

Lecture 3

Dynamic Games: Introduction

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A Thought Experiment

- ⌘ Try to imagine you have no moral principles (hard I know...)
- ⌘ Your equally amoral friend find \$100 left behind in a classroom. Your friend has the money in her hand. You see her pick it up.
- ⌘ You both know if you mention it to the prof, he will keep the cash.
- ⌘ She offers you \$10 to keep quiet. What do you do?
- ⌘ What if instead she offered \$25? \$5?

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Lecture Outline

- ⌘ Decision Trees again
- ⌘ Games against Nature?
- ⌘ Solving games back to front
- ⌘ Fredo and Charlie Brown
- ⌘ Examples:
 - ☒ Line Item Vetoes
 - ☒ The game of NIM.
 - ☒ Ultimatum games and "Bargaining"
 - ☒ Dictator games
 - ☒ Cut and choose

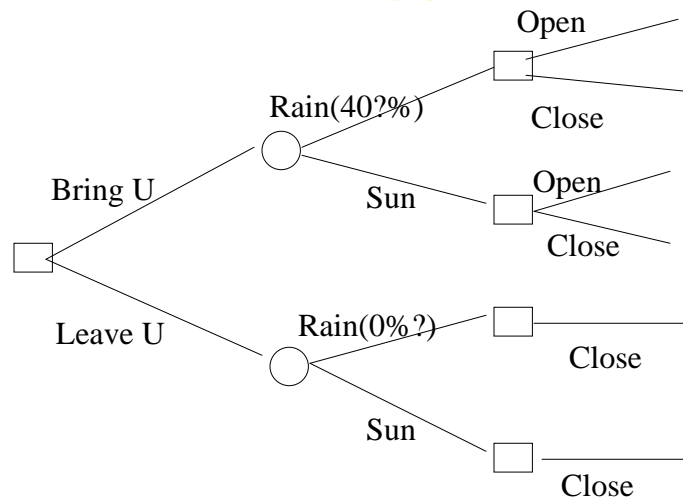
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One Person or Many Persons

- ⌘ Consider the decision tree example.
- ⌘ What about Sad Sam who never brings his umbrella because he knows it only rains when he forgets it?

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Decision Tree Example



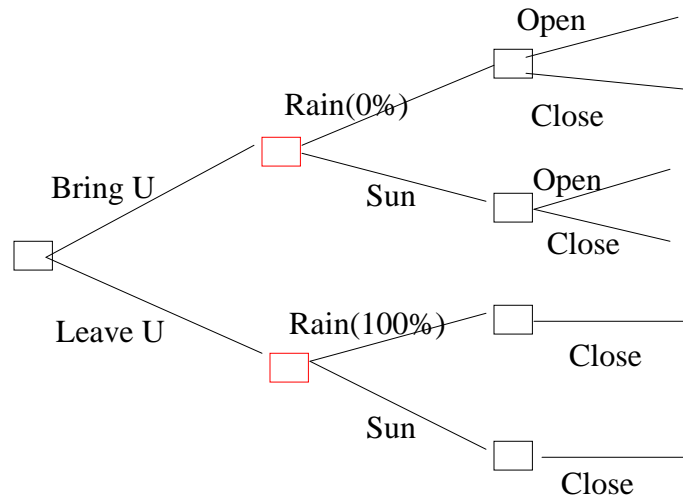
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Dynamic Games.

- ⌘ This is a silly example but it illustrates how one person decision trees become multi-person games.
- ⌘ Sad Sam is now playing a game against nature

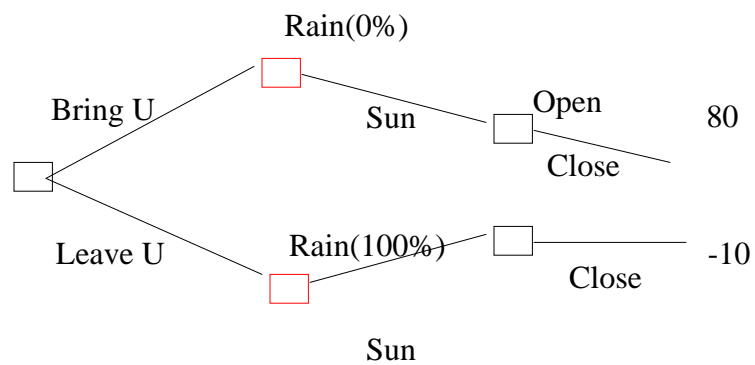
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Decision (now Game) Tree Example



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Decision (now Game) Tree Example



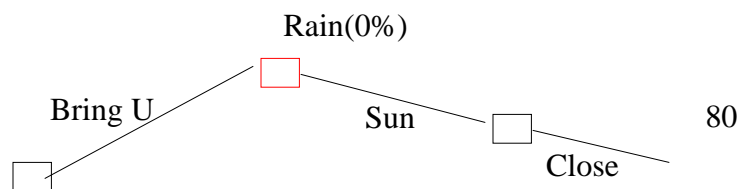
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Back to Front Reasoning Again

- ⌘ As before, back to front reasoning helps make this game simpler.
- ⌘ In fact, it makes the game very simple.

