Farm Business Management: The Fundamentals of Good Practice

Chapter 15: Introducing Further Methods of Farm Systems Analysis

Questions

1. Given the resource constraints 300 ≥ $6x_1 + 2x_2$ and 150 ≥ $x_1 + 2x_2$, draw a graph of the feasible region and shade it in. Also indicate the marginal rate of substitution between x_1 and x_2 over each segment of the production possibility boundary.

2. Given the following resource supplies, activity gross margins and activity resource requirements (all on a per unit of activity basis), write out the decision problem as a linear programming (LP) problem set of equations. Define all terms used.

Activity number	1	2	3	4
Land requirement (ha) (100 ha available)	1	1	1	1
Labour (h) (2000 h available)	40	10	18	35
Working capital ($) ($4000 available)	100	35	200	80
Gross margin/ha ($)	400	200	350	250

3. Given the LP objective function $Z = 125x_1 + 100x_2$, what is the slope of the iso-profit line?

4. For this objective function and the two equations in the first question above, estimate the optimal point and the values taken on by x_1, x_2 and Z. What are the total resources used by the solution?

5. How can the factor/factor problem be represented in a LP decision model?

6. How can the factor/product problem be represented in a LP model?

7. If the C_j (net revenue per unit if the *j*th activity) declines as x_j (level of the *j*th activity) increases, can this situation be represented in a LP model? If so, how?

8. What are the assumptions inherent in systems simulation models?

Tasks

1. Can there be more than one optimal point in a LP problem? Give reasons and draw a graph to show your arguments.

2. Will all management decision problems have a set of constraints? Give reasons.

3. Why does an optimal LP solution exhibit stability to limited price changes? Draw a graph to represent your answer. Include a commentary.

4. Whereabouts on the graph of a LP problem does the initial solution lie in the iterative solving process? Why is this solution used? Discuss the subsequent solution moves and draw a graph to reinforce what you are talking about.

5. What is the importance of having a good understanding of the LP assumptions? Similarly for dynamic programming and systems simulation? Use examples to reinforce your explanation.

6. Define the assumptions inherent in the LP objective function. And what are the assumptions about the marginal rates of substitution. Discuss the reality of these assumptions.

7. How can the certainty assumption in the LP model be overcome to a certain extent? Reinforce your answer with farm examples you are familiar with.

8. List and describe three of the general types of constraints that are likely to be found in most decision problems. Write out the form these equations will take.

9. Outline the divisibility and finiteness assumptions in the LP model. Can they be overcome, and what is their significance? Use examples you are familiar with.

10. Rough out a systems simulation model that would be suitable for exploring a decision problem that is common in your area of primary production. Explain why the systems simulation model is suitable for exploring the problem.

11. Using examples, explain why dynamic programming is a very good representation of typical farm decision problems exhibiting the features of the real world. In the process, also list out the assumptions inherent in the dynamic programming model.

12. What is meant by the term ‘the state variable values’ and why are they important in dynamic programming? Use at least two examples in explaining their importance.

13. What is the dimensionality problem in dynamic programming? Can it be overcome? Give examples from your knowledge of farm decision problems.