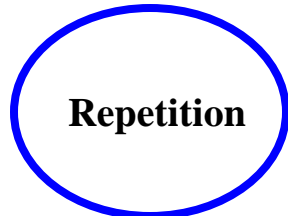
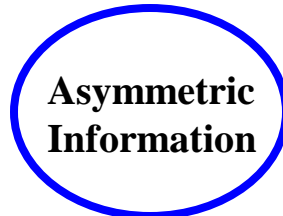


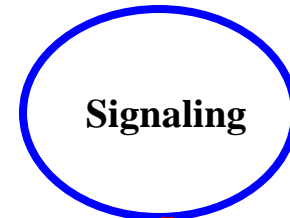
Part III: “Big” Applications



Classes 12-14



Classes 15-18



Classes 19-21

Signaling Games

How to Make Communication Credible

Chapter 1 (Today): Costly Signaling

Signaling Examples

- Entry deterrence:
 - Incumbent tries to signal its resolve to fight to deter entrants
- Credence Goods:
 - Used car warranties
- Social interactions
 - Fashion

How can strong informed players *distinguish themselves*?

Can weak players *signal-jam*?

Two of your class projects already using this...
(pitching a lemon, Estonia)

The beer & quiche model

- A monopolist can be either a ***tough*** incumbent or a ***wimp*** (not tough).
- Incumbent earns **4** if the entrant stays out.
- Incumbent earns **2** if the entrant enters.
- Entrant earns **2** if it enters against **wimp**.
- Entrant earns **-1** if it enters against **tough**.
- Entrant gets **0** if it stays out.

