Applet #2 Activities

Here you will use another simulation–based learning tool. This applet can be accessed at

`http://www.zoology.ubc.ca/~whitlock/kingfisher/CLT.htm`

and allows sampling from distributions other than Normal. As with the first applet, the goal is to understand the distribution of the sample mean. This time though the distribution from which samples are taken may be non–Normal. The applet illustrates an important result in statistics known as *The Central Limit Theorem.*

1. To begin with we see a distribution of responses to the question "How many cups of coffee do you drink each week?". Describe in words the shape of the distribution of the responses.

2. Work through the tutorial for the applet, then play around with it for a while on your own. Explain clearly three things you learn about the sampling distribution of the sample mean from a non-Normal distribution.

3. Staying with the "Coffee" example, set the sample size n to be 4. Observe the sampling distribution of the sample mean for this size of sample by clicking "Means For Many Samples". Describe the sampling distribution you observe.

4. Switch now to the "Flu" example, which illustrates the distribution of deaths by age for the Spanish flu epidemic that lasted from 1918 to around 1925. Note that this distribution is quite irregular in shape, having three modes. It is not very skewed. Again set the sample size n to be 4. Observe the sampling distribution of the sample mean for this size of sample by clicking "Means For Many Samples". Describe the sampling distribution you observe, and compare and contrast it with the sampling distribution for the sample sample size ($n = 4$) you saw in the "Coffee" example.

5. What do parts 3 and 4 tell you about how closely the sampling distribution of the mean will be approximated by a Normal distribution

when the sample size is small? In particular, when would you expect the sampling distribution of the mean to *not* resemble a Normal distribution?

6. Play around with the applet in "Custom" mode. Create a customised distribution that is very skewed, and draw a rough sketch of your distribution. Before you sample from this distribution, make a guess at what size of sample would be required in order for the sampling distribution of the mean to be similar to a Normal distribution. Then starting with $n = 5$, create many sample means by clicking "Means for many samples" and observe the shape of the sampling distribution of the mean. Increase the sample size n in steps of five, clicking "Means for many samples" at each selection, until you reach a sample size where the sampling distribution of the sample mean resembles a Normal distribution. (Note that clicking "Show Normal Approximation" fits a Normal distribution to the sampling distribution.) At what size of sample were you satisfied that a Normal distribution would be a reasonable model for the sampling distribution of the mean?

7. Still in "Custom" mode, set $n = 30$. Attempt to create a customised distribution from which samples of size 30 have a sample mean with a distribution that does not appear like a Normal distribution. Can you do it? If "yes", provide a sketch of your customised distribution. If "no", describe what you attempted and why.