The configuration space of at most n points on the circle

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We present some preliminary work on set-valued maps $f : X \multimap Y$ where the cardinality of $f(x)$ is at most n for every x. We discuss relations to several other theories, including Schirmer's theory of n-valued maps, Crabb's theory of "structured n-valued maps," symmetric product maps, and Skiba's "multi-valued weighted maps". We also will discuss the topology of the configuration space $C_n(X)$ of at-most-n points in some space X. Specifically we describe the homology and fundamental groups of $C_n(X)$ when X is the interval, the circle, or $\mathbb{R}^n$. The most interesting example is the circle.