to-large organizations
 - Groups
 - Different styles, backgrounds, expectations
 - Conflicting objectives
 - Consensus is often difficult to reach
 - Help: Computer support, GSS, ...



Model

- A significant part of many DSS and BI systems
- A **model** is a simplified representation (or abstraction) of reality
- Often, reality is too complex to describe
- Much of the complexity is actually irrelevant in solving a specific problem
- Models can represent systems/problems at various degrees of abstraction



Types of Models

- Models can be classified based on their degree of abstraction

Less

Degree of abstraction

More

- Iconic models (scale models)
 - Two or three dimensional such as photograph, car, airplane, or production line.
- Analog models
 - Symbolic representation of reality. Usually two dimensional charts or diagrams. More abstracted. Such as maps and charts.
- Mental Models (qualitative)
 - Descriptive representation of decision making situations that people form in their heads. Such as cognitive maps. (qualitative).
- Mathematical (quantitative) models
 - More abstracted models are represented mathematically.



The Benefits of Models

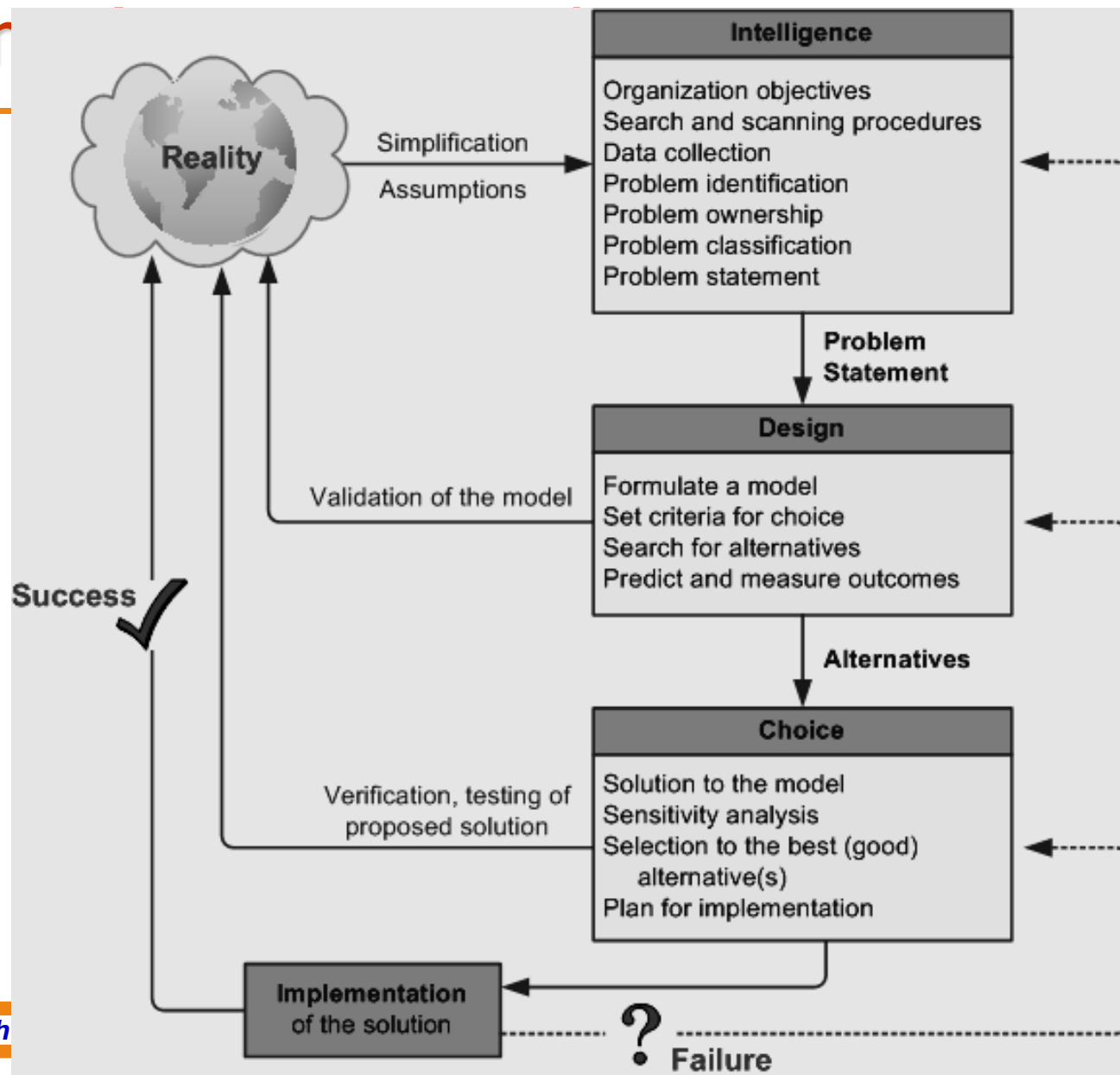
- Ease of manipulation
- Compression of time
- Lower cost of analysis on models
- Cost of making mistakes on experiments
- Inclusion of risk/uncertainty
- Evaluation of many alternatives
- Reinforce learning and training
- Web is source and a destination for it



