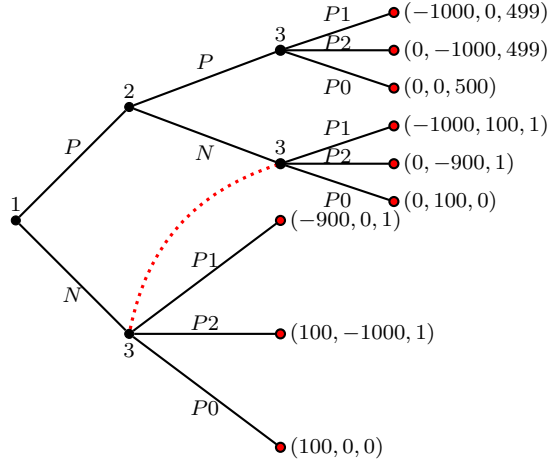


# **Problem Set 1, Exercise 7 (from 2009 exam)**

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January 2, 2017

Define the set of actions available to players 1 and 2  $\{P, N\}$ , where  $P$  stands for 'Pass' and  $N$  stands for 'Not pass'. Denote the set of actions available to the player 3  $\{P1, P2, P0\}$ , where  $P1$  stands for 'Punish player 1',  $P2$  stands for 'Punish player 2' and  $P0$  stands for 'Punish no one'. Then, the game in extensive form is:



There are three players, i.e.,  $N = \{1, 2, 3\}$  and their strategy spaces could be defined as

$$S_1 = \{P, N\}$$

$$S_2 = \{P, N\}$$

$$S_3 = \{P1, P2, P0\}^2 = \{(P1, P1), (P1, P2), (P1, P0), (P2, P1), (P2, P2), (P2, P0), (P0, P1), (P0, P2), (P0, P0)\}$$

We could also define the profit functions

$$\pi_1 : S_1 \times S_2 \times S_3 \rightarrow \{-1000, -900, 0, 100\}$$

$$\pi_2 : S_2 \times S_1 \times S_3 \rightarrow \{-1000, -900, 0, 100\}$$

$$\pi_3 : S_3 \times S_1 \times S_2 \rightarrow \{0, 1, 499, 500\}$$

or in table form

Player 1 plays $P$			Player 1 plays $N$		
$\begin{array}{c} \backslash \\ 3 \end{array} \begin{array}{c} 2 \\ \backslash \end{array}$	P	N	$\begin{array}{c} \backslash \\ 3 \end{array} \begin{array}{c} 2 \\ \backslash \end{array}$	P	N
(P1, P1)	(-1000, 0, 499)	(-1000, 100, 1)	(P1, P1)	(-900, 0, 1)	(-900, 0, 1)
(P1, P2)	(-1000, 0, 499)	(0, -900, 1)	(P1, P2)	(100, -1000, 1)	(100, -1000, 1)
(P1, P0)	(-1000, 0, 499)	(0, 100, 0)	(P1, P0)	(100, 0, 0)	(100, 0, 0)
(P2, P1)	(0, -1000, 499)	(-1000, 100, 1)	(P2, P1)	(-900, 0, 1)	(-900, 0, 1)
(P2, P2)	(0, -1000, 499)	(0, -900, 1)	(P2, P2)	(100, -1000, 1)	(100, -1000, 1)
(P2, P0)	(0, -1000, 499)	(0, 100, 0)	(P2, P0)	(100, 0, 0)	(100, 0, 0)
(P0, P1)	(0, 0, 500)	(-1000, 100, 1)	(P0, P1)	(-900, 0, 1)	(-900, 0, 1)
(P0, P2)	(0, 0, 500)	(0, -900, 1)	(P0, P2)	(100, -1000, 1)	(100, -1000, 1)
(P0, P0)	(0, 0, 500)	(0, 100, 0)	(P0, P0)	(100, 0, 0)	(100, 0, 0)