

ENGINEERING OPTIMIZATION  
ECE305/ECE505/MTH3EO/MTH5EO

# Practice Set 1

September 2, 2015

1. Given the perimeter of a rectangle must be at most 16cm, construct the rectangle with maximum area.
2. You have five items that you can put in your knapsack as gifts to friends. However their combined weight is more than the 20 pounds that you are willing to carry. Formulate the problem of choosing a subset of maximum total value.

Item	1	2	3	4	5
Weight(lb)	4	6	7	10	3
Value(\$)	12	12	12	27	5

Table 1

3. Formulate the following problem as an LP:

$$\text{Minimize } \|Ax - b\|_1 \text{ subject to } \|x\|_\infty \leq 1$$

4. Iron ore is produced in two mines, from where it is to be shipped to three steel plants. The amount of ore available at the mines, the Mtons of ore required at each steel plant, and the unit cost of shipping ore from each mine to each steel plant are given in Table 2,3 and 4 respectively. Determine the quantity to be transported from each source to each plant, so as to meet all the requirements at minimum total shipping cost.

Mine 1	103
Mine 2	197

(a) Table 2

Plant 1	71
Plant 2	133
Plant 3	96

(b) Table 3

Plant	1	2	3
Mine 1	9	16	28
Mine 2	14	29	19

(c) Table 4

5. We would like to study the effect of a certain medication on a patient. We draw blood samples at certain times after the patient takes a dose, and

measure the concentration of the medication in each sample, tabulating the time  $t_j$  and the concentration  $c_j$  for each sample. Based on our previous experience in such experiments, we find that the following function  $\phi(x; t)$  provides a good prediction of the concentration at tie  $t$ , for approximate values of the 5-dimensional parameter vector  $x = (x_1, x_2, x_3, x_4, x_5)$

$$\phi(x; t) = x_1 + tx_2 + t^2x_3 + x_4e^{-x_5t}$$

Formulate the problem to choose the parameter vector  $x$  so that this model best agrees with our observations.