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Sample Size Calculation For Comparing Two Test Conditions

When the purpose of an experiment is to compare two test conditions, side by side, then the following sample size calculation may be used; given that the samples are obtained independently of one another.

Define:

n = the sample size per group,

$\alpha$  = the false positive error rate (type 1 error),

$\beta$  = the false negative error rate (type 2 error),

$\sigma$  = the process standard deviation,

$\Delta$  = the smallest difference of interest between the two groups.

Then:

$$n = 2 * \left[ \frac{\left( z_{(1-\alpha/2)} + z_{(1-\beta)} \right) * \sigma}{\Delta} \right]^2$$

where  $z_{(1-\alpha/2)}$  and  $z_{(1-\beta)}$  are values related to the standard normal distribution that can be obtained from tables or software. Typical 'research' values for the error rates are  $\alpha = 0.05$  and  $\beta = 0.20$ . Using tables or software, we show that  $z_{.975} = 1.96$  and  $z_{.80} = 0.841$ .

Example: A process has a known sigma of 3.5 and we are interested in finding a difference of 4.0 or greater; smaller differences are not of interest. Using the 'research' error rates above, one can calculate the sample size as<sup>1</sup>:

$$n = 2 * \left[ \frac{(1.96 + 0.841) * 3.5}{4.0} \right]^2 = 12.02 \approx 12$$

Therefore 12 samples must be tested for each group for a total of 24 tests.

Note that the above procedure is a large sample technique. If the sample sizes are going to be much smaller (single digit) than other methods should be used.

JMP:

JMP implements a two groups sample size calculation procedure. Go to: DOE → Sample Size and Power → Two Sample Means.

### Sample Size

#### Two Means

Testing if two means are different from each other.

Alpha	0.050
Error Std Dev	3.5
Extra Params	0

Supply two values to determine the third.

Enter one value to see a plot of the other two.

Difference to detect	4
Sample Size	26.104752385
Power	0.8

Sample Size is the total sample size; per group would be n/2

In this dialog:

Alpha is the  $\alpha$  from above,  
 Error Std Dev is  $\sigma$  from above,  
 Extra Params should be left at 0,  
 Difference to detect is  $\Delta$  from above,  
 Power is  $1 - \beta$  from above.

<sup>1</sup> Brush, Gary G., How To Choose The Proper Sample Size, Volume 12, American Society for Quality Control, Milwaukee, WI.

Make entries in all fields except the sample size and run the menu. The sample size calculated is the total, so each group would get half. Note that the result above gives a total sample size of 26 while our hand calculation produced 24; a good agreement.