

Rules of Inference - I

Wednesday, September 2, 2020 9:55 AM

Ex: It is below freezing now. Therefore, it is either below freezing or raining now.

p: "It is below freezing now"] propositional variables
q: "It is raining"

Argument form

$$\frac{P}{\therefore P \vee q} \Rightarrow \text{Addition rule.}$$

Ex: It is below freezing \Rightarrow premise and raining now. Therefore, it is below freezing $\underline{\text{and}}$ raining now. \therefore It is below freezing now.

p: "It is below freezing now"

q: "It is raining now."

Argument form:

$$\frac{P \wedge q}{\therefore p} \Rightarrow \text{Simplification}$$

Ex: r - . . . 10 . . . 11 - 1 Laws

Ex: If [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"

q₁: "We will have a BBQ tomorrow."

Argument form

$$\frac{p \rightarrow q \\ q \rightarrow r}{\therefore p \rightarrow r} \Rightarrow \text{hypothetical syllogism}$$

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

Conclusion \rightarrow Therefore, you did not learn discrete maths.

p: "You did every problem in this book"

q₁: "You learned discrete maths."

on -- -- --

Argument form

not a valid argument form

$$\begin{array}{c}
 p \rightarrow q \\
 q \\
 \hline
 \therefore p
 \end{array}
 \quad | \quad ((p \rightarrow q) \wedge q) \rightarrow p.$$

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

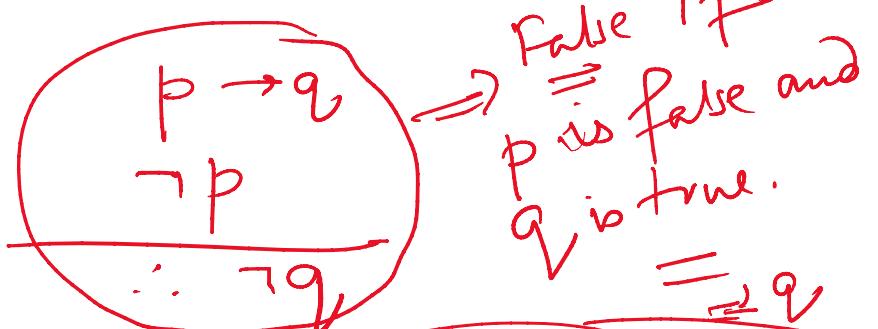
$$((p \rightarrow q) \wedge \neg p) \rightarrow \neg q$$

$p \rightarrow q$: 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:



Prob'l

Premises: if $(\sqrt{2} > \frac{3}{2})$ then $(\sqrt{2})^2 > (\frac{3}{2})^2$

$$\sqrt{2} > \frac{3}{2}$$

$$\text{Calculation: } (\sqrt{2})^2 > (\frac{3}{2})^2 = 9$$

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

$$\frac{\begin{array}{c} ((p \rightarrow q) \wedge p) \rightarrow q \\ \text{(Condition Implication)} \end{array}}{p \rightarrow q} \quad \Rightarrow \quad \underline{\text{modus ponent}}$$

$\therefore \textcircled{q} \Rightarrow \text{false}$

Even if the argument form is valid,
but the Conclusion is false as
 $\sqrt{2} > 3/2$

Consequently, we cannot ~~conclude~~ 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.

$$\textcircled{1} \quad \neg p \wedge q$$

$$\textcircled{2} \quad r \rightarrow p$$

Conclusion

$$\underline{\underline{t}}$$

- (2) $r \rightarrow t$
 (3) $\neg r \rightarrow s$
 (4) $s \rightarrow t$

—

Steps

1. $\neg p \wedge q$
2. $\neg p$
3. $r \rightarrow p$
4. $\neg r$
5. $\neg r \rightarrow s$
6. s
7. $s \rightarrow t$
8. t

Reasons.

Premise

Simplification on (1)

Premise

Modus tollens on (2)&(3)

Premise

Modus ponens on (4)&(5)

Premise

Modus ponens on (6)&(7)