COURSE 801: INDUSTRIAL ECONOMICS
MIDTERM EXAM, 19.9.19

Time: 75 minutes **30 Marks**

Answer ALL THREE questions. Keep your answers short and precise, taking care to bring out the relevance of the various assumptions of each model at the appropriate stages of your derivation.

1. *The following information is relevant for parts (a) and (b) below.* Two firms (1 and 2) produce a differentiated product with identical cost functions. Demand for the variety produced by firm 1 is given by $q_1 = D(p_1, p_2)$, and its costs are given by $C_1(q_1)$. Demand and cost functions for variety 2 are defined symmetrically by interchanging subscripts 1 and 2. The varieties are demand substitutes, and the firms compete in prices.
   a) Use firm 1's first order condition for profit maximization to obtain an expression for the slope of its best-response curve in (p_1, p_2) space. What restrictions must be imposed on the convexity of the demand and cost functions to ensure that prices are strategic complements?
   b) Now assume that costs are zero and prices are strategic complements. Suppose that firm 1 sets its price before firm 2, taking firm 2's best response as given. Prove that firm 1 will set a price higher than the price it would set in a simultaneous-move Bertrand-Nash equilibrium. (You can attempt this question independently of part (a)).

(5, 5)

2. A good is demanded by a unit mass of identical consumers who are uniformly distributed along a line segment of unit length, representing a product characteristic. Each consumer has inelastic unit demand with willingness to pay of v, which is high enough to ensure that the market is covered in equilibrium. The good is produced by two firms (1 and 2) with constant marginal costs $0 < c_1 < c_2 < v$, located respectively at 0 and 1 on the line segment. To buy the good, a consumer must incur transport costs (disutility) that is a linear function of the distance to a firm's location. The firms simultaneously choose prices, given their locations.
   a) In this setting, determine (i) whether this is a case of demand substitutability or complementarity, and (ii) whether prices are strategic substitutes or strategic complements.
   b) Determine the Bertrand-Nash equilibrium prices and market shares.

(4, 6)

3. Two identical firms produce a homogenous product and compete in prices. The Nash equilibrium of the stage game is the Bertrand Paradox. They compete in every period over an infinite horizon, with identical discount factors given by δ. They both operate in two markets (A and B) which are identical in demand, but in Market A prices are observed with no lag, whereas in Market B prices are observed after a lag of one period. That is, any deviation from a collusive price that occurs in period 1 can be punished with effect from period 2 in Market A but only from period 3 in Market B. Derive the critical minimum discount factors that can sustain tacit collusion with equal sharing of monopoly profits, using grim trigger strategies with Nash reversion, in the following cases:
   i) The firms treat the two markets as independent
   ii) The firms use cross-market retaliation to exploit multimarket contact.

   (4, 6)