# BUSINESS ANALYTICS

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# WHAT IS DATA ANALYTICS?

**Analytics** is the use of:

data,

information technology,

statistical analysis,

quantitative methods, and

mathematical or computer-based models

to help managers gain improved insight about their business operations and make better, fact-based decisions.

**Business Analytics** (BI) is a subset of **Data Analytics**

# WHAT IS BUSINESS ANALYTICS?

- A field that drives practical, data-driven changes in a business
- A practical application of statistical analysis that focuses on providing actionable recommendations
- What would the Analyst do with the results?
  - Focus on how to apply the insights they derive from data
  - To draw concrete conclusions about a business by answering specific questions about
    - why things happened
    - what will happen and
    - what should be done.

# BUSINESS ANALYTICS APPLICATIONS

Business Analytics Applications

- Management of customer relationships
- Financial and marketing activities
- Supply chain management
- Human resource planning
- Pricing decisions
- Sport team game strategies

# WHAT IS BUSINESS ANALYTICS?

Importance of Business Analytics

- There is a strong relationship of BA with:
  - profitability of businesses
  - revenue of businesses
  - shareholder returns
- BA enhances understanding of data
- BA is vital for businesses to remain competitive
- BA enables creation of informative reports

# SCOPE OF BUSINESS ANALYTICS

- Descriptive analytics
  - uses data to understand past and present
- Predictive analytics
  - analyzes past performance and predict future effects
- Prescriptive analytics
  - uses optimization techniques
  - action plans

# SCOPE OF BUSINESS ANALYTICS

Retail Markdown Decisions

- Most department stores clear seasonal inventory by reducing prices.
- The question is:
  When to reduce the price and by how much?
- **Descriptive analytics**: examine historical data for similar products (prices, units sold, advertising, …)
- **Predictive analytics**: predict sales based on price
- **Prescriptive analytics**: find the best sets of pricing and advertising to maximize sales revenue

# DATA FOR BUSINESS ANALYTICS

- DATA

  - collected facts and figures

- DATABASE

  - collection of computer files containing data

- INFORMATION

  - comes from analyzing data

# DATA FOR BUSINESS ANALYTICS

- Metrics are used to quantify performance.
- Measures are numerical values of metrics.
- Discrete metrics involve counting

  - on time or not on time

  - number or proportion of on time deliveries
- Continuous metrics are measured on a continuum

  - delivery time

  - package weight

  - purchase price

# DATA FOR BUSINESS ANALYTICS

## A Sales Transaction Database File

| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 1 | **Sales Transactions: July 14** | | | | | | | |
| 2 | | | | | | | | |
| 3 | **Cust ID** | **Region** | **Payment** | **Transaction Code** | **Source** | **Amount** | **Product** | **Time Of Day** |
| 4 | 10001 | East | Paypal | 93816545 | Web | $20.19 | DVD | 22:19 |
| 5 | 10002 | West | Credit | 74083490 | Web | $17.85 | DVD | 13:27 |
| 6 | 10003 | North | Credit | 64942368 | Web | $23.98 | DVD | 14:27 |
| 7 | 10004 | West | Paypal | 70560957 | Email | $23.51 | Book | 15:38 |
| 8 | 10005 | South | Credit | 35208817 | Web | $15.33 | Book | 15:21 |
| 9 | 10006 | West | Paypal | 20978903 | Email | $17.30 | DVD | 13:11 |
| 10 | 10007 | East | Credit | 80103311 | Web | $177.72 | Book | 21:59 |
| 11 | 10008 | West | Credit | 14132683 | Web | $21.76 | Book | 4:04 |
| 12 | 10009 | West | Paypal | 40128225 | Web | $15.92 | DVD | 19:35 |
| 13 | 10010 | South | Paypal | 49073721 | Web | $23.39 | DVD | 13:26 |