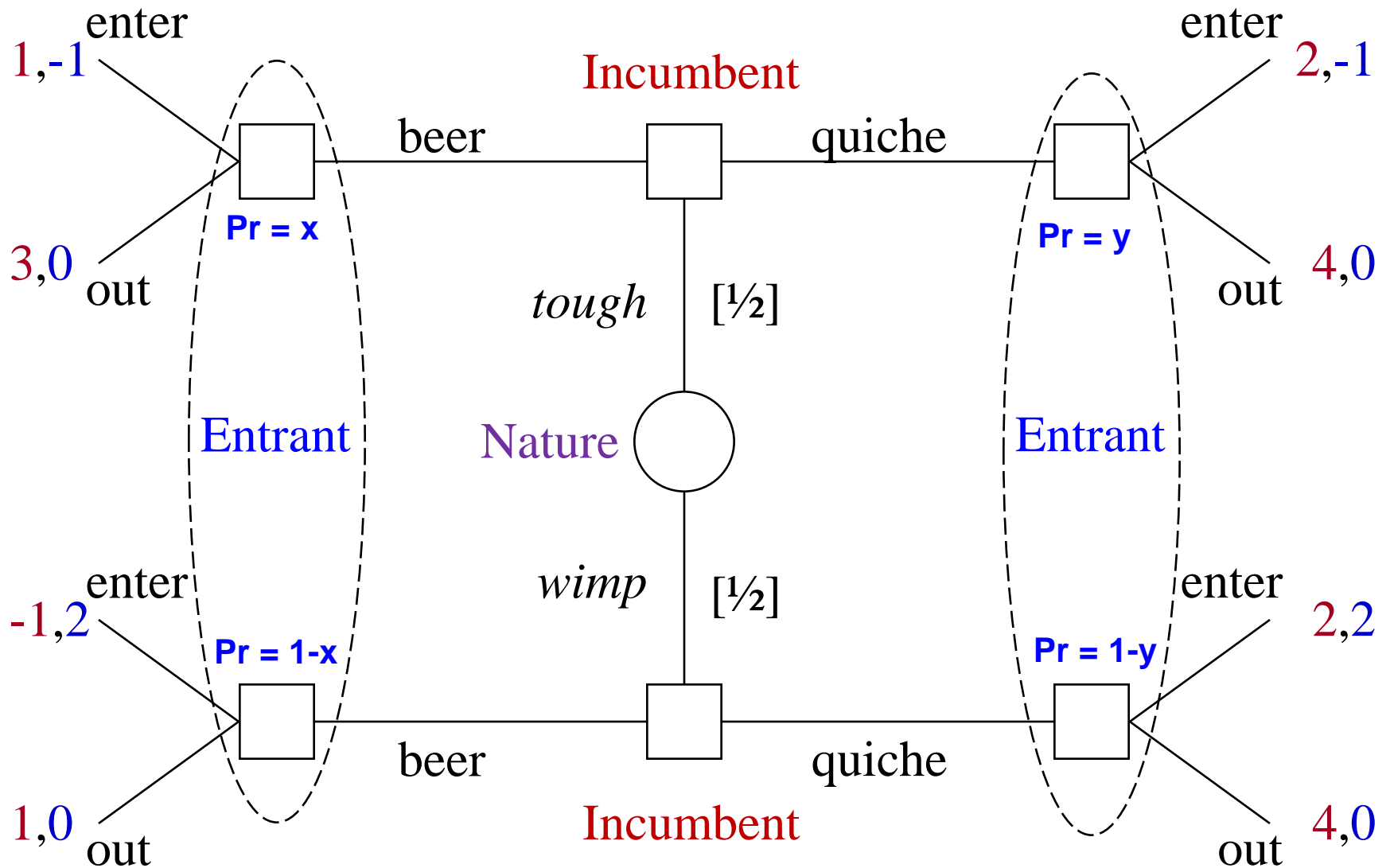
Beer & Quiche

- Prior to the entrant's decision to enter or stay out, the incumbent gets to choose its "breakfast."
- The incumbent can have beer or quiche for breakfast.
- Breakfasts are consumed in public.
- Eating quiche "costs" 0.
- Drinking beer costs differently according to type:
 - a beer breakfast costs a tough incumbent 1...
 - but costs a wimp incumbent 3.

What's Beer?

Toughness	Beer
Excess Capacity	High Output
Low Costs	Low Prices
Deep Pockets	Beat up Rivals & Previous Entrants

