

Predicate Logic Tutorial 3

1.

i) Which of the following are correct formalisations of the following statement:
“Bankers and estate agents are unpopular”?

- a. $\forall X (\text{banker}(X) \wedge \text{estate_agent}(X) \rightarrow \text{unpopular}(X))$
- b. $\forall X (\text{banker}(X)) \vee (\text{estate_agent}(X) \rightarrow \text{unpopular}(X))$
- c. $\forall X (\text{banker}(X) \vee \text{estate_agent}(X) \rightarrow \text{unpopular}(X))$
- d. $\forall X (\text{banker}(X) \rightarrow \text{unpopular}(X)) \wedge \forall X (\text{estate_agent}(X) \rightarrow \text{unpopular}(X))$

ii) Show $\vdash c \leftrightarrow d$, where c and d refer to the 3rd and 4th wffs above.

2. Prove the following:

- a. $\forall X (p(X) \rightarrow q(X) \wedge r(X)) \vdash \forall X (p(X) \rightarrow q(X)) \wedge \forall X (p(X) \rightarrow r(X))$
- b. $\forall X (p(X) \rightarrow (q(X) \rightarrow r(X))) \vdash \forall X (p(X) \wedge q(X) \rightarrow r(X))$
- c. $\forall X (p(X) \rightarrow \neg q(X)), p(a), \forall Y (q(Y) \vee s(Y)) \vdash s(a)$
- d. $\forall X (p(X) \rightarrow m(X) \vee n(X)), \forall X (m(X) \rightarrow \exists Y q(X, Y)), \forall X (n(X) \rightarrow \exists Y q(X, Y)), p(a) \vdash \exists Y q(a, Y)$

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