Lecture 5: Propositional Logic
Outline

• Syntax and Semantics

• Entailment

• Model checking

• Concepts needed for theorem proving
  – Logical equivalence
  – Validity
  – Satisfiability
Satisfiability and Validity

- A sentence is valid if it is true in all models.
- A sentence is satisfiable if it is true in some model.
- A sentence $P$ is valid if and only if $\neg P$ is unsatisfiable.
- A valid sentence is always satisfiable.
Satisfiable, unsatisfiable, or valid

1. \( P \)
2. \( \neg P \)
3. \( P \lor \neg P \)
4. \( P \land \neg P \)
5. \( P \lor Q \)
6. \( P \land Q \)
Satisfiable, unsatisfiable, or valid

7. \(P \Rightarrow Q\)

8. \(P \Leftrightarrow Q\)

9. \((P \land Q) \Rightarrow P\)

10. \((P \land Q) \Rightarrow \neg P\)
7. $P \Rightarrow Q \ (Q \lor \neg P)$

8. $P \iff Q \ ((Q \lor \neg P) \land (P \lor \neg Q))$

9. $(P \land Q) \Rightarrow P \ (P \lor \neg (P \land Q)) \rightarrow (P \lor \neg P \lor \neg Q)$

10. $(P \land Q) \Rightarrow \neg P \ (\neg P \lor \neg (P \land Q)) \rightarrow (\neg P \lor \neg P \lor \neg Q)$
• P1 (first programming assignment) has already been released. It is due on Tuesday Oct. 13th.
  --- due by midnight, upload your files to CS dropbox

• W1 is due on Tuesday Oct. 6th
  --- Due in class, hard copies.