Short Answer Questions (30 points)

1. Depending on the question, write either:
   - a number
   - one of: True, False, or NEI (Not Enough Information)
   - a definition (i.e. one or a few words)

(a) (3 points) True, False, or Not Enough Information: The entry deterrence model discussed in class predicts that the incumbent's capacity choice increases and then decreases as the entry cost increases.

(a) True

(b) (3 points) Consider a two-firm Bertrand model where each firm has the same (constant) marginal cost (=\$10) and the monopoly price = \$200. If Firm 1 plays p_1 = \$50, what is Firm 2's best response?

(b) \$50- ε

(c) (3 points) Consider a two-firm Bertrand model where each firm has the same (constant) marginal cost (=\$10) and the monopoly price = \$200. If Firm 1 plays p_1 = \$250, what is Firm 2's best response?

(c) \$200

(d) (3 points) True, False, or Not Enough Information: Consider the Cournot duopoly model with linear demand and constant marginal costs where a new technology shock decreases the marginal cost of Firm 1. Then, on the best-response diagram, Firm 1's best response curve shifts outwards.

(d) True

(e) (3 points) Consider the Cournot model with n identical firms, constant marginal cost, and linear demand. As the number of firm $n \to \infty$, what value does the price converge to?

(e) Marginal Cost

(f) (3 points) In the cement industry, firms make a capacity choice (for example, they choose how much machinery to invest in) and then compete on price. Which form of competition - out of the ones discussed in class - would be best suited to modeling this market?

(f) Cournot

(g) (3 points) Suppose there are 100 firms competing under Bertrand competition with demand curve $Q = 500 - p$. Of these firms, 99 have a marginal cost of \$200 and one has a marginal cost of \$90. What is the equilibrium price?

(g) \$200

(h) (3 points) Name one solution to the 'Bertrand Trap'.

(h) e.g. Product Differentiation

(i) (3 points) The Hotelling model with transport costs equal to zero (t=0) is equivalent to which form of competition?

(i) Bertrand

(j) (3 points) Suppose two firms are capacity constrained with capacities $k_1 = k_2 = 20$, and total demand is $Q = 200 - p$. What is the equilibrium total quantity under Bertrand competition?

(j) 40

2. Cournot Competition (30 points)

2. Suppose that total demand in the market for cement is $p = 100 - 3Q$. Firm 1 and Firm 2 are identical with constant marginal cost = 40. The firms compete on quantities (Cournot competition).

(a) (15 points) If Firm 1 chooses $q_1 = 2$, what is Firm 2's best response?

$\pi_2 = q_2(100 - 3q_1 - 3q_2 - 40)$

$= q_2(60 - 3q_1 - 3q_2)$

$= 60q_2 - 3q_1q_2 - 3q_2^2$

$\frac{d\pi_2}{dq_2} = 60 - 3q_1 - 6q_2 = 0$

$q_2 = 10 - \frac{1}{2}q_1$

At $q_1 = 2$, $q_2 = 9$

(a) 9

(b) (15 points) Determine the equilibrium quantity choices in the Cournot equilibrium.

Identical firms, so $q_1 = q_2 = q$

So, $q = 10 - \frac{1}{2}q_1$

And: $\frac{3}{2}q = 10 \Rightarrow q = q_1 = q_2 = \frac{20}{3}$

(b) $q_1 = \frac{20}{3}$, $q_2 = \frac{20}{3}$

3. Stackelberg Competition (30 points)

3. There are two firms in a market with total demand $p = 200 - 2Q$. Firm 1 moves first and Firm 2 moves second. Firm 1's total cost is $C(q_1) = 3q_1^2$. Firm 2's total cost is $C(q_2) = 0$.

   (a) (30 points) Suppose that the firms compete in a Stackelberg equilibrium. What is the equilibrium quantity for Firm 1?

$$\pi_2 = q_2(200 - 2q_1 - 2q_2)$$

$$\frac{d\pi_2}{dq_2} = 200 - 2q_1 - 4q_2 = 0$$

$$\Rightarrow q_2 = 50 - \frac{1}{2}q_1$$

$$\pi_1 = q_1(200 - 2q_1 - 2q_2) - 3q_1^2$$

$$= q_1(100 - q_1) - 3q_1^2$$

$$\frac{d\pi_1}{dq_1} = 100 - 2q_1 - 6q_1 = 0$$

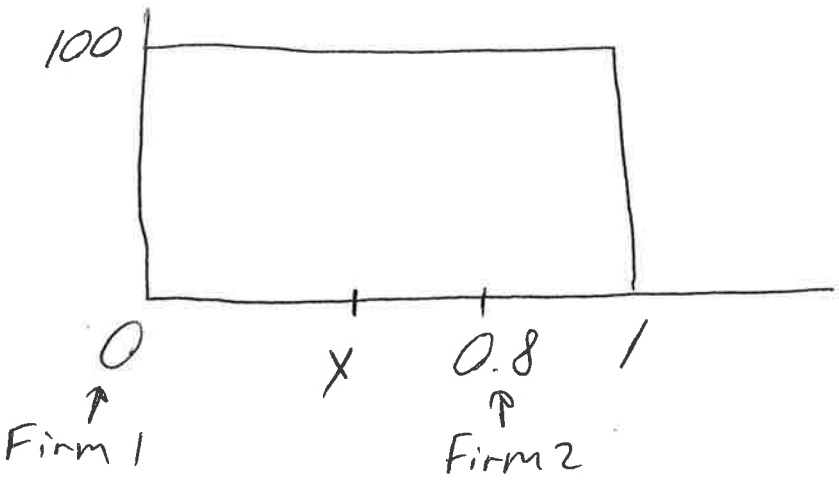
$$\text{So, } q_1 = 12.5$$

(a) 12.5

4. Hotelling Model (30 points)

4. Suppose 100 consumers are uniformly distributed on a 1 mile stretch of road. There are two supermarkets on the road: Supermarket 1 is located at the west end of the road (at location = 0), and Supermarket 2 is part way along the road (at location = 0.8). Transport costs for consumers are \$0.50 per mile. The supermarkets' marginal costs are 0. The supermarkets compete on prices: denote Supermarket 1's price p_1 and Supermarket 2's price p_2.

   (a) (15 points) What is the demand for each supermarket?[1]



Marginal consumer: $p_1 + 0.5x = p_2 + 0.5(0.8 - x)$

$\Rightarrow x = 0.4 + p_2 - p_1$

Demand: $q_1 = 100(0.4 + p_2 - p_1)$

$q_2 = 100(0.6 + p_1 - p_2)$

(a) $q_1 = 100(0.4 + p_2 - p_1)$

$q_2 = 100(0.6 + p_1 - p_2)$

[1] When computing consumer choices, only consider the transport costs to get to the supermarket, don't worry about the return journey.

(b) (10 points) If Firm 2 chooses a price $p_2 = 0.1$, what is Firm 1's best response p_1?

$$\pi_1 = 100(0.4 + p_2 - p_1)\,p_1$$

$$\frac{d\pi_1}{dp_1} = 0 \Rightarrow 0.4 + p_2 - 2p_1 = 0$$

$$\Rightarrow p_1 = 0.2 + \frac{1}{2}p_2$$

$$= 0.25 \text{ at } p_2 = 0.1$$

(b) 0.25

(c) (5 points) In <u>one sentence</u> explain: if prices are fixed and the supermarkets could relocate, would you expect the supermarkets to move location or to remain in their current locations?

The supermarkets would relocate to be closer to each other because fixed prices implies no "strategic effect" but still a "direct effect"