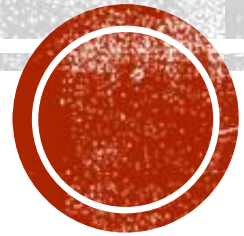
Records

Figure 1.1

Entities

Fields or Attributes

# TYPES OF DATA



- When collecting or gathering data we collect data from individuals cases on particular variables.
- A *variable* is a unit of data collection whose value can vary.
- Variables can be defined into *types* according to the level of mathematical scaling that can be carried out on the data.
- There are four types of data or levels of measurement:

| | |
|---|---|
| **1. Categorical (Nominal)** | **2. Ordinal** |
| **3. Interval** | **4. Ratio** |

# Categorical (Nominal) data

• **Nominal or categorical** data is data that comprises of categories that *cannot* be rank ordered – each category is just different.

• The categories available **cannot be placed in any order** and no judgement can be made about the relative size or distance from one category to another.

- Categories bear no quantitative relationship to one another
- Examples:
  - customer's location (America, Europe, Asia)
  - employee classification (manager, supervisor, associate)

• What does this mean**? No mathematical operations can be performed on the data relative to each other**.

•Therefore, nominal data reflect **qualitative differences** rather than quantitative ones.

# Nominal data

Examples:

**What is your gender?** *(please tick)*

Male ☐

Female ☐

**Did you enjoy the film?** *(please tick)*

Yes ☐

No ☐

# Nominal data

- Systems for measuring nominal data must ensure that each category is **mutually exclusive** and the system of measurement needs to be **exhaustive**.

- **Variables that have only two responses i.e. Yes or No, are known as *dichotomies*.**

# Ordinal data

- Ordinal data is data that **comprises of categories that *can* be rank ordered.**

- Similarly with nominal data the distance between each category cannot be calculated but the **categories can be ranked above or below each other.**

  - No fixed units of measurement
  - Examples:
    - college football rankings
    - survey responses
      (poor, average, good, very good, excellent)

- What does this mean? Can **make statistical judgements** and perform limited maths.

# Ordinal data

Example:

**How satisfied are you with the level of service you have received?** *(please tick)*

| | |
|---|---|
| Very satisfied | |
| Somewhat satisfied | |
| Neutral | |
| Somewhat dissatisfied | |
| Very dissatisfied | |

# Interval and ratio data

- Both interval and ratio data are examples of **scale data**.
- Scale data:
  - data is in numeric format ($50, $100, $150)
  - data that can be **measured on a continuous scale**
  - the **distance** between each can be observed and as a result **measured**
  - the data can be **placed in rank order**.

# Interval data

- Ordinal data but with constant differences between observations
- Ratios are not meaningful
- Examples:

•**Time** – moves along a continuous measure or seconds, minutes and so on and is without a zero point of time.

• **Temperature** – moves along a continuous measure of degrees and is without a true zero.

# Ratio data

- Ratio data measured on a ***continuous* scale** and ***does* have a natural zero point.**

  - Ratios are meaningful
  - Examples:
    - monthly sales
    - delivery times
    - Weight
    - Height
    - Age

