Pre-Lecture Exercise for Lecture 8

Pre-lecture exercises will not be collected for credit. However, you will get more out of each lecture if you do them, and they will be referenced during lecture. We recommend **writing out** your answers to pre-lecture exercises before class. Pre-lecture exercises usually should not take you more than 30 minutes.

In this pre-lecture exercise, we'll see an example of something subtle that will come up in Lecture 8. Suppose you are putting n items into six buckets. You decide to use the following randomized scheme:

1. Roll a 6-sided die.

2. If the die came up i, put all n items into bucket i.

Consider the following two quantities:

- Quantity 1: $\mathbb{E}[\text{number of items in bucket 1}]$

- Quantity 2: $\mathbb{E}[\text{number of items that land in the same bucket as item 1}]$

While Quantities 1 and 2 may seem similar, in fact they have very different values! Using the definition of expectation, compute Quantities 1 and 2 and see why they are different.