



Operations research

2nd lecture

Prof. L. Palagi



OR course at a glance

❖ 6 ects

❖ You can find all info on the web site

<http://www.dis.uniroma1.it/~palagi>

following the path

[didattica](#)

aa-2016-17

operations research

❖ Join the Google Group “OR_ICI_2016”

❖ Calendar of the lectures on the web site

❖ Written and Oral exam (grade is the average of grades on the two parts)



LABORATORY

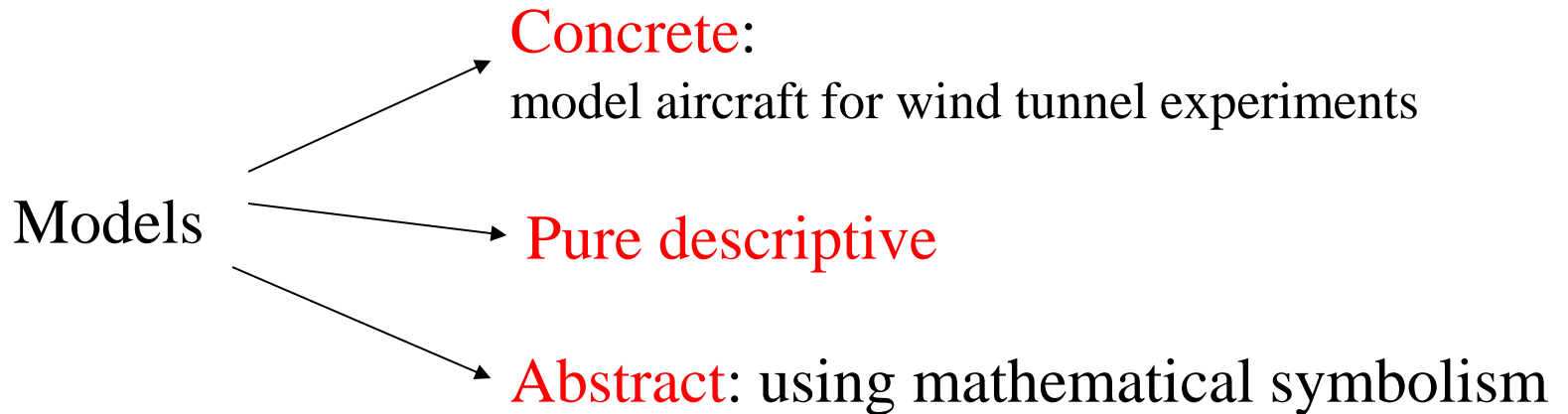
- ❖ Lab.of Operations research
(under the wrong name Lab. Of Operational System)
- ❖ 3 ects
- ❖ Homework during the course
- ❖ Qualifying examination but a grade is assigned to the HW that can be used for improving the final grade of the exam in Operations Research



The concept of a model

Many applications of science make use of **models**

The term '**model**' is usually used for a structure which has been built purposely to exhibit features and characteristics of some real object.





Define the problem

The management scientist defines the organization system including objectives

Estimate the parameters

Collecting data

Formulate a mathematical model

Verify the model, use for prediction

Select a suitable alternative

Valuate the result

Implement

Relationships in the real world (technological relationships, physical laws, marketing constraints) translated into a set of **equations**

The management scientist verifies whether the model is an accurate representation of reality

objective function: maximizing a profit, minimizing a cost

Use of software packages

obtained at the previous step

Feedback loops



Mathematical model: representation of a real problem in terms of mathematical expressions.

benefit

- It reveals not apparent relationships, makes mathematical analysis possible
- Simulation of scenarios (*what happens if ...*)
- Use of mathematical solution procedure

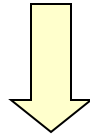
drawback

- Lack of precision of data
- Impossibility of quantifying some data (social value)



Optimization models plays a fundamental role in **mathematical programming**

mathematical programming



“planning”

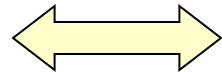
Different from
computer programming

Optimization model

Involve *maximize* something
or *minimize* something, choosing
among different alternatives



Set of possible
alternatives

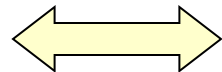


Feasible solutions x stays
in a set F

finite

infinite

One
optimization
criterion



$f: F \rightarrow \mathbb{R}$ **objective** function

$$\min_{x \in F} f(x)$$

or

$$\max_{x \in F} f(x)$$



An easy example

Definition of the
problem

Which is the **shortest path** to go **from**
place **A** to place **B** ?

Feasible solutions

$F = \{ \mathbf{x} = \text{all possible paths from A to B} \}$

Objective function

Minimize the length f of the path