Sampling Solutions

1. **True or False: As sample size doubles, its standard error halves, holding the standard deviation constant.**

   FALSE. SE = standard deviation/square root of sample size (n). As n doubles, SE shrinks by a factor of 1/square root of 2.

2. **True or False: Sample means calculated from random samples from a given population will always be normally distributed.**

   FALSE. This is true only if the sample size is large enough for the sampling distribution of the sample means to be normally distributed.

3. Suppose that the IQs of Duke University students can be described by a normal distribution with mean 130 and standard deviation of eight points (this is the population).

   a. **We select one Duke student at random. What is the probability that this student's IQ is less than 120?**

We need to calculate a z-score with a mean of 130, an X of 120 and a sigma of eight.

$$Z = \frac{X - \mu}{\sigma}$$

z = (120-130)/8 = -10/8 = -1.25

p(z<-1.25) = 0.1056 or approximately 10.6%.

b. We select 5 Duke students at random. What is the probability that their AVERAGE IQ is less than 120?

In this problem we are dealing with an AVERAGE. We therefore need to use the following to calculate the z-score:

$$Z = \frac{\bar{X} - \mu}{\sigma/\sqrt{n}}$$

Z=(120-130)/(8/sqrt(5)) = -2.795

P(z<-2.795) = 0.0026 or approximately 0.26%. This makes intuitive sense because we know that there is less variation in the averages of a set of randomly selected observations than there are in individual observations.