LOGICAL DEDUCTION IN A

PROPOSITIONAL LOGIC TO PREDICATE LOGIC

Deduction Using Propositional Logic: Steps

Choice of Boolean Variables a, b, c, d, ... which can take values true or false.

Boolean Formulae developed using well defined connectors \sim , \wedge , \vee , \rightarrow , etc, whose meaning (semantics) is given by their truth tables.

Codification of Sentences of the argument into Boolean Formulae.

Developing the <u>Deduction Process</u> as obtaining truth of a <u>Combined</u> Formula expressing the complete argument.

Determining the Truth or Validity of the formula and thereby proving or disproving the argument and Analyzing its truth under various.

Validity Tautology Satisfiability

Deduction Using Propositional Logic: Example 1

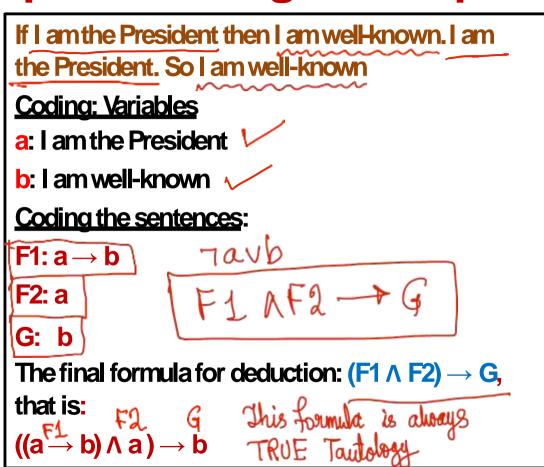
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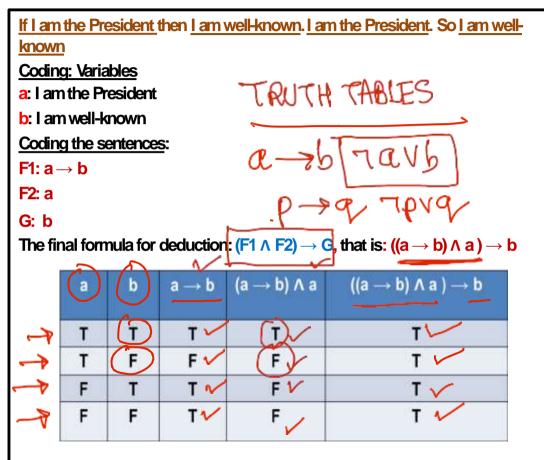
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Deduction Using Propositional Logic: Example 2

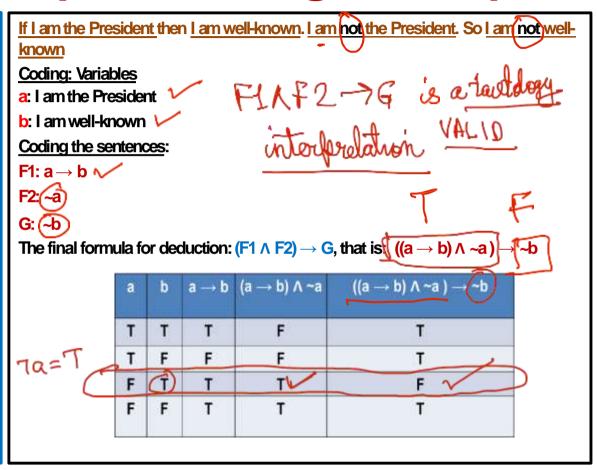
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Insufficiency of Propositional Logic

Wherever Mary goes, so does the lamb. Mary goes to school. So the lamb goes to school.

No contractors are dependable. Some engineers are contractors. Therefore some engineers are not dependable.

All dancers are graceful. Ayesha is a student. Ayesha is a dancer. Therefore some student is graceful.

Every passenger is either in first class or second class. Each passenger is in second class if and only if he or she is not wealthy. Some passengers are wealthy. Not all passengers are wealthy. Therefore some passengers are in second class.

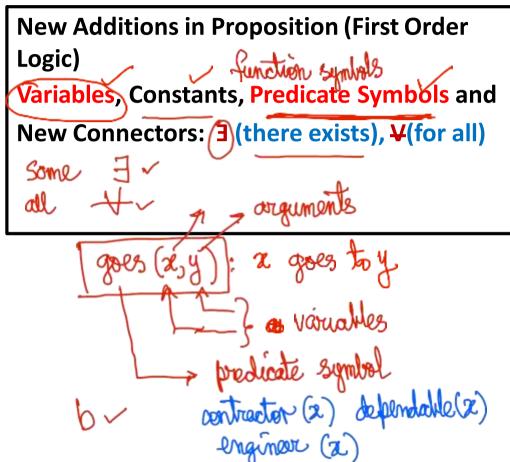
Predicate Logic First Order Logic

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Formulating Predicate Logic Statements

VALID

New Additions in Proposition (First Order Logic) Variables, Constants, Predicate Symbols and New Connectors: ∃ (there exists), ¥(for all) Example 1: I Wherever Mary goes, so does the Lamb. Mary goes to School. So the Lamb goes to School. Predicate: goes(x,y) to represent x goes to y New Connectors: (there exists), (V(for all) F1: (∇x) goes (Mary, (x)) \rightarrow goes (Lamb, (x)) F2: goes(Mary, School) Mory G: goes(Lamb, School) To prove: $(F1 \land F2) \rightarrow G)$ is always true

No contractors are dependable. Some engineers are contractors. Therefore some engineers are not dependable. <u>Predicates</u>: contractor(x), dependable(x), engineer(x) F1: (∇x) (contractor(x) \rightarrow ~dependable(x)) [Alternative: $^{\circ}$]x (contractor(x) $^{\wedge}$ dependable(x))] F2: $\exists x (engineer(x) \land contractor(x)) \checkmark$ G $\exists x (engineer(x) \land \neg dependable(x))$ To prove: $(F1 \land F2) \rightarrow G)$ is always true For (engineer (2) -> contractor(2)) 1 Jac enginan(a) FINF2-G

Example 3: -

More Examples Example: 4

All dancers are graceful. Ayesha is a student. Ayesha is a dancer.

Therefore some student is graceful.

graceful(x) student (x) dancer(x) Ayeshi

F1: 4x { dancor(x) -> gracefol(x)}

XX & Lamor (a) A graceful (a)}

F3: Student (Ayesha) F3: Samoor (Ayesha)

G: F2 x 2. student (2) 1 G: F2 x F2 x F3) ~ GT Every passenger is either in first class or second class. Each passenger is in second class if and only if the passenger is not wealthy. Some passengers are wealthy. Not all passengers are wealthy.

Therefore some passengers are in second class. P(x) = f(x) + g(x) = g(x) + weathy

Lypassonger - first class - ground class

F1) Hap(x) -> (f(x) V 8(x)) } ~ (f(x) N 7 8(x)) } ~

F2. 4x 9 p(x) -> ((8(x) -> + (w(x)))

F3) 35p(x) NW(x)} (¬W(x) → 8(x)))}

F4) ¬ (42f(x)→W(x)}) (F4: 3xf(x)N¬W(x)

G;) 3x5p(x) N S(x) } (F1NF2NF3NF4)→6

Thank you

Fredricate Logic | variables constants

Predicate Logic | predicates

H foral I there exists

Learnable - codification of sentences into formulae

Development of the combined formula VALID / SATISFIABLE etc