

## HOW SHOULD DATA BE ROUNDED?

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This paper considers the problem of how to round numerical results (such as health statistics, population censuses, or ...) that are to be reported, and describes two distinct approaches: rules and methods of rounding. Rounded percentages often fail to be “justified” – to add to 100% – and it is reasonable to address the question of how “best” to round. A *rule* of rounding is an independent rounding of each datum. The conventional rule of rounding – round to the closest integer – is “best” only in limited circumstances: the choice of rule should depend upon the distribution of the raw data. A *method* of rounding depends upon all of the data and guarantees justified results.

**Introduction.** Every day each and every one of us is confronted by numbers: election returns, income distributions, health statistics, laboratory results, population censuses, . . . For the most part these numbers are **rounded** in some way or other, but usually we never know exactly how. Frequently the numbers are reported in terms of percentages – presumably because in this light they are more telling – but often these percentages do not add up to precisely 100%. When the data is tabular, with row and column sums having significance of their own, this failure to have rounded data that is “justified” in rows and in columns as well as in total, is even more prevalent. What **should** be done is the question I address. Whenever justified answers are a must, the roundings may be viewed as distributions with fixed marginals that depend upon the distributions of the original numbers and how the roundings are obtained.

The headline of *Le Monde* of September 22, 1992 announced that the Treaty of Maastricht had been approved by 51.04% of French voters and disapproved by 48.95%. Nothing was said about the other .01% of the voters - some 2580 unaccounted for persons. In fact the margin was 51.0461% for and 48.9539% against (rounded to the nearest .0001%), so one might reasonably

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