## Classifying Data Elements in a Purchasing Database

| | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **Purchase Orders** | | | | | | | | | |
| 2 | | | | | | | | | | |
| 3 | **Supplier** | **Order No** | **Item No.** | **Item Description** | **Item Cost** | **Quantity** | **Cost per order** | **A/P Terms (Months** | **Order Date** | **Arrival Date** |
| 4 | Spacetime Technologies | A0111 | 6489 | O-Ring | $ 3.00 | 900 | $ 2,700.00 | 25 | 10/10/11 | 10/18/11 |
| 5 | Steelpin Inc. | A0115 | 5319 | Shielded Cable/ft. | $ 1.10 | 17,500 | $ 19,250.00 | 30 | 08/20/11 | 08/31/11 |
| 6 | Steelpin Inc. | A0123 | 4312 | Bolt-nut package | $ 3.75 | 4,250 | $ 15,937.50 | 30 | 08/25/11 | 09/01/11 |
| 7 | Steelpin Inc. | A0204 | 5319 | Shielded Cable/ft. | $ 1.10 | 16,500 | $ 18,150.00 | 30 | 09/15/11 | 10/05/11 |
| 8 | Steelpin Inc. | A0205 | 5677 | Side Panel | $195.00 | 120 | $ 23,400.00 | 30 | 11/02/11 | 11/13/11 |
| 9 | Steelpin Inc. | A0207 | 4312 | Bolt-nut package | $ 3.75 | 4,200 | $ 15,750.00 | 30 | 09/01/11 | 09/10/11 |
| 10 | Alum Sheeting | A0223 | 4224 | Bolt-nut package | $ 3.95 | 4,500 | $ 17,775.00 | 30 | 10/15/11 | 10/20/11 |
| 11 | Alum Sheeting | A0433 | 5417 | Control Panel | $255.00 | 500 | $ 127,500.00 | 30 | 10/20/11 | 10/27/11 |
| 12 | Alum Sheeting | A0443 | 1243 | Airframe fasteners | $ 4.25 | 10,000 | $ 42,500.00 | 30 | 08/08/11 | 08/14/11 |
| 13 | Alum Sheeting | A0446 | 5417 | Control Panel | $255.00 | 406 | $ 103,530.00 | 30 | 09/01/11 | 09/10/11 |
| 14 | Spacetime Technologies | A0533 | 9752 | Gasket | $ 4.05 | 1,500 | $ 6,075.00 | 25 | 09/20/11 | 09/25/11 |
| 15 | Spacetime Technologies | A0555 | 6489 | O-Ring | $ 3.00 | 1,100 | $ 3,300.00 | 25 | 10/05/11 | 10/10/11 |

Figure 1.2

# DATA FOR BUSINESS ANALYTICS

(continued)

## Classifying Data Elements in a Purchasing Database

| | A | B | C | D | E | F | G | H | I | J |
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| 15 | Spacetime Technologies | A0555 | 6489 | O-Ring | $ 3.00 | 1,100 | $ 3,300.00 | 25 | 10/05/11 | 10/10/11 |

Figure 1.2

Categorical
Categorical
Categorical
Categorical
Ratio
Ratio
Ratio
Ratio
Interval
Interval

# TYPES OF ANALYTICS

# DECISION MODELS

Model:

- An abstraction or representation of a real system, idea, or object
- Captures the most important features
- Can be a **written or verbal** description, a **visual display**, a **mathematical formula**, or a **spreadsheet** representation

