4.1 Randomess, Probability, and Simulation: Myths about Randomness

The idea of probability is that randomness is predictable in the long run. Unfortunately, our intuitions about randomness lead us to think that chance behavior should also be predictable in the short run. When it isn't, we look for some explanation other than chance variation.

Suppose you toss a coin 6 times and get TTTTTT. Believers in the so-called "law of averages" think that the next toss must be more likely to give a head. It's true that in the long run, heads will appear half the time. What is a myth is that future outcomes must make up for an imbalance like six straight tails.

Coins and dice have no memories. A coin doesn't know that the first 6 outcomes were tails,and it can't try to get a head on the next toss to even things out. Of course, things do even out *in the long run*. That's the law of large numbers in action. After 10,000 tosses, the results of the first six tosses don't matter. They are overwhelmed by the results of the 9,994 tosses.

Example: A husband and wife decide to have children until they have at least one child of each gender. The couple have seven girls in a row. Their doctor assured them that they were much more likely to have a boy for their next child after all those girls. Explain why the doctor is wrong.

The chance of having another girl is the same as having a boy.

When asked to predict the gender - boy (B) or girl (G) - of the next seven babies born in a local hospital, most people will guess something like BGBGBGG. Few people would say GGGBBBG because the sequence of outcomes doesn't "look random". In fact,these two sequences of births are equally likely. "Runs" consisting of several of the same outcomes in a row are surprisingly common in chance behavior.