Phases of Decision-Making Process

- Humans consciously or sub consciously follow a systematic decision-making process - Simon (1977)
 - 1) Intelligence
 - 2) Design
 - 3) Choice
 - 4) Implementation
 - 5) (?) Monitoring (a part of intelligence?)

Sim





Decision-Making: Intelligence Phase

- Scan the environment, either intermittently or continuously
- Identify problem situations or opportunities
- Monitor the results of the implementation
- **Problem** is the difference between what people desire (or expect) and what is actually occurring
 - Symptom versus Problem
- Timely identification of opportunities is as important as identification of problems



Decision-Making: Intelligence Phase

- Potential issues in data/information collection and estimation
 - Lack of data
 - Cost of data collection
 - Inaccurate and/or imprecise data
 - Data estimation is often subjective
 - Data may be insecure
 - Key data may be qualitative
 - Data change over time (time-dependence)



Decision-Making: Intelligence Phase

- Problem Classification
 - Classification of problems according to the degree of structuredness
- Problem Decomposition
 - Often solving the simpler subproblems may help in solving a complex problem
 - Information/data can improve the structuredness of a problem situation
- Problem Ownership
- Outcome of intelligence phase: **A Formal Problem Statement**



Decision-Making: The Design Phase

- Finding/developing and analyzing possible courses of actions
- A model of the decision-making problem is constructed, tested, and validated
- Modeling: conceptualizing a problem and abstracting it into a quantitative and/or qualitative form (i.e., using symbols/variables)
 - Abstraction: making assumptions for simplification
 - Tradeoff (cost/benefit): more or less abstraction
 - Modeling: both an art and a science



Decision-Making: The Design Phase

- Selection of a Principle of Choice
 - It is a **criterion** that describes the acceptability of a solution approach
 - Reflection of decision-making objective(s)
 - In a model, it is the result variable
 - Choosing and validating against
 - High-risk versus low-risk
 - Optimize versus satisfies
 - Criterion is not a constraint



Decision-Making: The Design Phase

- Normative models (= optimization)
 - the chosen alternative is demonstrably the best of all possible alternatives
 - Assumptions of rational decision makers
 - Humans are economic beings whose objective is to maximize the attainment of goals
 - For a decision-making situation, all alternative courses of action and consequences are known
 - Decision makers have an order or preference that enables them to rank the desirability of all consequences



Decision-Making: The Design Phase

- Heuristic models (= suboptimization)
 - the chosen alternative is the best of only a subset of possible alternatives
 - Often, it is not feasible to optimize realistic (size/complexity) problems
 - Suboptimization may also help relax unrealistic assumptions in models
 - Help reach a good enough solution faster



Decision-Making: The Design Phase

- Descriptive models
 - describe things as they are or as they are believed to be (mathematically based)
 - They do not provide a solution but information that may lead to a solution
 - **Simulation** - most common descriptive modeling method (mathematical depiction of systems in a computer environment)
 - Allows experimentation with the descriptive model of a system



Decision-Making: The Design Phase

- Good Enough, or Satisficing
 - “something less than the best”
 - A form of suboptimization
 - Seeking to achieving a desired level of performance as opposed to the “best”
 - Benefit: time saving
 - Simon’s idea of bounded rationality



Decision-Making: The Design Phase

- Developing (Generating) Alternatives
 - In optimization models (such as linear programming), the alternatives may be generated automatically
 - In most MSS situations, however, it is necessary to generate alternatives manually
 - Use of GSS helps generating alternatives
- Measuring/ranking the outcomes
 - Sometimes an outcome is expressed directly in terms of a goal for example profit is outcome and profit maximization is a goal and both expressed in dollar term.



