

# Applet #1 Activities

The following activities accompany an applet that can be accessed at

<http://www.zoology.ubc.ca/~whitlock/kingfisher/SamplingNormal.htm>

and is an excellent tool to help you understand *sampling distributions*. As you will appreciate, the sampling distribution of a statistic governs how that statistic behaves across multiple samples of the same size. The applet explores samples from a *Normal* distribution, specifically here a distribution of lengths of fish in a large lake. Recall the Normal distribution  $N(\mu, \sigma)$  is a model for distributions that appear to be “bell-shaped”, centred at some mean denoted  $\mu$  and with standard deviation denoted  $\sigma$ . The tool enables you to simulate multiple samples of size  $n$ , for different choices of  $n$ , and observe how the distribution of the sample mean behaves. Work through the tutorial for the applet, then play around with it for a while on your own before you attempt the following questions. Note you can in effect refresh the display at any time by re-setting the sample size  $n$ .

1. Explain clearly three things you learn about the sampling distribution of the sample mean when sampling from a Normal distribution.
2. Select the sample size  $n = 20$ , population mean  $\mu = 100$  mm, and population standard deviation  $\sigma = 15$  mm. Create many samples of size 20, and observe the distribution of the sample mean that is created. Supposing that the sample mean follows a Normal distribution and recalling what you know about such distributions, give a rough estimate of the standard deviation of the distribution of the sample means based on your simulations. Explain your reasoning clearly, basing your explanation on the simulations you observed.
3. Select the sample size  $n = 25$ , population mean  $\mu = 150$  mm, and population standard deviation  $\sigma = 40$  mm. Create many samples of size 25, and observe the distribution of the sample mean that is created. Supposing that the sample mean follows a Normal distribution and recalling what you know about such distributions, give a rough estimate of the standard deviation of the distribution of the sample means based on your simulations. Explain your reasoning clearly, basing your explanation on the simulations you observed.

4. Identify which expression you think best describes the standard deviation of the mean from samples of size  $n$  from the  $N(\mu, \sigma)$  distribution:

$$\frac{\sigma}{n} \quad \frac{\sigma}{n^2} \quad \frac{\sigma^2}{n} \quad \frac{\sigma}{\sqrt{n}} \quad \frac{\sigma^2}{\sqrt{n}}$$