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Decision (now Game) Tree Example



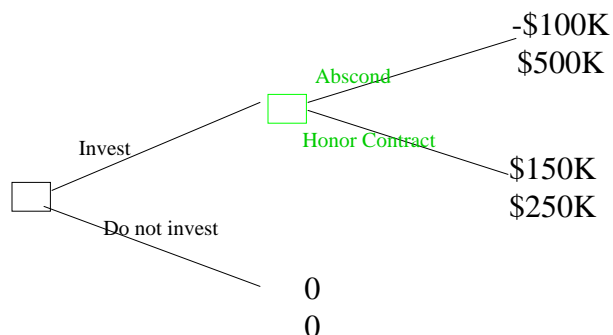
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Fredo and Charlie Brown

- ⌘ Dixit and Nalebuff describe an investment problem.
- ⌘ Fredo offers Charlie B an opportunity of a lifetime.
 - ☑ Invest \$100K now, and he will get half of the \$500K profits of a project.
 - ☑ But who is to say F will pay him back?

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Game Tree Analysis



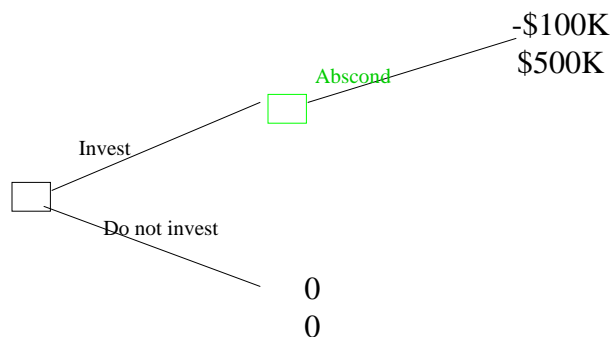
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Solving The Investment Game

- ⌘ Using Back to Front Reasoning, how will this game be played?
- ⌘ Notice, that there is an outcome both players would prefer.
- ⌘ But they cannot achieve it in this world.
- ⌘ Is there anything that they can do?
 - 📦 ... For later ...

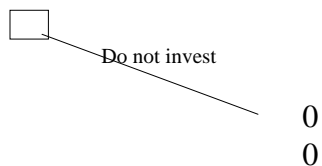
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Game Tree Analysis



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Game Tree Analysis



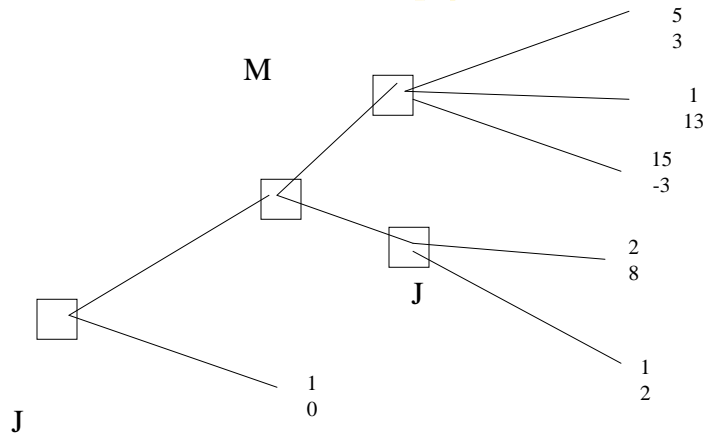
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Back to Front Reasoning

- ⌘ As with one-person decision trees, the easiest way to make sense of dynamic games is to work "Back to Front"
- ⌘ Examine all the final decision points (nodes). Determine the decision made there. (This should be "easy")
- ⌘ Replace the decision node with the payoffs that result from the projected decision.
- ⌘ Now move one step back and repeat...
- ⌘ Continue until you reach the beginning of the game.

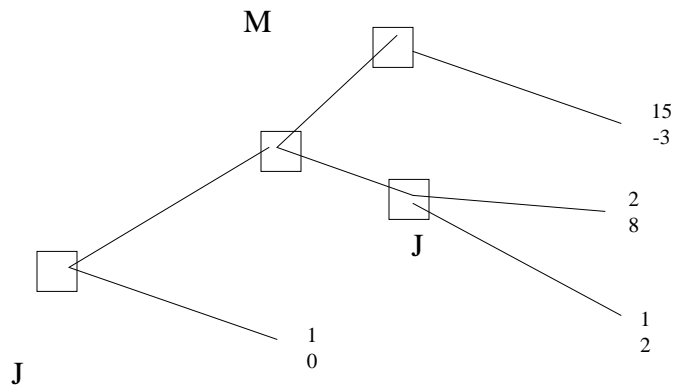
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Back to Front Reasoning.



