



# University of Palestine



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## Operations Research

TMIS 4319

**Lecturer**

**Dr. Ahmed H. Abo absa**

# Operations Research

## Course Description:

Operations Research is a very important area of study, which tracks its roots to business applications. It combines the three broad disciplines of Mathematics, Computer Science, and Business Applications. This course will formally develop the ideas of developing, analyzing, and validating mathematical models for decision problems, and their systematic solution. The course will involve programming and mathematical analysis

# Operations Research

## Course Objectives:

Upon completion of this course, the students will be able to:

- Solve business problems and apply its applications by using computer programming and mathematical analysis.
- Develop the ideas of developing, analyzing, and validating mathematical models for decision problems, and their systematic solution.
- Understand the main concepts of OR .

# Operations Research

## Course Text Book and Other References:

Hamdy A. Taha, “Operations Research An Introduction

Fredrik S. Hillier, "Introduction to Operations  
"Research

# **Operations Research**

## **Chapter 1**

### **Introduction**

# Introduction

- The Origins of Operations Research
- The Nature of OR
- What is Operations Research
- OR/MS: What is It?
- Differences Between OR and IT
- Terminology
- Model Types
- Phases of an OR Study
- OR Software Packages

# The Origins of Operations Research

The formal activities of Operations Research (OR) were initiated in England during World War II when a team of British scientists set out to make decisions regarding the best utilization of war material. Following the end of the war, the ideas advanced in military operations were adapted to improve efficiency and productivity in the civilian sector. Today, OR is a dominant *decision making tool*.

# The Nature of OR

As its name implies, operations research involves “research on operations.” Thus, operations research is applied to problems that concern how to conduct and coordinate the *operations* (i.e., the *activities*) within an organization. The nature of the organization is essentially immaterial, and, in fact, OR has been applied extensively in such diverse areas as manufacturing, transportation, construction, telecommunications, financial planning, health care, the military, and public services, to name just a few. Therefore, the breadth of application is unusually wide.

The *research* part of the name means that operations research uses an approach that resembles the way research is conducted in established scientific fields. To a considerable extent, the *scientific method* is used to investigate the problem of concern. (In fact, the term *management science* sometimes is used as a synonym for operations research.)



# What is Operations Research

- Operations Research ( OR) Is the application of scientific methods in solving problems facing management and to help to taking decisions.
- A rose by any other name...
  - Management Science
  - Systems Engineering
  - Industrial Engineering
  - Operations Management
  - Applied Mathematics

# OR/MS: What is It?

Operations research (also known as management science) is a *collection of techniques* based on *mathematics* and other *scientific approaches* that finds solutions to your problems.

# Differences Between OR and IT

- **IT**

- Focuses on data as a corporate resource
- Stores, retrieves, formats, displays data
- Understands business process and transactions

- **OR**

- Uses data as input
- Provides improved solutions
- Gives global focus
  - Multiple objectives
  - Multiple criteria
- Evaluates tradeoffs

# Terminology

*Decision Variable*—Represents an alternative available to the decision- Maker

*Objective Function*—A (usually real-valued) function measuring the “goodness” of alternatives

*Constraint*—An restriction on the set of alternatives that may be considered

## More Terminology

*Feasible*—An alternative (value) is feasible if it satisfies all constraints

*Optimal*—An alternative (value) is optimal if it yields the most favorable value of the *objective function* over all *feasible* solutions considered

# Model Types

- Linear Program (LP)
- Integer Linear Program (IP or ILP)
- Non-Linear Program (NLP)
- Dynamic Program (DP)
- Goal Program (GP)
- Queuing Models
- Simulations
- Network models
- Game theory

# Phases of an OR Study

1. Definition of the Problem
2. Construction of the Model(s)
3. Solution of the Model(s)
4. Validation of the Model(s)
5. Implementation of Recommended actions based on the solution(s)

# OR Software Packages

- A very popular approach now is to use today's premier spreadsheet package, *Microsoft Excel*, to formulate small OR models in a spreadsheet format. The **Excel Solver** then is used to solve the models.
- **LINDO** (and its companion modeling language **LINGO**) continues to be a dominant OR software package. Student versions of LINDO and LINGO now can be downloaded free from the Web.
- **CPLEX** is a state-of-the-art software package that is widely used for solving large and challenging OR problems
- **MPL** is a user-friendly modeling system that uses CPLEX as its main solver.