1. (a) CG, CH, DG, DH. (b) Four. (c) Two. (d) First we solve the subgame on the left, whose strategic form is:

<table>
<thead>
<tr>
<th></th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1, 0</td>
<td>0, 1</td>
</tr>
<tr>
<td>B</td>
<td>0, 2</td>
<td>2, 0</td>
</tr>
</tbody>
</table>

There are no pure-strategy Nash equilibria. To find the mixed-strategy equilibrium, let $p$ be the probability of $A$ and $q$ the probability of $C$. Then it must be that $q = 2(1 - q)$ and $2(1 - p) = p$.

Thus $p = q = \frac{2}{3}$. The expected payoffs at the Nash equilibrium are:

For player 1: $\frac{4}{9} + \frac{2}{9}0 + \frac{2}{9}0 + \frac{1}{9}2 = \frac{2}{3}$, for player 2: $\frac{4}{9}0 + \frac{2}{9}1 + \frac{2}{9}2 + \frac{1}{9}0 = \frac{2}{3}$

and for player 3: $\frac{4}{9}0 + \frac{2}{9}2 + \frac{2}{9}2 + \frac{1}{9}0 = \frac{8}{9}$.

Now we solve the subgame on the right. Its strategic form is as follows:

<table>
<thead>
<tr>
<th></th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>2, 3</td>
<td>1, 2</td>
</tr>
<tr>
<td>F</td>
<td>0, 3</td>
<td>3, 1</td>
</tr>
</tbody>
</table>

Player 3: L

Player 3: M

This game has three pure-strategy Nash equilibria: (E,G,L), (E,H,L) and (F,H,M). Thus the following are subgame-perfect equilibria:

1. \[
\begin{pmatrix}
A & B & C & D & E & F & G & H & L & R & L & M
\end{pmatrix}
\]

with payoffs $\langle 2, 3, 1 \rangle$

2. \[
\begin{pmatrix}
A & B & C & D & E & F & G & H & L & R & L & M
\end{pmatrix}
\]

with payoffs $\langle 2, 3, 1 \rangle$

3. \[
\begin{pmatrix}
A & B & C & D & E & F & G & H & L & R & L & M
\end{pmatrix}
\]

with payoffs $\langle 1, 2, 2 \rangle$
2. (a) The pure-strategy Nash equilibria are (A,D) and (B,E).
(b) For player 1 C is strictly dominated by A; after deleting C, for player 2 F becomes strictly dominated by E. Thus C and F must be played with zero probability at a Nash equilibrium. Let \( p \) be the probability of A and q the probability of D. Then it must be that \( 4q + 1 - q = q + 2(1 - q) \), so that \( q = \frac{1}{4} \). Furthermore, it must be that \( 2p + 1 - p = p + 5(1 - p) \) so that \( p = \frac{4}{5} \). Thus the mixed-strategy Nash equilibrium is

\[
\begin{pmatrix}
A & B & C & D & E & F \\
4 & 1 & 0 & 1 & 3 & 0 \\
5 & 5 & 0 & 4 & 4 & 0
\end{pmatrix}
\]. The corresponding payoffs are: **Player 1:** \( \frac{7}{4} = 1.75 \)  **Player 2:** \( \frac{9}{5} = 1.8 \)

3. (a) The game-frame is as follows (R = Rudy, CP = Chief of Police):

(b) Three    (c) Eight    (d) Five    (e) \( 2^5 = 32 \)