An algorithm for the construction of weighted degree lattice rules

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In classical multivariate quadrature with product rules it is natural to select an appropriate one-dimensional quadrature rule for each dimension in accordance with its importance. E.g., one may choose to use a Gauss rule of degree 13 for dimension 1, then a rule of degree 5 for dimension 2 and so on. With lattice rules (with a prime number of points) these one-dimensional degrees are all equal as we have the same projected point set in each dimension. We can however try to maximize the shape of the frequency indices (e.g., the Zaremba or hyperbolic cross for the Zaremba degree) while weighting the contributions of the different dimensions. This gives us a weighted degree of exactness. We present a new algorithm to construct lattice rules based on a weighted degree of exactness and a worst case error.