Extensive Form Games

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Introduction

- Big Limitation of Strategic Form Games: Allows only Simultaneous moves from players.

- Players decide their strategies without knowing the actual moves by other players.

- Consider following situations:
  - Entry into Market
  - A variant of Cournot Game in which a firm first observes the production decision of the other firm and then decides the quantity it would like to produce.
  - Bargaining between a buyer and a seller.

- Modeling these games as normal form games may not be a good idea.

Introduction (Continued)

- In strategic interactions
  - Players [Decision making units] may move simultaneously or sequentially.
  - They may move once or many times. The interactions may get repeated.

- How should we represent such interactions?

- We should consider:
  1. List of the players participating in the strategic interactions
  2. When does a player get to move in the game? [Order of Moves]
  3. What are the actions available to the player when she gets to move?
  4. How much does a player know when he gets to move? [Information]
  5. Pay-offs

- Notice: Only 1,3 and 5 were required in a normal form game.

Entry Game

- A simple example: Entry Game
  - A market characterized by a monopolist (Incumbent)
  - A rival firm (Potential Entrant) is contemplating whether to enter in the market or remain out.
  - The incumbent can engage in costly advertisement or price cut to fight the rival or do nothing (accommodate)

  Let us assume that the entrant moves first.

- How to represent such strategic interactions?
  - Potential Entrant: Enter (E) or Not enter (N) in the market
 - Incumbent: Accommodate (A) or Fight (F)

Payoffs:

- Entrant (Best to worst)
  ◦ Entry and Accommodate
  ◦ No entry
  ◦ Entry and Fight

- Incumbent
  ◦ No entry
  ◦ Entry and Accommodate
  ◦ Entry and Fight

Game Tree

- Game Tree: A simple and useful way of representing an extensive form game.

- A game tree is a graph.

- It consists of
  ◦ Nodes
  ◦ Branches

- Nodes -> Labels
  ◦ Initial Nodes: beginning of the game
  ◦ Decision Nodes: Player labels
  ◦ Terminal Nodes: Payoffs
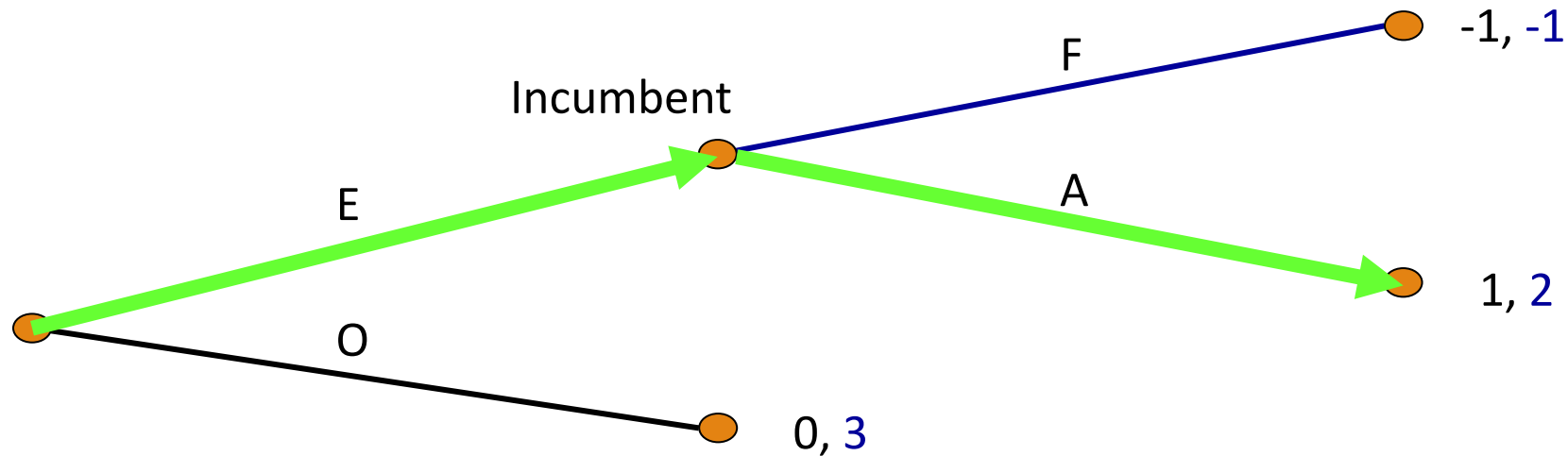
- Nodes -> Information

- Branches-> Actions.

Incumbent

F

-1, 1

A

1, 2

E

O

Entrant

0, 3
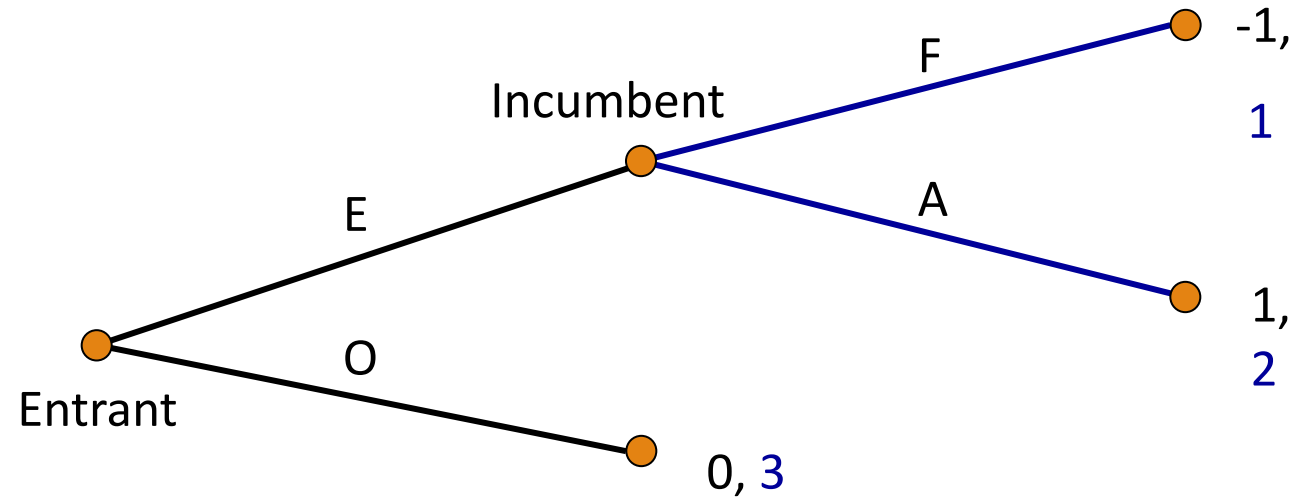
Entry Game and Nash Equilibrium

Coke\Pepsi	Fight	Accommodate
Entry	-1,-1	1,2
Out	0,3	0,3

Backward Induction

- Look forward and reason back

- Begin at the end

- Assumption: Rationality and Common Knowledge.

-1, -1

F

Incumbent

E

A

1, 2

O

0, 3

Comparison: Nash Equilibrium vs. Backward Induction Equilibrium

- Nash Equilibrium: (Out, Fight) and (Enter, Accommodate)

- Backward Induction: (Enter, Accommodate)

- Why do we have one more strategy profile as the Nash Equilibrium?