Lab 4 – Solution

1. Z follows the standard normal distribution $\mathcal{N}(0, 1)$. Using the standard normal table, compute the following probabilities:

$$\mathbb{P}(Z < 0) = 0.5 \qquad\qquad \mathbb{P}(Z > 0.52) = 0.3015$$

$$\mathbb{P}(Z > 1.32) = 0.0934 \qquad\qquad \mathbb{P}(Z > 6) = 0$$

$$\mathbb{P}(Z < -6) = 0 \qquad\qquad \mathbb{P}(Z < -2.22) = 0.0132$$

2. Go to `http://bcs.whfreeman.com/ips6e`, scroll down and select '*Statistical Applets*'. Choose the '*Normal Curve Applet*'.

   (a) Uncheck the 2-tail box and move the left-facing flag over the point -1.5 and the right-facing flag to the right end (so that you see 0.000). What value appears in the box to the left in the yellow shaded area? (This value corresponds to the value found in the standard normal table.) 0.0668

   (b) The exam scores in a calculus class follow a normal distribution with mean 72 and standard deviation 4. Use the '*Normal Curve Applet*' to compute the probability that a randomly selected student

   i. scores 76 or higher?
   ii. scores between 64 and 80?
   iii. scores lower than 68 or higher than 76?

   Hint: Don't forget to standardize your values first.

   i. The z-score that correspond to $x = 76$ is

   $$z = \frac{76 - 72}{4} = 1$$

   Move the right flag up to 1 (uncheck the 2-tail and move the left flag to the far left). The area under the curve is 0.1587, therefore the probability that a student scores 76 or higher is 0.1587.

   ii. The z-scores that correspond to $x = 64$ and $x = 80$ are

   $$z = \frac{64 - 72}{4} = -2, \quad z = \frac{80 - 72}{4} = 2$$

   Moving the *right* flag to -2 and the *left* flag to +2, the area under the curve is 0.9544, therefore the probability that a student scores between 64 and 80 is 0.9544.
   Another way to compute it is to move the *left* flag to -2 and the *right* flag to +2, the shaded area now is 0.0228+0.0228 , therefore the area that we want is 1-(0.0228+0.0228) = 0.9544.

iii. The z-scores that corresponds to $x = 68$ and $x = 76$ are

$$z = \frac{68 - 72}{4} = -1, \qquad z = \frac{76 - 72}{4} = 1$$

Moving the *left* flag to -1 and the *right* flag to +1, the area under the curve is 0.1587+ 0.1587 = 0.3174, therefore the the probability that a student scores lower than 68 or higher than 76 is 0.3174.

3. Sketch the following pairs of distributions on the same graph:

   (a) $\mathcal{N}(0,1)$ and $\mathcal{N}(3,1)$

   (b) $\mathcal{N}(1,2)$ and $\mathcal{N}(1,5)$

   (c) $\mathcal{N}(-2,3)$ and $\mathcal{N}(2,10)$