1. Let \( F(z) = \int_{-\infty}^{z} f(z')dz' \), where \( f(z) \) is the unit normal p.d.f. and \( F(z) \) is the corresponding cumulative distribution function. Then
\[
P(z_1 < z \leq z_2) = F(z_2) - F(z_1)
\]
. The VI’s labeled Normal Dist calculate \( F(z) \).

2. Let \( F^{-1}(z) \) be the inverse of \( F(z) \) in the previous problem. To generate a sample \( z \) from a unit normal distribution, first generate a sample \( r \) from a uniform distribution (between 0 and 1). Then \( z = F^{-1}(r) \). This follows from the conservation of probability (see Bevington, Sec. 5.3). To get a sample from \( P(x; \mu, \sigma) \) use the transformation \( z = \frac{x-\mu}{\sigma} \) or \( x = \sigma z + \mu \).

The vi for \( F^{-1}(r) \) is labeled Inverse Normal Dist. The “dice” vi generates a sample from a uniform distribution which is input to \( F^{-1}(r) \). The output from the unit normal distribution is scaled to give the desired \( \mu \) and \( \sigma \).

3. (a) For \( x = 3, n = 5, p = 0.4 \), \( P_B(x; n, p) = \frac{n!}{(n-x)!x!} p^x (1-p)^{n-x} = 0.2304 \).

(b) Poisson, \( \mu = 3.5, \sigma = \sqrt{\mu} \), \( P_P(x; \mu) = \frac{\mu^x}{x!} e^{-\mu} \)

   i. \( \sigma = \sqrt{3.5} = 1.87 \)

   ii. \( P_B(1) = 3.5e^{-3.5} = 0.106 \)

   iii. \( P_B(0) = e^{-3.5} = 0.0302 \)
4. (Problem 2.8 in Bevington, 3rd. Ed.)

Since there are two mutually exclusive outcomes, we use the binomial distribution, \( P_B(x; n, p) \).
We choose \( x \) to represent the number of cars turning to the right so \( p = 0.75 \). The total number of cars is \( n = 1035 \) and on this day, \( x = 752 \). From this, \( \mu = np = 776 \) and \( \sigma = \sqrt{np(1-p)} = 13.9 \). Since \( n \) is large, we approximate this with a Gaussian distribution.

For \( x = 752 \), we find \( z \equiv \frac{x - \mu}{\sigma} = \frac{752 - 776}{13.9} = -1.73 \).

Refer to Table C.2 in Bevington: \( P(|z| > 1.73) = 1 - P(z < 1.73) = 1 - 0.91636 = 0.084 \) (you could also use your VI in Prob. 1). There is an 8.4% probability this was a normal day.