### Definition: Logical Statement

A logical statement (or short statement) is a proposition by which it is possible to decide In computer science one often uses true or 1, and writes false or 0. In logic, one is generally whether it is true or false.

not interested in the content of a statement, but only in whether it is true or false. This is also called the truth value of a statement.

Example:

“Four is an odd number” is a false statement.

“Water is wet” is a true statement.

“X is an odd number” is also not a statement, because without additional information it4 x 3 x “Good day” is not a statement because this sentence is neither true nor false.

cannot be decided whether is even or odd. Only when we assign a number to does it become a statement that can be true or false. “ is an odd number” would accordingly be a true statement, while “ is an odd number” is a false statement.

Let A and B be statements. A ≡ BA and B are called logically equivalent if they have the sameA B Definition: Logical Equivalence of Statements

truth value. You write and say “ is logically equivalent to .”

Please note that the logical equivalence of statements does not refer to their content, but only to their truth value! The following example should illustrate this.

#### Example: Logical equivalence of statements

Let The statements are A1 and A2 be statements with different in content, so it is A1≔ A “It’s dark at night.” are logi-

cally equivalent (because both are true), so

Many authors use the symbol = instead of ≡. At this point, however, we have deliberately In literature, statements that have the same truth value are often referred to as the same. chosen the above definition to avoid misunderstandings.

Logical operators (also called connectives) can be used to combine logical statements Logical operators into what are called propositional formulas or expressions. We distinguish five types of The five logical operators

discussed here are sym-

connectives. bols which stand in for the words “and”,“or”, Definition: Conjunction “not”, “if”, and “if and B.Let A and A B be statements. The conjunction (also called an and-operator or and-connec-B A ∧ B A AND B AB A only if”.

tive) of and is written as or or (abbreviated) . This is read “ and

”

A ∧ B is true exactly when (and only when) statements A ∧ B A and B are both true. If at least

one of the statements is false, then is also false.

#### Example: Conjunction

Let D :=A := “7 is an even number,” B := “3 is greater than 4,” A B C := “7 is an odd number,” andC D

“4 is greater than 3.” Then statements and are false and statements and are Thus A ∧ BA ∧ C is obviously wrong because both statements C DA and B are wrong. A true.

C ∧ D is true, however, because both statements and are true. Likewise, is wrong, because at least one of the two statements, namely , is wrong.