Assignment 1

ECON 3161, Game Theory

Due: By the end of class on Thursday Sept. 6th

Directions: Answer all questions completely. Note the due date of the assignment. Late assignments will be accepted at the cost of 10 points per day, up until 11am on Sept. 11. At that time I will return the graded assignments and post the answers online. You may turn in assignments to me after that time so that I can check your work for you, but please realize that you will not receive a grade for the assignment. You may work in a group consisting of up to 3 members – for each group please turn in only 1 set of answers and make sure all group member names are on that set of answers. All group members will receive the same grade.

1. Ren and Chuck are engaged in a game of chicken using tractors (chicken is the game where people drive at one another and the first one to go off the road is the chicken). The players each have two strategies – stay on the road (stay) or veer off the road (veer). If both players choose stay then they are both not chickens, but they crash into each other. Thus, each player’s payoff is 0. If both players choose veer then they are both chickens but they do not crash. Each player’s payoff is 2. However, if one player chooses stay and the other player chooses veer, then the player who chooses stay gets 10 and the player who chooses veer gets 1. To be complete, chicken is a simultaneous move game.

a (10 points) Draw the strategic form (matrix) for this game.

b (10 points) Does either player have a strictly or weakly dominant strategy? If so, which player and which strategy?

c (10 points) Are there any pure strategy Nash equilibria to this game? If so, find it (them). If not, explain why not

2. Consider the following strategic form game between Players 1 and 2:

<table>
<thead>
<tr>
<th></th>
<th>W</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Player 1</td>
<td>A</td>
<td>3,2</td>
<td>1,1</td>
<td>4,3</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>1,3</td>
<td>3,0</td>
<td>6,4</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>2,1</td>
<td>0,1</td>
<td>1,2</td>
</tr>
<tr>
<td></td>
<td>D</td>
<td>1,0</td>
<td>2,0</td>
<td>2,1</td>
</tr>
</tbody>
</table>

a (10 points) Find the strategies that are strictly dominated and those that are weakly dominated.
Write down both the strategy that is strictly (or weakly) dominated and the strategy that strictly (or weakly) dominates it.

For parts b-d use the Iterated Elimination of Dominated Strategies (IEDS) method to reduce the matrix as far as possible.

b (10 points) Describe the steps you use to remove strategies.

c (10 points) What is the furthest the matrix can be reduced using IEDS? Write down this reduced matrix.

d (10 points) There are 2 pure strategy Nash equilibria to this game. What are they?
3. Suppose that there are 2 hunters, Hunter 1 and Hunter 2. The hunters can go after big game or small game. If a hunter goes after small game then he catches something for a payoff of 1. If he goes after something big and he hunts alone he fails to catch anything, for a payoff of 0. However, if a hunter hunts for something big and both hunters are hunting big game, then they have a hunting party and catch the big game for a payoff of 3 each.

a (10 points) Draw the strategic form (matrix) for this game.

b (10 points) What is (are) the pure strategy Nash Equilibrium (PSNE) of this game?

Now suppose that there are 3 hunters: Hunter 1, Hunter 2, and Hunter 3. If each goes after small game then each gets a payoff of 1. If one hunter goes after big game and the other two go after small game, then the small game hunters receive a payoff of 1 and the big game hunter receives a payoff of 0. If 2 hunters hunt big game and 1 hunter hunts small game, the 2 hunters who hunted big game each receive a payoff of 3, while the hunter who hunted small game receives a payoff of 5 (there is some big game left over and the big game hunters share it with the small game hunter). If all 3 hunters hunt big game, then all 3 hunters receive a payoff of 3.

c (10 points) What is (are) the pure strategy Nash Equilibrium (PSNE) of this game?

**Bonus:** (5 points)

Suppose that there are \( N > 3 \) hunters in problem 3. If they all hunt small game then they all receive a payoff of 1. If at least 2 of the hunters hunt big game, then all of the hunters who hunt big game receive a payoff of 3 and the ones who hunt small game receive a payoff of 5. If only 1 hunter hunts big game then that hunter receives a payoff of 0 while the other hunters (who are all hunting small game) receive a payoff of 1. Qualitatively describe (how many hunt big game, how many hunt small game) the PSNE for the game with an unknown number of hunters, \( N \). You do NOT need to write out all the PSNE.