Psyc 3101, Homework 5
Due Sept. 30

We know the sample mean is our best estimate of the population mean, but how good is it? How much can we rely on the sample mean to be close to the population mean? These exercises will give you an idea of how we answer that question.

Here are ten samples of 5 subjects each. I used a computer to draw them all from the same hypothetical population: a normal distribution with $\mu = 0$ and $\sigma = 2$.

	Sample Mean
{ 1.60, -0.32, 1.41, -1.01, -0.19}	0.298
{ 0.51, 2.38, -0.32, -1.45, 1.14}	0.452
{ 1.61, 2.91, 0.18, -3.63, -0.89}	0.036
{-1.49, 1.00, -1.29, 1.74, -1.07}	-0.222
{ 1.01, 2.21, 2.77, 1.45, -1.26}	1.236
{ 3.35, -2.44, 1.53, -0.66, 2.12}	0.780
{-0.39, -0.31, 2.45, 1.26, 1.51}	0.904
{-1.75, 1.69, -0.65, -2.29, 0.62}	-0.476
{-3.11, -3.62, -1.23, -1.29, -3.23}	-2.496
{-1.90, -0.52, 1.27, 1.32, -2.54}	-0.474

1. Calculate the mean of each sample (write your answers above, next to the samples). Notice how some sample means are bigger than μ and others are smaller. This is because of sampling variability.

2. Now calculate the mean of all ten sample means. Notice how the sample means average out to be very close to the population mean. This is because the sample mean is an unbiased estimator: some sample means are too big, others are too small, but on average they're just right.

Mean of means = .0038

3. Calculate the standard deviation of all ten sample means. This number tells you how much the sample means tend to differ (above or below) from the population mean. Think about what this number says about how reliable the sample mean is.

Standard deviation of means = 1.053

4. Here are ten new samples from a different population. The population mean is the same as before ($\mu = 0$), but now I've increased the variability of individual scores in the population by setting $\sigma = 10$.

	Sample Mean
{ -0.31, 19.00, 0.13, 7.99, 2.72}	5.906
{ 0.43, -5.64, 1.29, 9.60, 12.25}	3.586
{ 5.13, -12.49, 3.56, 13.53, 6.86}	3.318
{ 26.33, 22.07, -0.96, -7.43, -9.62}	6.078
{-12.21, 15.19, 12.21, -0.42, 0.64}	3.082
{ -8.34, 10.32, 12.11, -25.63, -5.36}	-3.380
{ 1.81, 19.09, -9.11, -0.60, -25.42}	-2.846
{-11.13, -15.36, 11.80, 7.37, -8.88}	-3.240
{ -8.15, -7.19, -13.62, 14.44, -14.27}	-5.758
{ 9.66, -13.43, 3.49, -14.79, -17.71}	-6.556

Calculate the mean of each sample, and then calculate the standard deviation of the ten sample means.

Standard deviation of means = 4.846

5. In which case (Questions 1-3 vs. Question 4) are the sample means more reliable? Why?

In the first case, the typical error between M and μ is about ± 1.053. In the second case, the typical error is about ± 4.846. Therefore the sample means are more reliable in the first case. That is, if we had the mean of a single sample, we could be more confident in the first case that the true population mean is close to our sample mean.