Find all Nash equilibria of the following games, and the Subgame Perfect Nash equilibria of the extensive form games. Answers are on the last page. Feel free to ask questions at the review or via email. For each normal form game, recall that Player 1’s strategies are on the left, and Player 2’s are on top.

1. 

<table>
<thead>
<tr>
<th></th>
<th>L</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>U</td>
<td>2,4</td>
<td>1,3</td>
</tr>
<tr>
<td>D</td>
<td>3,1</td>
<td>5,3</td>
</tr>
</tbody>
</table>

2. 

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<tr>
<th></th>
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<th>R</th>
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</thead>
<tbody>
<tr>
<td>U</td>
<td>-4,1</td>
<td>0,3</td>
</tr>
<tr>
<td>D</td>
<td>-2,1</td>
<td>4,0</td>
</tr>
</tbody>
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3. 

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<tbody>
<tr>
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<td>2,2</td>
<td>3,3</td>
</tr>
<tr>
<td>D</td>
<td>3,1</td>
<td>-1,0</td>
</tr>
</tbody>
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4. 

<table>
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<th>R</th>
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<tbody>
<tr>
<td>U</td>
<td>2,4</td>
<td>6,3</td>
</tr>
<tr>
<td>D</td>
<td>3,1</td>
<td>5,3</td>
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5. 

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<td>-1,3</td>
</tr>
<tr>
<td>D</td>
<td>3,1</td>
<td>5,</td>
</tr>
</tbody>
</table>

(a) Which payoff in the blank would make \((D, R)\) the unique Nash equilibrium?

(b) Which payoff would make both \((D, R)\) and \((D, L)\) Nash equilibria?
6. The following game is the normal form of a dynamic (extensive form) game in which Player 1 moves first and can choose $L$ or $R$. Player 2 observes this and can then choose $A$ or $B$.

$$
\begin{array}{cccc}
L & AA & AB & BA & BB \\
R & 2,4 & 2,4 & 4,1 & 4,1 \\
 & 5,0 & 2,1 & 5,0 & 2,1 \\
\end{array}
$$

(a) Find all Nash equilibria of the normal form game.
(b) Draw the game tree that represents the extensive form.
(c) Find all the Subgame Perfect Nash equilibria.

7.

![Game Tree](image)

8.
Solutions

1. \((D, R)\)
2. \((D, L)\)
3. \((D, L)\) and \((U, R)\)
4. There are no pure strategy Nash equilibria. Recall matching pennies in class!
5. (a) Any number strictly larger than 1.
   (b) 1.
6. (a) \((L, AB)\) and \((R, AB)\).
   (b)
   \[
   \begin{array}{c}
   P_1 \\
   | \quad |
   \hline
   L & R \\
   | \quad |
   \hline
   A & B \\
   \end{array}
   \]
   \[
   \begin{array}{c}
   P_2 \\
   | \quad |
   \hline
   (2, 4) & (4, 1) \\
   \end{array}
   \]
   \[
   \begin{array}{c}
   P_2 \\
   | \quad |
   \hline
   (5, 0) & (2, 1) \\
   \end{array}
   \]
   (c) \((L, AB)\) and \((R, AB)\) are subgame perfect.
7. \((R, AA)\) is the only subgame perfect Nash equilibrium.
8. \((R, BB)\) is the only subgame perfect Nash equilibrium.