**Problem Set 7**

**Part 1 (one point total).** *For each of the following strings of symbols determine whether the string is a Well-Formed Formula (WFF). For the purpose of this exercise,* **a** *and* **b** *are names, and* ***x****,* ***y****, and* ***z*** *are variables. (Parentheses dropping conventions may be used.)*

1. *L*ab→*L*ba
2. *Qxy*
3. ∀*x*∀*y*(*PxyRyx*↔*T*ab)
4. ∀*x*∀*y*(*Px*&*Qy*→∃*z*(*Rzx*&*Rzy*))
5. *L*a*x*→*T*b*y*

Answer:

1. The string is a WFF.
2. The string is not a WFF.
3. The string is not a WFF.
4. The string is a WFF.
5. The string is not a WFF.

**Part 2 (one point total).** *For each of the following formulae, identify the main connective or quantifier.*

1. ((*P*a&*Q*b)∨(*Q*a&~*R*b))
2. ∀*x*(~*Px*→*Qx*)
3. ~∃*x*(*Px*&*Qx*)
4. (((Pa→(Qa∨Ra))↔∀*xy*(T*x*&Q*y*→~R*xy*)))∨ ~∃*x*(P*x*&∀*y*(~Q*y*→R*xy*))

Answer:

1. The main connective is ∨ (The second connective).
2. The quantifier is ∀.
3. The main connective is ~ and the quantifier is ∃.
4. The main connective is ∨.

**Part 3 (Two points total).** *For each of the following English sentences, provide a translation into PL, using the following translation key (ignore issues of tense for now): (you may use parentheses dropping conventions.)*

*Ix*: *x* sits on the iron throne

*Kxy*: *x* kills *y*

*Dxy*: *x* drinks with *y*

*Pxy*: *x* plots with *y*

*Fxy*: *x* is friends with *y*

a: Arya

t: Tyrion

c: Cersei

b: Lord Balish

s: John Snow

1. Tyrion has a drink with John Snow.
2. Tyrion does not drink with Cersei.
3. Cersei kills Tyrion, unless Tyrion plots with John Snow.
4. If Cersei kills John Snow, then Arya kills Cersei and Lord Balish.
5. Neither Lord Balish nor Tyrion are friends with Cersei.
6. Lord Balish plots with Cersei, but they are not friends.
7. Tyrion is friends with John Snow if and only if John Snow Drinks with Tyrion, but Tyrion plots with John Snow regardless.
8. Cersei sits on the iron throne if both Lord Balish kills John Snow and Cersei kills Tyrion.
9. Cersei does not sit on the iron throne only if either Lord Balish kills John Snow or Cersei does not kill Tyrion.
10. If Cersei sits on the iron throne, then Arya kills Cersei if and only if Cersei kills John Snow, unless Lord Balish plots with both Tyrion and John Snow.

Solution:

