The World of Computerized Decision Support

(电脑化的决策支持世界**)**

NUS Computing Camp for High School Students 2011

Presented by:

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National University
of Singapore

School *of* **Computing**

About Me

- **Tan Wee Kek (陈伟克)**
  - I am an instructor and Ph.D. candidate with the Department of Information Systems (信息系统学系).
  - I teach information systems development (信息系统开发) – large scale business programming (大规模的商业软件编程) ☺

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What are Information Systems (什么是信息系统)?

- Information and communication technologies that help individuals and organizations to work more efficiently and effectively (应用信息和通信技术来帮助个人和组织更有效地工作).

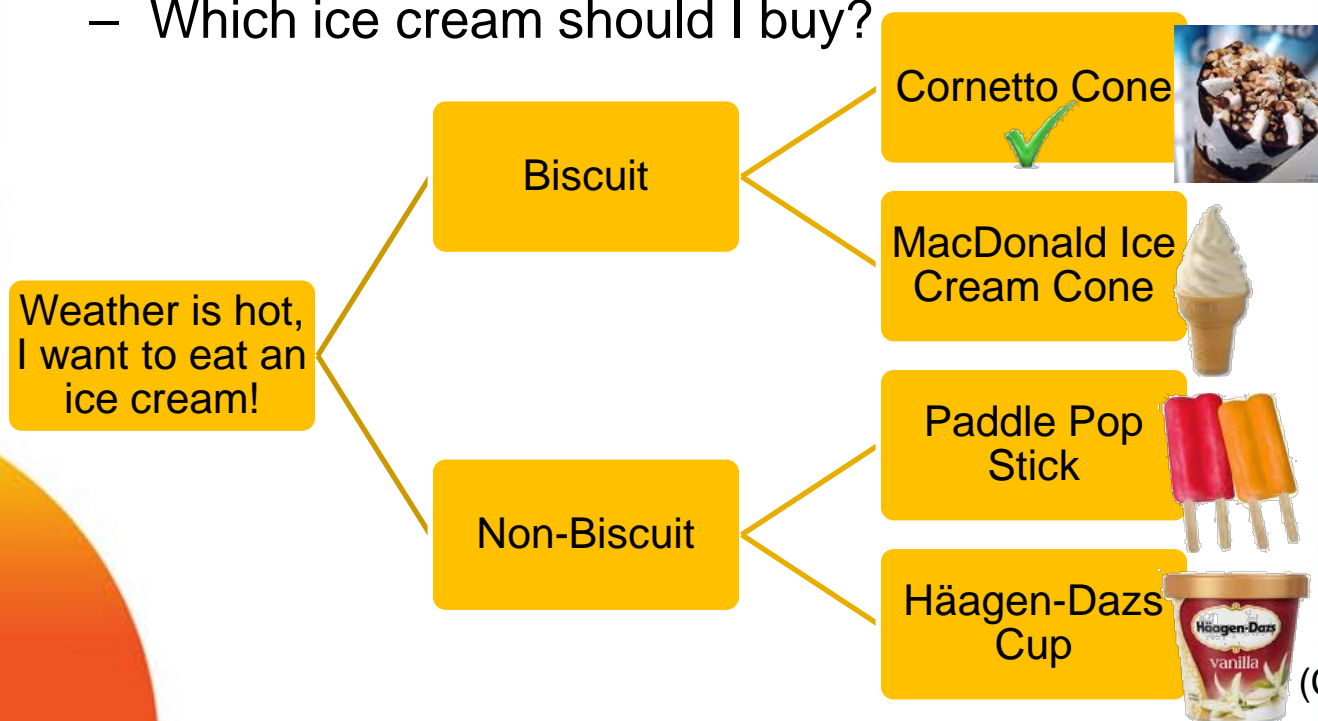- In a nutshell, we are……

  Computer Science + Business (电脑科学加商学)!

Today's Agenda

1. Introduction to Computerized Decision Support

2. Learning through Playing – The Ice Cream Game

3. Debrief

Introduction to Computerized Decision Support

*What is Decision Making (*决策*)?*

- A mental process that results in the selection of a course of action among several alternatives.

- Example:
  - Which ice cream should I buy?

Weather is hot, I want to eat an ice cream!

Biscuit

Non-Biscuit

Cornetto Cone

MacDonald Ice Cream Cone

Paddle Pop Stick

Häagen-Dazs Cup

Decision Making is Complex

- Decision itself is complex:
  - Many factors to consider: Price, flavor, availability, etc.
  - Should I even eat an ice cream? How about a cold drink?

