Project Description

A farmer plans to schedule production on his 200-hectare farm over the next five years. He currently has a herd of 120 cows. This herd consists of 20 calves and 100 lactating cows.

Each calf needs 2.3 hectares and each lactating cow needs 1 hectare of space. Each dairy cow produces an average of 1.1 calves per year. Half of these calves are not, which are immediately sold for $ 30. The remaining calves can either be sold immediately for $ 40 or raised to become a lactating cow at 2 years old. The farmer plans to sell all dairy cows at the age of 12 at an average price of $ 120 each. However, there is a 5% annual decrease in calves and a 2% decrease in lactating cows (due to disease, etc.). There are currently 10 cows of any age (from newborn to 11 years old). The decision to sell some calves at the present time has already been made and implemented.

Milk per cow generates an annual income of $ 370 for the farmer. There are currently facilities for raising 130 cows on the farm. Providing space for each cow above that number costs $ 200 per cow. Also, each dairy cow needs 6.0 tons of cereals and 7.0 tons of sugar beet annually.

Both cereals and sugar beets can be grown on the farm. Per hectare of land, 5.1 tons of sugar beet can be produced. Also, only 80 hectares are suitable for planting cereals, which can be divided into 4 groups depending on the harvest.

The grain harvest from each group is given in the table below:

Product (tons per hectare)	Hectares	Group
1.1	20	1
0.9	30	2
0.8	20	3
0.65	10	4

It is obvious that the space required for any action, ie raising grains, sugar beets, raising cattle and calves, must be considered separately and it is not possible to raise both livestock and agricultural products in one space. Therefore, it is not possible to overlap the space required for livestock and agricultural products.

Cereals can also be bought for $ 90 per ton and sold for $ 75 per ton. Sugar beets can also be bought for $ 70 per ton and sold for $ 58 per ton. The number of workers required and other costs are given in the table below.

At present, farm workers are paid $ 4,000 (in total) and provide 5,500 working hours (in total). For each additional 5500 hours, you have to pay $ 2.1.

	Required working time (hours per year)	Other costs (dollars per year)
Every calf	10	50
Every dairy cow	42	100
Each hectare for planting cereals	4	15
Each hectare for planting sugar beet	14	10

The farmer does not want the total number of lactating cows to decrease to less than 50% or increase to more than 75% at the end of the 5-year period.

Every 5 years, the buying and selling prices are constant and equal to the amounts stated.

How should a farmer act in the next 5 years to maximize his profit?