Beer & Quiche: first model



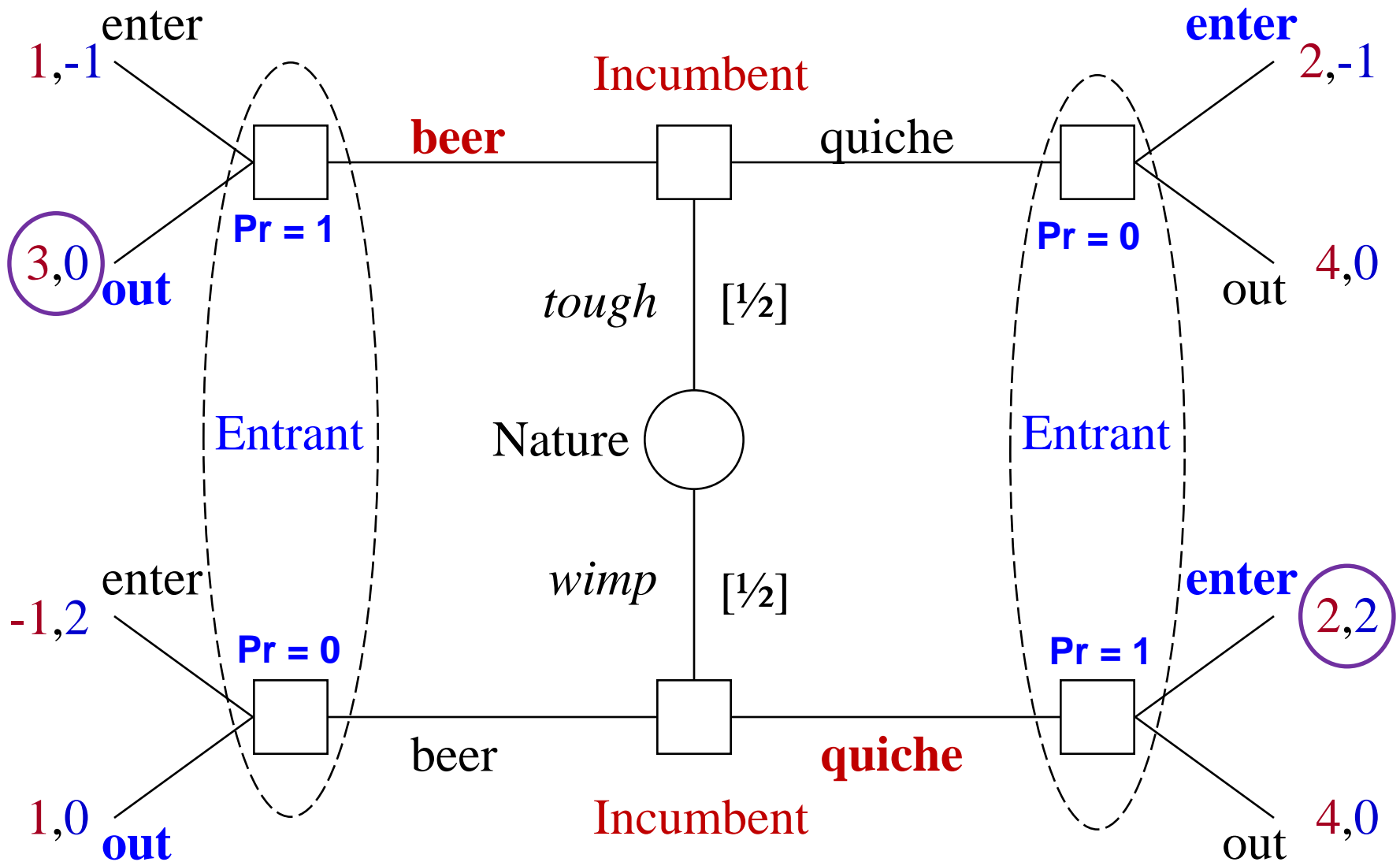
Signaling Equilibrium

- Can the Incumbent credibly use Beer to signal Toughness?

Consistency Checklist

1. Is the **Entrant's** strategy optimal given her beliefs?
2. Is **Incumbent's** strategy a best response to the **Entrant's** strategy?
3. Are **Entrant's** beliefs correct given **Incumbent's** strategy?

Beer & Quiche



Separating Equilibrium

- Tough drinks beer.
- Wimp eats quiche.
- Entrant **infers the true type.**
- **Degenerate beliefs** (0 or 100%).
- Entrant should **ignore prior information...**
... and use **strategic information.**

Credible Signals

- Why doesn't Wimp drink beer & deter entry?
 - ***It's too costly***
 - This is the key feature of “credible signaling”!
-
- What if the signal (beer) were a bit less costly?

Pooling Equilibrium

- Suppose the wimp prefers “**beer & out**” to “**quiche & enter**”
- The “beer signal” can’t work!
- If both types drank beer, the entrant would face 50:50 odds, and enter!
- Both types of incumbent are then better off w/quiche