# DECISION MODELS

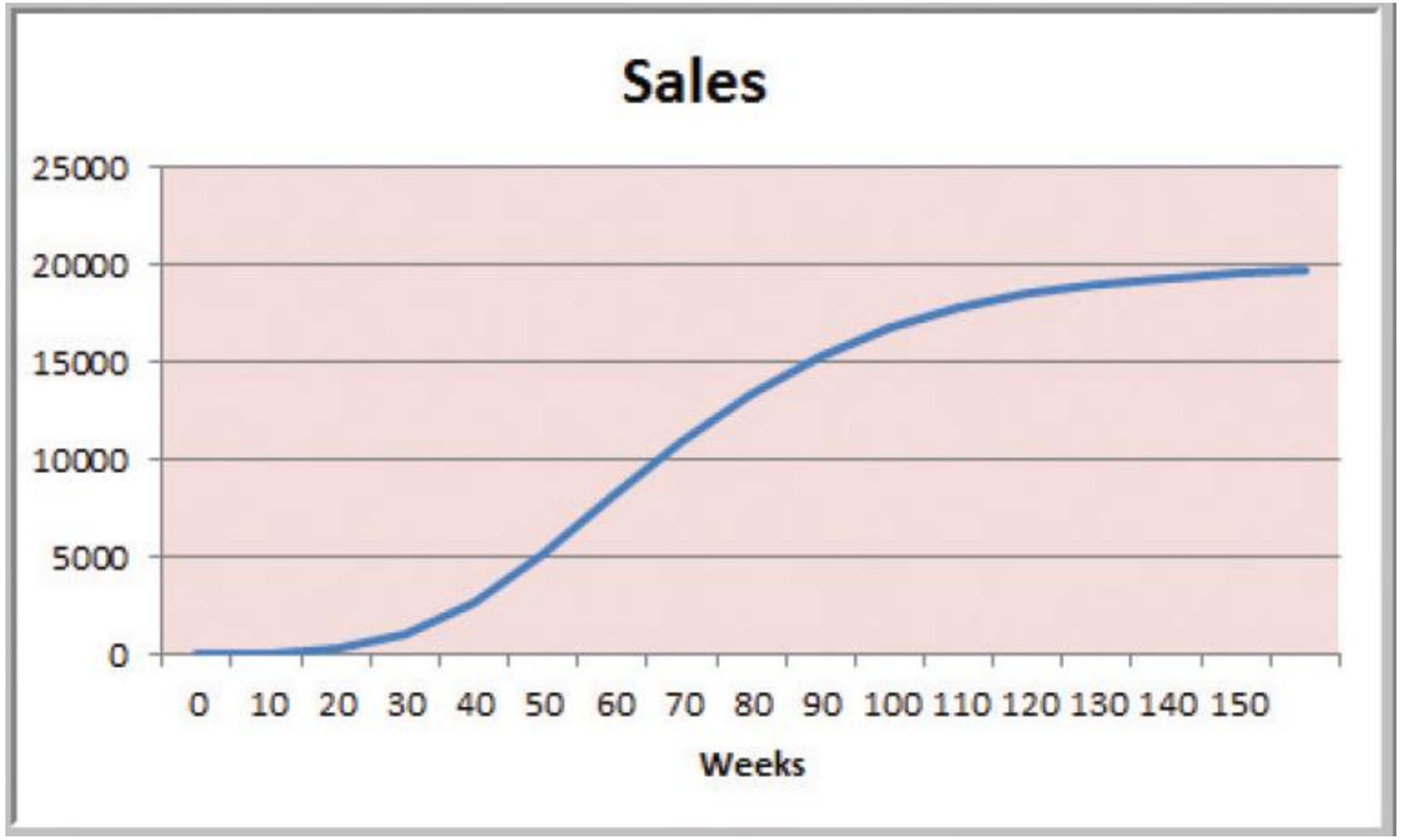



Figure 1.3

# DECISION MODELS

- A decision model is a model used to understand, analyze, or facilitate decision making.
- Types of model input

  **- data**

  **- uncontrollable variables**

  **- decision variables (controllable)**

# DECISION MODELS

**Descriptive Decision Models**

- Simply tell "what is" and describe relationships
- Do not tell managers what to do

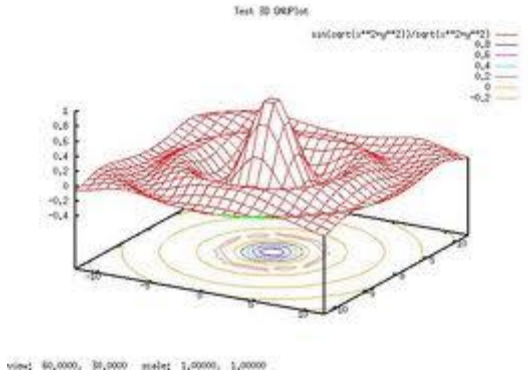
## An Influence Diagram for Total Cost

# Descriptive Analytics

- Descriptive analytics, such as reporting/OLAP, dashboards, and data visualization, have been widely used for some time.
- They are the core of traditional BI.

