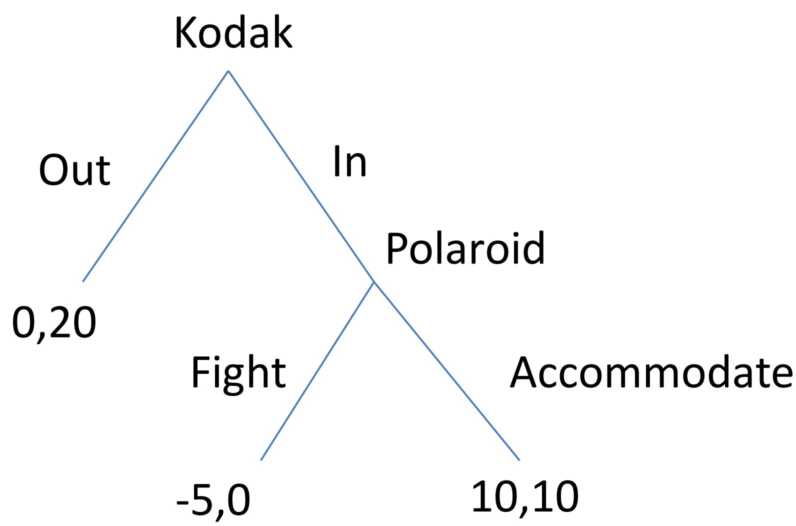
1 Entry Game



Kodak is contemplating entering the instant photo market and Polaroid Can Either fight the entry or accommodate.

A pure strategy of a player specifies an action choice at each decision node of that player.

- Kodak's Strategies: $S_K = \{In, Out\}$
- Polaroid's Strategies: $S_P = \{Fight$,Accommodate$\}$

Backward Induction Equilibrium.

- What should Polaroid do if Kodak enters.
- Given what it knows about Polaroid's response to entry, what should Kodak do?
- At a Backward Induction Equilibrium, each player behaves optimally at every decision node in the game tree (that is, plays a sequentially rational strategy)
- (In,Accommodate} is the unique backward induction equilibrium of this entry game.

Let's consider the normal form of this game in the following bi-matrix

	Fight	Accommodate
Out	(0,20)	(0,20)
In	(-5,0)	(10,10)

Set of Nash Equilibria= {(In,A) and (Out, F)}.

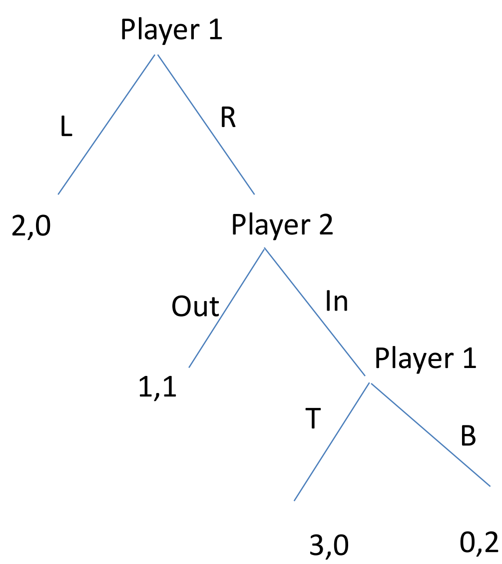
But note that (Out, F) is sustained by a non-credible threat by Polaroid.

Backward Induction eliminates such NE based on non-credible threats.

Kodak knows that if it plays in then Polaroid will Accommodate.

Backward Induction requires sequential rationality whereas Nash Equilibrium requires only rationality.

2 Another Example



This is the example in the Textbook Page 60.

Consider the last node that Player 1 has to move. Player 1 will choose T because 3 is better than 0.

Now consider the subbgane that starts with Player 2 choosing Out or In. Player 2 knows that if he plays In Player 1 will choose T. Hence Player 2 knows that choosing

In will bring him 0 whereas choosing Out will bring him 1. Therefore player 1 will choose Out.

Now consider the very first node in which Player 1 has to choose between L and R. Player 1 knows that if she plays R, Palyer 2 will choose Out and hence Player 1 will end up with a payoff 1. If player 2 chooses L, she gets 2. Therefore, Player 1 will choose L.

Therefore the Subgame Perfect Equilibrium (SPE) of this game is as follows

- Player 1 chooses L
- Player 2, if called to move, chooses Out.
- Player 1 chooses T, if called to move in the last stage.
- In other words, to describe a SPE you need to describe the optimal strategy of each player at each possible decision node, even if that decision node is never visited in equilibrium.
- The unique SPE outcome of the above game is that Player 1 plays L in the first stage and the game ends. Player 1 gets a payoff of 2 and player 2 gets a payoff 0.

- P1 and P2 are bargaining over one dollar. Players alternate in making offers.

