Agec 641 Chapters 8 and 9 Homework
Fall 2008

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

Characteristics by Year

	Alfalfa				Wheat		Cattle		
	1	2	3	4			1	2	3
Yield/acre	0	20	40	30	50	Yield/animal (if sold)	500	600	700
Cost/acre						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. Pete the grass seed grower is trying to determine the allocation of land to grass

seed and wheat for the next year. In addition, Pete needs to determine his fertilization and pest control strategies. The following data are relevant:

Land available	500 acres
Minimum wheat required (bushels)	2000 bushels
Minimum grass seed required (lbs.)	2000 lbs.
Maximum grass seed required (lbs.)	40,000 lbs.
Yield of grass seed (lb.) per acre[1]	$1000 + 10F - .05\ F^2$
Yield of grass seed (tons) straw per acre	$10 + 2F - .008\ F^2$
Yield of wheat (bushels) per acre	$40 + 2F - .05\ F^2$
Yield of wheat (tons) straw per acre	$10 + F - .001\ F^2$
Cost/acre of grass seed grown	\$100
Cost/acre of wheat grown	\$50
Cost/lb. of fertilizer	\$0.05
Price/lb. of grass seed	\$0.30
Price/ton of grass seed straw	\$5.00
Price/bu. of wheat	\$4.00
Price/ton of wheat straw	\$5.00

Pete has two pest management options available for grass seed. He may harvest the crop conventionally at a cost of \$25/acre then burn it at a cost of \$20/acre or he may harvest it with an intensive clipping process at a cost of \$60/acre increasing his grass seed straw yield by 10 percent. If he clips it, he later has to spray at a cost of \$7/acre.

Set up a profit maximizing LP.

3. Develop a formulation to fit a linear function to the data

Price of a Good		Quantity of that Good (own quantity)		Quantity of a Substitute Good
3		10		12
4		9		13
2		15		9
1		22		6
7		3		15

where you wish to

[1] F = lbs. of fertilizer used per acre

a) Minimize Total Absolute Deviation
b) Minimize the largest Absolute Deviation
c) Impose the hypothesis that the own quantity slope is positive
d) Impose the restriction that the own quantity slope term is larger than the intercept

4. Consolidated shrimp is trying to plan its shrimp harvest activities for the next year. Assume it knows several things.

a) There are 10 million small shrimp they can catch.

b) Any shrimp they do not catch now age and grow, could be caught by others or die. Of those not caught, 10% grow to large shrimp the firm could catch.

c) The number of either small or large shrimp caught is a function of days they try to catch shrimp and the number of shrimp present. The function is where D is percent of effort ranging from 0 to 1.

$$P = .7\, D^{.3} S^{.7}$$

where P = number caught
D = proportion spent
S = stock available (10 million for small, 10% of those left over after small catch for last shrimp)

Note: Effort across the two stocks cannot exceed 1.

d) A fishing day costs \$100. There are 40 small shrimp per lb. and they are worth \$5/lb. There are 5 large shrimp per lb. and they are worth \$12/lb.

e) Last year D=0.5 and S= 10000

(1) Formulate an LP to establish days they pursue each size of shrimp.

(2) Tell how the formulation would differ if the exponent on S was 0.6.