

Homework 2

Part I: Understanding quantified statements (30 pt.)

1. Let $Q(x,y)$ be the statement “ x has sent an e-mail to y .”
 - a. $\exists x \exists y Q(x,y)$
 - i. There is a person who sent an email to someone.
 - b. $\exists x \forall y Q(x,y)$
 - i. There is a person who sent an email to everyone.
 - c. $\exists y \forall x Q(x,y)$
 - i. There is someone who received an email from everyone.
 - d. $\forall x \exists y Q(x,y)$
 - i. Every person sent an email to someone.
 - e. $\forall y \exists x Q(x,y)$
 - i. Every person sent an email to everyone
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 - a. $\neg \exists y \forall x (P(x) \wedge Q(y) \rightarrow \neg R(x,y))$
 - b. $\exists x \exists y (P(x) \rightarrow \neg R(x,y))$
 - c. $\exists x \forall y (P(x) \rightarrow R(x,y))$
 - d. $\exists y \forall x (R(x,y) \wedge \forall z ((z \neq x) \rightarrow \neg R(z,y))$
 - e. $\exists x \exists y ((x \neq y) \wedge R(x,y) \wedge R(y,x))$

Part II: Using rules of inference for propositional logic

1. P :hypotheses
 - a. $\neg p$ or q : hypotheses
 - b. $P \rightarrow q$:conditional ident.
 - c. **Q** : modus ponens
2. –
 - a. Not p :hypothesis
 - b. Not(not P or Q) hypothesis
 - c. P and not Q negation
 - d. P : simplification
 - e. Not P and p : contradiction (a, d)