

- Holding the number of firms in an oligopoly constant in the short run, the introduction of a factor that softens competition (product differentiation, search costs, collusion, and so forth) will raise firms' profit, but an offsetting effect in the long run is that entry—which tends to reduce oligopoly profit—will be more attractive.
- Innovation may be even more important than low prices for total welfare in the long run. Determining which oligopoly structure is the most innovative is difficult because offsetting effects (dissipation and replacement) are involved.

## PROBLEMS

### 15.1

Assume for simplicity that a monopolist has no costs of production and faces a demand curve given by  $Q = 150 - P$ .

- Calculate the profit-maximizing price-quantity combination for this monopolist. Also calculate the monopolist's profit.
- Suppose instead that there are two firms in the market facing the demand and cost conditions just described for their identical products. Firms choose quantities simultaneously as in the Cournot model. Compute the outputs in the Nash equilibrium. Also compute market output, price, and firm profits.
- Suppose the two firms choose prices simultaneously as in the Bertrand model. Compute the prices in the Nash equilibrium. Also compute firm output and profit as well as market output.
- Graph the demand curve and indicate where the market price-quantity combinations from parts (a)–(c) appear on the curve.

### 15.2

Suppose that firms' marginal and average costs are constant and equal to  $c$  and that inverse market demand is given by  $P = a - bQ$ , where  $a, b > 0$ .

- Calculate the profit-maximizing price-quantity combination for a monopolist. Also calculate the monopolist's profit.
- Calculate the Nash equilibrium quantities for Cournot duopolists, which choose quantities for their identical products simultaneously. Also compute market output, market price, and firm and industry profits.
- Calculate the Nash equilibrium prices for Bertrand duopolists, which choose prices for their identical products simultaneously. Also compute firm and market output as well as firm and industry profits.
- Suppose now that there are  $n$  identical firms in a Cournot model. Compute the Nash equilibrium quantities as functions of  $n$ . Also compute market output, market price, and firm and industry profits.
- Show that the monopoly outcome from part (a) can be reproduced in part (d) by setting  $n = 1$ , that the Cournot duopoly outcome from part (b) can be reproduced in part (d) by setting  $n = 2$  in part (d), and that letting  $n$  approach infinity yields the same market price, output, and industry profit as in part (c).

### 15.3

Let  $c_i$  be the constant marginal and average cost for firm  $i$  (so that firms may have different marginal costs). Suppose demand is given by  $P = 1 - Q$ .

- Calculate the Nash equilibrium quantities assuming there are two firms in a Cournot market. Also compute market output, market price, firm profits, industry profits, consumer surplus, and total welfare.