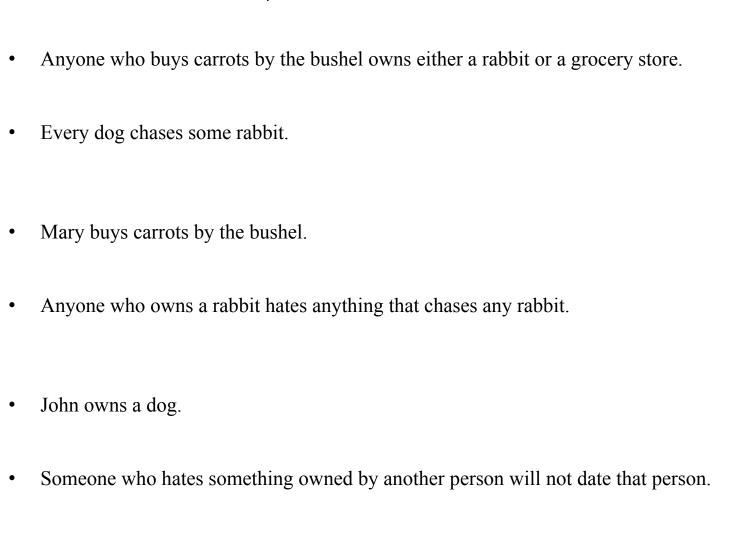
# Example Sentences in FOL

- Every child loves Santa.
- Everyone who loves Santa loves any reindeer.
- Rudolph is a reindeer, and Rudolph has a red nose.
- Anything which has a red nose is weird or is a clown.
- No reindeer is a clown.

- Scrooge does not love anything which is weird.
- Scrooge is not a child.

If Mary does not own a grocery store, she will not date John.



Every child loves Santa.

 $\forall x (CHILD(x) \rightarrow LOVES(x,Santa))$ 

Everyone who loves Santa loves any reindeer.

 $\forall x (LOVES(x,Santa) \rightarrow \forall y (REINDEER(y) \rightarrow LOVES(x,y)))$ 

Rudolph is a reindeer, and Rudolph has a red nose.
REINDEER(Rudolph) ∧ REDNOSE(Rudolph)

• Anything which has a red nose is weird or is a clown.  $\forall x (REDNOSE(x) \rightarrow WEIRD(x) \ \lor \ CLOWN(x))$ 

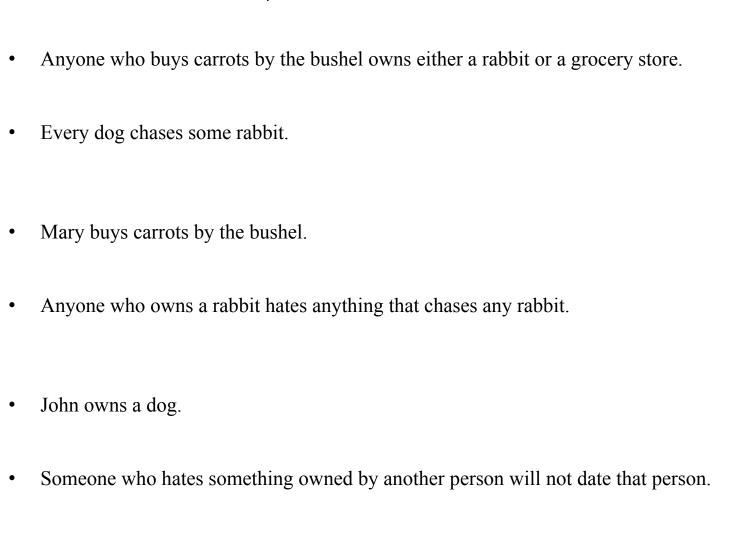
- No reindeer is a clown.
  - $\neg \exists x (REINDEER(x) \land CLOWN(x))$

Scrooge does not love anything which is weird.

 $\forall x (WEIRD(x) \rightarrow \neg LOVES(Scrooge,x))$ 

- Scrooge is not a child.
  - CHILD(Scrooge)

If Mary does not own a grocery store, she will not date John.



- Anyone who buys carrots by the bushel owns either a rabbit or a grocery store.  $\forall x \ (BUY(x) \rightarrow \exists y \ (OWNS(x,y) \land (RABBIT(y) \lor GROCERY(y))))$
- Every dog chases some rabbit.  $\forall x (DOG(x) \rightarrow \exists y (RABBIT(y) \land CHASE(x,y)))$
- Mary buys carrots by the bushel. BUY(Mary)
- Anyone who owns a rabbit hates anything that chases any rabbit.  $\forall x \ \forall y \ (OWNS(x,y) \land RABBIT(y) \rightarrow \forall z \ \forall w \ (RABBIT(w) \land CHASE(z,w) \rightarrow HATES(x,z)))$
- John owns a dog.  $\exists x (DOG(x) \land OWNS(John,x))$
- Someone who hates something owned by another person will not date that person.  $\forall x \forall y \forall z \ (OWNS(y,z) \land HATES(x,z) \rightarrow \neg DATE(x,y))$
- (Conclusion) If Mary does not own a grocery store, she will not date John.  $((\neg \exists x (GROCERY(x) \land OWN(Mary,x))) \rightarrow \neg DATE(Mary,John))$

- a. Some dragon is sleeping
- b. No dragon is sleeping
- c. Every dragon is sleeping
- d. Not every dragon is sleeping

a. Some dragon is sleeping

$$\exists x (D(x) \land S(x))$$

b. No dragon is sleeping

$$\neg \exists x (D(x) \land S(x))$$

c. Every dragon is sleeping

$$\forall x (D(x) \rightarrow S(x))$$

d. Not every dragon is sleeping

$$\neg \forall x (D(x) \rightarrow S(x))$$

a. Some dragon is sleeping or twitching

b. No dragon is sleeping or twitching

c. Every dragon is sleeping or twitching

d. Not every dragon is sleeping or twitching

a. Some dragon is sleeping or twitching

$$\exists x [D(x) \land (S(x) \lor T(x))]$$

- b. No dragon is sleeping or twitching
- $\neg \exists x [D(x) \land (S(x) \lor T(x))]$
- c. Every dragon is sleeping or twitching

$$\forall x [D(x) \rightarrow (S(x) \lor T(x))]$$

d. Not every dragon is sleeping or twitching

$$\neg \forall x [D(x) \rightarrow (S(x) \lor T(x))]$$

Paul and Fred left home but Mary did not Let L = left home, p = Paul, f = Fred, m = Mary Translate into FOL Paul left home L(p)

Fred left home L(f)

Mary left home L(m)

Mary didn't leave home ¬L(m)

Paul and Fred left home  $(L(p) \land L(f))$ 

Paul and Fred left home but Mary did not ((L(p)  $\land$  L(f))  $\land$  ¬L(m))