How to Not Lose at Games

(Game Theory in practice)

Mean guessing game

This game is for 2+ players.

Each player secretly picks an integer between 0 and 100.

The winner is the player who picked closest to two thirds of the mean of all numbers picked.

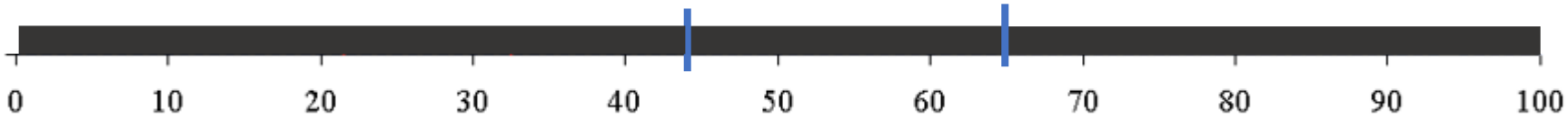
Common assumptions in Game Theory

- **Rationality**
  - Players will try to win/maximise their utility i.e. do the best they can

- **Common Knowledge of Rationality**
  - Everyone knows that all players are rational (and that everyone knows this, and so on)

Approach assuming other players are rational

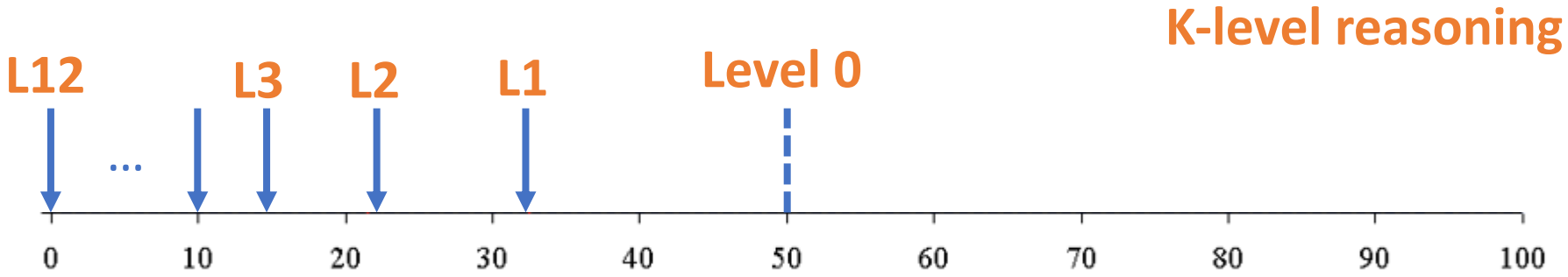
- 2/3 of the mean will never be more than ~67, so it is not rational to pick a number higher than this
- If you believe that all other players are rational, then 2/3 of the mean will never be above 2/3 of 67 = 44, so it is not rational to pick a number higher than this
- If you believe that all other players are rational, **and** that **they** believe all other players are rational….
- And so on, until the only remaining rational strategy is to select 0!



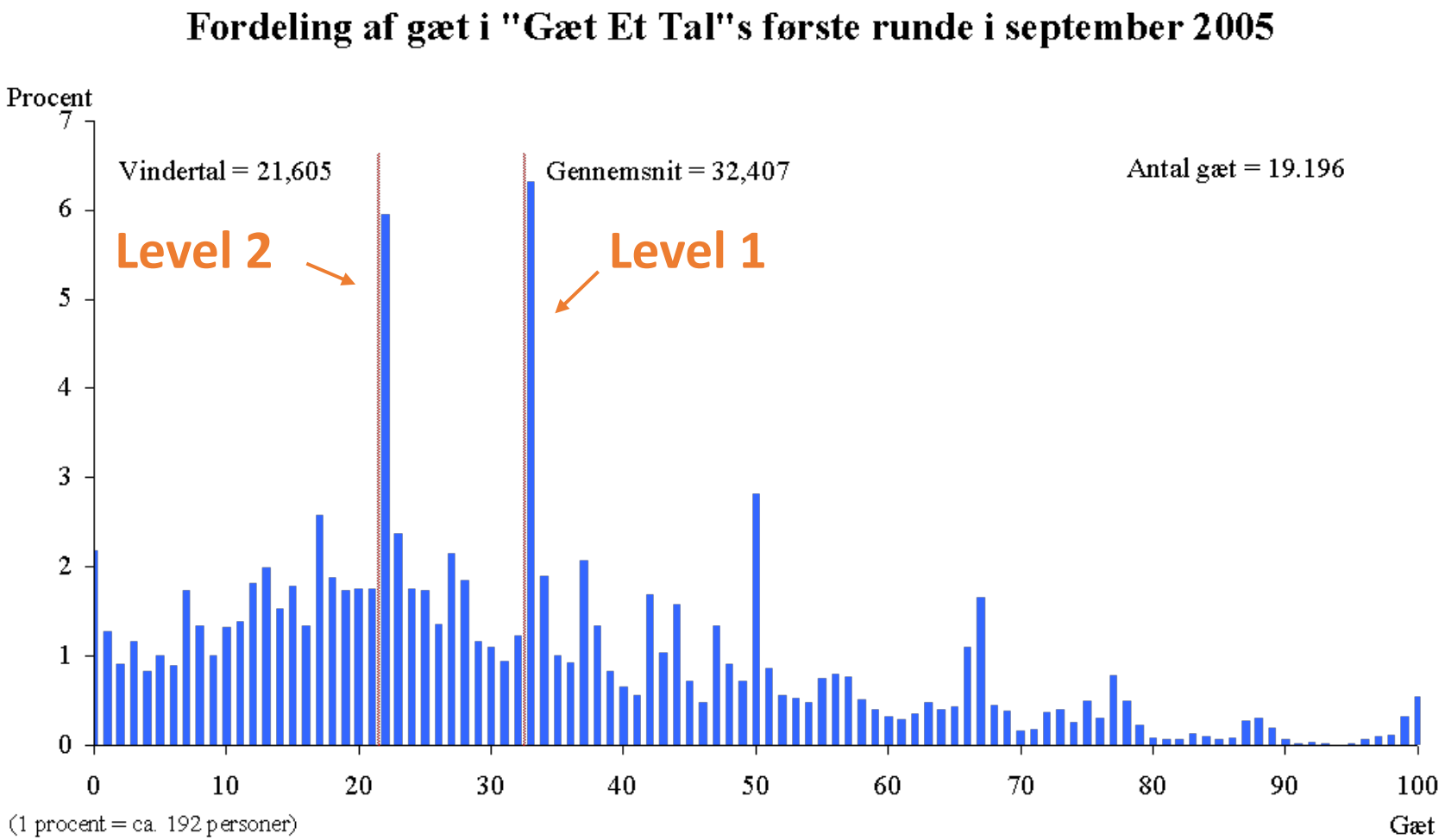
Note: 0 is a Nash Equilibrium

Approach with weaker assumptions

- Assuming everyone else is irrational and guesses randomly, the mean will be 50 and so the best guess is 33
- Assuming everyone else thinks this too (that everyone else is irrational) and also guesses 33, the best guess would be 22
- And so on…until you reach zero again



What happens in practice?



Average iterations: 1

What happens if you play multiple times?