- **Stage 1**: P1 proposes to take a share s_1 of the dollar leaving $1 - s_1$ to P2.
  - P2 either accepts the offer in which case the game ends and payoffs $(s_1, 1 - s_1)$ are immediately received or rejects the offer in which case play continues to second stage

Sequential Bargaining

- **Stage 2**: P2 proposes that P1 gets a share s_2 of the dollar leaving $1 - s_2$ to P2.
  - P1 either accepts the offer in which case game ends, payoffs $(s_2, 1 - s_2)$ are received or rejects the offer in which case the play continues to third period).

- **Stage 3**: An arbitrator decides that P1 and P2 both get an equal share.

- The players are impatient, they discount payoffs received in later periods by a factor $\delta = 0.8$ per period.
- Find the SPE of this game.

Solving P2's optimal offer in stage 2

- In stage 2, P2 knows that if P1 rejects an offer then she can secure a share 0.5 next period. This share is worth

$$\delta(0.5) = 0.8 * 0.5 = 0.4$$

in period 2 for P1.

- Therefore P1 will accept any offer s_2 where $s_2 \geq 0.4$ and reject any offer with $s_2 < 0.4$.Thus P2's optimal offer in period 2 is

$$s_2^* = 0.4$$

which P1 will accept. Thus P2 will receive

$$1 - s_2^* = 0.6.$$

Solving P1's optimal offer in stage 1

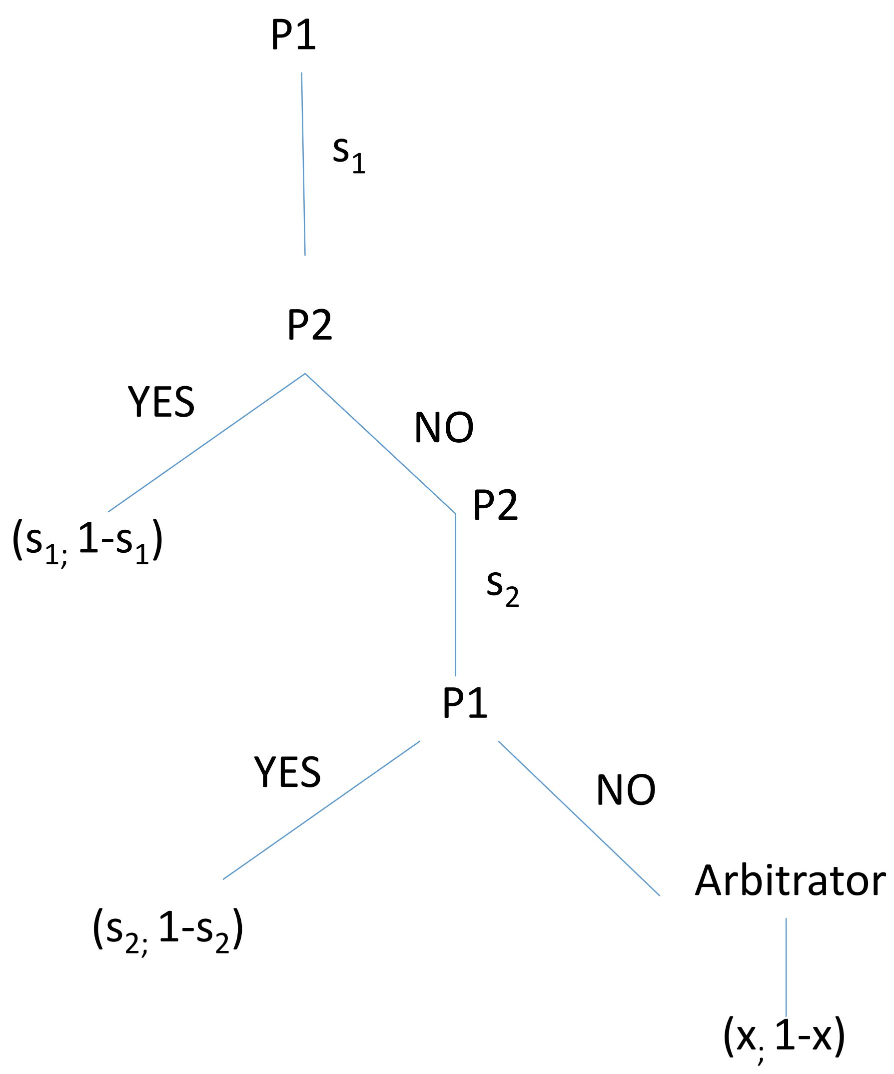
- In stage 1, P1 knows that if P2 rejects an offer then she can secure a share $1 - s_2^* = 0.6$ next period.
- This share is worth $\delta * 0.6 = 0.8 * 0.6 = 0.48$ to P2 in period 1.
- Therefore P2 will accept any offer s_1 where

$$1 - s_1 \geq 0.48 \Rightarrow s_1 \leq 0.52$$

- Thus P1's optimal offer in period 1 is $s_1^* = 0.52$ which P2 will accept.

The Backward Induction Equilibrium Outcome

- P1 offers $(0.52, 0.48)$ and P2 accepts. Settlement occurs immediately.


P1
s1
P2
YES
NO
(s1; 1-s1)
P2
s2
P1
YES
NO
(s2; 1-s2)
Arbitrator
(x; 1-x)