- Decision making situation (局势) is complex:
  - Group decision, time pressure, cause and effect, etc.

Decision Making is Complex (cont')

- Decision maker (决策者) is not capable of making the decision:
  - Limited information processing capability, cognitive laziness, irrational, bias, etc.

Computerized Decision Making

- Computer can process a huge amount of complex information in a fast and accurate manner.

- But computer lacks problem solving ability in general (一般来说):
  - Cannot identify new problem or exception.
  - Cannot interpret (阐释) information.

Computerized Decision Making (cont')

- Example:
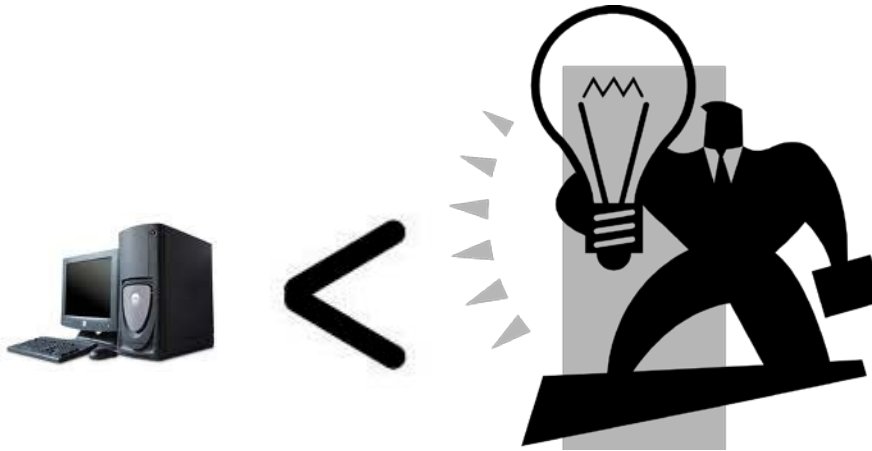 - Computer chooses Chocolate Nuts Ice Cream for you.

  - But computer is unaware that you are allergic to nuts and peanuts.

Computerized Decision SUPPORT

- Thus, computer supports but does not replace the human decision maker.

- More specifically, Decision Support System (DSS – 决策支持系统) provides information and tools to help in decision making.

Components (组成部分) of DSS

- **Data (数据)** – Raw facts.
  - Temperature and ice cream sales figures.

- **Model (模型)** – Representation of the real world.
  - Logical (逻辑).
    - IF <u>weather is hot</u> THEN <u>eat ice cream</u> ELSE <u>drink hot coffee</u>
  - Mathematical and statistical (数学和统计).
    - Profit = Revenue – Cost

Components (组成部分) of DSS (cont')

- **User Interface (UI – 用户界面)** – How decision maker interacts with the DSS.
  - Visual interface (可视化界面).

Types of DSS

- **Data-driven (**数据驱动**)** – Provides internal data to support decision making.
    - Ice cream sales by regions – Help to decide where to open new outlet.
    - Ice cream sales by months – Help to decide when to launch promotion.

- **Model-driven (**模型驱动**)** – Provides access to and manipulation of models to analyze problem and make decision.
    - Ice cream retailer – How much ice cream to order?

Other Types of DSS

- **Spreadsheet –based (电子表格式) DSS** – Use spreadsheets to model data.
  - *Demonstration:* Ice cream sales and order.
    - Cross-tabulation (交叉制表).
    - What-If and Goal Seek analyses.

- **Web-based (网页式) DSS** – DSS that is operated using a web browser (浏览器).
  - *Ice Cream Game.*

Other Types of DSS (cont')

- **Geographic Information Systems (地理信息系统)** – Display and analyze geographically referenced data.
    - *Demonstration:* StreetSine and OneMap.

Source: http://www.streetsine.com

More DSSs

- **Consumer (消费者) DSS**:
  - Example:
    - Tools for online shopping.
    - *Demonstration:* Comparison shopping – CNET Shopper
    - *Demonstration:* Recommendation Agent – Zion
- **Organizational (组织) DSS**:
  - Big companies need to make decisions too.
  - These decisions are, of course, also made by human.

Summary

- DSS uses data, model and user interface to help human in decision making.

- There are many types of DSS that can be used by you and me.

Learning through Playing – The Ice Cream Game

Helping Organizations to Make Decision

- The case of supply chain management (供应链管理).

- Supply chain is a systematic way to move products from manufacturer to consumer.

Ice Cream Supply Chain (冰淇淋供应链)

Consumer (消费者)	Retailer (零售商)	Wholesaler (批发商)	Distributor (经销商)	Factory (工厂)

- **Problem** – How does each node along the supply chain decide the amount of ice cream to order (供应链各节点如何决定订购多少冰淇淋)?