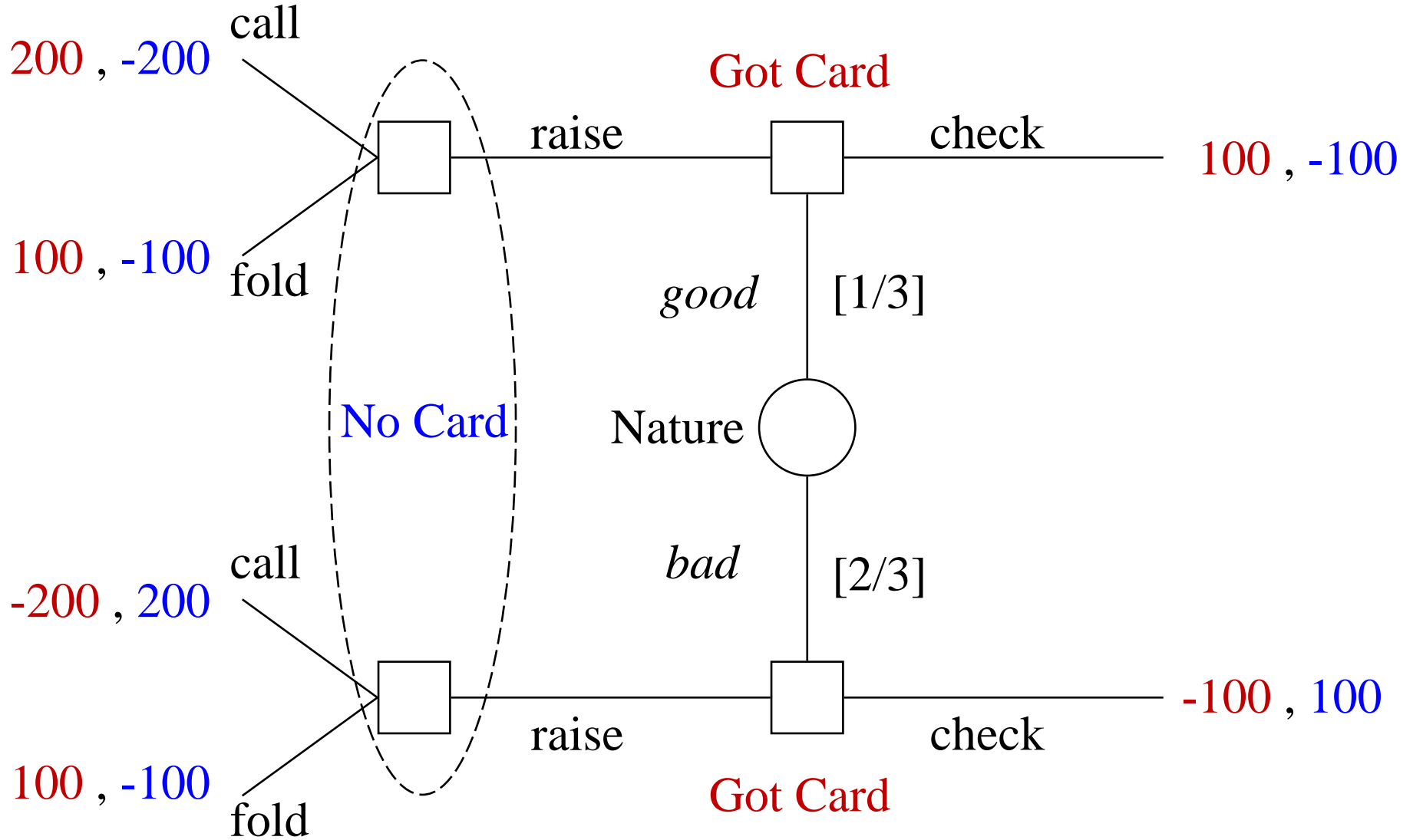
Cheap beer destroys signaling value

- Pooling equilibrium: both eat quiche, entrant enters

Takeaways

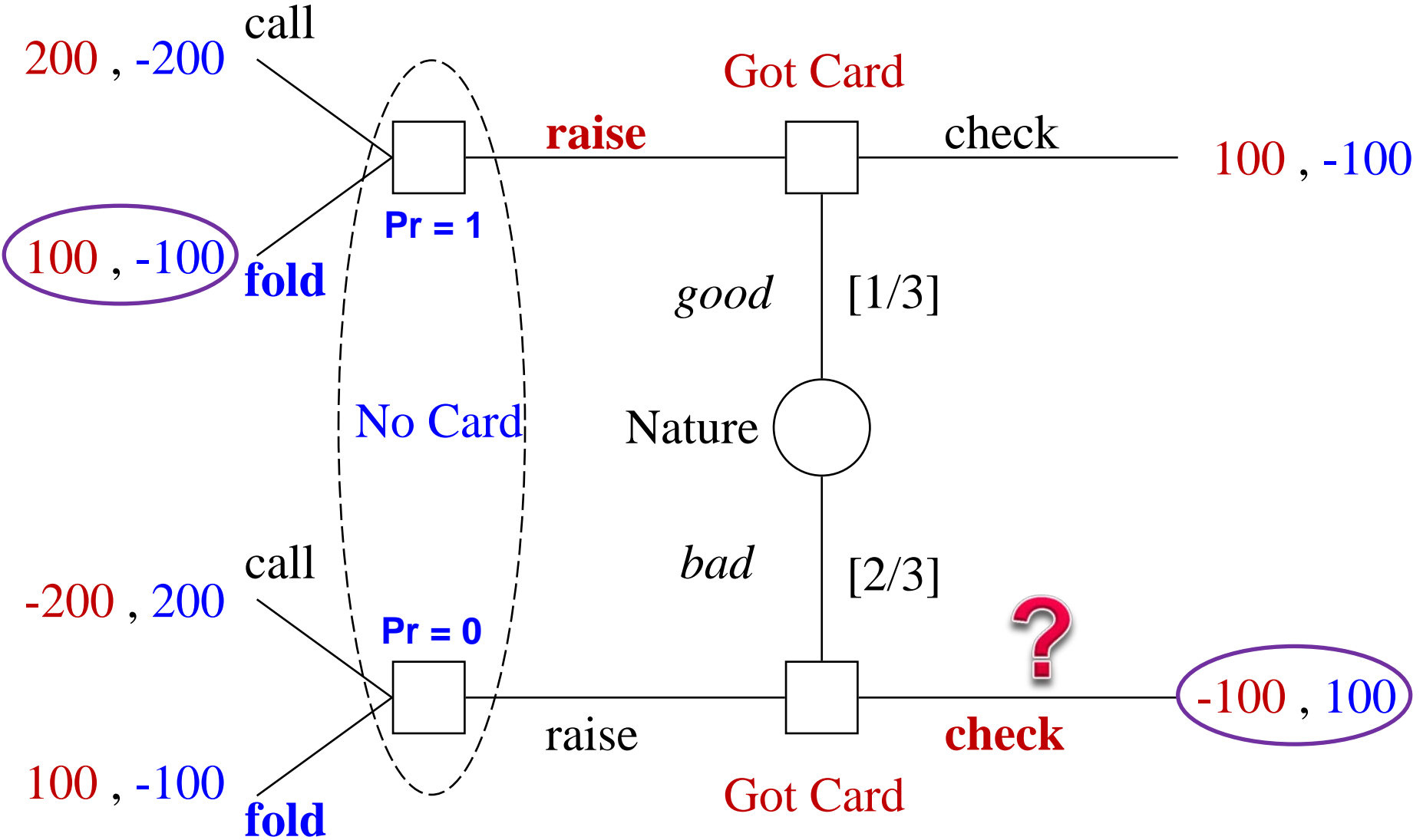
1. **Costly** signals can be used more credibly:
 - Warranties are expensive **for sellers of bad cars**
 - **What is fashion?**
 - **Extra capacity** must hurt inefficient firms more
2. Delicate balance:
 - Cheap signals → no persuasion
 - Expensive signals → no profit

