Let $P$ be the predicate $P(x, y) \equiv x$ owns $y$. Translate the following statements into equivalent formal expressions, using quantifiers when appropriate. The domain for $x$ is all people; the domain for $y$ is all things.

1. Jane owns the house.
2. Josh doesn’t own the cat.
3. Everyone owns something.
4. Everything is owned by someone.
5. Some things are not owned by anyone.
6. Some things are not owned by everyone.
7. Some people own nothing.
8. Some people don’t own everything.
9. Mr. Burns owns everything.
10. An object can’t have more than 1 owner.
11. Some people own exactly 3 things.
12. Some things are owned by more than one person.
13. Every person owns something that everyone else owns as well.
14. There is something that all but one person owns.
Formalize the following arguments using predicates and identify the basic arguments used at each step:

1. If you own a cat, then you are happy. If you don’t own a cat, then you own a dog. Joe doesn’t own a dog. Therefore, Joe is happy.

2. When dogs play, they get dirty. Dogs that don’t play, sleep. Sleeping dogs do not chase cats. Billy is not a dirty dog. Therefore, Billy doesn’t chase cats.