The World of Computerized Decision Support

(NUS Computing Camp for High School Students 2011)

Presented by:

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About Me

• **Tan Wee Kek (陈伟克)**
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  – 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?

- Biscuit
  - Weather is hot, I want to eat an ice cream!
  - Cornetto Cone
  - MacDonald Ice Cream Cone
  - Häagen-Dazs Cup
- Non-Biscuit
  - Paddle Pop Stick
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 weather is hot THEN eat ice cream ELSE drink hot coffee
  - Mathematical and statistical (数学和统计).
  - Profit = Revenue – Cost

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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](http://www.streetsine.com)
More DSSs

• **Consumer (消費者) DSS:**
  – Example:
    • Tools for online shopping.
    • **Demonstration:** Comparison shopping – CNET Shopper
    • **Demonstration:** Recommendation Agent – Zion

• **Organizational (組織) 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.
- Supply chain is a systematic way to move products from manufacturer to consumer.

**Ice Cream Supply Chain**

- **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.

• 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’)

![Graph showing the Bullwhip Effect](image-url)

- **Order Made**
- **Period**
  - 1 to 25

Legend:
- Retailer
- Wholesaler
- Distributor
- Factory

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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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