Homework 3   PS 30     October 2017

1. Read “Report Calls Recycling Costlier Than Dumping” by Eric Lipton at the “Media Clips” link. At the end of the story, Lipton states that if people don’t recycle much, then it is too costly to have a recycling program, but if people recycle a lot, it becomes economically worthwhile. Model the situation as a strategic form game (say with just two people for simplicity) and show that there are two Nash equilibria: one in which both people recycle a lot and one in which both people recycle little.

2. Read “Drifter Jailed on Girls’ Lies Set Course of Desperation” by H. G. Reza, Christine Hanley, and James Ricci at the “Media Clips” link. Model the situation as a strategic form game. You can simplify it so there are only two players. Is this a Prisoners’ Dilemma? Why is it standard procedure for police to interview witnesses separately?

3. Read the excerpt from Richard Wright’s Black Boy at the “Media Clips” link. Model this as a strategic form game and interpret the situation and the outcome in terms of the game and your predictions given the game.

4. Read “9 Questions about Syria You Were Too Embarrassed to Ask” by Max Fisher at the “Media Clips” link. On page 6, under the “You didn’t answer my question” heading, a situation concerning chemical weapons is described. Model this as a strategic form game.


6. Find all Nash (mixed strategy and pure strategy) equilibria to this version of the “Chicken” game:

\[
\begin{array}{c|cc}
 & [q] & [1-q] \\
\hline
[1-p] & 2 \text{ swerves} & 5, 0 \\
\end{array}
\]

7. Find all Nash equilibria to the “Early-late” game, which looks like this:

\[
\begin{array}{c|cc}
 & [q] & [1-q] \\
\hline
[1-p] & 1 \text{ arrives late} & 3, 3 \\
\end{array}
\]
8. Say you have an admirer whom you don't like very much. You can either go to the library or the coffee shop to study. You prefer the coffee shop but you want to avoid your admirer. Your admirer can also go to the library or coffee shop to study. Your admirer prefers the library but wants to be where you are more than anything else. So the game looks like:

<table>
<thead>
<tr>
<th></th>
<th>Admiration goes to library</th>
<th>Admiration goes to coffee shop</th>
</tr>
</thead>
<tbody>
<tr>
<td>You go to library</td>
<td>0, 3</td>
<td>4, 0</td>
</tr>
<tr>
<td>You go to coffee shop</td>
<td>6, 0</td>
<td>0, 1</td>
</tr>
</tbody>
</table>

a. Find all (pure strategy and mixed strategy) Nash equilibria of this game.

b. Now say that you begin to actually enjoy your admirer's company. The game is now:

<table>
<thead>
<tr>
<th></th>
<th>Admiration goes to library</th>
<th>Admiration goes to coffee shop</th>
</tr>
</thead>
<tbody>
<tr>
<td>You go to library</td>
<td>4, 3</td>
<td>0, 0</td>
</tr>
<tr>
<td>You go to coffee shop</td>
<td>0, 0</td>
<td>6, 1</td>
</tr>
</tbody>
</table>

Find all (pure strategy and mixed strategy) Nash equilibria of this game.

9. [from Spring 2002 midterm] Consider the following game.

<table>
<thead>
<tr>
<th></th>
<th>2a</th>
<th>2b</th>
<th>2c</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>0,9</td>
<td>3,0</td>
<td>1,5</td>
</tr>
<tr>
<td>1b</td>
<td>1,2</td>
<td>5,4</td>
<td>4,3</td>
</tr>
<tr>
<td>1c</td>
<td>0,6</td>
<td>2,1</td>
<td>6,7</td>
</tr>
</tbody>
</table>

a. Find all pure strategy Nash equilibria of this game.

b. Use the method of iterative elimination of (strongly or weakly) dominated strategies to eliminate as many strategies as possible (i.e. keep on eliminating until you can't eliminate any more).

c. After you have iteratively eliminated as much as you can, find all mixed strategy Nash equilibria of the “remaining” game. (Note: an answer like “p = 2/3, q = 2/5” is not sufficient. Please write down in a sentence which strategies are played with what probability.)

10. [from Spring 2002 final] In a simplified version of “Battleship,” say that there are four spaces, numbered 1, 2, 3, 4. Person 1 chooses to fire a missle at one of these four spaces. Person 2 has a ship which is two spaces long, and chooses where to put the ship on the board: she can either put it on spaces 1 and 2, on spaces 2 and 3, or on spaces 3 and 4. The people make their choices simultaneously.

a. Model this as a strategic form game and use the method iterative elimination of (strongly or weakly) dominated strategies to eliminate as many strategies as possible (i.e. keep on eliminating until you can’t eliminate any more).

b. Find all mixed-strategy and pure-strategy Nash equilibria of the remaining game.

c. Now say that there are 5 spaces, numbered 1, 2, 3, 4, 5. Model this as a strategic form game and find all mixed-strategy and pure-strategy Nash equilibria. Make a prediction in
this game like you did before (iteratively eliminate dominated strategies, and then find pure strategy or mixed strategy Nash equilibria of the remaining game).