$$n \geq \frac{5}{p} \; and \; n \geq \frac{5}{(1-p)} \; =$$
$$n \geq \frac{5}{0.09} \; and \; n \geq \frac{5}{(1-0.09)} \; =$$
$$n \geq 55.56 \; and \; n \geq 5.49$$

Since 200 > than both these values, we can assume a normal distribution.

The mean of the sampling distribution is 9% (p=0.09).

Since our sample size is <5% of the total population, as determined by 200/13,300 = 1.5%, our standard error is determined by:

$$Standard\ Error = \sqrt{\frac{0.09 * 0.91}{200}} = 2.02\%$$

Confidence Intervals

A confidence interval determines, based on my statistics of a sample of a population, how sure I am that my sample would reflect the distribution of the population. It is bound by an upper and lower range.

$$Margin\ of\ Error = Criticla\ Value\ x\ Standard\ Error$$

To calculate we have two options.

Confidence Interval if I know the standard deviation of the whole population:

$$\bar{x} \pm z_{\alpha/2}\left(\frac{\sigma}{\sqrt{n}}\right)$$

Confidence Interval if n > 30 and I do not know the standard deviation of the whole population:

$$\bar{x} \pm t_{\frac{\alpha}{2},n-1}\left(\frac{s}{\sqrt{n}}\right)$$

If n < 30, then we need to keep sampling.

This is a two-tailed calculation, since there is an upper and lower limit. Therefore, the column we need to look at for our sampling distribution is 0.025 for 95% confidence.

As a guide:

90%, z = 1.645
95%, z = 1.960
99%, z = 2.576

The margin of error is calculated by:

$$z\left(\frac{\sigma}{\sqrt{n}}\right)$$

We can tabulate by:

NAME	Average	Sample Size	Population SD	Standard Error	Margin of Error	Lower Limit	Upper Limit

Note the following effects:

If sample size increases, the range decreases.

If standard deviation increases, the range increases.

If the average increases, the range will stay constant.

If confidence increases, the range increases.

If t is used over z, the range increases, since t distributions are more 'generous'.

Minimum Sample Size

To calculate the minimum target sample size use:

$$n = ROUNDUP(z_{\frac{\alpha}{2}}\left(\frac{\sigma}{E}\right)^2)$$
$$Where\ E = your\ desired\ error$$

Example:

Calculate sample size, to with error of 1cm with 99% confidence:

σ = 6cm

$n = ROUNDUP(2.575\left(\frac{6}{1}\right)^2)$ = 239