Exam July 25, 2016

A factory produces deckchairs and beach umbrellas. The productive capacity (units) of the factory and the production costs (for units) are shown in the following table:

product	max production	cost
beach umbrella	650	25
deckchair	1200	18

The products are delivered to three resorts A, B, C in three different places. Transportation costs depend only on the distance and are reported in the table (euro per unit)

resort	transportation cost
A	5
B	8
C	2

Each resort has a minimum and maximum demand for umbrellas and deck chairs, indicated in the table:

	A		B		C	
	min	max	min	max	min	max
beach umbrella	0	100	50	150	320	370
deckchair	70	250	0	350	300	–

In addition at least 65 % of total production must be, for contractual constraints, delivered to the factory C. Prices Sales (EURo per unit) are shown in the table:

	prezzo
beach umbrella	31
deckchair	25

Assume that the factory sells everything it produces. Write a LP model to maximize the profitability of the company.

The mathematical model

– *Parameters.* $m = 2$ products, $n = 3$ resorts; r_i, p_i sales prices and costs for $i = 1 \ldots, m$; c_j transportation costs from factory to resort $j = 1, \ldots n$; q_i max available amount of product $i = 1, \ldots, m$ at the factory; l_{ij}, u_{ij} minimum and maximum amount of product i required by resort j.

– *Decision variables.* x_{ij} units of product i delivered to resort j.

– *Objective function.* We want to maximize the profit = revenue -costs

$$\sum_{i=1}^{m} r_i \sum_{j=1}^{n} x_{ij} - \sum_{i=1}^{m} p_i \sum_{j=1}^{n} x_{ij} - \sum_{i=1}^{m} \sum_{j=1}^{n} c_{ij} x_{ij}$$

– *Constraints.*

$$l_{ij} \leq x_{ij} \leq u_{ij} \qquad \forall \quad i = 1, \ldots, m, \; j = 1, \ldots, n$$

$$\sum_{j=1}^{n} x_{ij} \leq q_i \qquad \forall\ i = 1 \ldots, m$$

$$\sum_{i=1}^{m} x_{i3} \geq 0.65 \sum_{i=1}^{m} \sum_{j=1}^{n} x_{ij}$$

$$x_{ij} \geq 0 \text{ and integer}$$