Hubert Budzik

Cs 151

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.”
   1. ∃𝒙∃𝒚𝑸(𝒙,𝒚)
      1. There is a person who sent an email to someone.
   2. ∃𝒙∀𝒚𝑸(𝒙,𝒚)
      1. There is a person who sent an email to everyone.
   3. ∃𝒚∀𝒙𝑸(𝒙,𝒚)
      1. There is someone who received an email from everyone.
   4. ∀𝒙∃𝒚𝑸(𝒙,𝒚)
      1. Every person sent an email to someone.
   5. ∀𝒚∃𝒙𝑸(𝒙,𝒚)
      1. Every person sent an email to everyone
2. L
   1. **¬**∃𝒚∀𝒙(P(x) ∧ Q(y) 🡪 ¬R(x,y))
   2. ∃x∃y(P(x) 🡪 **¬**R(x,y))
   3. ∃x∀y(P(x) 🡪 R(x,y))
   4. ∃𝒚∀𝒙(R(x,y) ∧ ∀z((z≠x) 🡪 **¬**R(z,y))
   5. ∃x∃y((x≠y) ∧ R(x,y) ∧ R(y,x))

Part II: Using rules of inference for propositional logic

1. P :hypotheses
   1. **¬**p or q : hypotheses
   2. P 🡪 q **:**conditional ident.
   3. **Q :** modus ponens
2. –
   1. Not p :hypothesis
   2. Not(not P or Q) hypothesis
   3. P and notQ negation
   4. P : simplification
   5. Not P and p : contradiction (a, d)