How to cheat a bad mathematician[1]

Game A: – I pay you one dollar with probability $1/2 + \epsilon$
you pay me one dollar with probability $1/2 - \epsilon$.

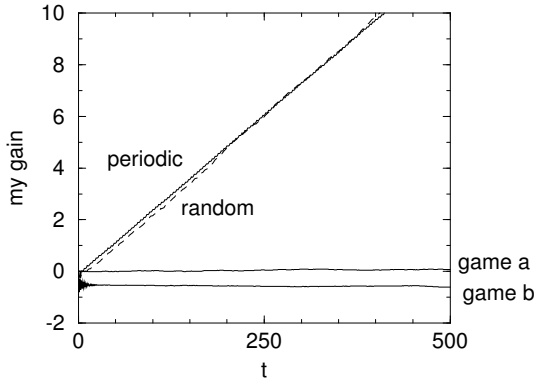
Game B: – if my current capital is a multiple of 3:
I pay you one dollar with probability $9/10 + \epsilon$
you pay me one dollar with probability $1/10 - \epsilon$;

– if my current capital is not a multiple of 3:
I pay you one dollar with probability $1/4 + \epsilon$
you pay me one dollar with probability $3/4 - \epsilon$.

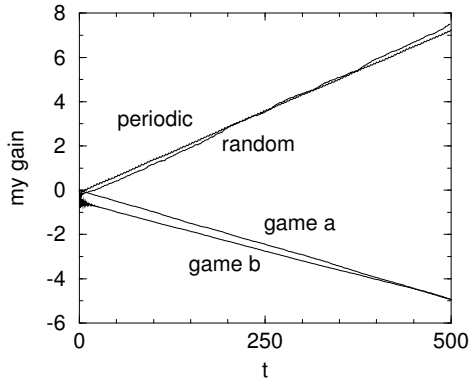
One can prove that both games are fair for $\epsilon = 0$ (detailed balance).
Then, setting $\epsilon > 0$ will give, in each game, advantage
to the mathematician (i.e. his average gain grows in time).

I make to the mathematician either one of these two offers:

- Let's play twice game A, twice game B, and so on.
- (for sceptical but still bad —specially at Markov chains— mathematicians)
  In each run, let's toss a coin to choose which game we play.



$\epsilon = 0$



$\epsilon = 0.005$

[1]This slide was part of a presentation by Juan MR Parrondo, entitled "Efficiency of Brownian Motors", given in the Workshop of the EEC HC&M Network on Complexity and Chaos (#ERBCHRX-CT940546) at the Institute for Scientific Interchange (ISI) Foundation (Torino, Italy), July, 1996.