ABSTRACT

The past is full of classical studies under crisp and exact data using the relation of the study variable with auxiliary information to estimate the finite population mean. The recent years 'Neutrosophic Statistics' (generalized classical statistics) is gaining importance. It deals with the indeterminacy, vague and uncertainty in data. This work is the first of its kind in neutrosophic statistics to estimate the population mean under interval neutrosophic data utilizing ratio estimation methods. We have introduced the ratio-type exponential estimator under interval neutrosophic data for estimation of finite population mean employing auxiliary information. The neutrosophic observation attains the form $OO_{NN}=OO_{LL}+OO_{UU}II_{NN}$, where $II_{NN}\in[II_{LL},II_{UU}]$,$OO_{NN}\in[OO_{LL},OO_{UU}]$. We have computed the expressions of MSE and given mathematical comparisons of the competitor estimators studied in this research work. Empirical research using real-life data of temperature along with a simulated analysis was conducted to support the claims. It is evidently reported that the asserted estimator is very helpful to handle the imprecise, vague, indeterminate data. It provides the results in interval form rather than a single-valued outcome, therefore there are more chances of population parameter to be in the estimated interval. The importance of statistical quality control is not hidden. A memory type control chart was also introduced for the very first time under neutrosophic data incorporating auxiliary information. Using interval neutrosophic data, an exponentially weighted moving average control chart with a ratio-type exponential estimator was created. The proposed control chart was analyzed with various combinations of smoothing constant and CL coefficient for the different run-length targets (300, 370, 400, and 500). The effect of increasing and decreasing behavior of smoothing constant and coefficient of CLs was also examined. The Neutrosophic Monto Carlo Simulation (generalized classical Monto Carlo simulation) was employed to get strong evidence in favor of the proposed control chart. Our suggested chart is outperforming the old classical chart under the classical ratio estimator. The chart exhibited efficient performance to detect an out-of-order process for the small shifts.