**Activity 1.1.8 Farm Subsidies**

Farming can be a very difficult way of life, as sometimes “Mother Nature” does not cooperate. A drought can wipe out entire crops. A spring season with too much rain can delay planting and make it difficult for seeds to sprout before they rot. On occasion, insects can damage entire fields of crops. Without healthy crops, there is nothing for the farmer to sell. This leads to very little income and difficult years. Without help, many farmers would be forced to sell their land and find other forms of work.

But, our country needs the farmers and the crops they grow. As a result, the US government helps American farmers by providing them subsidies. A subsidy is money paid directly to the farmers to help them and their families earn enough money to live comfortably and be able to continue farming, especially in difficult years. If the farmer accepts a subsidy, the government determines which crops are needed for the farm and directs the farmer on what to grow on the farm. Farmers must follow these directives in order to receive the subsidy.

Farmers do not have to accept government subsidies. They instead can try to earn a living without the government’s help. Some farmers decline subsidies believe that they can earn more money if they have full control to make their own decisions. Others decline subsidies because they feel uncomfortable taking directions from the government.

The following problem describes a situation in which a farmer is trying to decide whether or not to accept a government subsidy. We can explore this situation using linear programming.

Situation 1:

Suppose a farmer has 200 acres of land on which the family can plant any combination of corn and oats. Each acre of corn that is planted requires 2 worker-days of labor and costs the farmer $10. Each acre of oats that is planted requires ½ worker-day of labor and costs the farmer $5. Suppose the farmer gets $30 in revenue for each acre of corn planted and $20 in revenue for each acre of oats planted. If the farmer has $1,100 to spend on planting and 160 worker-days of labor available for the year, how many acres of corn and how many acres of oats should the farmer plant to maximize his revenue?

1. Identify the variables for this problem.
2. Write three inequalities that constrain the problem as well as the non-negativity constraints.
3. Graph the inequality constraints on the coordinate plane below. Label and scale the axes. Identify and shade in the feasible region.



1. Find the coordinates of the corner points of the feasible region.
2. Write the objective function.
3. Enter the corner points in the table below and find the objective function value for each corner point. Identify the corner point that maximizes the objective function.

|  |  |  |
| --- | --- | --- |
| *x=c* | *y=o* | *Objective Function Value* |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

1. State the solution and verify that it makes sense. Summarize your result in a statement using a complete sentence.

Situation 2:

Suppose a government corn subsidy becomes available that increases the corn revenue from $30 to $50 per acre. The farmer planned on planting corn anyway, so he is considering taking the subsidy. If he takes the subsidy, should the farmer change the number of acres of corn and the number of acres of oats that he plants? If so, how many acres of corn and how many acres of oats should the farmer plant to maximize his revenue?

1. Write the new objective function.
2. Enter the corner points (they have not changed) in the table below and find the new objective function value for each corner point. Identify the corner point that maximizes the new objective function.

|  |  |  |
| --- | --- | --- |
| *x=c* | *y=o* | *Objective Function Value* |
|  |  |  |
|  |  |  |
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1. State the solution and verify that it makes sense. Summarize your result in a statement using a complete sentence.
2. If the farmer takes the subsidy, should the farmer change the number of acres he plants with corn? Explain. If so, what will be his new maximum revenue?

Situation 3:

Suppose a government corn subsidy increases the corn revenue from $30 to $40 for an acre of corn. How will this affect the decision on planting?

1. Write the new objective function.
2. Enter the corner points (they have not changed) in the table below and find the new objective function value for each corner point. Identify the corner point that maximizes the new objective function.

|  |  |  |
| --- | --- | --- |
| *x= c* | *y=o* | *Objective Function Value* |
|  |  |  |
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1. State the solution and verify that it makes sense. Summarize your result in a few statements using complete sentences. Be sure to include how this subsidy affect the farmer’s decision on how much corn and oats to plant.
2. How will this subsidy affect the farmer’s decision on how much corn and oats to plant?
3. Write a summary paragraph about how subsidies might affect this farmer’s decisions.