Arrows

1. An Olympic archer is able to hit the bull's-eye 80% of the time. Assume each shot is independent of the other. She shoots 10 arrows.
   1. Find the mean and standard deviation of the number of bull's-eyes she may get.
   2. What is the probability that she never misses?
   3. What is the probability that there are no more than eight bull's-eyes?
   4. What is the probability that there are exactly eight bull's-eyes?
   5. What's the probability that she hits the bull's-eye more often than she misses?
2. The archer will be shooting 200 arrows in a large competition.
   1. What are the mean and standard deviation of the number of bull's-eyes she might get?
   2. Is a Normal Model an appropriate approximation here? Explain.
   3. Use the 68-95-99.7 Rule to describe the distribution of the number of bull's-eyes she may get.
   4. Would you be surprised if she made only 140 bull's-eyes? Explain.
3. Our archer purchases a new bow, hoping that it will improve her success rate to more than 80\% bull's-eyes. She is delighted when she first tests her new bow and hits six consecutive bull's-eyes. Do you think this is compelling evidence that the new bow is better? In other words, is a streak like this unusual for her? Explain.
4. The archer continues shooting arrows, ending up with 45 bull's-eyes in 50 shots. Now are you convinced that the new bow is better? Explain.

M&Ms

1. The candy company claims that 10% of the M&Ms it produces are green. Suppose that the candies are packaged at random in small bags containing about 50 M&Ms. A class of elementary school students learning about percents opens several bags, counts the various colours of candies, and calculates the proportion that are green.
   1. If we plot a histogram showing the proportions of green candies in the various bags, what shape would you expect it to have?
   2. Can this histogram be approximated by a Normal model? Explain.
   3. Where should the centre of the histogram be?
   4. What should the standard deviation of the proportion be?
2. Suppose the class buys bigger bags of candy, with 200 M&Ms each. Again the students calculate the proportion of grenn candies they find.
   1. Explain why it's appropriate to use a Normal model to describe the distribution of the proportion M&Ms they might expect.
   2. Use the 68-95-99.7 Rule to describe how this proportion might vary from bag to bag.
   3. How would this model change if the bags contained even more candies?
3. In a really large bag of M&Ms, the students found 500 candies, and 12% of them were green. Is this an unusually large proportion of green M&Ms?