5.1 Randomness, Probability, Simulation

Remember that to avoid bias in samples we let chance decide who recieves a treatment & who doesn't. I.e., picking names out of a hat. Why? Because it is not fair.
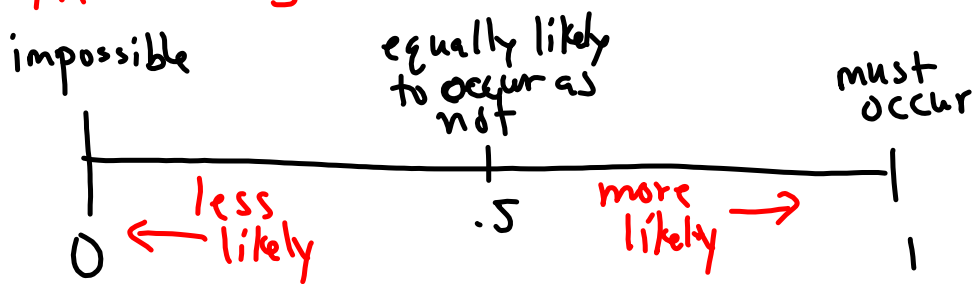
However, we need to keep in mind that chance behavior is unpredictable in the short term but it does have a regular & predictable pattern long term.

Law of large numbers

If we observe more & more repetitions of a chance process, the proportion of times that a specific outcome approaches a single value.

Ex: fair coin = .5   fair dice = $\frac{1}{6}$ or .17

This number is called the <u>probability</u>: is a number between 0 and 1 that describes the proportion of times the outcome would occur in a long series of repetitions.

impossible   equally likely
                    to occur as
                    not   must
                                                     occur

0   ← less   .5   more likely →   1
      likely   likely

Ex: The probability that a randomly selected US adult eats breakfast is .61.

a) What does a probability of .61 mean in this setting?

b) What is wrong with saying "if 100 US adults are chosen randomly, 61 would eat breakfast.

Even though this seems straightforward
as humans, we have the intuition that
random phenomena should be predictable
in the short term.

Ex: 27, 18, 17 35, 40

1, 2, 3, 4, 5

<u>Simulation</u>: the imitation of chance behavior based on a model tha accurately reflects the situation.

① <u>State</u>: Ask a question of interest about chance process.

② <u>Plan</u>: Describe how to use a chance device to imitate one repetition of a process. Tell what you will record at the end of each process.

③ <u>Perform</u>: many (20) repititions of the simulation.

④ <u>Conclude</u>: Use the results of your simulation to answer your question of interest.