2.1

Decision Making by Quantitative Analysis

Katta G. Murty Lecture slides

For problems which are very important, or very complex, good solutions cannot be developed without the aid of quantitative analysis.

Quantitative analysis requires the representation of the problem using a mathematical model. Mathematical modeling is a critical part of the quantitative approach to decision making. Constructing mathematical models, to represent real world problems reasonably closely, is an essential skill for all engineers.

Two types of factors effecting system performance:

- **Uncontrollable factors:** Factors such as environmental factors, not under the control of the decision maker.
- **Controllable inputs:** Factors whose values can be controlled by the decision maker, which affect the functioning of the system. These factors are called the *decision variables* in the model.

Deterministic models: If all uncontrollable inputs are known exactly and do not vary, system performance depends only on values of decision variables, model becomes a deterministic model. No uncertaity.

Stochastic or Probabilistic models: When uncontrollable inputs are uncertain and subject to variation. Here system performance uncertain even when the values of all decision variables are fixed.

We study deterministic models in this course.

Steps in Decision Making by Quantitative Analysis:

Model Building : Build a mathematical model that represents how system functions (identify decision variables, constraints on them, and objective function that measures system performance).

Solve Model : Use an efficient algorithm to get an optimum solution.

Implement solution, or Update Model & Repeat : Check solution for practical feasibility. If it is not, make necessary changes in model & repeat.

Also, many times decision makers use their practical knowledge to transform optimum solution into an implementable solution.