# automatic presentation

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Let $S$ be a relational structure (for example, a graph).

$S$ has an *automatic presentation* if (for some alphabet $\Sigma$) there is a language $L \subseteq \Sigma^*$ and a surjective map $f$ from $L$ onto the ) of $S$ such that

- $L$ can be checked by a `http://planetmath.org/DeterministicFiniteAutomaton`finite automaton (Membership)
- The language of all convolutions of $x, y \in L$ where $f(x) = f(y)$ can be checked by a  (Equality)
- For all $n$-ary `http://planetmath.org/Relation`relations $R_i$ in $S$, the language of all convolutions of $x_1, x_2, \ldots, x_n \in L$ where $R_i(f(x_1), f(x_2), \ldots, f(x_n))$ can be checked by a  ()

The class of languages accepted by finite automata, i.e. regular languages, is closed under operations like union, intersection, complementation etc, and it is decidable whether or not a finite  accepts the empty language. This allows any first order sentence over the structure to be decided - using union for 'and', complementation for 'not' etc., and emptiness for dealing with 'there exists'. As such, the first order theory of any structure with an automatic presentation is decidable.

Note that wrt group  this is inspired by, but not  to, the definition of automatic groups.