Instructions: You need paper (lined if possible), a ruler, and a pen or a pencil to write this quiz. You may answer the questions in any order you like. You should start each question on a new page. You must write your answers; typed answers will not be accepted. When you are finished answering the questions, please order the pages so your answer to question 1 is first, and then your answer to question 2. Then, in a single email message, send an image of each page to me at jburbirdg@uwaterloo.ca. Please put Econ 393, your name and your id number in the subject line of your email. The deadline for submitting your answers is 6:00 pm Tuesday July 21st, Toronto time. The marks allocated to each question are shown in brackets.

1. Each year 2000 risk-neutral citizens in Vancouver sell their used cars (one per car owner) and buy new cars. All used cars must be sold. Sellers know the true value of each vehicle. Buyers, who are also risk-neutral, know only that the values to each buyer are uniformly distributed between 0 and $3000. This is scenario A. Scenario B is identical except that in B, Steve's Garage will certify the true value of a car for $300, payable by each car owner who wants her/his car inspected.

(1 mark) (i) Draw the density function for car value to each buyer.
(1 mark) (ii) Describe the equilibrium in Scenario A.
(2 marks) (iii) Describe the equilibrium in Scenario B.
(2 marks) (iv) Use a diagram to explain how seller welfare is altered by moving from scenario A to scenario B.

**ANSWER**

(i) [Diagram showing the density function with a horizontal line at 1 divided by 3000 over the range 0 to 3000, with a vertical axis labeled 'density function' and a horizontal axis labeled 'value to car buyer.']
(ii) In Scenario A there is a pooling equilibrium in which all 2000 cars sell for the average car value, which is $1500 for each car.

(iii) In Scenario B the person whose car is worth $600 is the border between the pooling and the separating segments of the market. This person is indifferent between going to Steve’s Garage and netting 300 dollars or putting his car into the pool of cars that are not evaluated and getting $600/2 = 300 dollars. We have a pooling equilibrium for the 400 cars that are worth 600 dollars or less. All cars worth more than 600 dollars sell for their true value in a separating equilibrium.

(iv) Here’s the graph of seller net gain in Scenario A minus net gain in Scenario B.

![Graph showing net gain vs. car value for scenarios A and B.]

2. (6 marks) Suppose the used car market in Toronto this week has many people looking to buy a used car and 1000 people willing to sell their used cars. Used cars are one of two types — good cars or lemons. Buyers cannot tell car quality before they buy; each seller knows whether their car is a lemon or a good car. Buyers are willing to pay $a$ dollars for a good car and $b$ dollars for a bad car. Each seller of a good car wants at least $c$ dollars; each seller of a lemon wants at least $d > 0$ dollars. All buyers are risk neutral. Everybody knows that a fraction $f, 0 < f < 1$ of the 1000 cars are good. Assume $a > c > d$ and $a > b > d$. Describe each possible equilibrium in this market and the parameter values for which it exists.

**ANSWER**

This is an example of how markets with imperfect information may have two or more equilibria for the same parameter values. In this particular example two equilibria are possible. Here is the information in the question in the form of a table.
Given $b > d$ one equilibrium is a *separating* equilibrium in which only lemons sell for $b$ dollars each. Why $b$ rather than some price between $b$ and $d$? Because there are *many* potential buyers and no more than 1000 sellers. This equilibrium does *not* depend on the sign of $b - c$. Given the assumptions in this question it is always a possibility.

A pooling equilibrium *may* exist as well. Given the risk neutrality of buyers, each buyer is willing to pay $f a + (1 - f) b$ for any car in a pool with all 1000 cars in it. If $f a + (1 - f) b \geq c > d$ all car owners will be willing to put their cars into the pool for sale. Again, because there are *many* potential buyers, the equilibrium price is this pooling equilibrium would be $f a + (1 - f) b$ for every car.

<table>
<thead>
<tr>
<th>Car Quality</th>
<th>Fraction of each type</th>
<th>Buyers willing to pay</th>
<th>Sellers want at least</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>$0 &lt; f &lt; 1$</td>
<td>$a$</td>
<td>$c$</td>
</tr>
<tr>
<td>Lemon</td>
<td>$1 - f$</td>
<td>$b$</td>
<td>$d$</td>
</tr>
</tbody>
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