Managers need high-quality and timely information to support decision making.
Chapter 6 Learning Objectives

**Business Intelligence**

- Describe the concept of business intelligence and how databases serve as a foundation for gaining business intelligence.

**Business Intelligence Components**

- Explain the three components of business intelligence: information and knowledge discovery, business analytics, and information visualization.
**Business Intelligence**

Describe the concept of business intelligence and how databases serve as a foundation for gaining business intelligence.

**Business Intelligence Components**

Explain the three components of business intelligence: information and knowledge discovery, business analytics, and information visualization.
Why Organizations Need Business Intelligence: Threats and Opportunities
Why Organizations Need Business Intelligence: Understanding Big Data

- Businesses are dealing with the challenge of “Big Data”
  - High Volume
    - Unprecedented amounts of data
  - High Variety
    - Structured data
    - Unstructured data
  - High Velocity
    - Rapid processing to maximize value
Why Organizations Need Business Intelligence: Continuous Planning

- Real-Time Management
- Continuous Planning Process
- Analyze
- Plan
- Manage
- Monitor
- Compare Actual Performance Against Goals
- Update & Adjust Plans
- Track & Monitor Business Processes
# Databases: Tables and Records

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<th>First Name</th>
<th>Street Address</th>
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<td>825 Skylark</td>
<td>Pullman</td>
<td>WA</td>
<td>99164</td>
<td>Human Resources</td>
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</tbody>
</table>
Types of Decisions You Face
Scenario – Warehouse Manager

• You know you have too much cash tied up in inventory. You want to reduce inventory levels.
• You get a lot of heat when orders are placed and you can’t fill the order from inventory.
• What information do you need, how would you like to see it and how do you make decisions about adjusting inventory levels?
• Are these structured or unstructured decisions?
Decision Support vs. Artificial Intelligence

Decision Support
- Decision support systems
- Geographic information systems

Helps you analyze information

Artificial Intelligence
- Expert systems
- Neural networks
- Genetic algorithms
- Intelligent agents

Makes or recommends a decision for you
Business Intelligence (BI)

• Business Intelligence (BI) is the use of information systems to gather and analyze information from internal and external sources in order to make better business decisions.

• BI is used to integrate data from disconnected:
  – Reports
  – Databases
  – Spreadsheets

• Integrated data helps to monitor and fine-tune business processes.
Databases & Data Warehouses

Operational Databases

- Change a product price
- How many products individually sold over $10,000 last month?
- Change advertising time table
- How much money was spent on radio advertising last month?
- Increase customer credit limit
- Who is delinquent in paying their bills?
What Is a Hypercube?

Create multi-dimensional “cubes” of information that summarize transactional data across a variety of dimensions.

OLAP vs. OLTP

Envisioned by smart businesspeople, built by the IT pros
Data Marts
Business Intelligence Components

**Business Intelligence**
Describe the concept of business intelligence and how databases serve as a foundation for gaining business intelligence.

**Business Intelligence Components**
Explain the three components of business intelligence: information and knowledge discovery, business analytics, and information visualization.
Business Intelligence Components

• Three types of tools
  – Information and knowledge discovery
  – Business analytics
  – Information visualization

• Information and Knowledge Discovery
  – Search for hidden relationships.
  – Hypotheses are tested against existing data.
    • For example: Customers with a household income over $150,000 are twice as likely to respond to our marketing campaign as customers with an income of $60,000 or less.
# Ad Hoc Reports and Queries

<table>
<thead>
<tr>
<th>Report/Query</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scheduled reports</td>
<td>Reports produced at predefined intervals—daily, weekly, or monthly—to support routine decisions</td>
</tr>
<tr>
<td>Key-indicator reports</td>
<td>Reports that provide a summary of critical information on a recurring schedule</td>
</tr>
<tr>
<td>Exception reports</td>
<td>Reports that highlight situations that are out of the normal range</td>
</tr>
<tr>
<td>Drill-down reports</td>
<td>Reports that provide greater detail, so as to help analyze why a key indicator is not at an appropriate level or an exception occurred</td>
</tr>
<tr>
<td>Ad hoc queries</td>
<td>Queries answering unplanned information requests to support a nonroutine decision; typically not saved to be run again</td>
</tr>
</tbody>
</table>
Online Analytical Processing (OLAP)

- Complex, multidimensional analyses of data beyond simple queries
- OLAP server — main OLAP component
- Key OLAP concepts:
  - Measures and dimensions
  - Cubes, slicing, and dicing
  - Data mining
  - Association discovery
  - Clustering and classification
  - Text mining and Web content mining
  - Web usage mining

One application of OLAP...
Cubes

• Cube—an OLAP data structure organizing data via multiple dimensions

• Cubes can have any number of dimensions
  – Be careful, most people can’t comprehend after 3 dimensions!