Poker

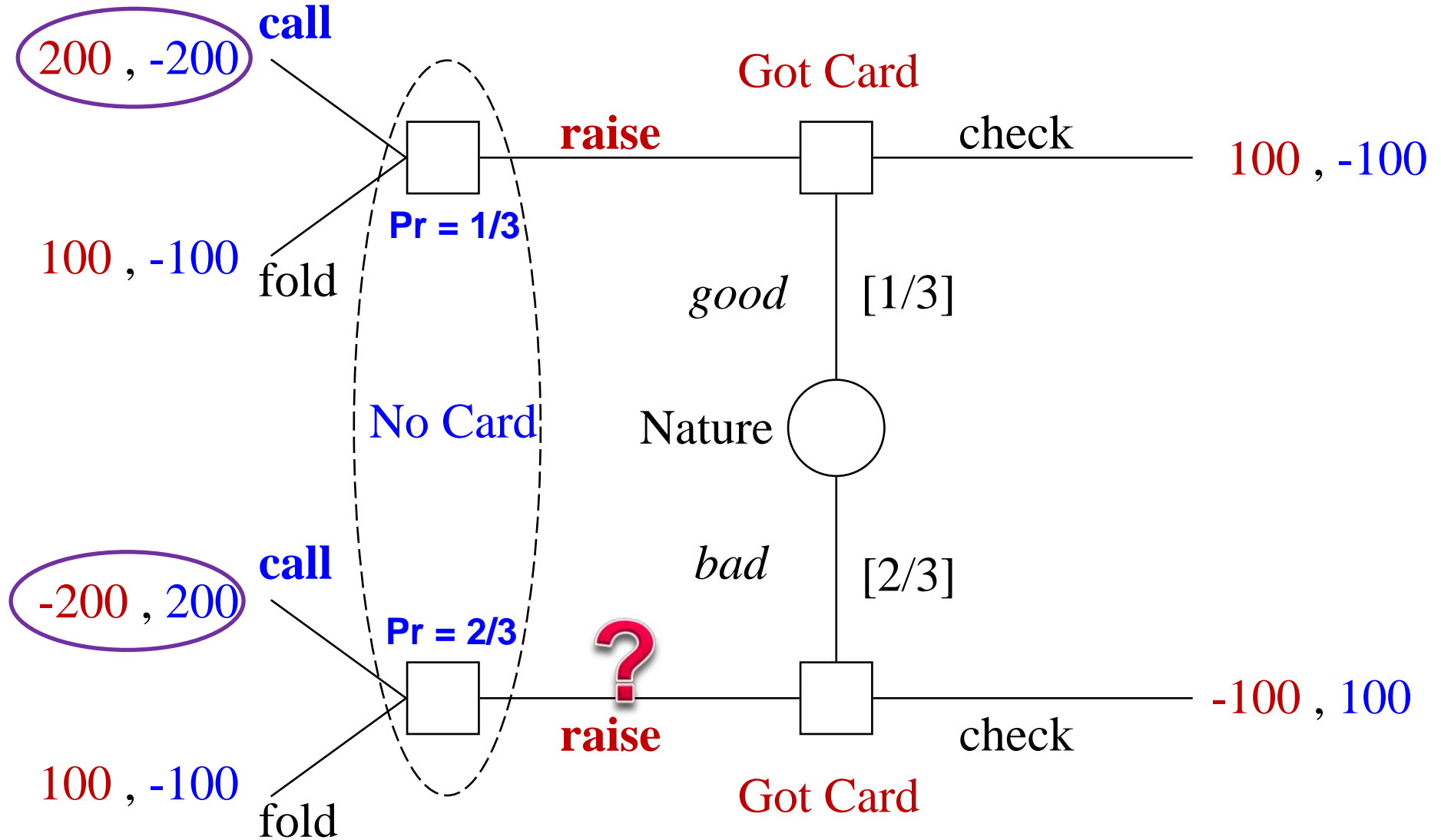


How Did You Play?

