THE FAMILY FARM

Fred and Martha Schmertz work a 40 acre family farm outside of Athens Georgia. They grow tubers. Specifically, they grow potatoes, yams, beets, and turnips. Planting season is coming around and they must decide how many acres of each type of tuber to grow. The resources required to plant, cultivate, and harvest these tubers are acres, fertilizer, machine hours, and person hours. The annual property tax is \$100 per acre and this tax is levied only if an acre is put into production. Fertilizer costs \$10 per 100 lbs and they have 4000 lbs on order. Although several types of machines are used in planting and cultivation, they can all be rented from the local co-op at \$20 per hour up to their total machine time allocation which is 600 hours. The labor costs are \$5 per hour and Martha estimates that they will be able to obtain up to 500 hours of labor this season. Fred and Martha ask the co-op agent for advice on what and how much to plant. The agent decides to model their problem as a linear program and obtains the following initial tableau:

	P	Y	B	T	S_1	S_2	S_3	S_4	b
$acres$	1	1	1	1	1	0	0	0	40
$fertilizer$	100	100	200	100	0	1	0	0	4000
$machinetime$	20	20	30	10	0	0	1	0	600
$labor$	30	20	20	20	0	0	0	1	500
	400	400	500	300	0	0	0	0	0

where the cost coefficients in the z-row is the profit per acre in dollars. After applying the simplex algorithm the agent obtained the following optimal tableau:

P	Y	B	T	S_1	S_2	S_3	S_4	b
50	0	0	100	0	1	-10	5	500
2.5	1	0	2	0	0	$-.1$	.15	15
$-.5$	0	0	0	1	0	0	$-.05$	15
-1	0	1	-1	0	0	.1	$-.1$	10
-100	0	0	0	0	0	-10	-10	-11000

QUESTIONS FOR THE FAMILY FARM PROBLEM

Instructions: Answer each of the following questions as if it were a separate event. Do not consider the cumulative effects between problems unless explicitly requested to do otherwise.

1. Are there any other planting strategies that Fred and Martha should consider before implementing the one described in the optimal tableau given below? If so, describe them, that is compute the entire new tableau associated with any other viable planting strategy.

2. What is the break even sale price of an acre of potatoes? If the market has changed so that we can now sell an acre of potatoes for \$1185, what is the new planting schedule?

3. If Fred and Martha are willing to pay double time for overtime work, how many hours of overtime should they purchase at this wage rate?

4. Suppose Fred and Martha have the opportunity to purchase a small used tractor for \$1800 which has an operating cost of about \$10 an hour. If it is estimated that this tractor will contribute 150 hours of machine time, should Fred and Martha purchase it?

5. The market for turnips has changed. They can now be sold for \$810 an acre. Under such circumstances what is the most that Fred and Martha are willing to pay for the tractor in question 4?