

Introductory Quantification

Symbolize the following sentences using the tools of universal and existential quantification.

1. No novels are biographies.
2. All biographies are boring.
3. Every student who eats Lucky Charms will pass the course.
4. Some students will not pass the course.
5. Everyone who majors in math or computer science will pass the course.
6. Anything that leads to violence is wrong.
7. Ghosts do not exist.
8. All bachelors are unmarried, but no unmarried women are bachelors.
9. Not all mushrooms are edible.
10. Only talented musicians perform in the symphony.
11. Only red roses are acceptable.
12. The only acceptable roses are red ones.
13. A room with a view is available.
14. A room with a view is expensive.
15. Swiss watches are not expensive unless they are made of gold.
16. Balcony seats are never chosen unless all the orchestra seats are taken.
17. Some employees will get raises if and only if some managers are overly generous.
18. Someone can be a president only if he or she was born in the USA.
19. The physicists and astronomers at the symposium are listed in the program if they either chair a meeting or read a paper.
20. If the scientists and technicians are conscientious and exacting, then some of the mission directors will be either pleased or delighted.

Symbolize the following arguments.

1. All secretaries and undersecretaries are intelligent and cautious. All those who are cautious or vigilant are restrained and austere. Therefore, all secretaries are austere.
2. If there are any oboists, there are some bassoonists. If there are any clarinetists, there are some flutists. Amelia is both an oboist and a clarinetist. Therefore, some bassoonists are flutists.
3. Only monsters live in closets. Thus, since Sully is a monster who doesn't live in a closet, all monsters do not live in closets.

Basic guidelines for symbolizing in FOL

All P are Q	$\forall x(P(x) \rightarrow Q(x))$
Some P are Q	$\exists x(P(x) \wedge Q(x))$
No P are Q	$\neg \exists x(P(x) \wedge Q(x))$ Or $\forall x(P(x) \rightarrow \neg Q(x))$
Some P are not Q	$\exists x(P(x) \wedge \neg Q(x))$

De Morgan's laws for quantifiers

$$\neg \exists x P(x) \leftrightarrow \forall x \neg P(x) \qquad \neg \forall x P(x) \leftrightarrow \exists x \neg P(x)$$