Question 1: Game theory and Cournot duopoly

The market for Tyledrin, a popular drug in Baldonia, is shared by two firms, Noventis (Firm 1) and Avartis (Firm 2). This drug is a commodity, and statistical analysis has revealed that quantity competition captures well the short-run competition between the two firms. It has further been determined that the demand is given by P = 200 – 2Q, where Q = q1 + q2 is total output, P is the price (in dollars per ton), and q1 is the quantity (in tons) supplied by Firm 1. Similarly, q2 is the quantity (in tons) supplied by Firm 2. Firms have identical constant marginal cost of $20 per ton. There are no fixed costs.

Task 1

Assume that firms choose q1 and q2 simultaneously and independently, once and for all. Calculate the best response (reaction) function for both firms.

Task 2

Find the Nash equilibrium in this market. Illustrate such equilibrium as the intersection of the graphs of the BRFs in a q1 vs q2 diagram.

Assume now that Firm 1 chooses its output before Firm 2. Moreover, Firm 2 observes Firm 1’s choice before choosing its own output. For this part suppose that quantity choices are irreversible.

Task 3

Use backward induction to determine what quantities will be chosen by the firms. Is there a first or a second player advantage in this setting?

Still assuming that Firm 1 chooses first, suppose that they get a chance to revise their output choice after Firm 2 has responded. Furthermore, Firm 2 anticipates that Firm 1 can revise its choice. Similarly, Firm 1 knows from the start that it will get an opportunity to revise its choice. Let’s assume that if Firm 1 reduces its output, it can recover the entire marginal cost ($20 per ton) corresponding to the units not offered to the market. Firm 2’s choice is irreversible. All payoffs accrue after Firm 1 chooses its revised quantity.

Task 4

Find the initial output chosen by Firm 1, the output chosen by Firm 2, and the revised output chosen by Firm 1.

Question 2: Banana Republic

Banana Republic sells casual dress items under its highly valued brand through its own network of stores. One of its seasonal products is offered for sale from November through February, at which point the product is removed from the stores to make room for the Spring season product. The fashion-driven, seasonal nature of demand and storage cost eliminate the option of storing surplus units for future use, so at the end of the season, the product is of no value to anyone.

This product is manufactured overseas. Quantities must be ordered by April 1 to give enough time for manufacturing, transportation, etc. The foreign manufacturers charge $20 per unit (delivered) plus a fixed lump-sum cost of $20,000 to cover overhead.

Based on market data from the season just ending, Banana Republic forecasts the demand for this item to be P=140-6Q (P in $ per unit and Q in '000 of units).

Task 1

What quantity, Q, should Banana Republic order, and what price P should it expect to charge? Illustrate the situation in a carefully labeled diagram, including the graphs of demand, marginal cost, marginal revenue, average total cost. Highlight the region that corresponds to the profit of the firm.

Independently from all this, Banana Republic had placed an order for an additional 2,000 units to be sold (through a distributor) in an Eastern European country. The cost of this additional output (20\*2,000) is paid at the time of contract signing with the manufacturer in April. Although the products are identical, the domestic and foreign markets are perfectly segmented, so there is no reason to be concerned that sales in the European market will affect domestic demand and prices.

In October, as shipments start to arrive, the Eastern European distributor unexpectedly experiences serious financial difficulties and cancels the order. Now, Banana Republic is stuck with an additional 2,000 units it had not planned on. Your problem is to decide on the best course of action under these unanticipated circumstances. The questions below compare three alternative scenarios.

Task 2

The company can divide the (unexpected) surplus of 2,000 units in any proportion between the following two alternatives:

A: Sell additional output through the company's stores.

B: Burn the product (at no cost).

That is, the firm can put the entire 2,000 extra units into option A, the entire amount into option B, or divide the 2,000 units in any way it wishes between the two options. (For option A, the demand forecast remains P=140-6Q). Would the firm ever choose to burn any of its output? How should you allocate the surplus output between the two alternatives A and B? (Hint: the marginal contribution of a unit of sale to total revenue is marginal revenue, not the price)

Task 3

Suppose there is now another option available:

C: Banana Republic can dispose of all or part of the surplus output of 2,000 units by removing the company's label, and sell it domestically through discount stores at a flat price of $10 (this effectively damages the products by removing a valuable brand label).

The firm is now comparing options A, B and C. Maintain the assumption that the company can divide the (unexpected) surplus of 2,000 units in any proportion between A, B and C. How many units would the firm allocate to each option?

Task 4

Think of examples where firms destroy or damage products or services, even though there are buyers willing to pay amounts in excess of marginal cost for the intact product.