The classical sampling theorem permits reconstruction of a bandlimited function $f$ from its values on a lattice. This work considers sampling sets which are unions of possibly different shifted lattices. Its approach is based on finding suitable decompositions $K = K_0 \cup K_1$ of the bandregion $K$ of $f$. Two such decompositions are presented, subject to $K$ satisfying certain compatibility conditions. It is demonstrated how the decompositions can be used to construct sampling theorems or recursive reconstruction algorithms, and a numerical implementation in two dimensions is presented. (Received September 22, 2005)