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CSCE 222

Discrete Structures for Computer Science

Dr. Hyunyoung Lee • Spring 2016 • Texas A&M University

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Abstract

These notes are intended as a resource for myself; past, present, or future students of this course, and anyone interested in the material. The goal is to provide an end-to-end resource that covers all material discussed in the course displayed in an organized manner. If you spot any errors or would like to contribute, please contact me directly.

1 Propositional Logic (1/22)

Proposition

- A declatitive sentence that is either True or False (**NOT** both).

Examples:

- College Station is the captital of the USa
- There are fewer politicians in College Station than in Washington, D.C.
- $1 + 1 = 2$
- $2 + 2 = 5$

A variable that represents propositions is called a propositional variable. (stick with boolean algebra)
For example: $p, q, r, ...$ [Propositional variables in logic play the same role as numerical variables in arithmetic]

Propositional Logic

- The area of logic that deals with propositions

Logical Connectives

- not
  - $\neg$
  - reverses the boolean (ex. from True to False).
- and
  - $\wedge$
  - only True if both components are True.
- or
  - $\vee$
  - only False if both componets are False.
- exclusive or
  - $\bigoplus$
  - True if only one or the other is True, but not both.
- conditional
  - $p \rightarrow q$
  - if p, then q
  - ex. if you do all your homework in this class, then you should get an A.
- biconditional
  - $p \leftrightarrow q$
  - is the same as $(p \rightarrow q) \wedge (q \rightarrow p)$.

Each logical connective is enclosed in parentheses except for the negation connective, $\neg$.

Operator Precedence Rules

1. negation
2. and
3. or and xor
4. conditional

5. biconditional

Tautology

- A proposition that always evaluated to True regardless of the assignment of truth values to its variables.
- ex. $p \vee \neg p$
- To prove a tautology, typically a truth table is required.