| Year | 2000 | | | |
|---|---|---|---|---|
| | Audio Division | | Video Division | |
| Line Items | Budget | Actual | Budget | Actual |
| Cost of Goods Sold | $6,851,006.49 | $7,132,961.38 | $4,322,514.74 | $4,526,954.71 |
| Marketing Expense | $750,179.20 | $756,596.17 | $455,048.05 | $462,815.40 |
| Research and Development Expense | $538,243.39 | $538,014.73 | $329,890.95 | $336,808.13 |
| Selling Expense | $1,632,921.64 | $1,579,790.18 | $986,887.49 | $927,970.90 |
| Taxes | $314,659.05 | $319,390.19 | $202,636.67 | $200,205.01 |

| Year | 2001 | | | |
|---|---|---|---|---|
| | Audio Division | | Video Division | |
| Line Items | Budget | Actual | Budget | Actual |
| Cost of Goods Sold | $2,554,556.31 | $2,700,773.16 | $1,726,031.16 | $1,773,448.08 |
| Marketing Expense | $294,766.22 | $290,696.70 | $187,757.29 | $176,778.55 |
| Research and Development Expense | $200,719.90 | $193,236.83 | $134,270.95 | $125,725.88 |
| Selling Expense | $620,427.30 | $611,649.47 | $405,092.93 | $400,181.91 |
| Taxes | $130,926.70 | $122,526.31 | $82,450.78 | $80,671.87 |



## *What has occurred?*

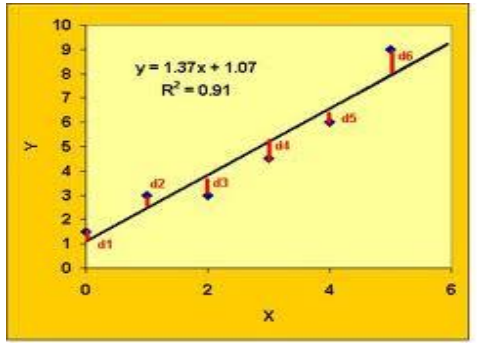
Descriptive analytics, such as data visualization, is important in helping users interpret the output from predictive analytics.

# DECISION MODELS

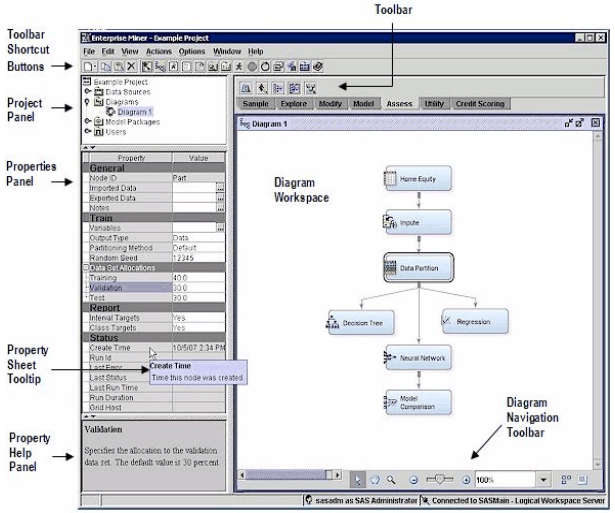
- **Predictive Decision** Models often incorporate uncertainty to help managers **analyze risk**.
- Aim to predict what will happen in the future.
- Uncertainty is imperfect knowledge of what will happen in the future.
- Risk is associated with the consequences of what actually happens.

# Predictive Analytics

- Algorithms for predictive analytics, such as **regression analysis, machine learning, and neural networks,** have also been around for some time.
- Prescriptive analytics are often referred to as advanced analytics.




*What will occur?*




- **Marketing is the target for many predictive analytics** applications.
- Descriptive analytics, such as data visualization, is important in helping users interpret the output from predictive and prescriptive analytics.

# DECISION MODELS

## A Linear Demand Prediction Model

As price increases, demand falls.

