Rules of Inference-1

Wednesday, September 2, 2020 9:55 AM

Ex: It is below freezing now. (premise) Therefore, it is either below freezing or raining now. (Conclusion)

p: "It is below freezing now"
q: "It is raining"

] propositional variables

Argument form

$$\frac{p}{\therefore p \vee q}$$

⇒ Addition rule.

Ex: "It is below freezing (premise) and raining now. Therefore, it is below freezing now." (conclusion)

p: "It is below freezing now"
q: "It is raining now."

Argument form:

$$\frac{p \wedge q}{\therefore p}$$

⇒ Simplification

Ex:

Ex:

It [If it rains today, then we will not have BBQ today. If we do not have BBQ today then we will have a BBQ tomorrow]. Therefore, if it rains today, then we will have BBQ tomorrow

p: "It is raining today."

q: "We will not have BBQ today"

r: "We will have a BBQ tomorrow."

Argument form

$$\begin{array}{l} p \to q \\ q \to r \\ \hline \therefore\ p \to r \end{array} \Rightarrow \text{Hypothetical Syllogism}$$

Ex: If you do ~~not~~ every problem in this book, then you will learn discrete mathematics. You learned discrete mathematics.

premises

conclusion → Therefore, you did not learn discrete maths.

p: "You did every problem in this book"

q: "You learned discrete maths.

q:

Argument form

$p \to q$

q

$\therefore p$

not a valid argument form

$((p \to q) \wedge q) \to p$

This is a fallacy: Indeed possible to learn discrete mathematics ~~with~~ in some other way rather than solving all the problems in the book.

$((p \to q) \wedge \neg p) \to \neg q$

$p \to q$: If you do every problem in this book, then you will learn discrete maths.

$\neg p$: You haven't done every problem in this book.

$\neg q$: You haven't learn discrete maths.

Argument form:

$p \to q$

$\neg p$

$\therefore \neg q$

$\Rightarrow$ False if p is false and q is true.

$\Rightarrow q$

Prob-1

Premises: if $\sqrt{2} > \frac{3}{2}$ (p), then $\left(\sqrt{2}\right)^2 > \left(\frac{3}{2}\right)^2$ (q)

$\sqrt{2} > 3/2$

Conclusion: $\left(\sqrt{2}\right)^2 > \left(\frac{3}{2}\right)^2 = \frac{9}{4}$

Conclusion: $(\sqrt{2})^2 > \left(\frac{3}{2}\right)^2 = \frac{9}{4}$

$((p \to q) \wedge p) \to q$ (conditional implication)

$p \to q$
p
$\therefore q$

$\Rightarrow$ modus ponent

$\Rightarrow$ false

Even if the argument form is valid, but the conclusion is false as

$\sqrt{2} \neq 3/2$

Consequently, we cannot ~~correct~~ conclude the conclusion is true.

Prob-2:

p = It is sunny this afternoon.
q = It is colder than yesterday.
r = We will go swimming.
s = We will take a canoe trip
t = We will be home by sunset.

Premises.	Conclusion
(1) $\neg p \wedge q$	t
(2) $r \to p$	

(2) $p \rightarrow q$

(3) $\neg r \rightarrow s$

(4) $s \rightarrow t$

Steps	Reasons.
1. $\neg p \wedge q$	Premise
2. $\neg p$	Simplification on (1)
3. $r \rightarrow p$	Premise
4. $\neg r$	Modus tollens on (2)&(3)
5. $\neg r \rightarrow s$	Premise
6. s	Modus ponens on (4)&(5)
7. $s \rightarrow t$	Premise
8. t	Modus ponens on (6)&(7)