Stat 185 - Review problems for Exam 2

Our second exam is next Wednesday, March 2. Here are a few problems to get you thinking. There's a good chance that *most* or even all of these problems will be represented on the exam. There might be one or two more, as well.

1. Suppose that X is a discrete random variable with the following distribution:

X	1	2	4
$P(X)$	1/4	1/4	?

   (a) What should the ? be in order to make this a good probability distribution?

   (b) What is the expected value or mean of X?

   (c) What are the variance and standard deviation of X?

2. I've got an unfair coin that comes up heads 90% of the time. Suppose I flip the coin and write down a 1 if it comes up heads or a 0 if it comes up tails. Let's denote that numerical value by the random variable X.

   (a) Write down the table that defines the distribution of X.

   (b) Compute $E(X)$, $\sigma^2(X)$, and $\sigma(X)$ - i.e. the mean, variance, and standard deviation.

3. Continuing with the previous problem that uses an unfair coin that comes up heads 90% of the time, now suppose I flip the coin 1000 times and count the number of heads that I get. We'll call that numerical value S.

   (a) Compute $E(S)$, $\sigma^2(S)$, and $\sigma(S)$ - i.e. the mean, variance, and standard deviation.

   (b) Use a normal approximation to find $P(S) < 888$.

4. Figure 1 shows two normal curves, one of which is the standard normal curve.

   (a) Which curve is the standard normal?

   (b) What is the mean of the other (non-standard) normal curve?

   (c) Which of the following could be the standard deviation of the other (non-standard) normal curve: $-1/2$, $1/2$, or 2?

5. Let Z denote a random variable with the standard normal distribution. Use a table to compute

   (a) $P(Z < 1.8)$

   (b) $P(-1 < Z < 1.8)$

   (c) $P(Z > -1)$

6. Let X denote a random variable with a normal distribution with mean $\mu = 72$ and standard deviation $\sigma = 4.8$. Use a table to compute

   (a) $P(X < 78)$

   (b) $P(70 < X < 82)$

   (c) $P(X > 80)$

7. Our CDC data set indicates that heights are normally distributed with a mean of $\bar{x} = 67.18$ and a standard deviation of $s = 4.126$. Let's assume these approximations are good for the entire adult population. Suppose we now pick a person from that population at random. What's the probability that they are more than 70 inches tall?

8. Our CDC data set indicates that average weight is 169.68 pounds with a standard deviation of 40.08 pounds, though it does *not* appear to be normally distributed. Suppose we pick 100 people from the population at large and compute the average of their weights. What is the probability that number is larger than 175 pounds?

9. A random sample of 57 bottlenose dolphins found their average length to be 9.7 feet with a standard deviation of 1.1 feet. Use that information to write down a 96% confidence interval for the length of bottlenose dolphins.

10. A recent survey of 1200 likely voters put President Biden's approval rating at 45%. Use that data to write down a 95% confidence interval for Biden's approval rating.

11. I need to design a survey to determine what percentage of North Carolina voters believe that it's important for the state to have public university that is designated as a liberal arts college. I'd like my margin of error to be $\pm 2\%$. How large a sample size do I need?

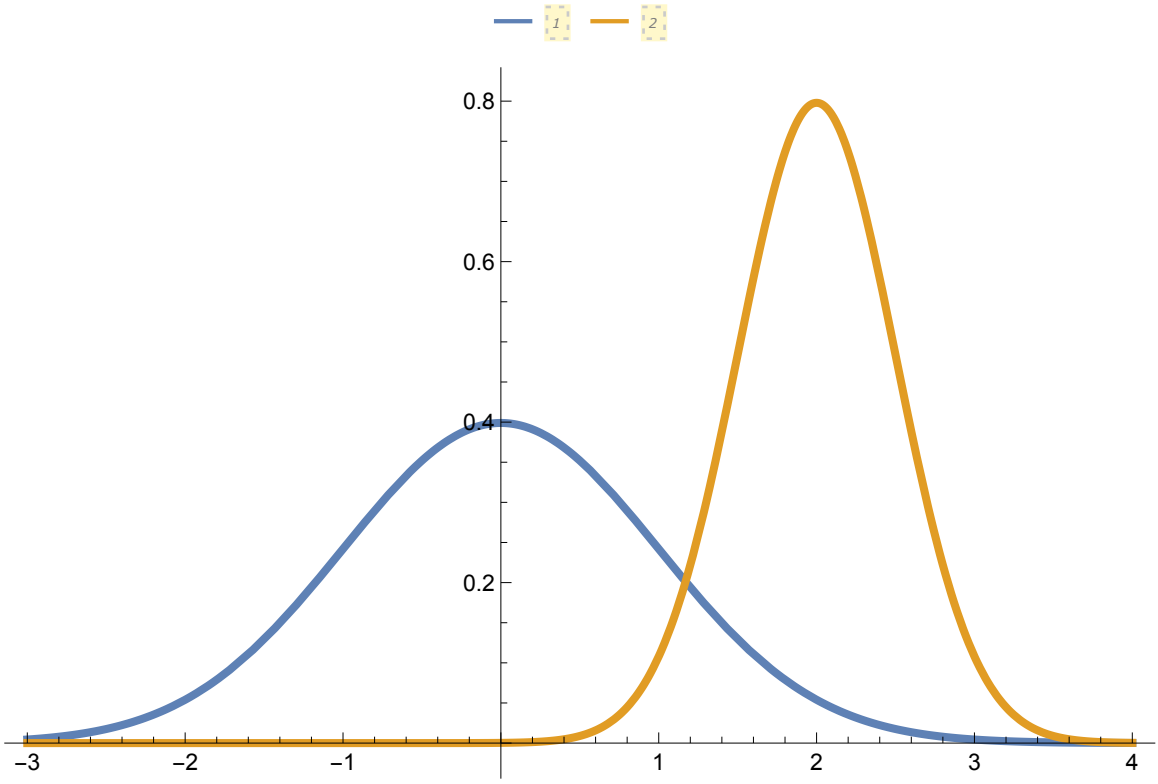

Figure 1: Two normal curves