U20CS005

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Tutorial-5

1. Let's consider a propositional language where
p means "Paola is happy"
q means "Paola paints a picture". &
r means "Renzo is happy"
- Formalize the following sentences:
(i) "If Paola is happy & paints a picture then Renzo isn't happy".
$p \wedge q \rightarrow \neg r$
(ii) "If Paola is happy, then she paints a picture".
$p \rightarrow q$.
(iii) "Paola is happy only if she paints a picture"
$p \rightarrow q$.

2. Let's conside a propositional language where
p means "x is a prime number".
q means "x is a odd".
Formalize the following sentence.
(i) "x being prime is a sufficient condition for x being odd"
$p \rightarrow q$.

3. Let A = "Aldo is Italian" & B = "Bob is English".
Formalize the following sentences:
(i) "Aldo isn't Italian"
$\neg A$.
(ii) "Aldo is Italian while Bob is English".
$A \wedge B$.
(iii) "If Aldo is Italian then Bob is not English".
$A \rightarrow \neg B$
(iv) "Aldo is Italian or if Aldo isn't Italian then Bob is English".

$A \vee (\sim A \rightarrow B) \equiv A \vee (A \vee B) \equiv (A \vee B)$.

v) "Either Aldo is Italian & Bob is English or neither Aldo is Italian nor Bob is English".
$(A \wedge B) \vee (\sim A \wedge \sim B)$.

2) Let's conside a propositional language where A = "Angelo comes to party", B = "Bruno comes to party", C = "Carlo comes to party", D = "Davide comes to party".

Formalize the following sentences:

(i) "If David comes to party then Bruno & Carlo comes too".
$D \rightarrow (B \wedge C)$

(ii) "Carlo comes to party only if Angelo & Bruno do not come".
$C \rightarrow (\sim A \wedge \sim B)$

(iii) "Davide comes to party if and only if Carlo comes & Angelo doesn't comes".
$D \leftrightarrow (C \wedge \sim A)$.

(iv) "If Davide comes to party, ~~provided~~ then if ~~that~~ Carlo ~~Davide~~ doesn't come then Angelo comes".
$D \rightarrow (\sim C \rightarrow A)$.

(v) "Carlo comes to party provided that Davide doesn't come, but, if David comes, then Bruno doesn't come".
$(C \rightarrow \sim D) \wedge (D \rightarrow \sim B)$.

(vi) "A necessary condition for Angelo comming to the party, is that, if Bruno & Carlo aren't comming, David comes".
$A \rightarrow (\sim B \wedge \sim C \rightarrow D)$

(vii) "Angelo, Bruno & Carlo comes to party if & if only if Davide doesn't come, but, if neither Angelo nor Bruno comes, then David comes only if

Carlo comes"

$((A \wedge B \wedge C) \leftrightarrow \sim D) \wedge ((\sim A \wedge \sim B) \rightarrow (D \rightarrow C))$.

5. Socrate says:
"If I am guilty, I must be punished;
I am guilty. Thus I must be punished."
Is the argument logically correct?

→ Yes the argument is logically correct.
Let p means "I am guilty" &
q means "I must be punished".
⇒ $p \rightarrow q$ is true & p is true then q is true.
ie $\frac{(p \rightarrow q) \wedge p}{\therefore q}$ (Modus ponens).