SAMPLE SOLUTION, CSC165 QUIZ 4, THURSDAY JUNE 16

Name: Student number:

Consider the following sentences, where the parentheses indicate the order of evaluation of the "$\Rightarrow$" operation:

s1: $(P(x, y) \Rightarrow (Q(x, y) \Rightarrow R(x, y))$

s2: $\forall x \in D, \exists y \in D$, s1.

1. Rewrite s1 in symbolic notation without using "$\Rightarrow$," that is, replacing this symbol by some combination of $\neg$ and $\vee$.

   $\neg P(x, y) \vee \neg Q(x, y) \vee R(x, y)$

2. Write the NEGATION of s2 in symbolic notation, making sure that the negation symbol "$\neg$" only appears directly next to predicates P, Q, or R.

   $\exists x \in D, \forall y \in D, P(x, y), \wedge Q(x, y) \wedge \neg R(x, y)$

3. Write the CONVERSE of s1 in symbolic notation, without using "$\Rightarrow$," that is, replacing this symbol by some combination of $\vee$ and $\neg$.

   $P(x, y) \vee (Q(x, y) \wedge \neg R(x, y))$