

# Part V–Game Theory

Linear programs deal with a single decision maker who acts in his or her best interest. Game theory deals with multiple decision makers, each of whom acts in his or her own best interest. At first glance, these subjects seem to have nothing in common. But there are two strong connections – one through the Duality Theorem, the other through the simplex method.

## **Chapter 14. Introduction to Game Theory**

Game theory has a wide variety of solution concepts and applications. Three different solution concepts are described and illustrated in this chapter. Several famous games are discussed. The Duality Theorem is used to construct optimal strategies for von Neumann’s matrix game and to construct a general equilibrium for a stylized model of an economy.

## **Chapter 15. The Bi-Matrix Game**

The bi-matrix game is not a zero-sum game. The Duality Theorem provides no insight into it. But the simplex method does. Feasible pivots are used to construct an equilibrium.

## **Chapter 16. Fixed Points and Equilibria**

An economic equilibrium has long been understood to be a “Brouwer fixed point,” namely, a vector  $x = f(x)$  where  $f$  is a continuous map of a closed bounded convex set  $C$  into itself. A deft adaptation of the pivot scheme in Chapter 15 constructs an equilibrium for an  $n$ -player competitive game. The same method provides a constructive proof of Brouwer’s fixed-point theorem.