ECON 439
Quiz 2
Dr. Kevin Hasker

1. *(1 Point)* **Honor Statement:** Please read and sign the following statement:

   I promise that my answers to this test are based on my own work without reference to any notes, books, or the assistance of any other person during the test. I will also not use a calculator or other electronic aid for calculation during this test.

   Name and Surname: _
   Student ID: _
   Signature: _

   $P = 30 - Q$ where $Q = q_1 + q_2$. The costs of firm one are $c_1(q) = q_1$ and for firm two are $c_2(q) = q_2$.

a	b	c_1	c_2	$BR_1(q_2)$	$BR_2(q_1)$	q_1^*	q_2^*	Q	P
30	1	8	1	$11 - \frac{1}{2}q_2$	$\frac{29}{2} - \frac{1}{2}q_1$	5	12	17	13
23	1	1	6	$11 - \frac{1}{2}q_2$	$\frac{17}{2} - \frac{1}{2}q_1$	9	4	13	10
27	1	6	3	$\frac{21}{2} - \frac{1}{2}q_2$	$12 - \frac{1}{2}q_1$	6	9	15	12
24	1	1	8	$\frac{23}{2} - \frac{1}{2}q_2$	$8 - \frac{1}{2}q_1$	10	3	13	11

2. Consider the following asymmetric Cournot oligopoly. Their are two firms who each choose a quantity: $q_i \geq 0$ ($i \in \{1, 2\}$). Price is determined by the inverse demand curve $P = a - bQ$ where $Q = q_1 + q_2$. The costs of firm one are $c_1(q) = c_1 q_1$ and for firm two are $c_2(q) = c_2 q_2$. **NOTE:** Throughout this question you **cannot** write down abstract coefficients, if at any point your answers include letters for the marginal cost or the demand coefficients you will get no points for this question.

   (a) *(2 points)* Set up the objective functions of both firms.

   $$\max_{q_1} (a - b(q_1 + q_2)) q_1 - c_1 q_1$$
   $$\max_{q_2} (a - b(q_1 + q_2)) q_2 - c_2 q_2$$

   (b) *(2 points)* Find the first order conditions of both firms.

   $$\begin{aligned} a - b(q_1 + q_2) - bq_1 - c_1 &= 0 \\ a - b(q_1 + q_2) - bq_2 - c_2 &= 0 \end{aligned}$$

   (c) *(6 points)* Find the best response of both firms.

   $$\begin{aligned} a - b(q_1 + q_2) - bq_1 - c_1 &= 0 \\ a - bq_2 - c_1 &= 2bq_1 \end{aligned}$$

$$q_1 = -\frac{1}{2b}\left(-a + c_1 + bq_2\right)$$

$$\begin{aligned} a - b\left(q_1 + q_2\right) - bq_2 - c_2 &= 0 \\ a - bq_1 - c_2 &= 2bq_2 \end{aligned}$$

$$q_2 = -\frac{1}{2b}\left(-a + c_2 + bq_1\right)$$

(d) *(6 points)* Find the equilibrium quantities of both firms, the total quantity produced and the price at which goods are sold.

$$\begin{aligned} q_1 &= -\frac{1}{2b}\left(-a + c_1 + b\left(-\frac{1}{2b}\left(-a + c_2 + bq_1\right)\right)\right) \\ q_1 &= \frac{1}{4}q_1 + \frac{1}{4}\frac{a}{b} - \frac{1}{2b}c_1 + \frac{1}{4b}c_2 \\ \frac{3}{4}q_1 &= \frac{1}{4}\frac{a}{b} - \frac{1}{2b}c_1 + \frac{1}{4b}c_2 \\ q_1 &= \frac{1}{3b}\left(a - 2c_1 + c_2\right) \end{aligned}$$

$$\begin{aligned} q_2 &= -\frac{1}{2b}\left(-a + c_2 + b\left(\frac{1}{3b}\left(a - 2c_1 + c_2\right)\right)\right) \\ &= \frac{1}{3b}\left(a + c_1 - 2c_2\right) \end{aligned}$$

$$\begin{aligned} Q &= q_1 + q_2 = \frac{1}{3b}\left(a - 2c_1 + c_2\right) + \frac{1}{3b}\left(a + c_1 - 2c_2\right) \\ &= -\frac{1}{3b}\left(c_1 - 2a + c_2\right) \end{aligned}$$

$$\begin{aligned} P &= a - b\left(-\frac{1}{3b}\left(c_1 - 2a + c_2\right)\right) \\ &= \frac{1}{3}a + \frac{1}{3}c_1 + \frac{1}{3}c_2 \end{aligned}$$

3. *(3 points)* Standard feedback questions: (points given if any answer is given)

   (a) The topic in this class I feel I understand the best is:

(b) The topic in this class I feel I understand the worst is:

(c) Out of ten, how do I think the professor is doing.