

# lecture 7:- Rules of Inference. P.

"If <sup>P59</sup> You have a Current password then

q You can log onto the network P.

" You have the Current password."

there fore

" you can log into the network".  
q.

P1:-  $P \rightarrow q$

P2:- P.

C  $\therefore q$ .

$((P1 \wedge P2 \wedge P3 \wedge \dots \wedge Pn) \rightarrow C)$

Tautology. — Valid.

$((P \rightarrow q) \wedge P) \rightarrow q$  Tautology.

## Rules of Inference

1-  $\frac{P}{P \rightarrow q} \therefore q$  Modus Ponens. 5-  $\frac{P}{\therefore P \vee q}$  Addition.

2-  $\frac{\neg q}{P \rightarrow q} \therefore \neg P$  Modus Tollens. 6-  $\frac{P \wedge q}{\therefore P}$  Simplification.

3-  $\frac{P \rightarrow q}{q \rightarrow r} \therefore P \rightarrow r$  Hypothetical Syllogism. 7-  $\frac{P}{q} \therefore P \wedge q$  Conjunction.

4-  $\frac{P \vee q}{\neg P} \therefore q$  Disjunctive Syllogism. 8-  $\frac{P \vee q}{\neg P \vee r} \therefore q \vee r$  Resolution.

Ex 6 P62: "It is not Sunny this afternoon and it is colder than yesterday". "We will go swimming"  $\rightarrow$  only if it is sunny". "If we do not go swimming  $\rightarrow$  then we will take a canoe trip" "If we

→ "If it is sunny. (P) we do not go swimming (Q)."   
 → "Then we will take a canoe trip (S)." "If we take a canoe trip (S) then we will be home by sunset (T)." leads to conclusion "we will be home by sunset (T)."   
 Sunset (T)

P1:  $\neg P \wedge Q$  ✓

P2:  $\neg Q \rightarrow P$  ✓

P3:  $\neg T \rightarrow S$  ✓

P4:  $S \rightarrow T$  ✓

C:  $\therefore T$

Rules of Inference

1-  $\frac{P}{P \rightarrow Q} \therefore Q$  Modus Ponens. 5-  $\frac{P}{P \vee Q}$  Addition.

2-  $\frac{\neg Q}{P \rightarrow Q} \therefore \neg P$  Modus tollens. 6-  $\frac{P \wedge Q}{\therefore P}$  Simplification.

3-  $\frac{P \rightarrow Q}{Q \rightarrow R} \therefore P \rightarrow R$  Hypothetical Syllogism. 7-  $\frac{P}{Q} \therefore P \wedge Q$  Conjunction.

4-  $\frac{P \vee Q}{\neg P} \therefore Q$  Disjunctive Syllogism. 8-  $\frac{P \vee Q}{\neg P \vee R} \therefore Q \vee R$  Resolution.

from P1  $\neg P$  - (5) by Simplification.

from P2, 5  $\neg Q$  - (6) by Modus tollens.

from P3, 6  $S$  - (7) by Modus ponens.

from P4, 7  $T$  - (8) a a a.

$\frac{S}{S \rightarrow T} \therefore T$  P2S  $Q, 2T$

Ex 7.62:-

P1:  $P \rightarrow Q$  ✓

P2:  $\neg P \rightarrow R$  ✓

P3:  $R \rightarrow S$  ✓

C:  $\therefore \neg Q \rightarrow S$

Rules of Inference

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4-  $\frac{P \vee Q}{\neg P} \therefore Q$  Disjunctive Syllogism. 8-  $\frac{P \vee Q}{\neg P \vee R} \therefore Q \vee R$  Resolution.

from P1  $\neg Q \rightarrow P$  (5) by Contrapositive.

from 1, 2  $\neg Q \rightarrow R$  (6) by Hypothetical Syllogism. Problem:

from 4, 2  $\neg q \rightarrow r$  — (5) by Hypothetical Syllogism. Problem:

from 3, 5  $\neg q \rightarrow s$  — 6 by " " " " we have to remember all logical equivalences.

Ex 8:- P 63:-

P1  $T \rightarrow (M \vee E)$  ✓

P2  $S \rightarrow TE$  ✓

P3  $T \wedge S$  ✓

C.  $\therefore M$ .

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3-  $\frac{P \rightarrow q}{q \rightarrow r}$  Hypothetical Syllogism. 7-  $\frac{P}{q}$  Conjunction.

4-  $\frac{P \vee q}{\neg P}$  Disjunctive Syllogism. 8-  $\frac{P \vee q}{\neg P \vee r}$  Resolution.

from P3  $T$  — (4) ✓ By Simplification.

from P3  $S$  — (5) ✓ " " " "

from P1, 4  $M \vee E$  — (6) ✓ By Modus Ponens.

from P2, 5  $TE$  — (7) ✓ " " " "

from (6, 7)  $M$  — (8) By Resolution.

Problem:  
(Sequence may break).

— 8 ✓