Logical Foundations of CS – CS5303

Quiz 4 — 33 points / 45 minutes

Exercise 1 (Skolem and CNF forms) (1 + 2 + 4 + 4 points) *Put the following formulas into Skolem form, and then CNF form.*

1. $\forall x,\ \exists y,\ father(y, x)$
2. $\exists x,\ (person(x) \wedge (\forall y,\ (person(y) \rightarrow \exists z,\ (person(z) \wedge \neg equal(y, z) \wedge ((knows(y, x)) \vee (knows(z, x)))))))$
3. $(\forall x,\ P(x)) \ \rightarrow \ ((\exists y, Q(y)) \rightarrow (\forall z, T(z, y, x)))$
4. $((\exists x, P(x)) \vee (\forall y, Q(x, y))) \rightarrow (\exists z, T(z, x, y))$

Exercise 2 (Translations of English sentences) (1 + 1 + 2 + 4 + 4 + 1 + 1 points) *Translate the following sentences, and answer the questions that are asked below (if any).*

1. *There is a penguin that can fly.*
2. *If anyone wakes up late and this is a workday, then this person is late at work.*
3. *There are good basket-ball players that are not tall.*
4. *It is necessary to be motivated to succeed at College.*
   - *Can you deduce from this statement that if you are not motivated, you will fail at College? Prove your answer.*
5. *It is sufficient to be tall to be a good basket-ball player.*
   - *Can you deduce from this statement, that if you are a good basket-ball player, you are tall? Prove your answer.*
6. *Not all penguins can fly.*
7. *No horse can fly.*

Exercise 3 (Reasoning) (4 + 4 points) *Are the following reasoning correct? Prove your answers, by translating the reasonings in FOL, and then by using a proving method/a deduction system.*

1. *When you wake up late, you are late at work and, if you work at Untel Company, you get a bad evaluation. Tom did not get a bad evaluation.*
   Can we deduce from the above that: he either did not wake up late or that he doesn't work at Untel Company?
2. *If you win at the lottery, then if the amount is significant, you can stop to work. Tom still did not stop to work.*
   Can you deduce from the above that he did not win the lottery?