Decision-Making: The Design Phase

- Risk
 - Lack of precise knowledge (uncertainty)
 - Risk can be measured with probability
- Scenario (what-if case)
 - A statement of assumptions about the operating environment (variables) of a particular system at a given time
 - Possible scenarios: best, worst, most likely, average (and custom intervals)



Decision-Making: The Choice Phase

- The actual decision and the commitment to follow a certain course of action are made here
- The boundary between the design and choice is often unclear (partially overlapping phases)
 - Generate alternatives while performing evaluations
- Includes the **search**, **evaluation**, and **recommendation** of an appropriate solution to the model
- Solving the model versus solving the problem!



Decision-Making: The Choice Phase

■ Search approaches

- Analytic techniques (solving with a formula)
- Algorithms (step-by-step procedures)
- Heuristics (rule of thumb)
- Blind search (truly random search)

■ Additional activities

- Sensitivity analysis (slight changes in the parameters should lead to slight or no changes in the alternative chosen)
- What-if analysis (used to explore major changes in the parameters)
- Goal seeking (determine values of the decision variables to meet a specific objectives)



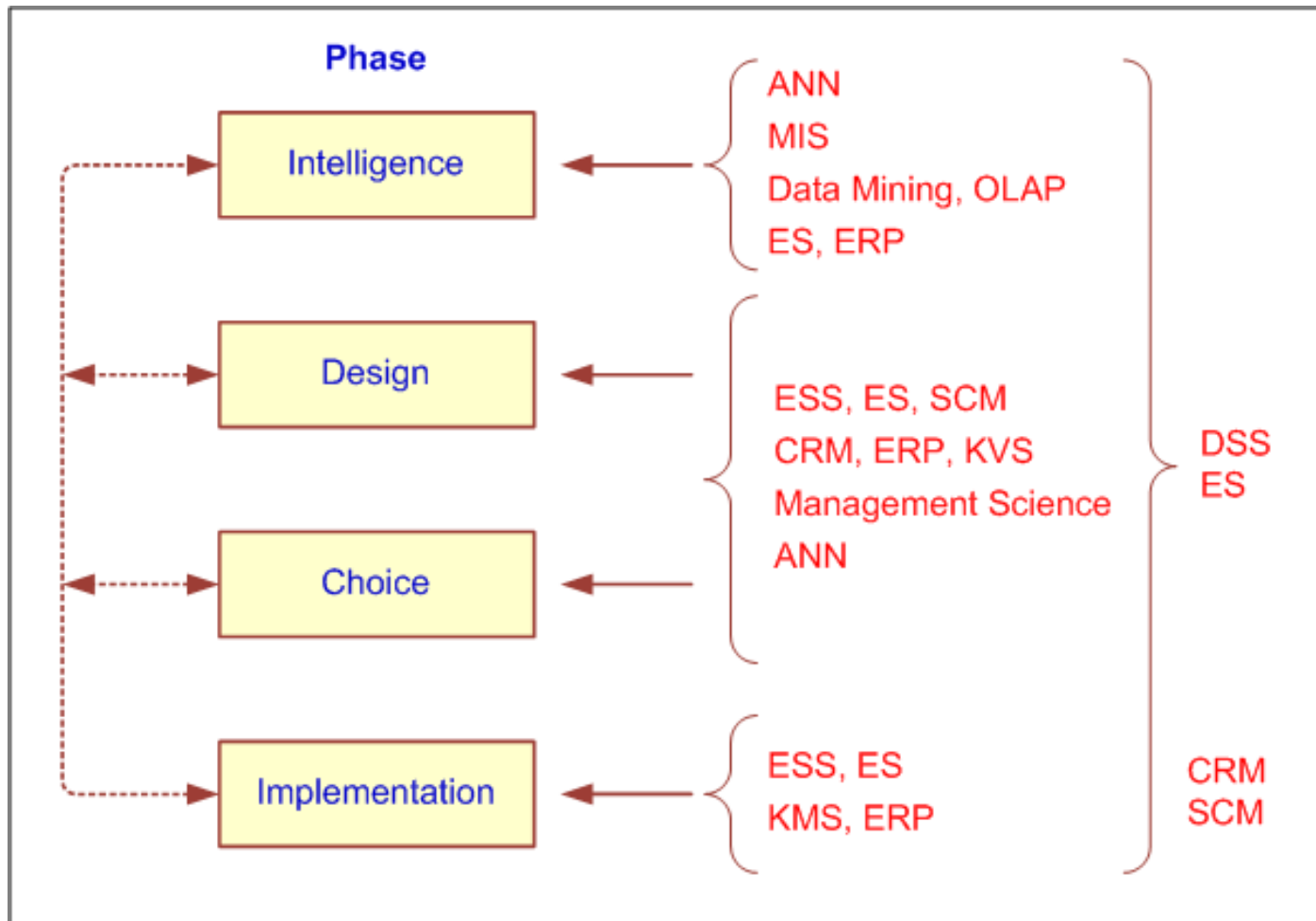
Decision-Making: The Implementation Phase

“Nothing more difficult to carry out, nor more doubtful of success, nor more dangerous to handle, than to initiate a new order of things.”

