Sunday, October 3, 2021 9:43 PM

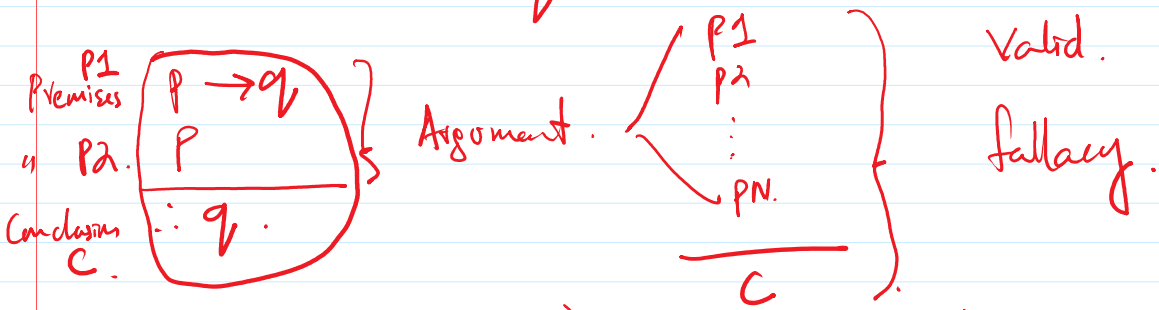
Lecture 7:- Rules of Inference.

"If you have a current password (p) then you can log onto the network (q)".

"You have the current password" (p).

therefore.

"you can log onto the network" (q).



$((P1 \wedge P2 \wedge \dots \wedge PN) \rightarrow C) \rightarrow$ tautology.

$((p \rightarrow q) \wedge (p)) \rightarrow q \rightarrow$ tautology.

1). $\dfrac{p \quad p \rightarrow q}{\therefore q}$ Modus Ponens.

2) $\dfrac{\neg q \quad p \rightarrow q}{\therefore \neg p}$ Modus tollens.

3). $\dfrac{p \rightarrow q \quad q \rightarrow r}{\therefore p \rightarrow r}$ Hypothetical Syllogism.

4) $\dfrac{p \vee q \quad \neg p}{\therefore q}$ Disjunctive Syllogism

5) $\dfrac{p}{\therefore p \vee q}$ Addition.

6). $\dfrac{p \wedge q}{\therefore p}$ Simplification.

7) $\dfrac{p \quad q}{\therefore p \wedge q}$ Conjunction.

8) $\dfrac{p \vee q \quad \neg p \vee r}{\therefore q \vee r}$ Resolution ★.

Ex6:- P62:- "It is not (¬p) sunny this afternoon and it is colder than yesterday (q). "We will go

and it is colder than yesterday". "We will go swimming only if it is sunny". "If we do not go swimming then we will take a canoe trip". "If we take a canoe trip then we will be home by sunset".

leads to Conclusion.

"We will be home by sunset".

p1 $\neg p \wedge q$ ✓

p2 $r \rightarrow p$ ✓

p3 $\neg r \rightarrow s$ ✓

p4 $s \rightarrow t$ ✓

C $\therefore t$

1). $\frac{p \quad p \rightarrow q}{\therefore q}$ Modus Ponens.

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5) $\frac{p}{\therefore p \vee q}$ Addition.

6). $\frac{p \wedge q}{\therefore p}$ Simplification.

7) $\frac{p \quad q}{\therefore p \wedge q}$ Conjunction.

8) $\frac{p \vee q \quad \neg p \vee r}{\therefore q \vee r}$ Resolution ★.

from p1 $\neg p$. — (5) ✓ by Simplification.

from (p2, 5) $\neg r$ — (6) ✓ by modus tollens.

from (p3, 6) s — (7) ✓ " modus ponens.

from (p4, 7) t — (8) " " ".

which is Conclusion.

Ex 7: p63:-

(p1) $p \rightarrow q$ ✓

p2 $\neg p \rightarrow r$ ✓

p3 $r \rightarrow s$ ✓

C $\therefore \neg q \rightarrow s$

1). $\frac{p \quad p \rightarrow q}{\therefore q}$ Modus Ponens.

2) $\frac{\neg q \quad p \rightarrow q}{\therefore \neg p}$ Modus tollens.

3). $\frac{p \rightarrow q \quad q \rightarrow r}{\therefore p \rightarrow r}$ Hypothetical Syllogism.

4) $\frac{p \vee q \quad \neg p}{\therefore q}$ Disjunctive Syllogism

5) $\frac{p}{\therefore p \vee q}$ Addition.

6). $\frac{p \wedge q}{\therefore p}$ Simplification.

7) $\frac{p \quad q}{\therefore p \wedge q}$ Conjunction.

8) $\frac{p \vee q \quad \neg p \vee r}{\therefore q \vee r}$ Resolution ★.

$\frac{\neg p}{\therefore q}$ $\qquad$ $\therefore q \vee r$

from P1 $\neg q \to \neg p$ — (4) CP.
from P2, 4 $\neg q \to \delta$ — (5) HS.
from P3, 5 $\neg q \to s$ — (6) HS.
(6) is also conclusion.

Problem: we need to remember all logical equivalences.

EX8: P1 $T \to M \vee E$
P2 $S \to \neg E$
P3 $T \wedge S$
C. $\therefore M$.

1). $\frac{P \quad P \to q}{\therefore q}$ Modus ponens.
2) $\frac{\neg q \quad P \to q}{\therefore \neg p}$ Modus tollens.
3). $\frac{P \to q \quad q \to r}{\therefore P \to r}$ Hypothetical Syllogism.
4) $\frac{P \vee q \quad \neg p}{\therefore q}$ Disjunctive Syllogism
5) $\frac{P}{\therefore P \vee q}$ Addition.
6). $\frac{P \wedge q}{\therefore P}$ Simplification.
7) $\frac{P \quad q}{\therefore P \wedge q}$ Conjunction.
8) $\frac{P \vee q \quad \neg P \vee r}{\therefore q \vee r}$ Resolution *.

from P3 T — (4) by S
" S — (5) by S.
from (P1, 4) $M \vee E$ — (6) by MP.
from (P2, 5) $\neg E$ — (7) by MP.
from (6, 7) M — 8 by DS.

Problem: 2.
The order may be different.

Swi-Prolog.

Problem 3.
You need to remember all rules.