Title: Deduction
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Deduction

Synonyms

Definition

Deduction is the process of inferring whether a given statement is entailed, that is, whether it logically follows from a theory.

Characteristics

Deductive reasoning allows one to infer statements that are logical consequences of a set of given statements. For instance, given a theory stating that all swans are white ($\forall x. \text{swan}(x) \rightarrow \text{white}(x)$) and that Odette is a swan ($\text{swan}(\text{Odette})$), it can be deduced that Odette is white ($\text{white}(\text{Odette})$). The example uses one of the general inference rules of first order logic, which can be written as $\frac{\forall x. p(x) \rightarrow q(x) \text{ and } p(a)}{q(a)}$. The top part denotes the statements present in the given theory (read as “whenever a property p holds for some object x , another property q also holds for x ” and “ p holds for the given object a ”), and the bottom part the deduced statement (“ q holds for a ”).

In contrast to [induction](#), deduction does not hypothesize new knowledge, but makes information implicitly contained in a logical theory explicit. It thus is *truth-preserving*: whenever the premises of deductive inference hold, the conclusions must hold as well. Deduction either generates additional statements that follow logically from

the theory, or verifies a given statement by constructing a [proof](#). Deductive reasoning is the basis for theorem proving and logic programming.

Cross-references

- Induction
- PROLOG, AI programming language
- Proof, Logic

References

Flach P (1994) Simply logical - Intelligent Reasoning by Example. John Wiley.

Genesereth M, Nilsson N (1987) Logical Foundations of Artificial Intelligence. Morgan Kaufmann.