- The Prince, Machiavelli 1500s

- Solution to a problem = Change
- Change management?
- Implementation: putting a recommended solution to work

How Decisions Are Supported





How Decisions Are Supported

- Support for the Intelligence Phase
 - Enabling continuous scanning of external and internal information sources to identify problems and/or opportunities
 - Resources/technologies: Web; ES, OLAP, data warehousing, data/text/Web mining, EIS/Dashboards, KMS, GSS, GIS,...
 - Business activity monitoring (BAM)
 - Business process management (BPM)
 - Product life-cycle management (PLM)



How Decisions Are Supported

- Support for the Design Phase
 - Enabling generating alternative courses of action, determining the criteria for choice
 - Generating alternatives
 - **Structured/simple problems:** standard and/or special models
 - **Unstructured/complex problems:** human experts, ES, KMS, brainstorming/GSS, OLAP, data/text mining
- A good “criteria for choice” is critical!



How Decisions Are Supported

- Support for the Choice Phase
 - Enabling selection of the best alternative given a complex constraint structure
 - Use sensitivity analyses, what-if analyses, goal seeking
 - Resources
 - KMS
 - CRM, ERP, and SCM
 - Simulation and other descriptive models



How Decisions Are Supported

- Support for the Implementation Phase
 - Enabling implementation/deployment of the selected solution to the system
 - Decision communication, explanation and justification to reduce resistance to change
 - Resources
 - Corporate portals, Web 2.0/Wikis
 - Brainstorming/GSS
 - KMS , ES



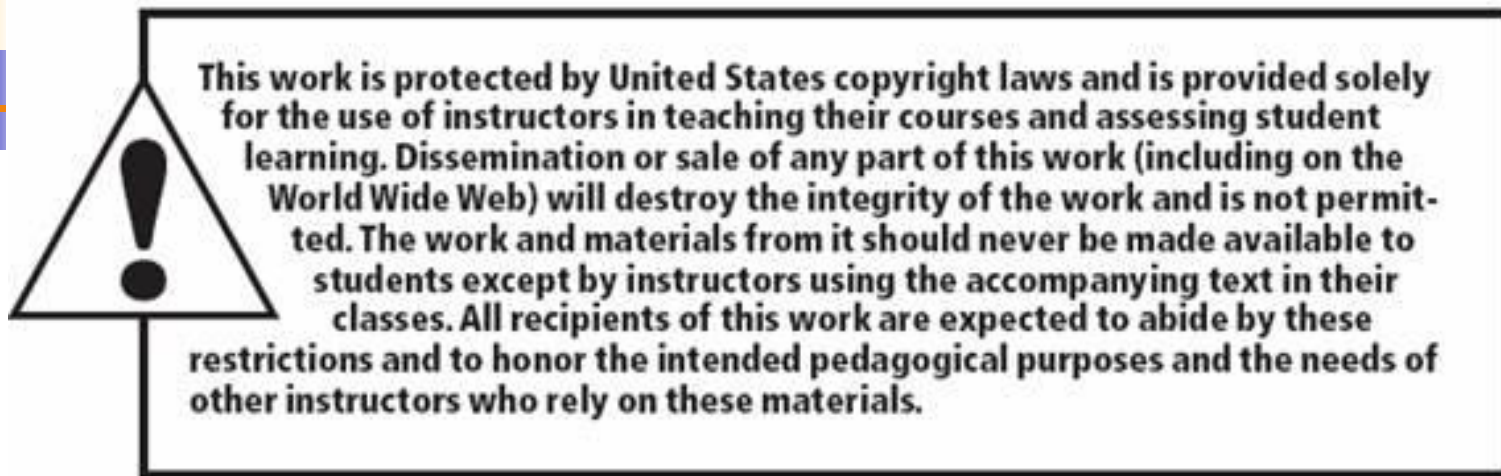
New Technologies to Support Decision Making

- Web-based systems
- m-Commerce
- PDA, Cell phones, Tablet PCs
- GSS with visual/immersive presence
- RFID and other wireless technologies
- Faster computers, better algorithms, to process “huge” amounts of heterogeneous/distributed data



End of the Chapter

- Questions / Comments...



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