Ice Cream Game

- You will find out for yourself by playing the ice cream game.

- Simulate the ice cream supply chain:
  - Each team will form a supply chain of 4 nodes (节点).
  - Each node receives order from the downstream (下游) node and makes order with the upstream (上游) node to fulfill downstream node's demand.
  - Ship ice creams received from upstream node to downstream node.
  - Ensure that you have enough ice cream in your warehouse to meet downstream node's demand.

Ice Cream Game (con't)

- But its not easy because of time lag:
  - It takes 4 periods to move an order of ice creams between each node.
  - Example:
    - Retailer orders some ice creams in Period 3.
    - Order reaches Wholesaler in Period 4.
    - Wholesaler transports ice creams to Retailer in Period 5.
    - Ice creams arrive at Retailer in Period 6.
    - Retailer makes ice creams available in warehouse for sales in Period 7.

Ice Cream Game (con't)

- And its not easy because of cost $$$:
  - Each ice cream stored in your warehouse costs $1.
  - Each shortfall ice cream that you cannot meet the order received costs $2
    - Unsatisfied customers.

我要吃
冰淇淋?!

- See which team has the lowest cost at the end!

Starting the Game

- Each node starts with:
  - 12 ice creams in the warehouse.
  - 4 ice creams in the receiving stage.
  - 4 ice creams in the transport stage from the upstream node.
  - An unknown "Order Received".
- Altogether 25 periods.

Playing the Game

- Follow instructions on the game board.
- You receive an order and transport the required ice cream.
- There could be a shortfall.
- Then you place an order for more ice cream.
  - **Period X** – Order made (下订单).
  - **Period X+1** – Order reached upstream node (订单传送到上游节点).
  - **Period X+2** – Order transported (出货).
  - **Period X+3** – Order received (收货).
  - **Period X+4** – Ready for sales (售货).
- Update game record.

Organizational DSS

- Each team makes your own order decision.

- *Champion Ice Cream* will use a DSS to play the game.

  - Can choose to ignore the recommendation.

- At the end of 25 periods, the team with a total cost lower or equal to *Champion Ice Cream* will win a prize!

- Regardless, the non-DSS team with the lowest cost will still win a prize.

Debrief

Supply Chain Decision

- Uncertainty in the ice cream demand (需求不明确):
  - Order too much: Inventory cost and wastage.
  - Order too little: Shortfall / Backorder cost and unhappy customers.

- Lag time (滞后时间) in the ordering process:
  - Order goes from retailer to wholesaler, etc.
  - Factory needs time to manufacture and transport to distributor, etc.

Supply Chain Decision (cont')

- Each node keeps safety stock (安全库存) to meet demand surge (需求激增):
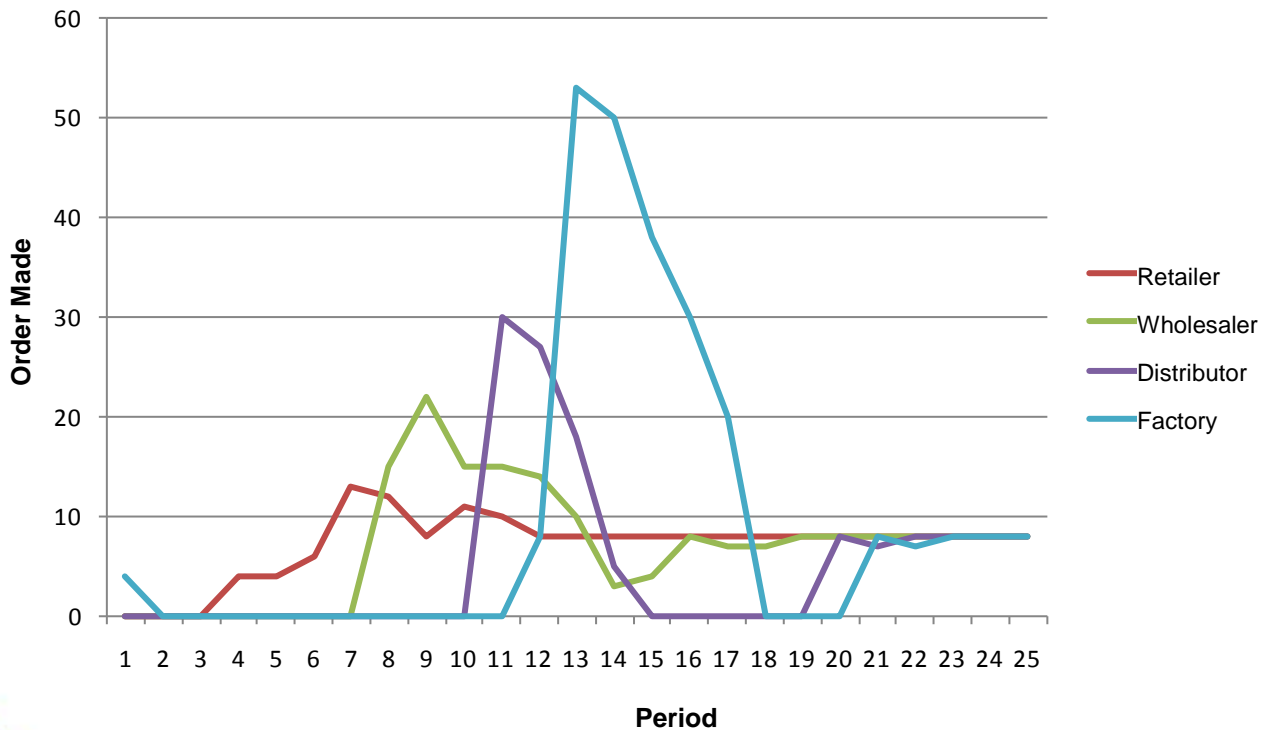 - Each node further from the customers tries to stock more.

