## Formal Logic III

Background

This is a continuation of Formal Logic II. The aims are:

propositional logic – declarative sentences, natural deduction, semantics, normal forms

predicate logic – syntax, natural deduction, semantics, undecidability

modal logics – syntax, semantics, logic engineering, natural deduction, multi-agent systems

**Lesson 0**

Propositional logic  
 : Susan saves

: Susan buys a house

: The house has seven bathrooms

: The house is used as a guesthouse

: Peter likes the house

**“only if”**

“The house is used as a guesthouse sonly if it has seven bathrooms”

“Susan buys a house only if the house does not have seven bathrooms”

**“unless”**

“if… then”

“Unless Susan saves, she does not buy a house with seven bathrooms”

“Unless Peter does not like the house, Susan saves and buys a house used as guesthouse”

*Negate one side of the statement*

**“if and only if”**

“logically equivalent to”

“The house is used as a guesthouse if and only if Susan does not buy it, but Peter likes it”

“Peter likes the house if and only it has seven bathrooms or is not used as guesthouse”

*Remember “but” in logic is treated as “AND”*

**Lesson 0**

Symbols

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Name** | **Description** |
|  | phi | Premise/formula |
|  | psi | Conclusion |
|  | Proves | Proves/implies/yields |
|  | Sequent | Is valid if a proof can be found |
|  |  |  |

We apply proof rules to premises, we get formulas.

We apply more proof rules to formulas, we get a conclusion

Hence:

Example:

**Lesson 1**

Natural Deduction Rules

Used to build proofs

Start with the premises.

Figure out a way to the conclusion by the rules given

Conjunction