# Logica & Linguaggio, PL: Tableaux

#### RAFFAELLA BERNARDI

UNIVERSITÀ DI TRENTO

P.ZZA VENEZIA, ROOM: 2.05, E-MAIL: BERNARDI@DISI.UNITN.IT

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• If  $\psi$  is *valid*, can we conclude it is satifiable, falsifiable or unsatisfiable?

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 If ψ is *unsatisfiable*, can we conclude it is satifiable, falsifiable or valid? We can conclude ψ is *falsifiable*:

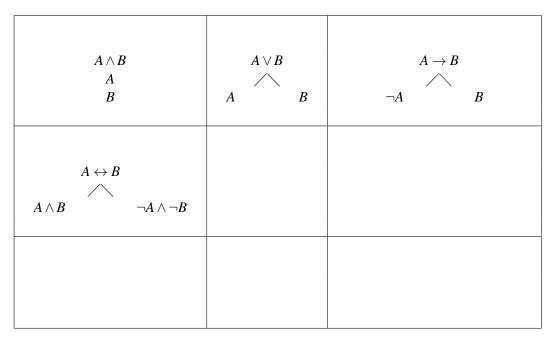
IF  $\forall I, I \not\models \psi$  THEN  $\exists I, I \not\models \psi$ 

Falsiability is a weaker property then unsatisifiability.

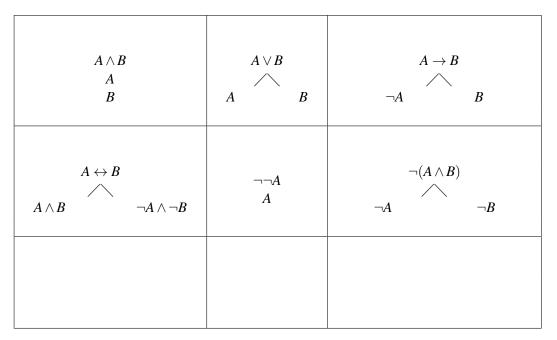
$\begin{array}{c} A \wedge B \\ A \\ B \end{array}$	

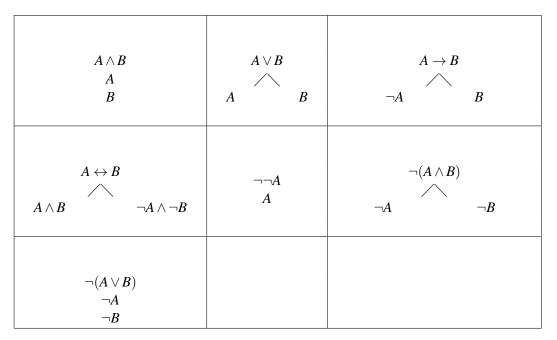
$\begin{array}{c} A \wedge B \\ A \\ B \end{array}$	$A \lor B$ $A \lor B$ $A B$	

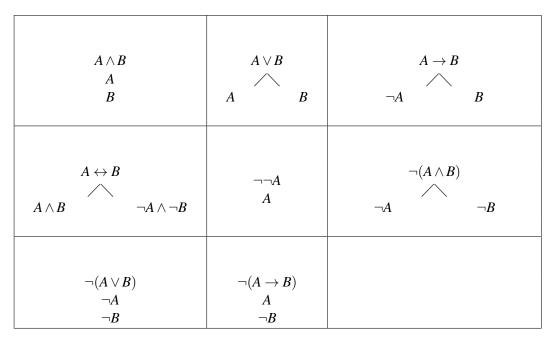
$\begin{array}{c} A \wedge B \\ A \\ B \end{array}$	$A \lor B$ $A \lor B$ $A B$	$A \rightarrow B$ $\frown$ $\neg A \qquad B$

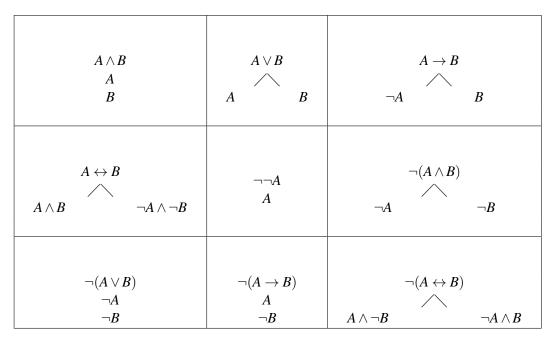


$\begin{array}{c} A \wedge B \\ A \\ B \end{array}$	$A \lor B$ $A \lor B$ $A = B$	$A \rightarrow B$ $\frown$ $\neg A \qquad B$
$A \leftrightarrow B$ $\land \land$ $A \wedge B \qquad \neg A \wedge \neg B$	$\neg \neg A$ A	









### 3. Alberi di refutazione (tableaux

Le tavole di verità non sono l'algoritmo più efficiente. Esistono altre procedure più veloci. Gli alberi di *refutazione* (tablaux) sono uno di questi:

Si formi una lista di formule con tutte le premesse e la negazione della conclusione. Se si arriva a trovare un'interpretazione per la quale tale lista contiene tutte formule vere, allora quell'interpretazione mostra che esiste un controesempio: l'argomentazione non è valida (non è una conseguenza logica). Se non si riesce a trovare nessuna interpretazione che renda vera tale lista, allora la conclusione non è stata refutata, dunque l'argomentazione è valida.

You are asked to prove whether  $\psi$  is valid by means of tableaux.

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If  $\neg \psi$  is unsatisfiable then  $\psi$  is also valid.

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• If all branches close:  $\psi$  is unsatisfiable.

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 Can you make a stronger claim?

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 ψ is satisfiable.

Are you sure you cannot give a stronger answer, i.e. are you sure  $\psi$  is not valid? In order to check whether  $\psi$  is valid you have to look at  $\neg \psi$ . If  $\neg \psi$  is unsatisfiable then  $\psi$  is also valid.

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Can you make a stronger claim?

No this is already a strong result, there is no need to look at  $\neg \psi$ .