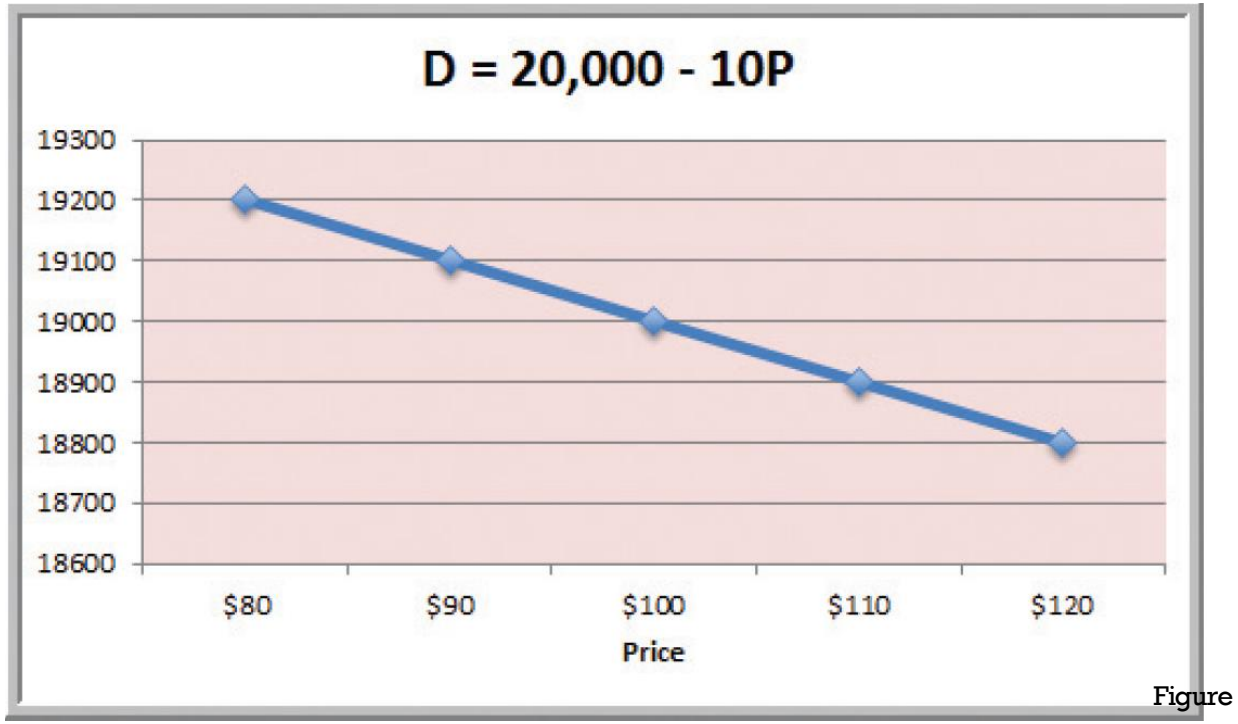



Figure 1.8

# DECISION MODELS

## A Nonlinear Demand Prediction Model

Assumes price elasticity (constant ratio of % change in demand to % change in price)

