Solving Chapter 17 Problems (Supplement to Notes)

The first part of any problem is knowing what you want to find. There are essentially four kinds of problems in this chapter: ordinary normal, $\hat{p}$, $\bar{x}$, and total problems.

Ordinary Normal

For some random variable, say X, distributed normally with a mean of μ and a standard deviation of σ, you should expect to use the **AnyNormal** sheet.

You will NOT be given a sample size for this type of problem, but you are often asked for a probability or a percentile.

Recall that the percentile is the value from the distribution which has the percentile area BELOW it. If you are given an area above, you must subtract that value from 1 BEFORE entering areas into the worksheet to calculate percentiles.

Sample Proportion

For $\hat{p}$, you will see a percent and a sample size given. If you don't have those, or you have more than that, it is probably not a $\hat{p}$ problem.

The sampling distribution of the sample proportion of successes is $\hat{p} \sim \mathcal{N}\left(p,\ \sqrt{\dfrac{p \cdot (1-p)}{n}}\right)$.

Areas and percentiles associated with this distribution can be found with the **phat** sheet of the **NormCalc** workbook OR with the **Normalphat** sheet of the **Test 3 Workbook**.

Sample Mean

The sample mean is denoted $\bar{x}$ and has sampling distribution that is normal with a mean that matches the population mean and a standard deviation of $\sigma/\sqrt{n}$. That is, $\bar{x} \sim \mathcal{N}\left(\mu,\ \dfrac{\sigma}{\sqrt{n}}\right)$.

For problems with a sample mean, you must be given the population mean, the population standard deviation, and the sample size. If you don't have those, you don't have this kind of problem.

Areas and percentiles associated with this distribution can be found with the **mean** sheet of the **NormCalc** workbook OR with the **Normalxbar** sheet of the **Test 3 Workbook**.

Total

A total problem asks you the mean and standard deviation of a sum OR the probability or percentile associated with doing the same thing many times. Waiting on many customers and playing a particular game repeatedly are typical examples.

Problems about a total may be worked in two different ways, both which give the same numerical answer, but only one of which is theoretically sound.

- The theoretically sounds way is to convert the total to an average and use the sampling distribution of the sample mean to solve the problem:

  First, a total is $\sum_{i=1}^{n} x_i$. An average is $\bar{x} = \dfrac{\sum_{i=1}^{n} x_i}{n}$. Under the right conditions, $\bar{x} \sim \mathcal{N}\left(\mu,\ \dfrac{\sigma}{\sqrt{n}}\right)$.

  Any problem where you know about TOTALS can be converted to an average by dividing by the sample size. For example, $P(\text{Total} > 50 | n = 10) = P\left(\bar{x} > \frac{50}{10} = 5\right)$.

  Any solution with the average can be changed to a solution about the total by multiplying by the sample size. $P(\bar{x} < \mathit{value}) = .1 \Longrightarrow P(\text{Total} < \mathit{value} \times n) = .1$

- The non-so-theoretically sound but mathematically identical way to work the problem is to use the formulas for the mean and standard deviation of a sum (found in top of the IndepRV sheet) to find

  $\mu_{x_1+x_2+\cdots+x_m} = m \cdot \mu_X$ and $\sigma_{x_1+x_2+\cdots+x_m} = \sqrt{m} \cdot \sigma_X$,

  which can be entered into the **AnyNormal** sheet to find the areas and percentiles associated with the sampling distribution of a total.