Exercises for Wednesday, first hour

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Random walk with gravity A molecule moves around in a glass of water which we consider as divided up into three compartments. Whenever possible, the molecule moves one compartment down with probability $1/5$, and one compartment up with probability $1/20$.

1. Write down the transition probabilities associated with this system in an exhaustive and explicit fashion.
2. Find the associated equilibrium distribution.
3. What would you guess the equilibrium distribution would look if we had started with k compartments instead of three?

Tiny chess What's the entropy rate of a knight walking on a 3×3 chess board?

What about a bishop?

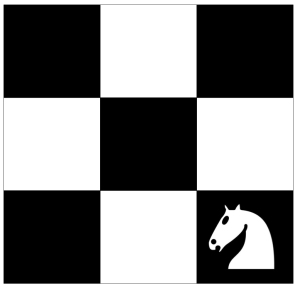

Figure 1: A knight on a 3×3 chess board.

Morse code (Cover and Thomas, Ex. 4.8) An alphabet contains a dot which takes one unit of time to transmit, and a dash which takes two.

1. When the two symbols have probability p and $q = 1 - p$, what's the entropy rate of this process?
2. For which choice of p and q is this entropy rate the largest?