

Agec 641 Chapters 8 and 9 Homework  
Fall 2008

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

<b>COFFEE</b>				
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
<b>BANANAS</b>				
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
<u>Data for Annuals</u>		Labor Use	Yield	Cost
<b>SOYBEANS</b>		3	10	5
<b>SORGHUM</b>		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 a 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.

Specify whatever other data you might need.

- 2. Top Farmer Joe has to plow, disc, plant, and harvest his land for two crops. The costs and speeds of operation for machinery operations 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



Minimum grass seed required (lbs.)	2000 lbs.
Maximum grass seed required (lbs.)	40,000 lbs.
Yield of grass seed (lb.) per acre <sup>1</sup>	$1000 + 10F - .05 F^2$
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.

4. 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

- Minimize Total Absolute Deviation
- Minimize the largest Absolute Deviation
- Impose the hypothesis that the own quantity slope is positive
- Impose the restriction that the own quantity slope term is larger than the intercept

---

<sup>1</sup> F = lbs. of fertilizer used per acre

5. 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.