

Operations Research (OR)

A Brief Introduction

BINGHAMTON
UNIVERSITY

Definition

- Operations research, management science, or decision science
- Operations Research involves a variety of techniques that aim to
 - create mathematical models that describe real or theoretical systems
 - solve the models for optimal solutions to improve systems efficiency and support decision-making
- It is a scientific approach to making best decisions
- Usually under conditions requiring the allocation of limited resources

The Origin of OR

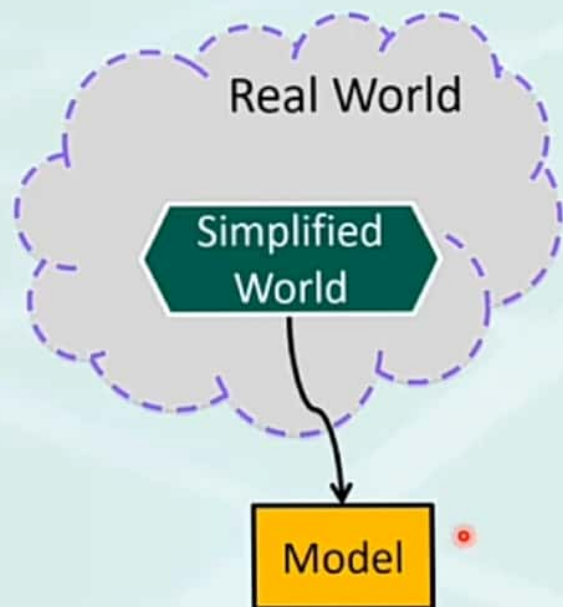
- British Scientists during WWII
- Optimal allocation of various war supplies
 - deployment of radars
 - management of convoy
 - bombing missions
 - anti-submarine operations
- **Military Operations Research**, later Operations Research

OR Modeling

- OR requires the use of **models**, which are mathematical representations of the actual systems
- Modeling: Describing a system at **a high level of abstraction** (or **simplification**), which ignores irrelevant details and only represent the relevant details

Level of Abstraction

"All models are wrong,
but some are useful."
- George Box (1919–2013)



Optimization Model

- An optimization model seeks to find values of the **decision variables** that optimize (maximize or minimize) one or more **objective functions** among the set of all values for the decision variables that satisfy the given **constraints**

Optimization Model

- **Decision variables** (or control variables)
 - Controllable variables influencing the performance of the system
- **Objective function(s)**
 - A function we wish to maximize or minimize
 - Single objective vs. Multiple objectives
- **Constraints**
 - A set of restrictions of decision variables



Success Stories

Organization	Problem	Annual Saving
Continental Airlines	Reassign crews to flights when schedule disruptions occur	\$40 million
Samsung	Reduce manufacturing times and inventory levels	\$200 million
P&G	Redesign the production and distribution system	\$200 million
HP	Product portfolio management	\$180 million
Taco Bell	Plan employee work schedules at restaurants	\$13 million
Sears	Vehicle routing and scheduling for home services and deliveries	\$42 million
Time Inc.	Management of magazine distribution channels	\$3.5 million
Merrill Lynch	Pricing analysis for providing financial services	\$50 million

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OR Career and Applications



Operational Research: the Science of Better (17 minutes)



A Day in the Life - Operations Research Analyst (1 minute)



A New View of Analytics and Operations Research (4 minutes)



Real World Applications of Operations Research (7 minutes)