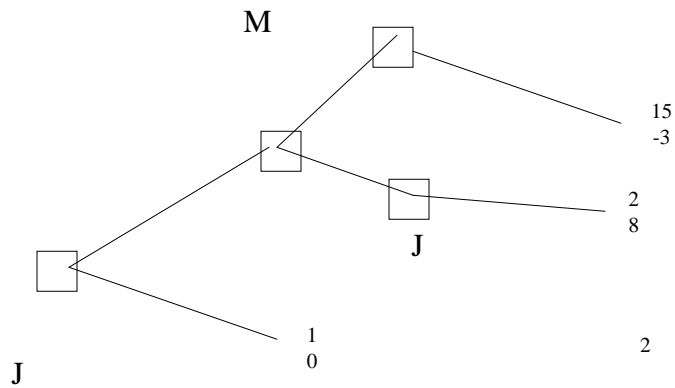
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Back to Front Reasoning.



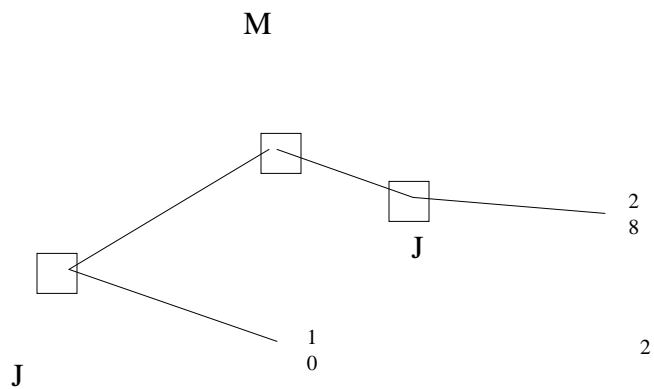
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Back to Front Reasoning.



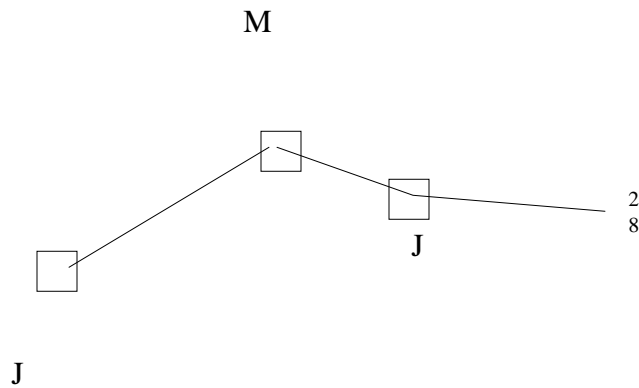
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Back to Front Reasoning.



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Back to Front Reasoning.



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Back To Front Reasoning

- ⌘ What remains is a prediction or recommendation of how the game will be (should be?) played.

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Line Item Veto


- ⌘ We usually think that having more to choose from is good.
- ⌘ Here is an example where more choices are bad.
- ⌘ http://news.yahoo.com/s/politico/20090304/pl_politico/19589
- ⌘ It is because of the dynamic game structure.
- ⌘ Dixit and Nalebuff p. 40. Analysis on board.

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Nim Version 1


- ⌘ Game trees can be helpful but may be too complex.
- ⌘ Back to front reasoning, though, is still important. Consider the game of NIM.
 - ☒ Start with a pile of matches
 - ☒ Take turns. When it is your turn, you can take either 1 or 2 matches from the pile.
 - ☒ If it is your turn and there is just 1 match left in the pile, you lose.

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2 First
3
4
5
6
7
8

25



2 First
3 First
4
5
6
7
8

26



2
3
4
5
6
7
8

First
First
Second


27



2
3
4
5
6
7
8


First
First
Second
First

28




2	First
3	First
4	Second
5	First
6	First
7	
8	

29



2	First
3	First
4	Second
5	First
6	First
7	Second
8	

30



2	First
3	First
4	Second
5	First
6	First
7	Second
8	First

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Nim Version 2



- ⌘ Start with two piles of matches
- ⌘ Take turns. When it is your turn, you can take 1 or more matches from *either* pile.
- ⌘ You are not allowed to take matches from *both* piles.
- ⌘ If it is your turn and there is just 1 match left in one pile and no matches left in the other pile, you lose.