A cube with three dimensions
Slicing and Dicing

• Slicing and dicing—analyzing the data on subsets of the dimensions
Data Mining

• Used for discovering “hidden” predictive relationships in the data
  – Patterns, trends, or rules
  – Example: identification of profitable customer segments or fraud detection
  – Any predictive models should be tested against “fresh” data.

• Data-mining algorithms are run against large data warehouses.
  – Data reduction helps to reduce the complexity of data and speed up analysis.
Text mining the Internet

- **Internet**
  - Document Collection Spider
  - Document Warehouse
  - Text Mining System

  **Ranked Documents**
  1. Doc A
  2. Doc B
  3. Doc C
  4. ...

  **Clustered Documents**
  - Cluster A
  - Cluster B

  **Networked Documents**
  - Doc A
  - Doc B
  - Doc C
  - Doc D
  - Doc E
Textual Analysis Benefits

- Marketing—learn about customers’ thoughts, feelings, and emotions.
- Operations—learn about product performance by analyzing service records or customer calls.
- Strategic decisions—gather competitive intelligence.
- Sales—learn about major accounts by analyzing news coverage.
- Human resources—monitor employee satisfaction or compliance to company policies (important for compliance with regulations such as the Sarbanes-Oxley Act).
Web Usage Mining

- Used by organizations such as Amazon.com
- Used to determine patterns in customers’ usage data.
  - How users navigate through the site
  - How much time they spend on different pages
- Clickstream data—recording of the users’ path through a Web site.
- Stickiness—a Web page’s ability to attract and keep visitors.
Web Usage Mining

• Project 3
  – Create an e-Portfolio
  – Enable Google Analytics
  – Analyze the traffic to your site

• What will you be doing with Google Analytics?
Twitter Feeds

• Have you ever heard of anyone mining Twitter feeds?

• As a business person, what kind of information could you learn about your customers if you subscribed to every Twitter feed imaginable and mined the data?
Presenting Results

Diagram showing the flow of data from inventory, sales, and other data sources to data mining and visualization systems, which then feed into paper reports, digital dashboards and other systems, email alerts, and mobile users and systems.
Any Danger?

• Is there any danger in a business student becoming too “tech savvy”? 
• Is there an danger in a business student not becoming “tech savvy” enough? 
• What is a “program” and is there anything that is more nerdy that being a “programmer”? 

Should you be a little more of a nerd?
Business Analytics

• BI applications to support human and automated decision making
  – Business Analytics—predict future outcomes
  – Decision Support Systems (DSS)—support human unstructured decision making
  – Intelligent systems
  – Enhancing organizational collaboration
Decision Support Systems (DSS)

• Decision-making support for recurring problems
• Used mostly by managerial level employees (can be used at any level)
• Interactive decision aid
• What-if analyses
  – Analyze results for hypothetical changes
  – Example: Microsoft Excel
Architecture of a DSS
## Common DSS Models

<table>
<thead>
<tr>
<th>Area</th>
<th>Common DSS Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corporate level</td>
<td>Corporate planning, venture analysis, mergers and acquisitions</td>
</tr>
<tr>
<td>Accounting</td>
<td>Cost analysis, discriminant analysis, breakeven analysis, auditing, tax computation and analysis, depreciation methods, budgeting</td>
</tr>
<tr>
<td>Finance</td>
<td>Discounted cash flow analysis, return on investment, buy or lease, capital budgeting, bond refinancing, stock portfolio management, compound interest, after-tax yield, foreign exchange values</td>
</tr>
<tr>
<td>Marketing</td>
<td>Product demand forecast, advertising strategy analysis, pricing strategies, market share analysis, sales growth evaluation, sales performance</td>
</tr>
<tr>
<td>Human resources</td>
<td>Labor negotiations, labor market analysis, personnel skills assessment, employee business expenses, fringe benefit computations, payroll and deductions</td>
</tr>
<tr>
<td>Production</td>
<td>Product design, production scheduling, transportation analysis, product mix, inventory levels, quality control, plant location, material allocation, maintenance analysis, machine replacement, job assignment, material requirements planning</td>
</tr>
<tr>
<td>Management science</td>
<td>Linear programming, decision trees, simulation, project evaluation and planning, queuing, dynamic programming, network analysis</td>
</tr>
<tr>
<td>Statistics</td>
<td>Regression and correlation analysis, exponential smoothing, sampling, time-series analysis, hypothesis testing</td>
</tr>
</tbody>
</table>
Is Nicholas’ robot “intelligent”? Will it become “intelligent” over the summer?

