Chapter 7 – 4D:

Determining the Sample Size required to Estimate a Population Standard Deviation σ within a given percent of the actual value with a given confidence Level for a normal population

To determine the sample size n that will provide an estimate of the population standard deviation σ with a **confidence level of** $1-\alpha$ and with an **error of no greater than a given percentage** use the following two tables. The population **must be normal.**

Note: We are limited to a 95% and a 99% confidence level with these two tables. We are also limited to finding an estimate of the population standard deviation σ with an **error of no greater than 1, 5, 10, 20, 30, 40 or 50 percent**. Tables for other confidence levels exist but the tables values listed here will provide answers for the problems in this section.

For a Confidence Level of 95%

Sample size n to estimate σ	
To be 95 % confident that the estimate is within	of the value of σ the sample size n should be at least
1 %	19, 204
5 %	767
10 %	191
20 %	47
30 %	20
40 %	11
50 %	7

For a Confidence Level of 99%

Sample size n to estimate σ	
To be 99 % confident that the estimate is within	of the value of σ the sample size n should be at least
1 %	33,218
5 %	1,335
10 %	335
20 %	84
30 %	37
40 %	21
50 %	13

Notice that it does not take a large sample size to get the error in the estimate within 5 %. The sample size required to decrease error in the estimate from 5 % to 1 % is very large. For this reason it is very common to require that the estimate be within 5% of the actual value.

Example 1

Find the minimum sample size required to be 99% confident that the sample standard deviation s_x is within 5% of the true population standard deviation σ_x. The population is normal.

Answer: A sample size of 1335

Statement: If I conduct a random sample of 1335 people, I am 99% confident that the sample standard deviation s_x I get from the sample will be within 5% of the true value of population standard deviation σ_x .

For a Confidence Level of 99%

Sample size n to estimate σ	
To be **99 %** confident that the estimate is within	of the value of σ the sample size n should be at least
1 %	33,218
5 %	**1,335**
10 %	335
20 %	84
30 %	37
40 %	21
50 %	13

Example 2

The Sacramento Pepsi bottler want to sample some of the 20 oz bottles. Find the minimum sample size required to be 95% confident that the sample standard deviation s_x in the amount of Peps in the bottles is within 10% of the true population standard deviation σ_x. The population is normal.
Answer: A sample size of 191

Statement: If I conduct a random sample of 191 20 oz. Pepsi bottles, I am 95% confident that the sample standard deviation s_x I get from the sample will be within 10% of the true value of population standard deviation σ_x .

For a Confidence Level of 95%

Sample size n to estimate σ	
To be **95 %** confident that the estimate is within	of the value of σ the sample size n should be at least
1 %	19, 204
5 %	767
10 %	**191**
20 %	47
30 %	20
40 %	11
50 %	7