Sociology 364
Handout on Computing Sample Sizes

A. Sample Size Required for Estimating the Population Mean

If we want the "margin of error" to be smaller than some value B, with a probability of at least 1 - α, the appropriate sample size is obtained as follows

$$n = s^2\left(\frac{z_{\alpha/2}}{B}\right)^2$$

Derivation:

$$B = z_{\alpha/2}\left(\frac{s}{\sqrt{n}}\right) \quad (1)$$

Another name for B is the "margin of error"

$$\sqrt{n} = z_{\alpha/2}\left(\frac{s}{B}\right) \quad (2)$$

Rearrange the terms

$$n = s^2\left(\frac{z_{\alpha/2}}{B}\right)^2 \quad (3)$$

Square each side

B. Appropriate Sample size to estimate p (See Agresti and Finlay, p 107, for derivation)

Similarly, assuming $\pi = 0.50$ (which allows for a conservative estimate of the standard error), the appropriate sample size n to estimate a population proportion with probability 1 - α is found as follows

$$n = .25\left(\frac{z_{\alpha/2}}{B}\right)^2$$

Examples
Problem 34 (p. 118), Agresti and Finlay.

Step 1: State the Formula

Since, the problem involves calculating the appropriate sample size to calculate a *population proportion*, the appropriate formula is

$$n = s^2\left(\frac{z_{a/2}}{B}\right)^2$$

Step 2: Find the Necessary Values

a. We are told that the requisite probability is 0.95, thus 1 - α = 0.95 and $z_{\alpha/2} = z_{0.025} = 1.96$.

b. The allowed margin of error B is given as 5 acres.

c. The standard deviation σ is also given as 50.

Step 3: Substitute these values into the formula:

$$n = 50^2\left(\frac{1.96}{5}\right)^2$$
$$= 384$$

Step 4: Clearly State Your Conclusion

For example: “In order to estimate the mean acreage of farms in Brazil to within 5 acres, with a probability of 0.95, we would need to draw a sample of size 384.”
In other words. if we repeatedly drew samples of size 384, our estimate of farm size would be accurate -- give or take (+/-) 5 acres -- 95 percent of the time.