CARLETON UNIVERSITY
Department of Economics

ECON 4301A
**Market Structure and Firm Behaviour**

2012 Fall

**ASSIGNMENT # 2**

---

**DUE BY 15:30 FRIDAY 30 NOVEMBER 2012**

Marks will be deducted if the presentation of your answers is not intelligible, coherent, and comprehensive. All graphs should be readily decipherable and clearly labeled. Any mathematical derivations should be documented. THIS MEANS THAT EXCEPT FOR ALGERBRAIC SIMPLIFICATIONS, YOU MUST SHOW AND EXPLAIN EACH STEP OF THE DERIVATION. This assignment is worth 20% of your grade.

---

1. Two firms produce an identical good. The demand and cost conditions are described by:

$$\begin{aligned} P(q_1, q_2) &= 100 - q_1 - q_2 \\ MC_1 &= 20 \\ MC_2 &= 30 \end{aligned}$$

   (a) Derive the reaction functions for each firm assuming Cournot behaviour.

   (b) Plot the reaction functions on a graph with the vertical axis being $q_2$, and the horizontal axis being $q_1$.

   (c) Determine the Nash equilibrium quantity for each firm, and the market price.

   (d) What will happen to industry output and price if the two firms maximize joint profits rather than behave as Cournot duopolists? Determine the equilibrium price and quantity in this case. Why is the collusive outcome NOT a Nash equilibrium?

   *Hint: In this situation you must show that the collusive outcome is in fact not a Nash Equilibrium to a one shot game.*

. . . 2

2. Suppose that demand is given by $P = 130 - Q$ and marginal cost equals 10. Firms are Bertrand competitors with unconstrained capacity that produce a homogeneous product and play a supergame. The collusive agreement being considered is for each firm to produce half of the monopoly output.

   (a) For what values of the discount factor can grim punishment strategies support an equal division of the monopoly output?

   (b) Which type of competition – Bertrand or Cournot – is more likely to sustain the collusive agreement? Why?

3. An industry consists of two firms. The demand function for the product of firm $i$ is $q_i = 24 - 5p_i + 2p_j$. The marginal cost of production for each firm is zero.

   (a) Find the price best-response function for firm 1 and firm 2.

   (b) Graph the best-response functions.

   (c) Find the Nash equilibrium prices and profit.

4. For the case in which there are six firms competing over locations in the Hotelling linear city, and the equilibrium locations when the distance between the two most interior firms are:

   (a) $\frac{1}{8}$.

   (b) $\frac{1}{4}$.

   (c) 0.

*Hint: This is problem 3 on page 416 of the textbook. Start with the following set-up and then use the definition of a Nash Equilibrium to solve for the equilibrium lengths:*

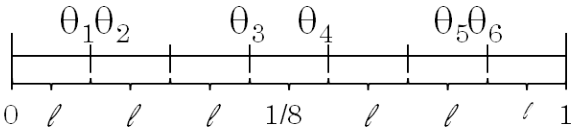


Figure 1: Locations with 6 Firms

5. A country consists, for all intents and purposes, of two towns, Right and Left. Each has one third of the population: the remaining one-third lives uniformly scattered on the one straight road that connects the two towns. Everyone is a drinker. Jim Beam and Jack Daniels own the only two liquor licenses. Each drinker will go regularly to whichever bar is the closest. Unfortunately for Jim and Jack, Antie Temperance has convinced the powers that be that if the these two gentlemen were unregulated, they would conspire to raise prices; the resulting hardship would be intolerable! Hence, the price of a drink in each bar is equal and determined by the government. The only variable that Jack and Jim have control over is their location.

   (a) What is the appropriate definition of a Nash equilibrium for this location game?

   (b) Find the Nash equilibrium locations of the two drinking establishments.

   (c) If we interpret "location" as "type of product," how would you expect the two drinks to taste vis-à-vis each other? What does this say about the markets ability to provide a variety of products?

   (d) Are the Nash equilibrium locations likely to be the "socially optimal" ones?

   (e) Suppose instead that $\frac{1}{8}$ of the population lives in each of the two towns, with the remaining $\frac{3}{4}$ distributed uniformly between the two towns. If there are four taverns, what is the symmetric Nash equilibrium in locations?

   *Hint: The set-up for this question will be discussed in class. However, think about firm profits as expressed in equation 11.5 on page 381 in the textbook where price is equal to 1 and marginal cost is zero. Also note that firms are guaranteed a certain level of customers at each of the end points (i.e. the people in the two towns).*

* * *