

Phl 313K
Spring 1998
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Translate the following into symbolic language, using the following key:

S α : α is small
L α : α is large

C α : α is a cube
T α : α is a tetrahedron
D α : α is a dodecahedron

L $\alpha\beta$: α is to the left of β
R $\alpha\beta$: α is to the right of β
F $\alpha\beta$: α is in front of β
B $\alpha\beta$: α is in back of β

B $\alpha\beta\gamma$: α is between β and γ

1. Some tetrahedron is large.
2. No cube is large.
3. Some tetrahedron is neither large nor small.
4. Some tetrahedron is not large.
5. Some large cube is to the left of b.
6. Something to the left of b is in back of c.
7. b is not to the left of a cube.
8. All cubes are small.
9. Each small cube is to the right of a.
10. Each cube is either in front of b or in back of a.
11. Everything between a and b is a cube.
12. All dodecahedra are not small. [ambiguous]
13. a is not to the right of everything.
14. a is not to the right of anything.
15. a is not to the right of any cube.
16. If something is a cube, then it is to the right of a and to the left of b.
17. There are at least two cubes.
18. Every small cube is in back of a large cube.
19. Some cube is in front of every tetrahedron.
20. Every cube in front of every tetrahedron is large.
21. Everything to the right of a large cube is small.
22. Anything with nothing in back of it is a cube.
23. Every dodecahedron is to the left of some tetrahedron.
24. No dodecahedron has anything in back of it.
25. Every cube with something in back of it is small.
26. Every dodecahedron with nothing to its right has something to its left.
27. Only large things have nothing in front of them.
28. Every cube in back of a dodecahedron is also to the left of it.
29. The only large cubes are b and c.
30. There are at least three tetrahedra.

Answers:

1. $\exists x(Tx \& Lx)$
2. $\neg \exists x(Cx \& Lx)$

3. $\exists x(Tx \& \neg(Lx \vee Sx))$, or $\exists x(Tx \& \neg Lx \& \neg Sx)$
4. $\exists x(Tx \& \neg Lx)$
5. $\exists x((Lx \& Cx) \& Lxb)$
6. $\exists x(Lxb \& Bxc)$
7. $\neg \exists x(Cx \& Lbx)$
8. $\forall x(Cx \rightarrow Sx)$
9. $\forall x((Sx \& Cx) \rightarrow Rxa)$
10. $\forall x(Cx \rightarrow (Fxb \vee Bxa))$
11. $\forall x(Bxab \rightarrow Cx)$
12. $\forall x(Dx \rightarrow \neg Sx)$; $\neg \forall x(Dx \rightarrow Sx)$
13. $\neg \forall x Rax$
14. $\forall x \neg Rax$
15. $\forall x(Cx \rightarrow \neg Rax)$, or $\neg \exists x(Cx \& Rax)$
16. $\forall x(Cx \rightarrow (Rxa \& Lxb))$
17. $\exists x \exists y(Cx \& Cy \& x \neq y)$
18. $\forall x((Sx \& Cx) \rightarrow \exists y((Ly \& Cy) \& Bxy))$
19. $\exists x(Cx \& \forall y(Ty \rightarrow Fxy))$
20. $\forall x((Cx \& \forall y(Ty \rightarrow Fxy)) \rightarrow Lx)$
21. $\forall x(\exists y((Ly \& Cy) \& Rxy) \rightarrow Sx)$
22. $\forall x(\neg \exists y Byx \rightarrow Cx)$
23. $\forall x(Dx \rightarrow \exists y(Ty \& Lxy))$
24. $\forall y \neg \exists x(Dx \& Byx)$ or $\neg \exists x(Dx \& \exists y Byx)$ or $\forall y \forall x(Dx \rightarrow \neg Byx)$ or $\forall x(Dx \rightarrow \neg \exists y Byx)$
[all equivalent]
25. $\forall x((Cx \& \exists y Byx) \rightarrow Sx)$
26. $\forall x((Dx \& \neg \exists y Ryx) \rightarrow \exists z Lzx)$
27. $\forall x(\neg \exists y Fyx \rightarrow Lx)$
28. $\forall x \forall y((Cx \& Bxy) \rightarrow Lxy)$
29. $\forall x((Lx \& Cx) \rightarrow (x=b \vee x=c)) \& Lb \& Lc$
30. $\exists x \exists y \exists z(Tx \& Ty \& Tz \& x \neq y \& y \neq z \& x \neq z)$