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Some improved additive randomized response models utilizing higher order moments ratios of scrambling variable

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Abstract. In this article, some new randomized response models have been proposed. Properties of the proposed randomized response models have been studied. The proposed models are found to be more efficient than the randomized response models studied by Himmelfarb and Edgell [1], Gjestvang and Singh [2] and Singh [3] under certain realistic conditions. Numerical illustrations are also given in support of the present study.

Keywords: Randomized response sampling, estimation of proportion, respondents protection, sensitive quantitative variable

AMS Subject Classification: 62D05

1. Introduction

We suggest an efficient use of higher order moments ratios of the scrambling variables used in the (i) Himmelfarb and Edgell [1], (ii) Gjestvang and Singh [2] additive model and (iii) the optimal orthogonal additive model due to Singh [3]. Motivation of using the ratios of higher order moments of scrambling variables has been taken from the work of Sen [4], Upadhayaya and Singh [5] and Singh and Chen [6]. Warner [7] was the first to develop an ingenious procedure to estimate the proportion of sensitive characters like induced abortion, drug used, family income etc. a detaild review and applications of such techniques can be found in Fox and Tracy [8], Chaudhuri and Mukerjee [9], some recent contribution to randomized response sampling is given by Odumade and Singh [10,11], Singh and Chen [6], Singh [3], Gjestvang and Singh [2,12], Singh and Mathur [13,14] and Singh and Tarray [15]. We below give the description of the models due to Himmelfarb and Edgell [1], Gjestvang and Singh [2] and Singh [3] models respectively.

1.1. Himmelfarb and Edgell [1] additive model

The conventional additive model used for collecting information on quantitative sensitive variables is envisaged by Himmelfarb and Edgell [1]. Their model allows the interviewee to hide personal information using a scrambling variable S to their response. For example, Let X be the true response variable for which we wish to estimate its mean μ_x. Let S be a scrambling variable whose mean μ_s and variance σ_s^2 are known.

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