→ What we have learned in last week?

① logical equivalence law.

② Propositional functions; arguments; arity: universe of discourse.

③ Quantifiers.

④ logic programing. Transcribing English to logic

→ Exercises:

1.2. equivalence law:

* Show $(p \vee q) \rightarrow r \equiv (p \rightarrow r) \wedge (q \rightarrow r)$

solution:

$$
\begin{aligned}
& (p \vee q) \rightarrow r && \text{(Given)}. \\
& \neg (p \vee q) \vee r && \text{(implication)}. \\
= & (\neg p \wedge \neg q) \vee r && \text{(De Morgan)}. \\
= & r \vee (\neg p \wedge \neg q) && \text{(commutative)} \\
= & (r \vee \neg p) \wedge (r \vee \neg q) && \text{(Distribution)} \\
= & (\neg p \vee r) \wedge (\neg q \vee r) && \text{(Commutative)}. \\
= & (p \rightarrow r) \wedge (q \rightarrow r) && \text{(Implecation)}.
\end{aligned}
$$

1.3:10: ~~*~~Universal Quantifiers P47

Let $C(x)$ be the statement "x has a ~~dog~~ cat"

$D(x)$ be the statement "x has a dog".

define the range for x

Express each of these statements in terms of $C(X)$ and $D(X)$.

— a) there is A student in our class has a cat and a dog:

- we assume that this means that one student has ~~all~~ ~~these~~ both animals:

$$\exists x\,(C(x) \wedge D(x))$$

— b) all student in our class have a dog or a cat.

- $\forall x\,(C(X) \vee D(X))$

— d) No student in our class has a cat and a dog.

- This is the negation of part (a):

$$\neg\exists x\,(C(X) \wedge D(x))$$

— c) $\exists x\,(C(x) \wedge \neg D(x))$ → what does this expression mean

- Some student in our class has a cat but not a dog.