

# Lab 03

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## 1. Why are we not good randomizers?

A random event is not predictable. Its outcome is uncertain and yet it has a regular distribution. For example, if we toss a coin, we do not know whether it will be heads or tails. We do, however, know that it will be heads about half the time. We let this knowledge and various other factors influence our perception of what is truly random. Since we 'know' a coin will turn up heads about half the time, we will not expect to see very many tails in a row. We 'adjust' the outcomes so that the average is about what we expect to see. The problem is that by fixing the average, we ruin the shape and most likely standard deviation of the distribution.

3. Change to  $n = 5$  and again to  $n = 10$ . What is happening to the distribution?

As the size of the sample,  $n$ , increases, the distribution looks more normal and the spread decreases, but the mean,  $\mu$  stays the same.

4. Why do you think this is?

As the sample size increases, there are less samples with means near the ends and more with means near the middle. In fact, the standard deviation decreases by a factor of  $1/\sqrt{n}$ .

5. Do you have any averages over the first or last column? Can you explain this?

The only way to get an average of 0.05 or 0.95 is for all 5 (or 10) of your boxes to be 0.05 or 0.95. Although that particular sample is just as likely as any other, there is only 1 sample of size 10 that has an average of 0.05 or 0.95 and there are numerous ones that have more central averages with the most having an average of 0.5. So even though each sample is just as likely since they are random, the different values for the average, 0.05, 0.15, etc., are not. More samples have averages in the middle, hence the building up of the normal curve.