



Operations Research & Analytics

Here we apply any of a number of powerful mathematical and statistical tools to maximize the efficiency or profitability, or minimize the financial or other costs, of various types of operations processes; or to manage risk; or assist with decision analysis or project management.



Optimization

If you need to maximize the efficiency of a process to save time or money, maximize profit, etc., we use powerful analytic tools to achieve the optimal outcome. Here are some examples of typical **optimization** solution areas:

- Make vs. Buy Decisions
- Determining Minimum Order/Purchase Size
- Transportation Route Optimization
- Production and Inventory Planning
- Data Envelopment Analysis (e.g., determining the operating efficiencies of various units within a company, or of various companies within an industry)
- Employee Scheduling
- Contract Awarding
- Capital Budgeting
- Nonlinear Network Flow Problems
- Facilities Location Problems
- Queueing optimization to manage customer traffic or inventory

Depending on the situation, we might employ any of a variety of analytic tools and techniques to solve such problems. For an overview of these tools and techniques, please visit our [Optimization Programming overview page](#). Or to see applied examples of specific optimization techniques, visit any of these specific pages:

- [Linear](#) or [Integer/Mixed-Integer](#) Programming (the latter being applied when some variables are continuous and some are integers)
- [Nonlinear](#) Programming
- [Evolutionary Optimization](#)
- [Goal Programming](#) and [Multiple Objective Linear Programming \(MOLP\)](#)
- [Queueing Optimization](#)

Life Data Analysis

We can employ powerful statistical modeling techniques to estimate and predict a wide variety of time-to-event outcomes and similar phenomena. Here are just a few examples of the almost limitless number of application areas:

- Medical/biological survival analysis
- Industrial engineering (production/delivery)
- Weather forecasting
- Extreme Value forecasting
- Wireless telecommunications signal degradation analysis
- Insurance claims forecasting models

For more details and an example of industrial component reliability/failure analysis, please visit our [Life Data Analysis page](#).

Risk Analysis via Simulation Modeling and Advanced Statistical Analysis

Unlike optimization problems, where the inputs are known, risk simulation solves problems where the exact parameters are unknown and may fluctuate randomly within a range of uncertainty. And while there are other methods of risk analysis, such as traditional Best-Case/Worst-Case and What-If analysis, Simulation Modeling is far superior because it uses powerful mathematical and statistical processes instead of relying heavily on intuition or guessing.

We employ sophisticated modeling techniques such as **Monte Carlo simulation analysis** to help you manage risk. And we can build models based on a wide variety of random variables. So whatever your risk-analysis situation, we have the tools to assist you.

Here are just a few examples of how risk simulation analysis can be applied:

- For a growing company that has decided to switch from using a private health insurance company to self-insuring its employees, risk simulation can help determine how much money should be accrued in the next year to cover employees' health insurance claims.
- In a manufacturing environment, simulation modeling can help estimate the most cost- and time-efficient servicing intervals for equipment.
- When considering siting facilities in a region that has a potential for natural disasters such as floods, earthquakes or forest fires, risk analysis can assist with the decision.
- For a company that accepts customer reservations for services, risk simulation can help manage available resources to achieve acceptable levels of under- and over-booking, thus helping to sustain both profitability and customer satisfaction.
- Risk analysis can help management understand the financial risk associated with undertaking a particular project, which might be affected by things such as personnel or budget problems, vendor or customer problems, scheduling complications, etc.
- Risk modeling can assist management with inventory control, helping to determine:
 - The best level of inventory to maintain
 - When goods should be reordered/manufactured
 - How much safety stock needs to be held in inventory

For a more in-depth discussion about risk analysis, please visit our [Risk Analysis page](#), which also contains links to specific examples of problems and solutions.

In addition to simulation modeling, we can also apply advanced statistical modeling techniques to solve problems such as **fraud detection**, **credit risk analysis**, etc. (Rules-base fraud detection,

while useful, has some real limitations. Supplementing rules-based systems with advanced analytical techniques can significantly improve detection accuracy.) Please visit our [Bank Loan Credit Risk modeling page](#) to see a detailed example.

Decision Analysis

We have many tools and techniques to assist with decision making. These include things such as payoff matrices and single- and multi-stage decision trees, combined with sophisticated decision rules such as Expected Monetary Value (EMV), Utility Functions and Multicriteria Decision Making. Our models can incorporate Bayesian analysis and other forms of conditional probability analysis to take into account real-world uncertainties. And we can also perform sensitivity analysis to determine how strongly decisions are impacted by changes in the model's values.

Examples of the application of decision analysis include determining:

- How large a manufacturing plant to build
- Which parcel of commercial real estate to purchase
- Whether a consulting firm should invest resources developing a complex grant proposal
- Other areas of application might include environmental remediation, healthcare management, litigation or dispute resolution, etc.

To see a detailed discussion of decision analysis, including examples of specific techniques, please visit our [Decision Analysis page](#).

Project Planning and Management

Whether your project is relatively simple and straightforward or much more complicated, we can assist with project planning and scheduling. For simpler projects, you may be inclined to use techniques such as **CPM/PERT**. But each of these approaches has limitations. So we offer options such as **CCPM (Critical Chain Project Management)** and sophisticated **simulation modeling techniques** for dealing with uncertainty. We can also employ powerful optimization solutions if you need to understand the tradeoffs and overall impact of "crashing" a project by throwing more resources at the problem to finish it faster.

To find out more, please visit our [Project Management page](#).