

A SAS/Graph Application in Support of Quality Improvement

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Introduction

Statistical Quality Control's widespread use throughout many industries is due to its statistical simplification not its statistical sophistication. That is, SQC made it possible for widely accepted statistical concepts to be accessible to employees in all phases of the manufacturing process. Indeed, SQC arose from this need to give the non-statistician the tools and confidence that he/she needs in order to apply statistical concepts in support of quality improvement. In fact, over the years, SQC has come to mean much more than quality control charts (r-charts, $\bar{x}$ -charts, etc.). It encompasses all statistical concepts that can be used in support of quality control/improvement by means of accessibility to not only the management but to the front line worker as well.

In keeping with the above definition, it is our belief, as consultants and educators, that a great deal of time should be spent on training the end users (non-statisticians). Hence, we must constantly be looking for ways to make the statistical concepts more understandable and palatable.

In this presentation, we will discuss the restructuring of key statistical testing tools into the process monitoring framework and exhibit several sample size relationships to that of the process mean and the process variability. SAS/GRAPH is invaluable for improving insight into these relationships for the layman (non-statistician). We will include SAS/GRAPH programs that exhibit the functional relationships between the power of a test, confidence of a test, and sample size. Methods of generalizing these results to more complex monitoring environments (using more sophisticated statistical models) are also discussed with examples of the use of IML for their implementation.

Figure 1 shows us what sample size, n , is necessary to detect an off-aim drift (i.e., away from μ_0) toward a value μ_1 such that the probability is $1 - \beta$ of detecting when the standardized difference $\delta = (\mu_0 - \mu_1)/s$ exceeds a preselected value with a confidence probability of $1 - \alpha$ that the collective conclusions hold true. Figure 2 shows similar relationships for detecting a shift in a process variance, i.e., away from σ_0^2 toward a value σ_1^2 , with $\delta = \sigma_0^2/\sigma_1^2$. In Figure 3, $\delta = \sigma_0^2/\sigma_1^2$ and in Figure 4, $\delta = (\mu_1 - \mu_2)/s$.

