



## Simulation

- Befriend Uncertainty

'Measure what is measurable, and make measurable what is not so.' -Galilei, Galileo (1564 - 1642)

'Why speculate when you can calculate?' - John Baez

**Simulation is 'modeling the uncertain' in a risk-free environment.**

Simulation forms an essential numerical tool

- to solve a **complex problem** where an analytic solution is not feasible
- when there are large numbers of interacting variables with non-linear relationships
- when choices are limited but **decision variables** have significant uncertainty

Simulation has been used extensively in business for:

- **Queuing applications:** Number of service counters required for a desired service level at different times of the day/month for given customer arrival rates. A few application areas are **Call Centers, ATMs, Banks, Airline /Rail reservation counters, Retail billing counters.**
- **Supply chain:** Number and size of warehouses, stocking and ordering policy for given demand and desired order fill rates; identifying information gaps and bottlenecks in a supply chain so as to **improve response time.**
- **Scheduling:** Sequencing and allocation of capacity for given demand and operational constraints. Examples: Shop

## sc simulator

### scSimulator

#### Supply Chain Simulator

provides a powerful user configurable engine for supply chain simulation.



scSimulator determines

near optimal inventory policy in terms of re-order point and maximum stock for all the nodes of supply chain. A visual comparison of this policy with the user's present stock policy enables users to reduce costs, improve service levels and enhance profitability.

### More Resources on Simulation

[Introduction to Simulation](#)

[Simulation Challenges](#)

[Simulation Tips](#)

[Manufacturing Simulation](#)

#### Simulation At the Pentagon:

"An interim Pentagon report on Gulf War Illness concluded that **advanced modeling and**

floor scheduling, Public transport - Air-line / rail / bus scheduling.

- **Customer Behavior:** Simulation of **word-of-mouth diffusion** of new product concept in a population to chart the evolution of its demand.
- **Competitor Behavior:** **Modeling competitor moves** resulting from entering a new market, using game theory.
- **Stock markets:** Arriving at circuit filters, given desired levels of volatility, by **simulating trades**.

Consider two business examples where simulation can make a difference in decision-making:

### 1 Nationwide New Product Launch:

Managers rely heavily on experience to make decisions for a new product launch. Success of such a launch hinges on many variables, which include - **perception** of product by target segment, reach of the promotional campaign, **price sensitivity** and **competitors' moves**.

Simulation can model these uncertainties by **simulating the entire market place** and help the manager make the decisions by generating and evaluating alternative scenarios, and deriving the chances of success. For example, **Game-theoretic** approaches can be used to model **competitor moves**.

### 2 Warehouse Capacity Planning:

A firm has developed alternative sets of **demand forecasts** for the next five years, each with a certain **probability**. The decision to be taken is whether to increase the present warehousing capacity in the light of the demand forecast and desired service level. The alternatives could be physical capacity addition or deploying an extra shift with different cost impacts.

The above situation of supply chain can be simulated with different demand scenarios and alternatives for capacity increase to come up with different service levels. **Examining a variety of scenarios** leads to an informed decision on capacity planning.

Development of any simulation goes through four phases:

- **Identifying goals:** Defining the goals of simulation and decisions to be addressed.
- **Model Design:** Understanding the problem domain, in terms of relevant variables, their distributions and their inter-relationships.

**simulation technologies** could have warned military officials about the risks posed to troops during air attacks against Iraq's chemical and biological weapons facilities. "

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### About DecisionCraft Analytics

We provide decision-making solutions to improve operational efficiency and business responsiveness. Our consulting services employ our strengths in industry knowledge, conceptual rigor, and information technologies. Developed using concepts from decision theory; our solutions use robust optimization, simulation, and statistical engines adapted to our client's focus areas.

### DecisionCraft Products

qcCharts™  
 dataOrganizer™  
 Supply Chain Simulator  
 Travel Route Optimizer  
 Logistics Planner

- **Model Execution:** Programming the design using statistical techniques and algorithms.
- **Model validation:** Using statistical techniques and confidence intervals to analyze execution.

Key characteristics of a good simulation:

- **Hi-Fidelity** - should represent the actual situation closely
- **What-if analysis** - should generate all possible scenarios effortlessly
- **Interactive Visualization** - derive insights about all possible scenarios
- Generation of and fitment to **a range of probability distributions for variables**
- **Model validation** using advanced statistical techniques

Next issue: [Travel Route Optimization](#)

Previous issue: [Data Mining](#)

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