

Foundations of Operations Research - Notes -
v0.1.0

260236

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Preface

Every theory section in these notes has been taken from the sources:

- Course slides. [\[1\]](#)

About:

 [GitHub repository](#)

These notes are an unofficial resource and shouldn't replace the course material or any other book on foundations of operations research. It is not made for commercial purposes. I've made the following notes to help me improve my knowledge and maybe it can be helpful for everyone.

As I have highlighted, a student should choose the teacher's material or a book on the topic. These notes can only be a helpful material.

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1 Introduction

Definition 1

Operations Research (OR), often shortened to the initialism OR, is the branch of mathematics in which **mathematical models** and **quantitative methods** (e.g. optimization, game theory, simulation) are **used to analyze complex decision-making problems** and **find (near-)optimal solutions**.

The overall and primary *goal* is to *help make better decisions*.

OR can be seen as an interdisciplinary field at the intersection of applied mathematics, computer science, economics, and industrial engineering.

Operations research is often concerned with **determining the extreme values of some real-world objective**: the *maximum* (of profit, performance, or yield) or *minimum* (of loss, risk, or cost). Originating in military efforts before World War II, its techniques have grown to concern problems in a variety of industries. [2]

1.1 Decision-making problems

Decision-making problems are analyzed using mathematical models and quantitative methods.

Definition 2

Decision-making problems are problems in which we must **choose** a (feasible) **solution among a large number of alternatives based on one or several criteria**.

Some practical **examples** include network design, shortest paths, staff scheduling, and service management.

In other words, they are complex decision-making problems that are **addressed through a mathematical modeling approach** (mathematical models, algorithms, and computer implementations).

References

- [1] Braz Pascoal Marta Margarida. Foundations of operations research. Slides from the HPC-E master's degree course on Politecnico di Milano, 2024.
- [2] wikipedia. Operations research - Wikipedia. https://en.wikipedia.org/wiki/Operations_research. [Accessed 08-09-2024].

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