Brown eggs problem from Spring 2009 final exam.
Question 4e.

Recall that we have 60 eggs, of which 18 are brown.
We pick 5 eggs randomly, without replacement.

What is the expected # of brown eggs?

Let's use linearity of expectations. Even though the brown eggs are not distinguishable in the problem, we will nevertheless number them 1 through 18.
For $1 \le i \le 18$, let X_i be a random variable such that

$$X_i = \begin{cases} 1 & \text{if the } i^{th} \text{ brown egg is one of the 5 picked} \\ 0 & \text{otherwise.} \end{cases}$$

Then $X = X_1 + X_2 + \cdots + X_{18}$ is the number of brown eggs picked.

It is easy to compute $E[X_i]$:

meaning it is one of the 5 picked or not one of the 5 picked.

$$E[X_i] = 0 \cdot \text{Prob}[i^{th} \text{ brown egg not picked}] + 1 \cdot \text{Prob}[i^{th} \text{ brown egg picked}]$$

$$= \text{Prob}[i^{th} \text{ brown egg is picked}]$$

numbers cancel nicely

$$= \underbrace{\frac{1}{60}}_{\text{picked 1st}} + \underbrace{\frac{59}{60}}_{\text{not picked first}} \cdot \underbrace{\frac{1}{59}}_{\text{picked second}} + \frac{59}{60} \cdot \frac{58}{59} \frac{1}{58} + \overbrace{\frac{\cancel{59}}{60} \cdot \frac{\cancel{58}}{\cancel{59}} \cdot \frac{\cancel{57}}{\cancel{58}} \frac{1}{\cancel{57}}}^{=1/60} + \underbrace{\frac{59}{60}}_{\text{not 1st}} \underbrace{\frac{58}{59}}_{\text{not 2nd}} \underbrace{\frac{57}{58}}_{\text{not 3rd}} \underbrace{\frac{56}{57}}_{\text{not 4th}} \cdot \underbrace{\frac{1}{56}}_{\text{picked 5th}}$$

...

$$= \frac{1}{60} + \frac{1}{60} + \frac{1}{60} + \frac{1}{60} + \frac{1}{60} = 5/60 = 12$$

By linearity of expectations,

$$E[X] = E[X_1 + X_2 + \cdots + X_{18}]$$

$$= E[X_1] + E[X_2] + \cdots + E[X_{18}]$$

$$= 18 \cdot 1/12 = 1.5$$