Sample Size versus Detection Probability (one mean)
 $\alpha=.05$

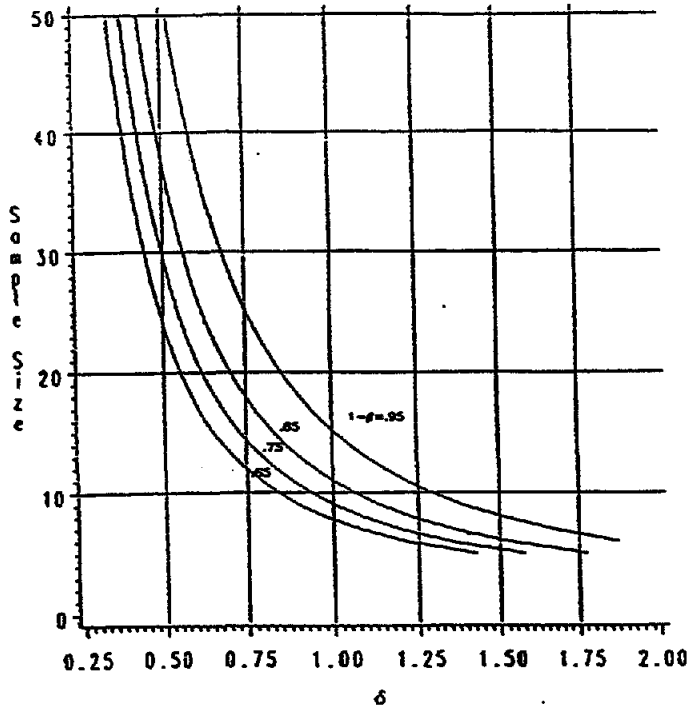


Figure 1: Relationships between n , δ , $1-\alpha$, $1-\beta$

Sample Size versus Power (Variance)
 $\alpha=.05$

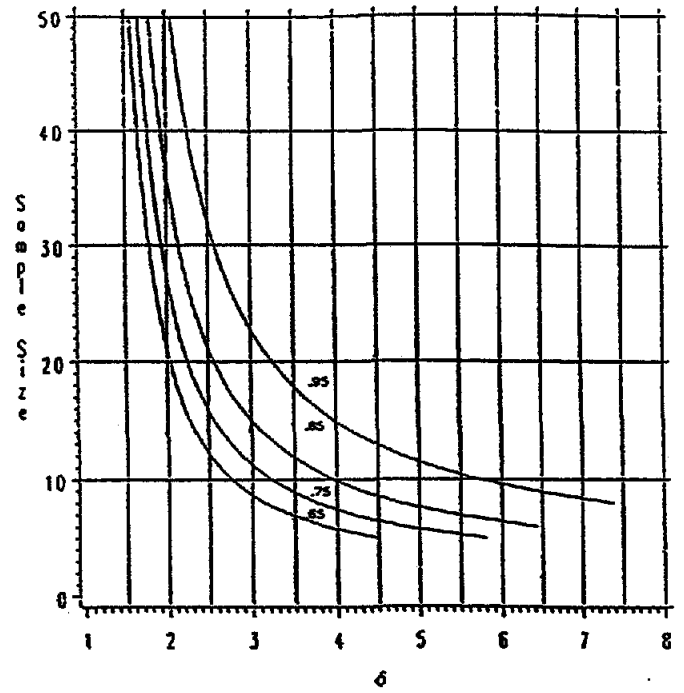


Figure 2: Relationships between n , δ , $1-\alpha$, $1-\beta$

Sample Size versus Power (Two Variances)
 $\alpha=.05$

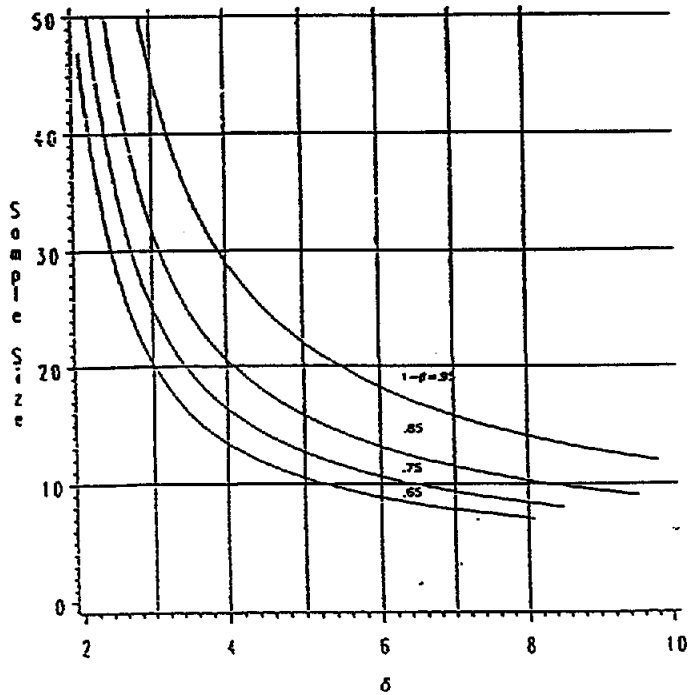


Figure 3: Relationships between n , δ , $1-\alpha$, $1-\beta$

Sample Size versus Detection Probability (two means)
 $\alpha=.05$

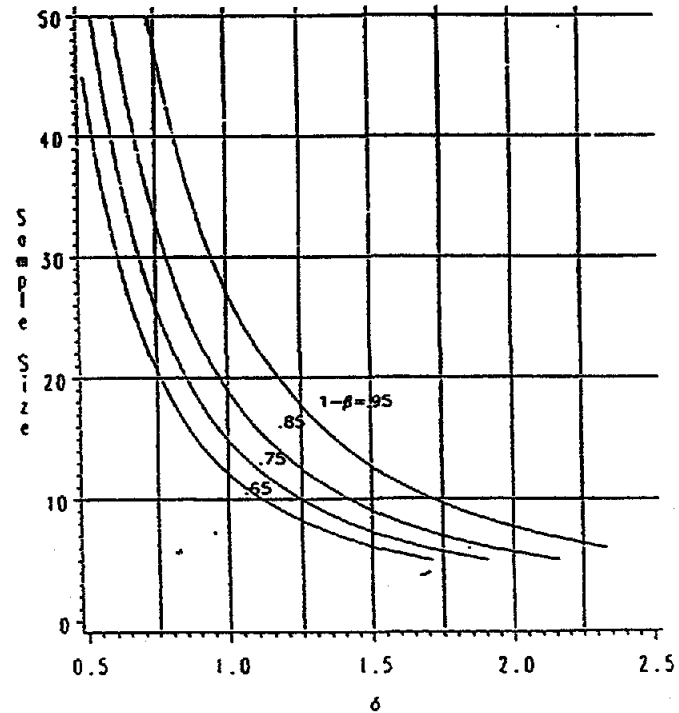


Figure 4: Relationships between n , δ , $1-\alpha$, $1-\beta$