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NIM Version 3

⌘ Pearls Before Swine

⌘ <http://www.transience.com.au/pearl.html>

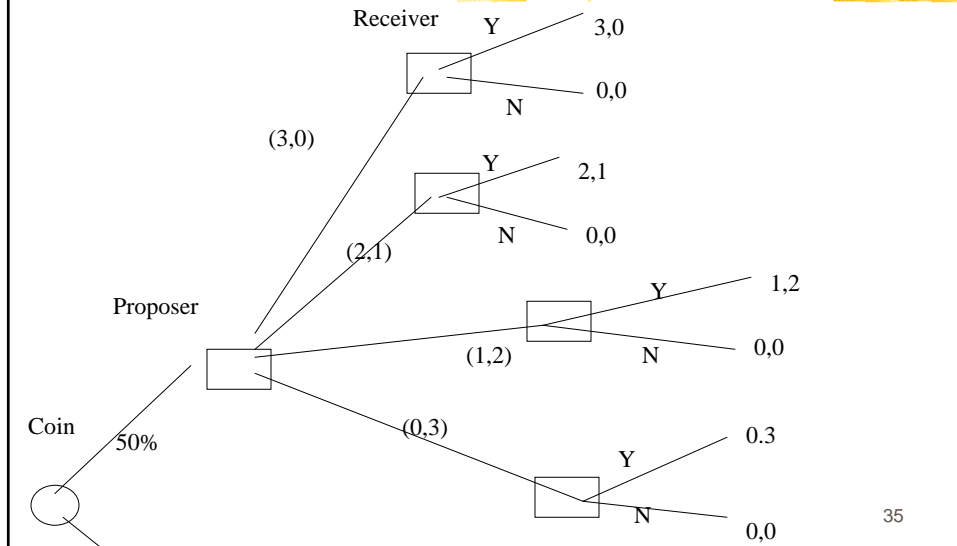
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A Simple Bargaining Game

- ⌘ You and your business partner have 3 \$100 bills to divide between you. They cannot be broken.
- ⌘ You flip a coin to decide who goes first.
- ⌘ The winner chooses a split.
- ⌘ The loser gets to agree or disagree.
- ⌘ If disagree, the money goes to the stockholders (not you)

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A Simple Bargaining Game



Analysis

- ⌘ Suppose you lose the coin flip.
- ⌘ Which offers do you accept?
- ⌘ (What if they were \$1000 bills?)

Analysis

- ⌘ Suppose now you have 10 \$100 bills to divide. How does the game proceed?
- ⌘ What about 1000 \$100 bills?

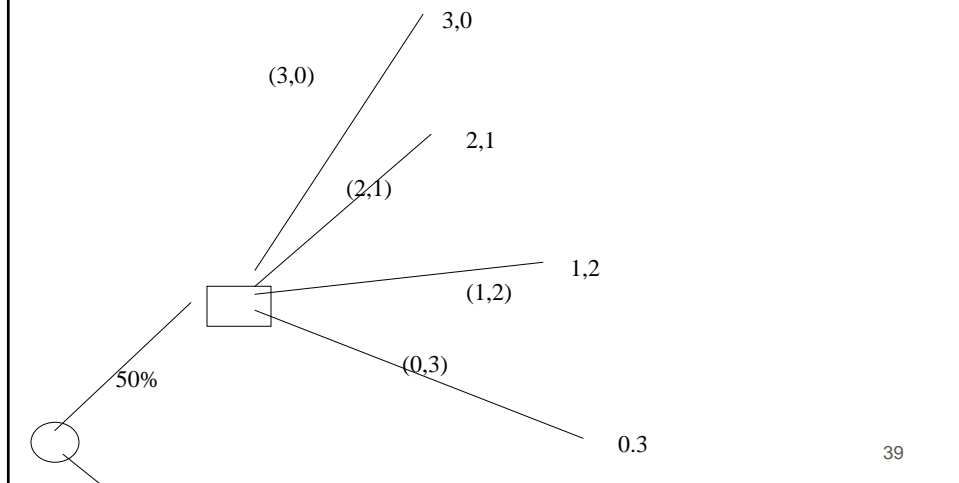
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Dictator Game

- ⌘ Now suppose you agree on a different way to divide the profits.
- ⌘ The winner of the coin flip decides on a split and the loser does not get a say.
- ⌘ How is the game played now?

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The Dictator Game



Discussion

- ⌘ How does back to front reasoning predict play will occur in each game?
- ⌘ How would you play?
- ⌘ D and N pp. 51 and 52 describe some laboratory experiments of these games.
- ⌘ Very often, the first mover "leaves money on the table? Why?

First Mover?



- ⌘ Is it always an advantage to be the first mover?
- ⌘ Consider again the problem of dividing 3 \$100 bills.
- ⌘ Now the game is, the winner of the coin toss chooses a split (eg. (0,3), (1,2) etc.)
- ⌘ The loser gets to choose which of the two portions she prefers, first or second.
- ⌘ See also Dixit and Nalebuff, Red vs. Black.