Notre Dame Journal of Formal Logic
Volume 25, Number 3, July 1984

Probability Logic

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Introduction Among logicians it is well-known that Leibniz was the first to conceive of a mathematical treatment of logic. Much less known, however, was his insistence that there was need for a new kind of logic that would treat of degrees of probability. Although it isn't clear what Leibniz had in mind for such a logic—understandably, since the subject of probability had just begun in his lifetime and the florescence of modern logic was not to begin until the 19th century—he did envision that it would be a means for estimating likelihoods and a way of proof leading not to certainty but only to probability (see his *Nouveaux Essais*, pp. 372-373). Beginning in his day, and extending through the present century, a number of mathematicians and logicians, e.g., Jacob Bernoulli, J. H. Lambert, A. De Morgan, G. Boole, C. S. Peirce, J. M. Keynes, H. Reichenbach, R. Carnap, and, more recently, D. Scott and P. Krauss have made either forays or detailed attacks on establishing such a logic, but with differing conceptions as to its nature. A few brief remarks will give some idea as to what these were like.

To Bernoulli (as also to Leibniz) probability was degree of certainty, differing from it as part to whole. In his *Ars Conjectandi* (Part IV, Chapter III) he considers the various kinds of arguments (i.e., grounds) for a conclusion (opinion or conjecture) and the problem of estimating their weights so as to compute the probability of the conclusion. Situations involving arguments are divided into three types: those in which the argument is necessarily the case but indicates (proves) the conclusion only contingently; those in which the argument is contingent but when present necessarily proves the conclusion; and those in which the presence of the argument and its proving of the conclusion are both contingent. The "proving power" of an argument is determined by the number of cases in which the argument is, or is not, present and also by the number of

*An abbreviated version of this paper was presented at a session of the 7th International Congress of Logic, Methodology and Philosophy of Science, Salzburg, July 11-16, 1983.

Received March 7, 1983; revised June 8, 1983