ECON/MGEC 333
GAME THEORY AND STRATEGY
Midterm Examination I

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Instructions

• Please write your name in the space provided at the top.
• Answer all questions.
• Write your answers in the space provided for each answer.
• Show enough of your work so that your reasoning can be followed.
• You may detach the last two pages and use as scrap paper.
• Time allowed: 90 minutes.

<table>
<thead>
<tr>
<th>Question</th>
<th>Max</th>
<th>You get</th>
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</thead>
<tbody>
<tr>
<td>Question 1</td>
<td>30 pts</td>
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<tr>
<td>Question 2</td>
<td>35 pts</td>
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<tr>
<td>Question 3</td>
<td>35 pts</td>
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<tr>
<td>Total</td>
<td>100 pts</td>
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Good Luck!
1. **(30 pts)** Consider the following game:

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<thead>
<tr>
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<th>( S )</th>
<th>( H )</th>
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<tbody>
<tr>
<td>( S )</td>
<td>4,4</td>
<td>0,2</td>
</tr>
<tr>
<td>( H )</td>
<td>2,0</td>
<td>2,2</td>
</tr>
<tr>
<td>( N )</td>
<td>3,0</td>
<td>1,0</td>
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</tbody>
</table>

   (a) **(15 pts)** Find the set of pure strategy Nash equilibria.

   (b) **(15 pts)** Find a mixed strategy Nash equilibrium in which player 1 plays all three actions with positive probabilities.
You may continue your answer to Question 1 on this page
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2. (35 pts) A buyer and a seller simultaneously submit a price, which can be any non-negative number. If the price chosen by the buyer is at least as large as the price chosen by the seller, i.e., \( p_b \geq p_s \), trade occurs and the buyer pays \( p_b \) whereas the seller receives \( p_s \). The rest, i.e., \( p_b - p_s \), goes to a charity. If trade occurs, payoff of the buyer is his value \( v \) minus the price he pays and the payoff of the seller is the price she receives minus her cost, \( c \). Assume that \( v > c \geq 0 \). If trade does not occur, both players receive zero payoff.

(a) (10 pts) Formulate this situation as a strategic form game.
(b) (10 pts) Show that any \((p_b, p_s)\) such that \( c \leq p_b = p_s \leq v \) is a Nash equilibrium.
(c) (15 pts) Find the set of all pure strategy Nash equilibria.
You may continue your answer to Question 2 on this page
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3. (35 pts) Now consider the game in question (2), but with incomplete information. Buyer’s value \( v \) and seller’s cost \( c \) have independent uniform distributions over the interval \([0, 1]\). However, only buyer knows his value and only seller knows her cost. Find a Bayesian equilibrium in which the buyer plays according to a linear strategy:

\[
p_b(v) = \alpha + \beta v
\]

and the seller plays according to

\[
p_s(c) = \gamma + \delta c.
\]

Note that \( \alpha, \beta, \gamma, \delta \) are coefficients that you should determine so that the resulting strategies constitute a Bayesian equilibrium.
You may continue your answer to Question 3 on this page
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You may use as scrap paper
You may use as scrap paper