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A COMPACT TABLE FOR POWER OF THE t-TEST[1]

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1. Introduction. While most intermediate and advanced statistical textbooks discuss the power of the t-test, few if any provide tables that would enable the student to acquire a working knowledge of this important topic. The omission may be due in part to the fact that available tables giving good coverage run to many pages, and are therefore not suited for inclusion in the brief compendium at she back of a textbook. We present here a one-page table for t-power which covers any value of the (one-sided) significance level α in the range from .005 to .1 (double these values for the two-sided test); any value of the second-type error probability β in the range from .01 to .5; and any number f of degrees of freedom greater than 2.

Such a table should not only be compact but also convenient to use. In particular, it should not require high-powered interpolation since this would be almost prohibitively laborious in a triple-entry table. The problem is therefore to find a compact presentation in which the tabulated quantity will admit accurate interpolation over wide intervals by means of low order formulas—ideally, by means of linear interpolation. A second possible difficulty in the use of such a table stems from the great variety of statistical problems involving t-power. No matter how a table is designed, it will deal by direct entry with only one type of problem. Many of the more interesting applications will call for some sort of trial-and-error. Initial or trial values with which to enter the table are obtained by guess, or by some approximate method. Unless one is lucky, the solution corresponding to the initial values may have to be adjusted, calling for an iterative use of the table. A satisfactory presentation of t-power must therefore provide for trial values with which to enter the table; preferably, these should be accurate enough so that iteration will not be necessary.

The presentation provided here gives reasonably accurate answers without iteration and using only linear interpolation. In order to achieve these features in a one-page table of broad coverage, we found it necessary to reparametrize the problem. Our presentation uses not the error probabilities themselves but rather their normal transforms, say

$$\Phi^{-1}(1 - \alpha) = u, \qquad \Phi^{-1}(1 - \beta) = v.$$

We must therefore assume that the user has at hand a table of the normal distribution Φ. In terms of u and v, the asymptotic expansion recorded in Section 4

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