***Exercise to Lecture 6*, interpretation of FOL formulas**

***Exercise 1***: Decide, which interpretation is a model of which of the following formulas.

**Interpretation**:

• universe U = {a; b; c}

• PU ⊆ U = {a; c}

• QU = Ø

• RU ⊆ U × U = {(a, c); (b, b); (b, c); (c, a)}

• LU ⊆ U × U = {(a, a); (b, b); (c, c); (a, b); (b, c); (c, a)}

• fU: U×U 🡪 U =
 {(a,b,c); (a,c,c); (b,c,c); (b,a,c); (c,a,c); (c,b,c); (a, a, c); (b,b, c), (c,c, c)}

***Formulas***:

a) *x P*(*x*)

b) *x* *Q*(*x*)

c) *x**y* *R*(*x*, *y*)

d) *x* *L*(*x*, *x*)

e) *x**y* [*R*(*x,* *y*) ⊃ *R*(*y*, *x*)]

f) *x**y* *P*(*f*(*x,* *y*))

g) *x* [*Q*(*x*)  *y* *R*(*y,* *x*)]

h) *x**y* [*R*(*x,* *y*) ⊃ *L*(*y,* *x*)]

***Exercise 2***: For the following formulas, define their models and interpretations that are not models.

a) ***x* [*P*(*x*)  *Q*(*x*)]**

**b) *x* [*P*(*x*) ⊃ *Q*(*x*)]**

**c) *x* [*P*(*x*)  *Q*(*x*)**

**d) *x* *R*(*x*, *f*(*x*))**

**e) *x**y* [*R*(*x*, *y*) ⊃ *R*(*y*, *x*)]**