BASU'S CONTRIBUTIONS TO THE FOUNDATIONS OF SAMPLE SURVEY

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Introduction

Whenever I read a paper by Dev I am impressed with the clarity of his writing and thinking. He is able to distill the essence of the topic at hand and present it in such a way that it seems almost obvious to me. This is particularly true in the foundations of sample survey where he has elegantly demonstrated the proper role of the sufficiency and likelihood principles. Because these principles fail to justify much of the current design based practice and because he has presented his arguments in a Bayesian context some survey samplers have chosen to either ignore or attempted to modify the consequence of these principles. This coldness to Bayesian ideas in survey sampling could be considered surprising since it is the one area in statistics where everyone agrees prior information should be used.

In the next section, the results of Basu and Ghosh (1967), which characterize the minimal sufficiency partition for discrete models, will be briefly summarized. In the third section, the results of Basu (1969) will be summarized. Here he demonstrated the role of the sufficiency and likelihood principles in sample survey, from which it follows, that once the sample has been drawn the inference should not depend in any way on the sampling design. In the fourth section, some of the implications of these results will be noted. In particular, the famous *Jumbo* example of Basu (1971) will be discussed. It will be shown how Basu's argument there suggests a pseudo-Bayesian approach to survey sampling. This approach is quite flexible in that one can incorporate various levels of prior information without specifying a prior distribution. Finally, the role of random sampling in survey sampling will be discussed briefly. It should be noted that Basu (1978) contains some further reflections on his earlier work.

Sufficiency in Discrete Models

For many years, in statistical decision theory, it has been an accepted convention, to begin by assuming the existence of a nonempty set X, equipped with a σ-algebra of subsets of X, say β, along with $\mathbb{P} = \{P_\theta | \theta \varepsilon \Omega\}$ a family of probability measures on (X, β). One of the consequences of Basu's work (along with others) was to fit survey sampling into this scheme. For such a model it is of interest to find the minimal sufficient statistic, assuming it exists. Now, in general, for such models a minimal sufficient statistic need not exist. However, for discrete models, which includes the sample survey model, a minimal sufficient statistic always exists and is easy to find.