Chapter V Homework

1. The Haul-It-Yourself Company is faced with an oversupply of trailers in some cities and shortages in other cities. The numbers of trailers and cities are given below.

City	Number	Status
Miami	100	Oversupply
Atlanta	50	Oversupply
Chicago	125	Shortage
St.. Louis	95	Shortage
Houston	70	Oversupply

The cost of shipping trailers between cities is given below (on a per trailer basis):

	Miami	Atlanta	Chicago	St. Louis	Houston
Miami	0	20	30	32	10
Atlanta	20	0	25	20	25
Chicago	30	25	0	5	20
St. Louis	32	20	5	0	12
Houston	10	25	20	12	0

a. Formulate a LP problem to determine the least cost method of moving the trailors from the oversupply cities to the shortage cities.
b. Write the dual of the problem formulated in part a.
c. Give an economic interpretation of
   1) the dual variables
   2) the dual objective
   3) the dual constraints

2. Fine Food Specialties, Inc. purchases 3 raw ingredients and combines them to produce 2 products. The two products must meet certain specifications regarding fat content, protein and fiber. The relevant data are

	Supply		Composition		
Ingredient	Cost ($/cwt)	Availability (cwt)	Fat %	Protein %	Fiber %
INGR1	4.50	18,000	10	25	18
INGR2	5.00	20,000	9	24	18
INGR3	3.75	17,000	11	29	17

	Formulation			Demand	
Product	Max Fat %	Min Protein %	Max Fiber	Price ($/cwt)	Sales Potential (cwt)
PROD1	10.0	24.8	18	7.15	Max 25,000
PROD2	10.1	25.2	17.8	7.5	Min 22.000
					Max 32.000

a) Formulate a linear programming model for each product that will determine the cost minimizing production mix.

b) Formulate a profit maximizing problem that will develop optimal mix of products and ingredients

c) Interpret the optimal types of duality information you would get from part a.

3. Donald the tree miller is developing a plan on how to deal with todays delivery of logs. Donald wishes to figure the way that logs can be processed so as to make maximum profits. Donald has several processes that can be used, the result of which is 2x4's, plywood, milling residue, and 1X2's. Each process uses energy, logs, saw time, bundling and holding capacity. The processes resource usages and yields are

Yield in thousand board feet of:	**Process 1**	**Process 2**	**Process 3**
2x4's	0.5	-	0.6
1x2's	0.3	-	0.25
plywood	-	0.6	-
mill reside	0.1	0.2	0.07
Use inputs of:	**Process 1**	**Process 2**	**Process 3**
Energy	4kwh	3.9kwh	3.5kwh
logs	1	1	1
Saw time	4 min	12 min	8 min
Bundling	3 min	1 min	6 min

In addition, each of the products produced used the following amounts of cost above the process cost and holding capacity.

	Cost per 100 board feet	**Holding Capacity per 100 board feet**
2x4	$0.5	2.5 cu. Ft.
1x2	$0.2	2.1 cu. Ft.
plywood	$0.6	6 cu ft

mill residue	$0.01	0.1 cu ft

The sale price for 2x4's is $8.00 for 4 bd ft, 1x2's $3 for 1 bd ft, Plywood $22 for 32 bd ft, and mill residue $0.095 per bd ft.

The Firm has unlimited Energy at $60 MW/hour, 500 logs, 40 hours Saw time, 40 hours Bundling capacity and 10,000 bd. ft. of holding capacity (although more can be rented at 0.10/unit).

Formulate a profit maximizing LP.

4. Set up your own version of one of the problem structures in Chapter 5

Do the following:

a) formulate a word version of the problem
b) setup and solve in GAMS

c) explain the answer