

CS 511, Fall 2020, Handout 04

Valid WFF's/Tautologies


Contradictions/Unsatisfiable WFF's

Contingent WFF's/Satisfiable+Falsifiable WFF's

Assaf Kfoury

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# Universe of Propositional WFF's

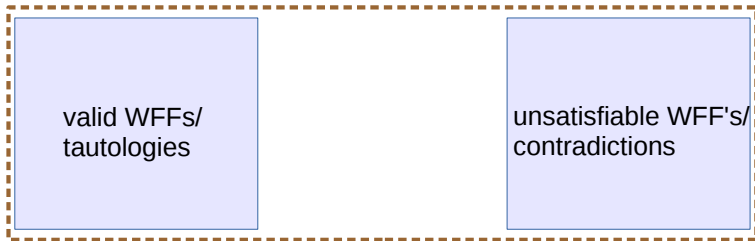


A diagram showing the universe of propositional WFFs. A large dashed brown rectangle contains two smaller solid light blue rectangles. The left rectangle is labeled 'valid WFFs/tautologies' and the right rectangle is labeled 'unsatisfiable WFF's/contradictions'.

valid WFFs/  
tautologies

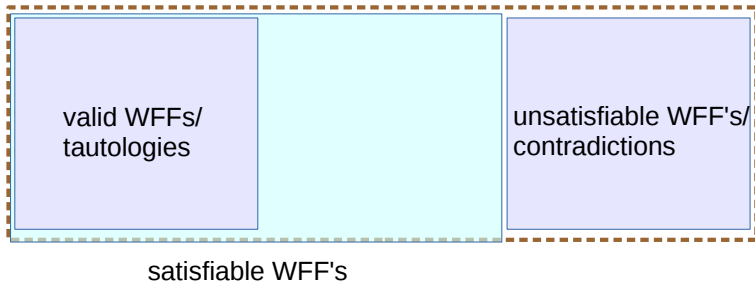
unsatisfiable WFF's/  
contradictions

# Universe of Propositional WFF's

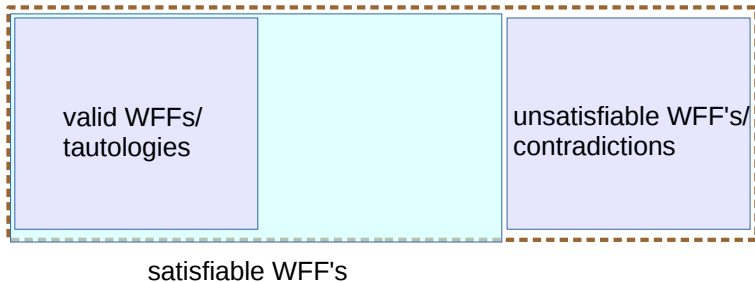


- ▶ the logical negation of a **tautology** is an **unsatisfiable WFF**  
(Why? Look at the truth tables.)
- ▶ the logical negation of an **unsatisfiable WFF** is a **tautology**  
(Why? Look at the truth tables.)
- ▶ WFF's that are neither tautologies nor contradictions are sometimes called **contingent**, which are in the middle of the diagram above.

# Universe of Propositional WFF's

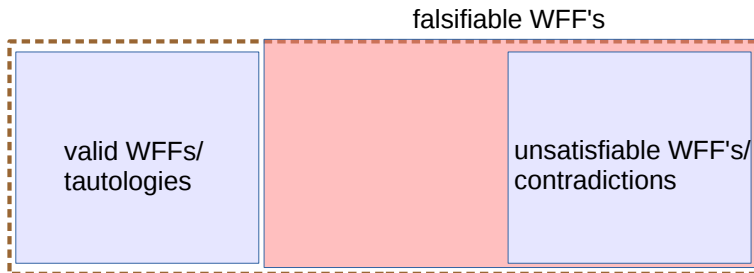


# Universe of Propositional WFF's

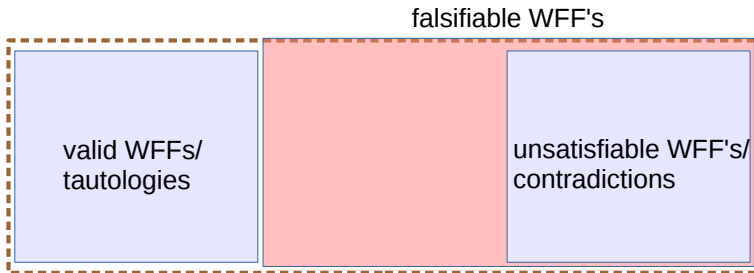


- **Warning:** the logical negation of a **satisfiable WFF** is NOT necessarily an **unsatisfiable WFF**, even though the diagram and the words seem to suggest it!

# Universe of Propositional WFF's

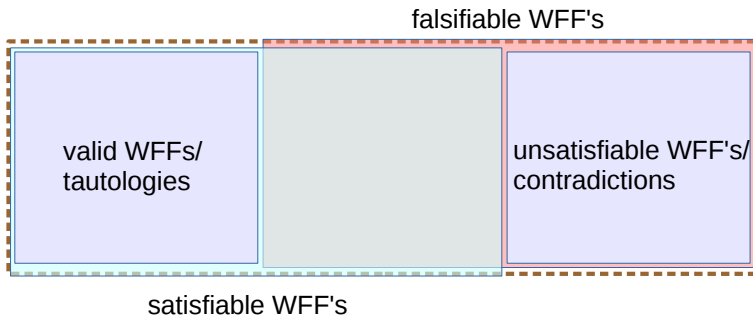


# Universe of Propositional WFF's



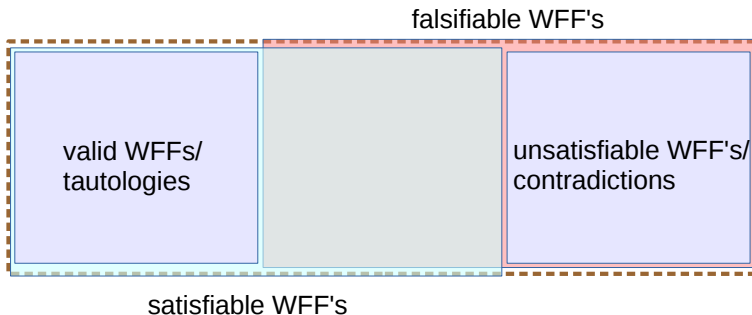
- **Warning:** the logical negation of a **falsifiable WFF** is NOT necessarily a **tautology**, even though the diagram and the words seem to suggest it!

# Universe of Propositional WFF's





# Universe of Propositional WFF's



- ▶ Note that the set of **satisfiable WFF's** and the set of **falsifiable WFF's** overlap.
- ▶ The race is on for defining and implementing procedures to decide membership of a propositional WFF in each of the 3 groups separately:

1. **tautologies/valid WFF's**
2. **contingent WFF's**, *i.e.*, WFF's that are both satisfiable and falsifiable
3. **contradictions/unsatisfiable WFF's**

(All the notions in 1, 2, and 3, are all defined **semantically**, *i.e.*, with **truth-tables** .)

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