## week02 tutorial

## Q1

Use quantifiers to express the statement that "There is a woman who has taken a flight on every airline in the world.

P(x) = a women

Q(x) = who has taken a flight on every airline in the world

$$\exists x \exists y \forall z (P(x,y) \land Q(y,z))$$

Q2

$$1.Q(0,0,0) \wedge Q(0,1,0) \ 2.Q(0,1,1) ee Q(1,1,1) ee Q(2,1,1) \ 3.Q(1,0,0) ee Q(1,0,1) ee (1,1,0) ee Q(1,1,1) ee \ Q(2,0,0) ee Q(2,0,1) ee Q(2,1,0) ee Q(2,1,1) \ 4.more. \ . \ .$$

Q3

$$egin{aligned} orall x(P(x) \wedge Q(X)) \ &= P(x) \ &= R(x) \end{aligned}$$

$$orall x(Q(x) \wedge S(x)) \ = S(x)$$

$$orall x(R(x) \wedge S(x)) \ Q.\, E.\, D.$$

**Q4** 

$$\exists x \neg P(x)$$

$$= \neg \forall x P(x)$$

$$= \forall x Q(x) \ Q(a)$$

$$= \forall x S(x) \ S(a)$$

$$egin{aligned} orall x(R(x) &
ightarrow 
abla S(c) &
ightarrow 
abla R(c) \ &= \exists x 
eg R(x) \end{aligned}$$

$$egin{aligned} p ⅇ q \ 
eg p ⅇ q \ p ⅇ 
eg q \ 
eg p ⅇ 
eg q \ 
eg q \ 
eg Q. E. D \end{aligned}$$