

Mystery Box

Consider a box filled with 100 tickets, some of which are red and some of which are blue. Suppose each red ticket in the box is worth \$1 and each blue ticket is worth \$5. I will sell you the box for \$200. This would correspond to having 75 red and 25 blue tickets.

I won't tell you exactly how many red tickets are in the box, but I will let you peek by drawing 8 tickets from the box. You can even decide whether you want to draw them with, or without replacement.

As a group, discuss the following:

- What are the benefits/drawbacks of drawing with and without replacement? Which is preferable? Why? *Hint: Perhaps consider the extreme cases when $n = 1$ and $n = 100$.*

Now, let's actually sample!

[Don't proceed with the next questions until we have generated data as a class]

As a group, discuss the following:

1. What is your best estimate for the proportion of red tickets?
2. Why is this your best estimate?
3. How certain are you that this is exactly the true proportion?
4. How certain are you that this is close to the true proportion?
5. Quantify your certainty by using the 68-95-99.7 rule, along with the Central Limit Theorem (assume that 8 is "big enough" to use CLT here).
6. Suppose there were actually 75 red tickets. How likely would it be to see a result exactly like the one you did?
7. How likely would it be to see a result like the one you did, or more extreme?
8. Will you buy the box?