

MATH 326: HOMEWORK 4  
SPRING 2013

1. Show that the vectors

$$x_1 = \begin{bmatrix} 1 \\ 1 \end{bmatrix}, \quad x_2 = \begin{bmatrix} 2 \\ 1 \end{bmatrix}$$

form a basis for  $\mathbb{R}^{2 \times 1}$ . [Hint: (i) Show that the vectors are linearly independent. (ii) Show that you can find coefficients  $\alpha_1$  and  $\alpha_2$  so that

$$\alpha_1 x_1 + \alpha_2 x_2 = \begin{bmatrix} a \\ b \end{bmatrix},$$

where  $a$  and  $b$  are arbitrary real values. Note, you can do both these things simultaneously.]

2. Assume that a leather company manufactures two types of belts: regular and deluxe. Each belt requires 1 square yard of leather. A regular belt requires 1 hour of skilled labor to produce, while a deluxe belt requires 2 hours of labor. The leather company receives 40 square yards of leather each week and a total of 60 hours of skilled labor is available. Each regular belt nets \$3 in profit, while each deluxe belt nets \$5 in profit. The company wishes to maximize profit.
- (a) Ignoring the divisibility issues, construct a linear programming problem whose solution will determine the number of each type of belt the company should produce.
- (b) Put the problem you found into standard form.
3. Identify all basic solutions to the equations in standard form in Problem 2 and indicate which ones are feasible to the problem and which are not.
4. Use Matlab to solve the diet problem (see class notes) in standard form. [Hint: standard problem would require using the surplus variables and in Matlab we can define empty matrices  $A=[]$ ,  $b=[]$  and define  $H$  and  $r$  instead.]