The central logical notions of validity, entailment, and satisfiability are defined the same way for second-order logic as they are for first-order logic, except that the underlying satisfaction relation is now that for second-order formulas. A second-order sentence, of course, is a formula in which all variables, including predicate and function variables, are bound.

**Definition syn.1** (Validity). A sentence $\varphi$ is valid, $\models \varphi$, iff $M \models \varphi$ for every structure $M$.

**Definition syn.2** (Entailment). A set of sentences $\Gamma$ entails a sentence $\varphi$, $\Gamma \models \varphi$, iff for every structure $M$ with $M \models \Gamma$, $M \models \varphi$.

**Definition syn.3** (Satisfiability). A set of sentences $\Gamma$ is satisfiable if $M \models \Gamma$ for some structure $M$. If $\Gamma$ is not satisfiable it is called unsatisfiable.

Photo Credits

Bibliography