AGEC 641 Chapters 8 Homework

1. Suppose farmer Jones has livestock, wheat, and alfalfa. Livestock are kept for up to 3 years, alfalfa for up to 4 years, and wheat for 1 year. The technical data are:

	---------Alfalfa---------				Wheat		---------Cattle--------		
Year	1	2	3	4			1	2	3
Yield/acre	0	20	40	30	50	Yield/animal (if sold)	500	600	700
Cost/acre	100	10	10	10	30	Cost/animal	100	110	120
Annual labor use/acre	8	12	12	12	20	Acres/animal	2	2.3	2.5
						Annual labor use\animal	10	10	10

- The acreage available is 200.
- The annual labor available is 2010.
- Prices: Alfalfa $3.00, Wheat $4.00, Cattle $0.50.

Model the problems as dynamic LPs using the four assumptions:

a). Equilibrium known life (assume alfalfa kept 3 years, cattle 2 years);
b). Equilibrium unknown life (assume alfalfa is kept a maximum of 3 years, cattle a maximum of 3 years);
c). Disequilibrium known life (assume alfalfa is kept 3 years, cattle 2 years model 5 years);
d). Disequilibrium unknown life (assume alfalfa is kept a maximum of 4 years; cattle a maximum of 3 years model 5 years).

Be sure to specify what additional data you might need.

2. Perennial coffee producers produce several crops. First and fundamentally they produce coffee. However, they also produce some annual crops and some bananas. They wish to establish optimal cropping plans under several assumptions. Technical data follow.

Coffee

Year of Crop from Establishment	Labor Use	Yield	Cost
1	10	0	50
2	3	20	10
3	4	25	10
4	5	12	10
5	6	3	10

Bananas

Year of Crop from Establishment	Labor Use	Yield	Cost
1	10	0	45
2	4	15	10
3	4	30	15
4	4	20	20

5	4	10	25
6	4	6	30

Other Annual Crops

Data for Annuals	Labor Use	Yield	Cost
SOYBEANS	3	10	5
SORGHUM	4	22	6

PRICES

- Coffee 20
- Bananas 15
- Soybeans 5
- Sorghum 3

Labor Available 2400

Land Available 600

a). Assuming an unknown life and the firm is beginning business, model a 3-year disequilibrium plan. If you need any other data make it up.
b). Assuming an unknown life and the firm wishes to know where it should be in the long run, model an equilibrium plan.
c). Do (a) assuming a known life of 4 years for coffee and bananas.
d). Do (b) assuming a known life 4-year life for coffee and bananas.

3. The Greenhouse, Inc. is a wholesale nursery that raises and sells petunias, marigolds, and geraniums. The nursery divides its year into 4 quarters. The length of time, space requirement, cash cost of production, and expected selling price for each plant are

	Time (Quarters)	Space (sq. ft.)	Cash Cost	Selling Price
Petunia	2	1	2.25	3.00
Marigold	1	1	1.00	1.50
Geranium	4	1	4.00	6.50

Assume you can start the flowers in any quarter and that 10,000 square feet are available. Set up both an equilibrium and a 2-year disequilibrium LP.

4. Finally Finished Finance Company wishes to maximize its profits this year. Several investments and borrowing activities are available to Finally Finished. Assume investments can only be made on the first of the quarter

Investment Maturity	When you invest $1 you get back this much extra at the end of the period	Maximum Principle Amount in any Quarter
1 quarter	.0110	8,000
2 quarter	.025	2,000
1 year	.06	6,000
Borrowing		

3 months	.014	5,000
6 months	.024	1,000
12 months	.051	1,500

At the beginning of any year, FFF cannot have any more than $15,000 in investments. Amounts above that are paid out as earnings. Each month at least 1 dollar out of every 10 must be in cash. Every quarter the debt to current worth ratio must not exceed .5.

Set up a LP to

a). maximize ending net worth 2 years from now.
b). establish an equilibrium investment pattern that maximizes earnings.

5. Top Farmer Fred has to plow, disc, plant, and harvest his land. The costs and speeds of operation are given below.

	Cost/acre	Acres/hour	Tractor/hour	Men/hour
Plow	2.5	5	1	1
Disc	2.6	15	1	1
Plant	3.9	20	1	1
Harvest	1.2	3	1/2	1

Plowing can be done from: Sept. - May
Discing March - May
Planting April - May
Harvesting Sept. - October

Yields in bushels are:

Harvest Date	Planting Date	
	April	May
September	130	110
October	140	125

The price is $2.50/bushel.

Production costs $55 per acre for all other inputs.

Fred has one worker who works 140 hours per month, plus himself, and two tractors which work 140 hours each. Assume implements are never binding. Fred can hire more labor but he must hire an equal amount of labor in every period. The laborer costs 5.00/hr. Once hired and when you pay this $5.00, you get 1 hour in every week of the year.

Set up a LP problem to maximize income over 400 acres. Make sure that the jobs are properly sequenced including fall plowing following harvest. Also, discuss dynamic assumptions. Is your model an equilibrium model or is it disequilibrium? How would you establish the other type of model?

6. Suppose you make the assumption that Top Farmer Fred's above problem can be set up as a 1-year model but that this year's acres can be no more than 10% different from last year's. Set up the appropriate model.

7. Chick Henry owns a broiler and layer operation. He has 1000 hens who lay on the average one egg per hen per day. The eggs may be sold immediately or placed into an incubator and hatched. The hatched chicks are then fed and sold as broilers (for consumption as meat).

Eggs are sold in cartons which contain one dozen (12). Sorting and grading eggs cost $0.12 per carton and the eggs are sold for $0.65 per carton.

The incubated eggs take 3 weeks to hatch at a cost of $0.03 per egg. The hatched chicks may be placed on one of two feeding programs. Program 1 requires 9 weeks to complete. The chicks are fed 10 pounds of corn and 1 pound of supplement and reach a weight of 3 pounds. Program 2 also requires 9 weeks to complete. The chicks are fed 12 pounds of corn and 3 pounds of supplement and reach a weight of 5 pounds. Corn costs $0.04/pound and supplement $0.05/pound. Chickens sell for $0.20/pound (live weight).

The incubator can hold 800 eggs/day and at most 900 eggs/day can be sorted and placed into cartons. The barn in which the chickens are fed can hold 2000 chickens/day.

Assuming Chick's goal is to maximize net returns, formulate his problem as a linear programming problem.

8. Explain how to set up terminal conditions when a) ending inventory must equal a quantity; b) ending inventory is worth a fixed price; c) every 10% more inventory is worth 20% less starting with 10 units being worth $100.