**Notes: Week of Aug31.Fall2012**

Course website: [www.cis.syr.edu/~sueo/cis275](http://www.cis.syr.edu/~sueo/cis275)

**Summary of slides with Annotations in brackets**

**Propositions** – declarative statements that are either true or false – not both.

-truth value might be unknown

**Propositional Logic** – formalism for reasoning about truth values of propositions

-**Syntax:**

**propositional variables** *(in this course, lower case letters)*

**logical connectives** combine variables into compound propositions

¬p negation (\not p")

p ^ q conjunction (\p and q")

p v q disjunction (\p or q")

p → q conditional (\p implies q", \if p then q")

p ↔ q biconditional (\p if and only if q")

-**Semantics**

Two truth values : T (True) and F (False)

Truth value depends on interpretation of variables

Use **truth tables** to help calculate meanings of propositions

-each row shows an interpretation of the variable, 2n rows for *n* variables

Each subterm gets its own column--ie: (p ^ q) v (q ^ r) has a column for p ^ q and q ^ r

**Tautology** – Always evaluates to true no matter what the truth values of the variables are

**Contingency** – Sometimes true, sometimes false

**Contradiction –** Always evaluates to false

**Conditionals ­**- p → q .

Read as: If p, then q. Whenever p, then q. p only if q. q if p.

[Also: p implies q]

Converse: q → p

Inverse: ¬p →¬ q

Contrapositive: ¬q →¬ p

**Important:** A conditional and its contrapositive always have the same truth value

**Important:** A conditional’s converse and inverse always have the same truth value

**Valid Argument**

- argument: a line of reasoning

- valid : Whenever all of the premises are true, the conclusion must also be true.

--never conclude something false from true premises

**[** In other words, a valid argument either has true premises and a true conclusion, or at least one false premise. An invalid argument has true premises and a false conclusion. **]**

**Logical Equivalence**

* Logically equivalent propositions have the same truth values for ALL possible interpretations of the variable. A and B are logically equivalent when A↔B.
* -Write A≡B to show logical equivalence

**Logical Implications**

* Multiple propositions together can logically imply another proposition.
* A­1…An can logicially imply B: A­1…An **.∙.** B [**.∙. –** triangle of dots symbol means therefore]

Logical equivalences and implications for the **derivation rules**.

**Formal proof** – sequence of annotated statements in the logic

Statements are assumptions (‘assumption’ or ‘given’)

Or they are obtained through derivation rules, annotated by the rule applied

**Put all assumptions and givens at the start of the formal proof**

**See pdfs for sample proofs and list of derivation rules**