No Separating Equilibrium



No Pooling Equilibrium

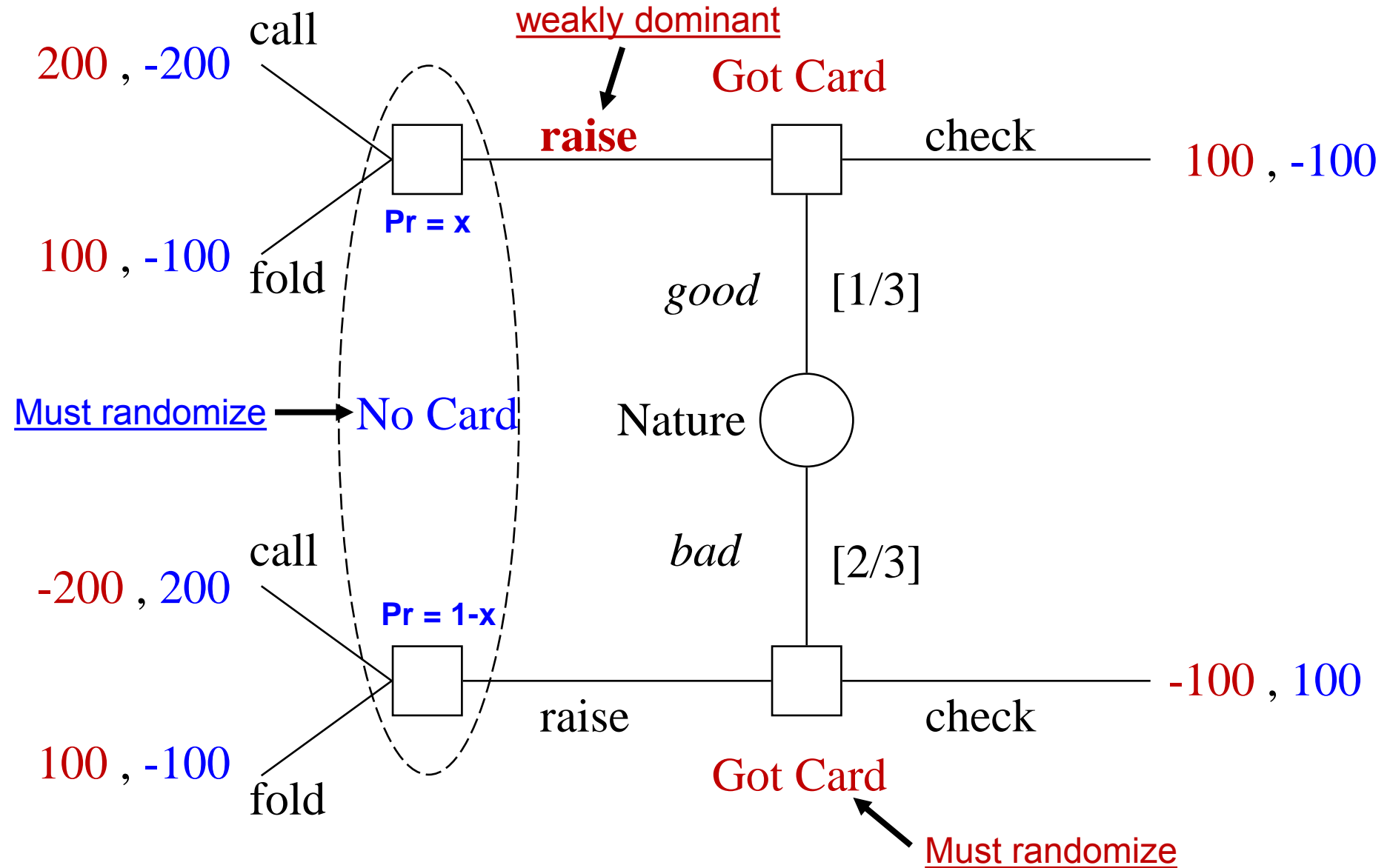


Bluffing Game (poker)

How would you play against a game theory **classmate**?

1. Can you expect No-Card to **always Fold**?
2. What about **always Call**?
3. Can you expect Got-Good-Card to **always raise**?
... That's a start!
4. Can you expect Got-Bad-Card to **always raise**?

