Linear Programming Lab

The Scenario:

Consider Kenzambique, a (fictitious) coastal nation with a developing economy. In the past five years, the number of international fishing vessels in this country's territorial waters has increased rapidly, dealing devastating blows to the economies and well-being of the country's fishing villages. The government cannot afford the level of coastal patrolling required to force out the international fishing fleets, but they heard about a neighboring country with a similar problem – and their creative solution of selling fishing licenses to the international fleets at a much higher price than the licenses available for domestic fishermen. Kenzambique's government is designing a plan to implement this approach.

The Kenzambique's government wants to determine the optimal number of domestic and international sets of licenses to sell. A license set contains 100 licenses, and can be sold as fractional sets. To prevent the collapse of the local economy, at least four sets of fishing licenses must be sold to domestic fishing companies. To honor promises made to international dignitaries by corrupt political officials, at least one set of fishing licenses must go to an international fishing company. Based on an analysis of the fish stock, the fish population cannot support more than 10 sets of fishing licenses, or the fish population will collapse. Each domestic set of licenses sells for \$10k, and each international set of licenses sells for \$40k. The country is depending on bringing in at least \$120k from the sale of licenses.

A committee will be convening to decide how many sets of domestic licenses and how many sets of international licenses to sell. Each of you have been asked to testify at a hearing of the committee.

Task 1. In Groups of 4 or 5, answer the following questions to begin modeling this problem as a linear programming problem. Then, graph the corresponding feasible region on the grid provided.

Let,
$x_1 =$ the number of domestic fishing license sets sold, and
$x_2 =$ the number of international fishing license sets sold

1. Write the non-negativity constraints.

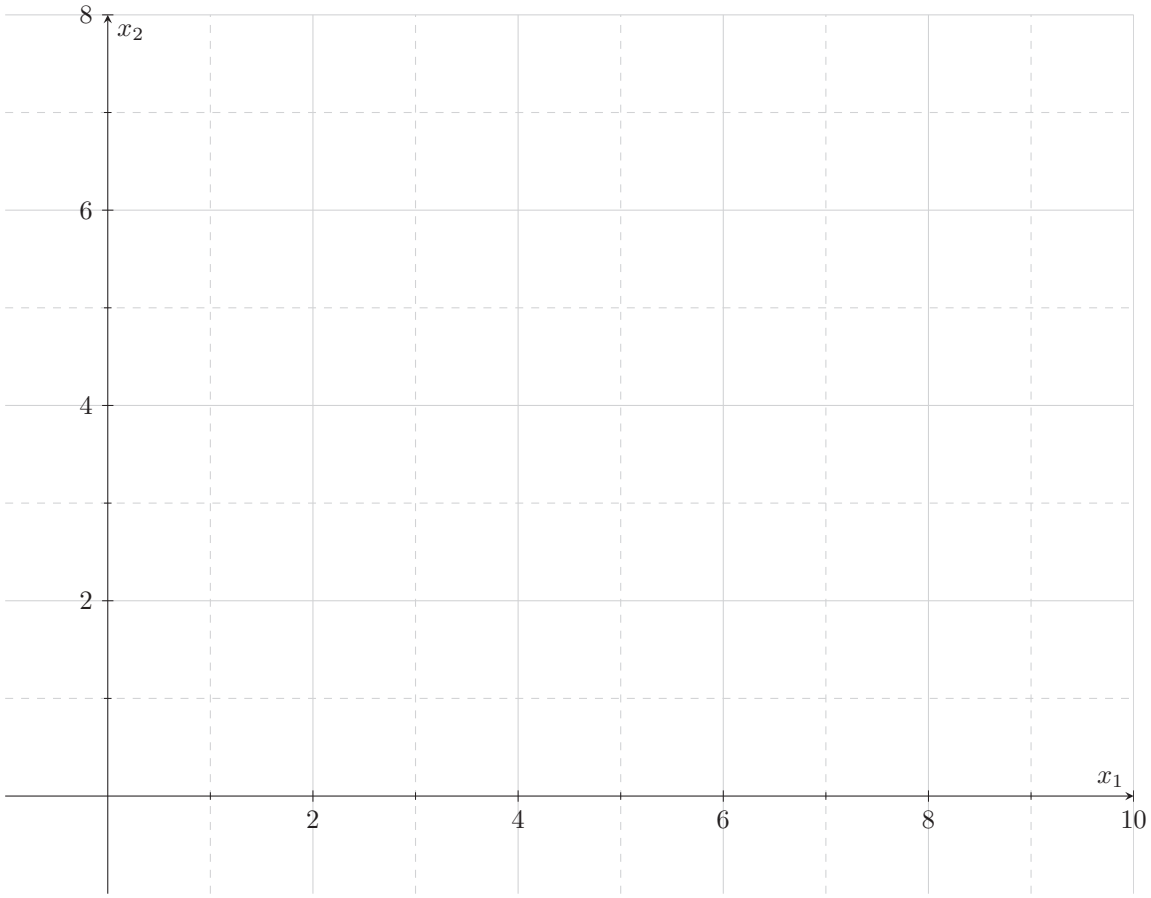
2. Write the constraint for domestic fishing licenses.

3. Write the constraint for international fishing licenses.

4. Write the constraint that protects the fish population.

5. Write the constraint for Kenzambique's government revenue.

6. Graph the feasible region created by these constraints.



7. Calculate and label all corner points of the feasible region you have drawn.

Task 2. Each committee member represents a specific stakeholder. Assign each group member a character (A-E). Individually, using the prompts given to you by your instructor, determine the best resolution for your stakeholder. Write the character you are assigned here:

After you determine your character's objective, **CONVENE A HEARING**.

- Speak and argue from your character's perspective focusing on the interests your stakeholder cares about most.
- Use the feasible region graphed to support your arguments, but don't simply state "my solution is point (x, y)." Instead, explain why a certain solution fits your stakeholder's needs.
- Listen to the others: you may need to counter their arguments, form alliances, or compromise.

If one solution clearly dominates, the committee may adopt it. If not, you must negotiate and recommend a compromise that the group can support.

For your memorandum:

- In the *purpose* paragraph you need to write your objective clearly – what are you minimizing or maximizing?
- Then, in the *recommendation* paragraph, identify the optimal solution your stakeholder would pursue based on this objective.
- Also provide a recommendation for a compromise solution if you are unable to persuade the committee to adopt your optimal point. Justify why this compromise is acceptable to your stakeholder using both the math and the context.

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