Discrete Mathematical Structures
CS 3233 Lecture One

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August 24, 2005

Course Introduction

- See syllabus:
  - http://www.cs.utsa.edu/~winsboro/teaching/CS3233F2005/Syllabus.htm
- Read the text book
  - Lectures are associated with sections in the text as indicated on the syllabus
- Occasionally I will be unable to lecture due to travel
  - I will announce whether class will meet during my absence
- If you cannot make my office hours, please set up an appointment
  - Email, call, drop by
  - If I can't meet you immediately, don't take it personally!
- Please speak up!

Section 1.1: Introduction to Logic

- Aim: formalize mathematical argument
- *Propositional logic* (also called *propositional calculus*)
  - Deals with propositions
  - A proposition is a declarative sentence that is either *true* or *false*, but not both

Propositions

- Some sentences that are propositions
  - 1+1 = 2
  - Today is Saturday
  - Will is a new professor and San Antonio is the center of the universe
- Some sentences that are not propositions
  - Is this a CS class?
    - Not declarative
  - Read your syllabus carefully
    - Not declarative
  - x + 5 = 7
    - Neither true or false, since the truth value depends on the value assigned to x

Negation

- Def: Given a proposition p, $\neg$p denotes the negation of p
  - $\neg$p means “it is not the case that p”
- Truth table for $\neg$p:

p	$\neg$p
T	F
F	T

Given truth assignments for p

Resulting truth value of $\neg$p

Conjunction

- Def: Given propositions p and q, $p \wedge q$ denotes the conjunction of p and q
  - $p \wedge q$ means “p and q ”
- Truth table for $p \wedge q$:

p	q	$p \wedge q$
T	T	T
T	F	F
F	T	F
F	F	F

Given truth assignments

Resulting truth value

Disjunction

- Def: Given propositions p and q, p ∨ q denotes the disjunction of p and q
  - p ∨ q means “p or q ” (*inclusive or*)
- Truth table for p ∨ q:

p	q	p ∨ q
T	T	T
T	F	T
F	T	T
F	F	F

Given truth assignments

Resulting truth value

Implication

- Def: Given propositions p and q, $p \rightarrow q$ is an implication
  - $p \rightarrow q$ means “p implies q ”
  - p is the *hypothesis, antecedent* or *premise*
  - q is the *conclusion, consequence,* or *consequent*
  - Truth table for $p \rightarrow q$:

p	q	$p \rightarrow q$
T	T	T
T	F	F
F	T	T
F	F	T

Understanding Implications

- Some readings of $p \rightarrow q$:
  - if p, then q
  - q if p
  - q when p
  - p only if q
  - q follows from p
  - q is a necessary condition for p
  - p is a sufficient condition for q
  - q is necessary for p
  - p is sufficient for q

Exclusive Or

- Def: Given propositions p and q, $p \oplus q$ denotes the exclusive or of p and q
  - $p \oplus q$ means “p or q, but not both”
- Truth table for $p \oplus q$:

p	q	$p \oplus q$
T	T	F
T	F	T
F	T	T
F	F	F

Biconditionals

- Def: Given propositions p and q, $p \leftrightarrow q$ is a *biconditional*
  - $p \leftrightarrow q$ means “p if and only if q”
- Truth table for $p \leftrightarrow q$:

p	q	$p \leftrightarrow q$
T	T	T
T	F	F
F	T	F
F	F	T