Be wary of “Artificial” anything?
Expert Systems

Chest Pain Questions

Your answers to these questions are confidential and are not linked to your user name or password or other personally identifiable data such as those obtained for credit card payment. See our Privacy Policy.

1. Where is the chest pain located?
   - A. Under the sternum (breastbone) or between the shoulder blades
   - B. Left chest in front ("under the heart")
   - C. "Pit of stomach" or in mid upper abdomen
   - D. Along the sides of the sternum (breastbone) where the ribs join it (parasternal)
   - E. None of the above
   - F. Unknown/not applicable

2. How would you describe the character of the pain?
   - A. Prolonged, dull, or aching
   - B. Sharp, knife-like, or stabbing
   - C. A feeling of pressure, tightness, heaviness, or crushing sensation
   - D. None of above
   - E. Unknown/not applicable

3. Is pain precipitated by any of the following?
   - A. Emotional excitement or a meal
   - B. Exertion, sexual activity, or cold weather
Could You Use an Expert System?

• Talk to the person next to you about the various jobs that you have had.
• Discuss situations where a decision tree could be used to lead an employee who wasn’t really an expert through a series of questions and eventually to the answer they are looking for.
• Where is the intelligence...in the employee or the decision tree?
Can you recognize patterns and be trained?

- You see a new breed of dog
- How do you know it is a dog?
- How do you know it is even an animal?

- How do you know if an animal is a mammal?
- How about a whale?
- How about a platypus?
Scenario – Loan Officer

• You need to make approval/rejection decisions on loan applications?
• What information do you look at to make your decisions?
• Do you make decisions based on individual pieces of information or combinations of information?
• What combinations correlate with good/bad loans?
Example: Neural Network System

Neural Network System

Input:
- Age
- Income
- Debt Level
- Financial History
- Job Status
- Length of Employment
- Home Ownership
- Assets
- Investments
- Marital Status
- Spouse Income
- Dependents
- Health
...

Process:
- Brain
- Monitor
- Network Connections
- Input Data

Output:
- Recommendation
  - ✔️ Approve Loan
  - ❌ Reject Loan

Graph:
- Income
- Debt Level
- Financial History
- Spouse Income
- Dependants
- Marital Status
- Job Status
- Length of Employment
- Home Ownership
- Assets
- Investments
- Health

Decision Path:
- Woman at fork
- Decision: Approve or Reject Loan
Intelligent Agent Systems

• Program working in the background
• Bot (software robot)
• Provides service when a specific event occurs
Types of Intelligent Agent Systems

• User agents
  – Performs a task for the user

• Buyer agents (shopping bots)
  – Search for the best price

• Monitoring and sensing agents
  – Keep track of information and notifies users when it changes

• Data-mining agents
  – Continuously browse data warehouses to detect changes

• Web crawlers (aka Web spiders)
  – Continuously browses the Web

• Destructive agents
  – Designed to farm e-mail addresses or deposit spyware
Question

• What is a “Baby Boomer” and how many of them are in the workforce today?
• How many will be in the workforce 10 years from now?
• What is “Tacit Knowledge”?
• Why is this keeping CEOs awake at night?
• Is there technology that we can use to help with this?
Knowledge Management

Explicit Knowledge Assets

Tacit Knowledge Assets

?
**Benefits and Challenges of Knowledge-Based Systems**

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Challenges</th>
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</thead>
<tbody>
<tr>
<td>Enhanced innovation and creativity</td>
<td>Getting employee buy-in</td>
</tr>
<tr>
<td>Improved customer service, shorter product development, and streamlined operations</td>
<td>Focusing too much on technology</td>
</tr>
<tr>
<td>Enhanced employee retention</td>
<td>Forgetting the goal</td>
</tr>
<tr>
<td>Improved organizational performance</td>
<td>Dealing with knowledge overload and obsolescence</td>
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</table>
Information Visualization

- Display of complex data relationships using graphical methods
  - Enables managers to quickly grasp results of analyses
  - Visual analytics
  - Dashboards
  - Geographic information systems
Digital Dashboards

**Employee Absenteeism Summary**

- **Company Average**
- **Total Absenteeism**

**Absenteeism Drill Down**

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<tr>
<th>Department</th>
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*Exit*  *Next Screen*  *Drill Down*  *Exit*  *Prior Screen*  *E-Mail*
Dashboards

- Dashboards use various graphical elements to highlight important information.
Thematic Maps

- A thematic map showing car thefts in a town
Geographic Information System (GIS)