

Discrete Mathematical Structures

CS 3233 Lecture Six

Prof. William Winsborough

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Assignment 1 is Due Today

- If you are not done yet, turn in what you have
 - You have until 2pm tomorrow to turn in the rest
 - Solutions turned in after class today will be penalized 10% as explained in the syllabus
 - Please slide late assignments under my office door
 - Do **not** attempt to deliver them after 2pm
- 9/3/05

Schedule Conflicts?

- Does anyone have a conflict with coming to recitation Wednesday (including those in the Monday recitation)?
- Should we have a lecture then?

Nesting \forall and \exists

- What does $\forall x \exists y.(x+y = 0)$ mean?
 - Is it true?
- What does $\exists x \forall y.(x+y = 0)$ mean?
 - Is it true?
- How about:
 - $\forall x \exists y.(x < y)$
 - $\forall x \exists y.(y < x)$
 - $\exists y \forall x.(x < y)$
 - $\exists x \forall y.(x < y)$
- Study table 1 on page 50

Negation, Revisited

- Exercise: Express $\neg(\forall x \exists y.(y < x))$ by a formula that has all the quantifiers out front

$$\neg(\forall x \exists y.(y < x))$$

$$\equiv \neg(\forall x.(\exists y.(y < x))) \quad \text{just added parens}$$

$$\equiv \exists x.\neg(\exists y.(y < x)) \quad \text{negation of universal}$$

$$\equiv \exists x. \forall y.\neg(y < x) \quad \text{negation of universal}$$

Theorems and Proofs

- A *theorem* is a statement that can be shown to be true
- A proof is a demonstration that a statement is a theorem
- Methods of proof
 - Construction of truth tables
 - Use of equivalences
 - By using these alone, can prove only logical equivalences
 - More general rules of inference

Important Related Terminology

- Result: often used to mean a theorem
- Proposition: a simple theorem, often presented without proof
- Lemma: a theorem whose main utility lies in helping to prove other, more interesting theorems
- Corollary: a theorem that follows easily from another more general theorem
- Conjecture: a statement that you suspect is true but that you do not yet have a proof for

Rules of Inference for Propositional Logic

- These provide a general, systematic method of proving propositional formulas
- See Table 1 p.58
- Known equivalences can also be used in proofs
- Consider Example 9 p.60