This thesis is dedicated to a research concerning representations of Boolean functions. We present the concept of a representation using intervals of integers. Boolean function $f$ is represented by set $I$ of intervals, if it is true just on those input vectors, which correspond to integers belonging to intervals in $I$, where the correspondence between vectors and integers depends on the ordering of bits determining their significancies. We define the classes of $k$-interval functions, which can be represented by at most $k$ intervals with respect to a suitable ordering of variables, and we provide a full description of inclusion relations among the classes of threshold, 2-monotonic and $k$-interval Boolean functions (for various values of $k$). The possibility to recognize in polynomial time, whether a given function belongs to a specified class of Boolean functions, is another fundamental and practically important property of any class of functions. Our results concerning interval functions recognition include a proof of co-NP-hardness of the general problem and polynomial-time algorithms for several restricted variants, such as recognition of 1-interval and 2-interval positive functions. We also present an algorithm recognizing general 1-interval functions provided that their DNF representation satisfies several (quite strong) conditions. For 2-monotonic or threshold functions we construct an algorithm finding an interval representation with the minimum number of intervals. The extension problem for interval functions involves deciding, whether a given partially defined function can be extended to a $k$-interval function, and we present polynomial-time algorithms solving it for the classes of positive 1-interval, general 1-interval and renamable 1-interval functions. In the best-fit extension problem, which generalizes the extension problem, we are given a partially defined function and our task is to find a totally defined $k$-interval function, which disagrees with the input