

elkany.e-wt.ro

→ OPERATIONS RESEARCH  
AND OPTIMIZATION

BIA DATA

gabriel.istaita@e-wt.ro

USE FORUM on learning.

Cosmin Banchis

COURSE + LAB

1st EXAM: TAKE-HOME VIA E-UNT

OTHER EXAMS NORMALLY IN PERSON

RECORDED + MY HANDWRITTEN NOTES

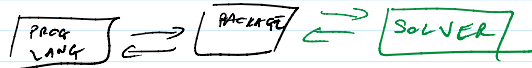
+  
RESOURCES VIA COVSE WEBSITE

TEXTBOOK (RECOMMENDED)

MATTEO FISCHETTI INTRO TO MATHEMATICAL  
OPTIMIZATION

PYTHON + MODULE (PULP, ...)

PERHAPS JULIA + JUMP



HARD: MODELING

SOLVERS GLPK (gnu linear programming kit)

CPLEX (IBM) free academic license  
GUROBI

need uni IP to activate license

QUITE MATH HEAVY!

BENEFIT: METHOD TO SOLVE OPTIMIZATION  
PROBLEMS IN A GENERAL/GENERIC  
WAY

LINEAR  
PROGRAMMING

INTEGER (MIXED)  
LINEAR PROGRAM  
MING

OPERATIONS  
RESEARCH

APPLYING DISCRETE  
OPT. METHODS MOSTLY  
TO BUSINESS PROBLEMS

PROINFORMATICS

DMH  
GURPIT, A

↓  
PROINFORMATICS      DAN  
 GUSFIELD

- ① LP      easy computationally / few problems
- ② ILP     harder computationally / more expressive.

LP      millions vars.  
 ILP     10,000 vars.

ILP → if the program completes it gives  
 you OPTIMAL soln.

(different from heuristics      gen. algs  
                                                  from modeling  
                                                  ML)

optimize timetable → TIMETABLING

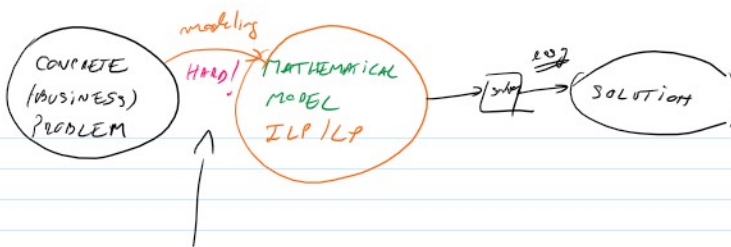
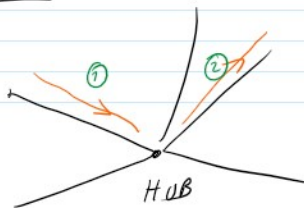
O.R. STARTED IN  
 THE '60'S  
 (us. / u.k.)

WAR!

RAVINDRA AHUJA

DELTA  
AIRLINE

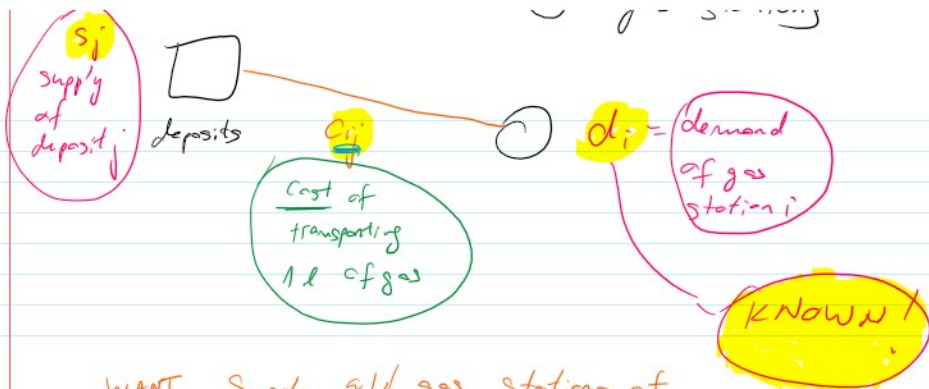
HUB AND  
SPOKE



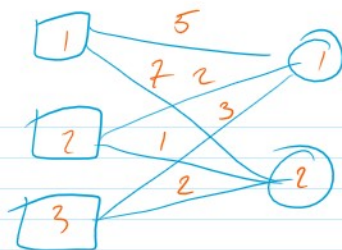
Gas company

○ gas stations





WANT Supply all gas stations at minimal total cost



SOLUTION

$$y_{ij} = \text{amount } i \rightarrow j$$

$$y_{12} = 7$$

$$y_{22} = 2$$

$$c_{ij} = \text{cost } i \rightarrow j$$

LP

min (total cost)

constraints

"cannot send negative amounts"

physical constraints

"all demands are met"

business constraints

"cannot send more gas than supply"

$$\min \left( \sum_i \sum_j c_{ij} y_{ij} \right)$$

$$\sum_j y_{ij} \geq d_i \quad (\forall i)$$

$$\sum_i y_{ij} \leq s_j \quad (\forall j)$$

$$y_{ij} \geq 0 \quad (\forall i, j \in R)$$

linear

linear  $\geq \leq (=)$  constant

modeling

olve

solver

OPT