Cornish-Fisher expansions using sample cumulants and monotonic transformations

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General formulas of the asymptotic cumulants of a studentized parameter estimator are given up to the fourth order with the added higher-order asymptotic variance. Using the sample counterparts of the asymptotic cumulants, formulas for the Cornish-Fisher expansions with the third-order accuracy are obtained. Some new methods of monotonic transformations of the studentized estimator are presented. In addition, similar transformations of a fixed normal deviate are proposed up to the same order with some asymptotic comparisons to the transformations of the studentized estimator. Applications to the mean and the binomial proportion are shown with a numerical illustration for estimation of the proportion.