



Theory of Inference

Method of Contradiction

In order to show that a conclusion  $C$  follows logically from the premises  $H_1, H_2, \dots, H_m$ , we assume that  $C$  is false and consider  $\neg C$  as an additional premises. If the new set of premises gives contradict value, then the assumption  $\neg C$  is true does not hold simultaneously with  $H_1 \wedge H_2 \wedge \dots \wedge H_m$  being true.

Method of Contrapositive

In order to prove  $H_1 \wedge H_2 \wedge \dots \wedge H_m \Rightarrow C$ ,

if we prove  $\neg C \Rightarrow \neg (H_1 \wedge H_2 \wedge \dots \wedge H_m)$

then the original problem follows. This method is called contrapositive method.



## Rule of Inference

Rule P : A premise may be introduced at any point in the derivation

Rule T : A formula  $S$  may be introduced at any point in a derivation if  $S$  is tautologically implied by any one or more of the preceding formulas.

Rule CP : If  $S$  can be derived from  $R$  and set of premises, then  $R \rightarrow S$  can be derived from the set of premises alone.



## Implication Rules

1. a)  $P, P \rightarrow Q \Rightarrow Q$   
b)  $\neg Q, P \rightarrow Q \Rightarrow \neg P$   
c)  $\neg P, P \vee Q \Rightarrow Q$
2.  $P \rightarrow Q, Q \rightarrow R \Rightarrow P \rightarrow R$
3.  $P, Q \Rightarrow P \wedge Q$

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$$P \wedge Q \Rightarrow P, Q$$

$$P, Q \Rightarrow P \vee Q$$

$$P \wedge \neg Q \Leftrightarrow \neg (P \rightarrow Q)$$

$$P \rightarrow \neg Q, Q \Rightarrow \neg P$$



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