IOE 510, MATH 561
WINTER 2002

HW2

Due in class
23 Jan 02.

4.4.1: Find the rank of the following set of vectors Γ, a basis for this set, representation of each nonbasic vector in terms of this basis; and determine for each nonbasic vector which basic vectors it can replace to lead to another basis: **(i):** $\Gamma = \{(1,0,-1,2,1), (-1,1,2,-1,0), (3,-1,-4,5,2), (1,1,1,0,2), (1,2,2,1,3)\}$ **(ii):** $\Gamma = \{(1,1,-1,2,1), (2,-1,2,1,2), (4,1,0,5,4), (0,0,1,0,0), (7,1,2,8,7)\}$.

1 Do (i). Find linear dependence relation for Γ, if it is linearly dependent. You can use GJ pivots with a memory matrix, or any other method.

2. Formulate as a linear program.

1.12 A forestry company has four sites on which they grow trees. They are considering four species of trees, the pines, spruces, walnuts, and other hardwoods. Data on the problem are given below. How much area should the company devote to the growing of various species in the various sites?

Site Number	Area Available at Site (ka)	Expected Annual Yield from Species (m^3/ka)				Expected Annual Revenue from Species (money units per ka)			
		Pine	Spruce	Walnut	Hardwood	Pine	Spruce	Walnut	Hardwood
1	1500	17	14	10	9	16	12	20	18
2	1700	15	16	12	11	14	13	24	20
3	900	13	12	14	8	17	10	28	20
4	600	10	11	8	6	12	11	18	17
Minimal required expected annual yield (km^3)		22.5	9	4.8	3.5				

3

1.14 A product can be made in three sizes, large, medium, and small, which yield a net unit profit of \$12, 10, and 9, respectively. The company has three centers where this product can be manufactured and these centers have a capacity of turning out 550, 750, and 275 units of the product per day, respectively, regardless of the size or combination of sizes involved. Manufacturing this product requires cooling water and each unit of large, medium, and small sizes produced require 21, 17, and 9 gallons of water, respectively. The centers 1, 2, and 3 have 10,000, 7000, and 4200 gallons of cooling water available per day, respectively. Market studies indicate that there is a market for 700, 900, and 450 units of the large, medium, and small sizes, respectively, per day. By company policy, the fraction (scheduled production)/(center's capacity) must be the same at all the centers. How many units of each of the sizes should be produced at the various centers in order to maximize the profit?

Formulate this as a linear program too