

Name: _____

On this quiz, you **do not** need to calculate the final answer. An answer that looks something like

$$\frac{\binom{6}{2}\binom{8}{5}}{\binom{23}{4}} \quad \text{or} \quad \frac{(12)_3 + (11)(10)(9)}{14!}$$

is entirely acceptable.

1. Every day, a kindergarten class chooses randomly one of the 50 state flags to hang on the wall, without regard to previous choices. We are interested in the flags that are chosen on Monday, Tuesday, and Wednesday of next week.
 - (a) What is the probability that the class hangs Wisconsin's flag on Monday, Michigan's flag on Tuesday, and California's flag on Wednesday?

Solution: We are making 3 draws from a set of 50 with replacement where order matters. So, the size of the sample space is 50^3 .
We're asked to find the probability of one particular outcome, and all outcomes have equal probability. So the probability is $1/50^3$.

- (b) What is the probability that Wisconsin's flag will be hung at least two of the three days?

Solution: Part (b) is trickier. We need to count the number of outcomes in which Wisconsin appears either two or three times. This is not so easy to do, because we have to be careful not to count the same outcome multiple times. One way to do this is to break up the outcomes into four events:

1. Ones of the form Wisconsin, Wisconsin, (not Wisconsin)
2. Ones of the form Wisconsin, (not Wisconsin), Wisconsin
3. Ones of the form (not Wisconsin), Wisconsin, Wisconsin
4. Ones of the form Wisconsin, Wisconsin, Wisconsin, Wisconsin

The key thing here is that these four events are disjoint, i.e., not outcome appears in more than one of them. So we can just add together the outcomes in each one without counting any outcome more than once.

Event #1 contains 49 outcomes. This is because we have 49 choices for how to fill in the (not Wisconsin) slot on Wednesday, and no other choices (since the first two slots must be Wisconsin). The same is true for events #2 and #3. Event #4 has only one outcome in it. So the total number of outcomes is $49 + 49 + 49 + 1 = 148$, and our final answer is $148/50^3$.

2. A box contains 5 yellow, 6 green, and 7 red jelly beans. If 8 jelly beans are chosen randomly from the box, what is the probability that 3 are yellow and 3 are green?

Solution: Use sampling without replacement where order is irrelevant. There are $\binom{18}{8}$ outcomes. The number of outcomes with 3 yellow, 3 green, and 2 red beans is

$$\binom{5}{3} \binom{6}{3} \binom{7}{2}.$$

So the probability is

$$\frac{\binom{5}{3} \binom{6}{3} \binom{7}{2}}{\binom{18}{8}}.$$