Reminder: To receive full credit for your homework, include as part of your solution a brief description of the problem that provides context.

This assignment includes problems related to binomial, normal, and sampling distributions. Several problems require R to make several graphs. **Please do not include the graphs with the assignment.**

Please download the file `prob.R` from a link on the tentative course schedule. (I find this to be a pain using Internet Explorer, because the file must be saved as HTML or text.) After starting R, use the File menu to select "Source R Code…". You then need to find the file you downloaded. By default R looks for files ending in `.R`. If you saved it in a different format (for example, as a text file), you might need to ask R to look at all file types in the directory where you saved it.

1. Graph the binomial distribution for $n = 10$ and $p = 0.1$ with the command `gbinom(10,0.1)`. Repeat this for $p = 0.2, 0.3, \ldots, 0.9$. [Please do not include these graphs with your assignment.]
   (a) How does the center of the distribution change as p changes?
   (b) For which value of p is the distribution most strongly skewed right? left? most symmetric?
   (c) For which value of p is the standard deviation the largest?
2. Graph the binomial distribution for $n = 1$ and $p = 0.5$ with the command `gbinom(1,0.5)`. Repeat this for $n = 2, 4, 8, 16, 32, 64, 128$. [Please do not include these graphs with your assignment.]
   (a) How does the center of the distribution change as n changes?
   (b) Is this distribution skewed for any n?
   (c) What is the smallest n for which the distribution looks approximately normal? (There is no single correct answer.)
   (d) What happens to the range of values for which the probabilities are large enough to be visible as n increases?
   (e) What happens to the range of values for which the probabilities are large enough to be visible over n as n increases?
3. Graph the binomial distribution for $n = 1$ and $p = 0.1$ with the command `gbinom(1,0.1)`. Repeat this for $n = 2, 4, 8, 16, 32, 64, 128$. [Please do not include these graphs with your assignment.] About how large does n need to be before the distribution looks nearly symmetric and approximately normal? Compare your answer here to the answer in part (c) in the previous problem.
4. Exercise 5.3 (page 157).
5. Exercise 5.6 (page 157).
6. Exercise 5.16 (page 167). (The command `gnorm(145,22,prob=T,a=135,b=155)` draws a sketch for part (a) of this problem. The command `gnorm(145,22/sqrt(16),prob=T,a=135,b=155)` draws a sketch for part (b) of this problem.)
7. Exercise 5.18 (page 167).
8. The function `gmix` will graph the sampling distribution of the mean drawn from of a bimodal distribution where you can specify the sample size, the means,standard deviations, and the weight of the first mode. It also draws a normal distribution with the same mean and SE for comparison. For example, `gmix(1,115,25,450,50,0.9)` will draw a graph similar to the one on page 170. A sampling distribution for $n = 1$ is just the population. The first mode is centered at 115 with an SD about 25. The second mode is centered at 450 with an SD about 50. About 90% of the probability is in the first mode. You can reproduce the later graphs by changing the first argument from 1 to whichever sample size you desire.

   Consider the graphs of these two populations.

   1. `gmix(1,115,25,450,50,0.9)`
   2. `gmix(1,115,25,450,50,0.5)`

   (a) For each population, what is the smallest n in $5, 10, 15, 20, \ldots$ for which the sampling distribution appears to be unimodal? (In a unimodal distribution, there is a point where the function is increasing to the left of the point and descreasing to the right of the point.)
   (b) For each population, what is the smallest n in $1, 2, 4, 8, 16, \ldots$ (doubling the sample size) for which you think that a normal approximation would be pretty good? (For example, when is the 90th percentiles pretty close to that for the normal curve? When is the area within one SE close to that of the normal curve?)
   (c) One distribution is approximately normal for a smaller n than the other. Make a guess as to why. What important characteristic distinguishes the two populations?