

PHIL 250: Exercise 1

This exercise is designed to make you familiar with translations of sentences of English into logical notation.

Let the *extra-logical* vocabulary of the language **L** consist of:

- exactly two names  $a, b$  ;
- exactly two one-place predicates  $F, G$  ; and
- exactly two two-place predicates  $L, R$ .

The language **L** contains no other extra-logical vocabulary.

The *logical* vocabulary of **L** consists of:

- the negation sign  $\neg$ ;
- the signs  $\wedge, \vee, \rightarrow$  for conjunction, disjunction and implication;
- the existential and universal quantifiers  $\exists, \forall$ ; and
- the two-place relation  $=$  of identity.

We use the following ‘translation manual’ for the primitive extra-logical expressions:

$a$	:	Albert
$b$	:	Betty
$Fx$	:	$x$ is flatulent
$Gx$	:	$x$ is grumpy
$Lxy$	:	$x$ loves $y$
$Rxy$	:	$x$ is richer than $y$

Translate the following English sentences into the formal notation of **L**:

1. Albert is flatulent and loves Betty.
2. Albert isn't flatulent but loves Betty.
3. Betty is grumpy but Albert loves her.
4. If Betty is flatulent then Albert loves her.
5. If Albert is flatulent then Betty doesn't love him.
6. Either Albert is flatulent or Betty is grumpy and loves him.
7. Albert is flatulent and grumpy only if Betty doesn't love him.
8. If Albert is either flatulent or grumpy then he doesn't loves Betty.
9. Albert is flatulent but richer than Betty, and she is grumpy but loves him.
10. Someone is grumpy and richer than Betty but no one loves him.
11. Everyone richer than Betty loves himself.
12. No one who is flatulent loves Betty.
13. Someone who is flatulent is richer than Betty and loved by her.
14. Everyone whom Betty loves is grumpy if flatulent.

15. Everyone richer than Betty is either grumpy or flatulent.
16. Someone loves Betty and is richer than Albert, who is flatulent.
17. Everyone richer than Albert loves everyone whom he loves.
18. Anyone richer than Albert loves no one whom he loves.
19. Anyone grumpy is loved by no one but Betty.
20. Anyone richer than Albert is loved by everyone poorer than Betty.

Translate the following sentences of **L** into English:

1.  $Ga \wedge Fb$
2.  $Rab \wedge \neg Fa$
3.  $Laa \rightarrow Lbb$
4.  $\forall xFx$
5.  $\exists xGx$
6.  $\neg \forall xFx$
7.  $\neg \exists xGx$
8.  $\exists x \neg Gx$
9.  $\forall x \neg Fx$
10.  $\forall x \neg Lxx$
11.  $\forall x \forall y Lxy$
12.  $\forall x \exists y \neg Lyx$
13.  $\exists x \exists y Rxy$
14.  $\forall x (Lbx \rightarrow Fx)$
15.  $\exists x (Rbx \vee Fx)$
16.  $\forall x (\neg a = x \rightarrow Lxb)$
17.  $\neg \exists x (Fx \wedge Gx \wedge \forall y Lyx)$
18.  $\exists x Lbx \wedge \neg \exists x Lax$
19.  $\exists x (Lbx \wedge \neg Lax)$
20.  $\forall x \exists y (Lxy \wedge Lyx)$