1. (a) Describe the state by three numbers \( \begin{pmatrix} n \\ a \\ b \end{pmatrix} \) where \( n \) is the number picked by the referee, \( a \) is the number given to Ann and \( b \) is the number given to Bob. Thus the set of states is:

\[
\begin{array}{cccccc}
1 & 1 & 3 & 3 & 5 & 5 \\
2 & 0 & 4 & 2 & 4 & 4 \\
2 & 0 & 4 & 2 & 6 & 4 \\
\end{array}
\]

(b) Ann only observes \( a \) and Bob only observes \( b \).

Ann:

\[
\begin{array}{cccccc}
1 & 0 & 2 \\
1 & 2 & 0 \\
& & & & &
\end{array}
\]

Bob:

\[
\begin{array}{cccccc}
1 & 3 & 2 & 2 \\
& & & & &
\end{array}
\]

(c)

CK:

\[
\begin{array}{cccccc}
3 & 5 & 4 & 4 \\
3 & 4 & 2 & 6 \\
& & & & &
\end{array}
\]

(d) At \( \begin{pmatrix} 3 \\ 4 \\ 2 \end{pmatrix} \) the smallest common knowledge event is \( \left\{ \begin{pmatrix} 1 \\ 3 \\ 5 \\ 2 \\ 4 \\ 6 \end{pmatrix} \right\} \) which corresponds to “Ann’s number is either 0 or 4” and also “Bob’s number is either 2 or 6”.
(e) (e.1) \[ E = \begin{bmatrix} 3 & 4 \\ 4 & 6 \end{bmatrix}, \ K_A E = \begin{bmatrix} 3 & 4 \\ 2 & 6 \end{bmatrix}, \ K_B E = \begin{bmatrix} 5 \\ 4 \\ 6 \end{bmatrix}, \ K_{AB} E = \emptyset. \]

\[ K_{BA} E = \begin{bmatrix} 5 \\ 4 \\ 6 \end{bmatrix}. \]

(e.2) There is only one such state \( \alpha \), namely \( \alpha = \begin{bmatrix} 5 \\ 4 \\ 6 \end{bmatrix} \).

2. (a) The game is as follows:

(b) The normal form is as follows (payoffs are expected payoffs):

```
<table>
<thead>
<tr>
<th></th>
<th>CC</th>
<th>CD</th>
<th>DC</th>
<th>DD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Player 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>0.8</td>
<td>7.2</td>
<td>0.8</td>
<td>8.8</td>
</tr>
<tr>
<td>B</td>
<td>1</td>
<td>4.8</td>
<td>0.8</td>
<td>3.2</td>
</tr>
</tbody>
</table>
```

(c) Neither player has a strictly dominated strategy.

(d) The pure-strategy Nash equilibria are (A,DD) and (B,CC).