Editorial
Reasonable Engineering Guess

A recurrent problem is: The estimation of the population fraction that falls beyond $\pm k$ standard deviations from the mean. Two methods, both unsatisfactory, are touted in the reliability literature for solving this problem.

1) Assume that the distribution is Gaussian (s-normal) and calculate the fraction in the usual way. The difficultly is that this method falls off too rapidly in the tails and doesn't allow for real-life vagaries. For example, the fraction which would be beyond ± 4 standard deviations from the mean would be 0.0063%. There wouldn't have to be too many hitches in a process to increase that fraction considerably.

2) Assume the Chebyshev limit: The maximum fraction that can lie beyond $+k$ standard deviations from the mean is $\min[k^{-2}, 1]$. The difficulty is that this worst possible case is extremely pessimistic and is rarely likely to happen. (An often forgotten point is that for the method to be true, the mean and standard deviation must be known exactly.) For example, the maximum fraction that can lie beyond 4 standard deviations from the mean is 6.3%.

A compromise between the two methods would be the geometric mean, but that is tedious to calculate. The Reasonable-Engineering-Guess is obtained by using $0.8k$ in the Gaussian formula, and is close to the geometric mean over a wide range of k. For $k = \pm 4$, the Reasonable-Engineering-Guess gives 2 gaufc$(0.8 \cdot 4) = 0.14\%$ for the tail area. This seems much more likely to fit reality than the other methods do; there's no proof, of course, because we rarely know the answer for a practical problem. Try the Reasonable-Engineering-Guess—you'll be pleased with how easy and reasonable it is.

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This editorial was first published in the August 1975 (vol R-24) issue—over a quarter of a century ago. It is republished to show that many things do not change, especially where people and their beliefs and problems are concerned. More of these ancient editorials will be republished in future issues to remind the newcomers that many problems are not new at all.

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