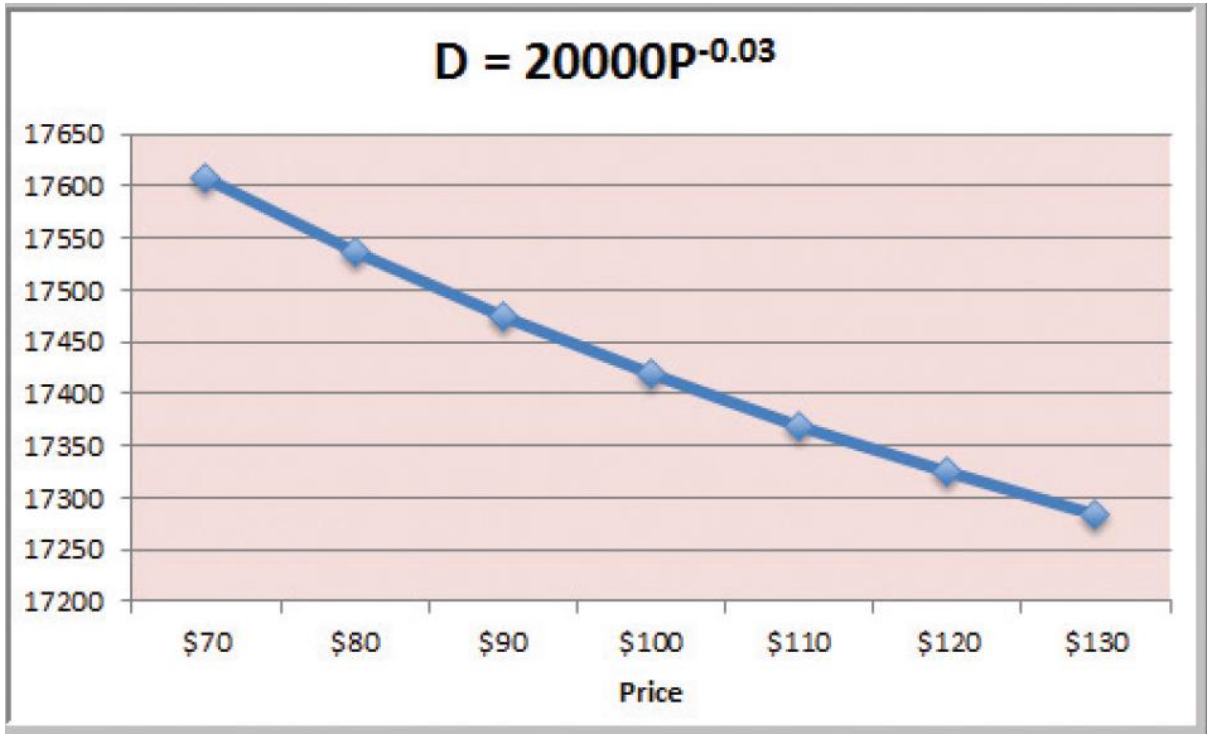



Figure 1.9

# DECISION MODELS

**Prescriptive Decision Models** help decision makers identify the best solution.

- Optimization - finding values of decision variables that minimize (or maximize) something such as cost (or profit).
- Objective function - the equation that minimizes (or maximizes) the quantity of interest.
- Constraints - limitations or restrictions.
- Optimal solution - values of the decision variables at the minimum (or maximum) point.

# ORGANIZATIONAL TRANSFORMATION

- Brought about by opportunity or necessity
- The firm adopts a new business model enabled by analytics
- Analytics are a competitive requirement

# CONDITIONS THAT LEAD TO ANALYTICS-BASED ORGANIZATIONS

- The nature of the industry
- Seizing an opportunity
- Responding to a problem

# THE NATURE OF THE INDUSTRY: ONLINE RETAILERS

## *BI Applications*

- Analysis of clickstream data
- Customer profitability analysis
- Customer segmentation analysis
- Product recommendations
- Campaign management
- Pricing
- Forecasting
- Dashboards

# THE NATURE OF THE INDUSTRY



- Online retailers like Amazon.com and Overstock.com are high volume operations who rely on analytics to compete.
- When you enter their sites a cookie is placed on your PC and all clicks are recorded.
- Based on your clicks and any search terms, recommendation engines decide what products to display.
- After you purchase an item, they have additional information that is used in marketing campaigns.
- Customer segmentation analysis is used in deciding what promotions to send you.
- How profitable you are, influences how the customer care center treats you.
- A pricing team helps set prices and decides what prices are needed to clear out merchandise.
- Forecasting models are used to decide how many items to order for inventory.
- Dashboards monitor all aspects of organizational performance

# THANKYOU !!!!