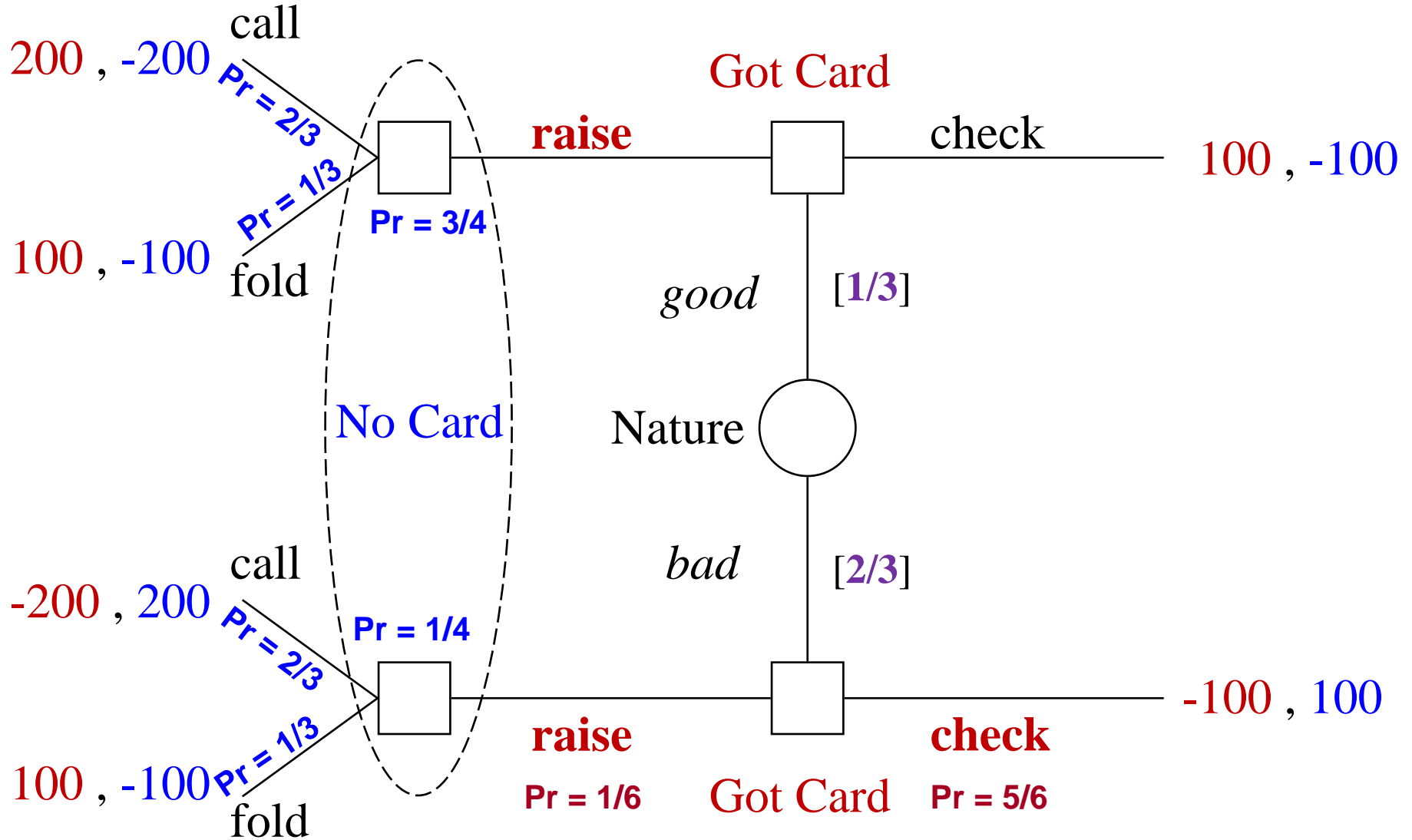
Poker: Equilibrium



Poker: Equilibrium

- Key property of Nash Equilibrium:
“If a player randomizes in equilibrium, she must be indifferent between all the strategies she uses”
- Expected payoffs must be equal
- Otherwise, the player would choose the better strategy all (not some of) the time...

Poker: Equilibrium



Calculations

1. If No-Card randomizes it must be that
 $E[u(\text{call})] = E[u(\text{fold})] = -100$
 $200 \cdot \Pr[\text{bad} \mid \text{raise}] - 200 \cdot \Pr[\text{good} \mid \text{raise}] = -100$
 $\Pr[\text{good} \mid \text{raise}] = \frac{3}{4}$ (**no-card's equilibrium belief**)
2. We know $\Pr[\text{raise} \mid \text{good}] = 1$; in order for
 $\Pr[\text{good} \mid \text{raise}] = (1/3)/(1/3 + \Pr[\text{raise} \mid \text{bad}] 2/3) = \frac{3}{4}$
it must be $\Pr[\text{raise} \mid \text{bad}] = 1/6$.
3. If Bad-Card randomizes, it must be that
 $E[u(\text{raise})] = E[u(\text{check})] = -100$
 $-200 \cdot \Pr[\text{call}] + 100 \cdot \Pr[\text{fold}] = -100$
 $\rightarrow \Pr[\text{call}] = 2/3$

Let's Compare

Takeaways

1. Information is valuable, even in **zero-sum games**
2. **Costly** signals can be used more credibly

Next time

- **Cheap talk** signals are **less likely** to be effective
- What does this have to do with R&D in large Pharma?
(aka, CEOs wish scientists were peacocks)

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15.025 Game Theory for Strategic Advantage
Spring 2015

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