

## A class of asymptotically normal degenerate quasi $U$ -statistics

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**Abstract** Some quasi  $U$ -statistics, unlike other variants of  $U$ -statistics, arising in distance based tests for homogeneity of groups, have first-order stationary kernels of degree 2, and yet they enjoy asymptotic normality under suitable hypotheses of invariance. Central limit theorems for a more general class of quasi  $U$ -statistics with possibly higher order stationarity (and degree) are formulated with the aid of appropriate martingale (array) characterizations as well as permutational invariance structures.

**Keywords** Genomics · Hamming distance · Martingale · Orthogonal system · Permutation measure · Second-order asymptotics · Higher order decomposability