Bullwhip Effect (牛鞭效应)

- Order variability is amplified upstream in the supply chain (供应链上游的订单变异被放大).
  - Resembling a "cracking whip"
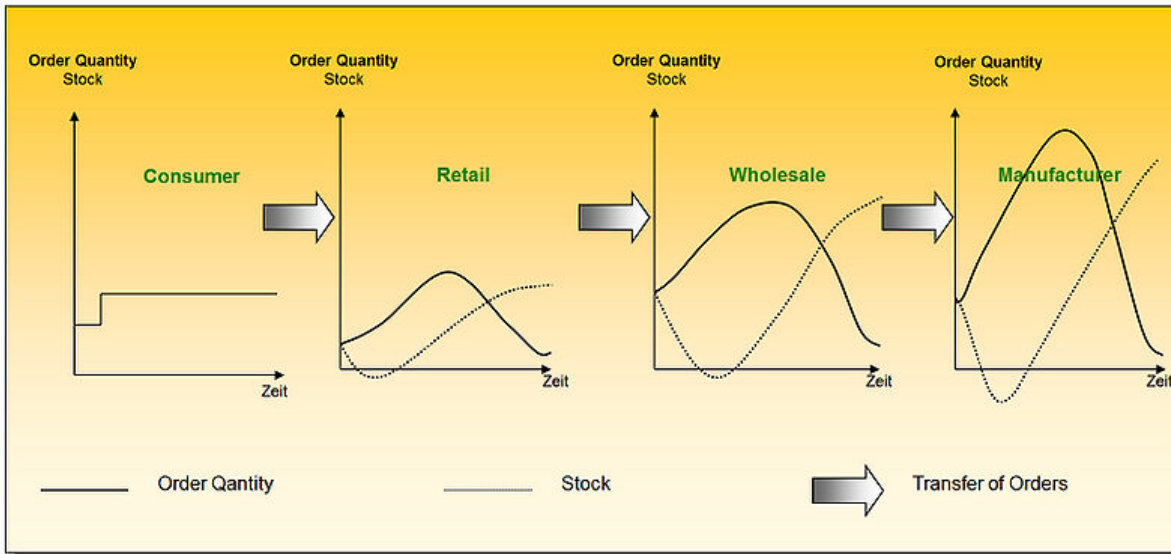
Source: http://en.wikipedia.org/wiki/Bullwhip_effect

Bullwhip Effect (牛鞭效应) (cont')

How to Remedy the Problem?

- Use information system to propagate ice cream orders to all nodes in the supply chain (运用信息系统，以传播各供应链节点的冰淇淋订单到所有其它节点).
    - Reduce the lag time in the flow of information.

- Use DSS to recommend the ideal amount of ice cream each node should order (运用决策支持系统来推荐各节点应订购的冰淇淋数量).

Expected Outcome (预期结果)

- ***Champion Ice Cream*** should have the lowest cost if it had followed all the recommendations ($228).

Summary

- Appreciate how information systems and DSS can help individuals and organizations to work more efficiently and effectively (了解到信息系统和决策支持系统如何帮助个人和组织更有效地工作).

- Take up Computing today and choose Information Systems or Electronic Commerce (今天就选择信息系统或电子商务课程) ☺

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