Prisoner's Dilemma:

- Accused of a major crime
- No eyewitness
- To get one or both to confess
Both prisoners are interrogated in separate rooms — No communication allowed between them.

2 Possible Actions
- Confess (C)
- Deny (D)
IF both deny, each gets 1yr sentence.

If both confess, each gets a prison sentence of 3 years.

—IF one confesses and other denies, confessor walks free or 0 yr; one who denies gets a sentence of 4 yrs.
Prisoners
Confess or Deny
Minimize Prison sentence

No Communication

Game Table:

<table>
<thead>
<tr>
<th></th>
<th>P₁</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>-3</td>
<td>0, -4</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>-4</td>
<td>0, -1</td>
<td>-1, -1</td>
</tr>
</tbody>
</table>
Payoff is determined by action of individual together with actions of competitors.

Set of Players: \{ P_1, P_2 \}

Set of rules -

\( A_i \) denotes action set of player \( i \)
\[ A_1 = \{C, D\} \]
\[ A_2 = \{C, D\} \]
\[ O = \{ (C, C), (C, D), (D, C), (D, D) \} \]
$U_i(0)$

$U_1(0), \ U_2(0)$

Payoffs

$U_i(a_i, a_{-i})$

$a_{-i}$: actions of rest

$U_1(a_1, a_2)$

$U_2(a_2, a_1)$
$U_i(a_i, A_{-i})$

Utility or payoff of $i$th player.

$U_i(c, c) = -3$

Player 1 confesses

Player 2 confesses
\[ U_1(C, D) = 0 \]

Player 1: Confesses
Player 2: Denies

\[ U_2(C, D) = 0 \]

Player 2: Confesses
Player 2: Denies
Player 1: Denies
$u_1(c,c) = -3$
$u_1(c,d) = 0$
$u_1(d,c) = -4$
$u_1(d,d) = -1$

$u_2(c,c) = -3$
$u_2(c,d) = 0$
$u_2(d,c) = -4$
$u_2(d,d) = -1$
\[ U_i (a_i, a_{-i}) \]

Player \( i \)  
Action of Player \( i \)  
Action of all players other than \( i \)

Why is PD useful in practice:

Retail Price war

2 Shops, Retail chains,
Prices - High (H)  
- Low - (L)

<table>
<thead>
<tr>
<th></th>
<th>H</th>
<th>L</th>
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<tbody>
<tr>
<td>R&lt;sub&gt;1&lt;/sub&gt;</td>
<td>500, 500</td>
<td>0, 750</td>
</tr>
<tr>
<td>L&lt;sub&gt;1&lt;/sub&gt;</td>
<td>750, 0</td>
<td>250, 250</td>
</tr>
</tbody>
</table>

Deny

Simple market - Retail chains, online retail stores,

Confess