

## Philosophy 500 — June 7 Solutions

### Exercises

UD: all people      Bx: x is a bouncer.      Ixyz: x introduced y to z.  
a: Alice      Mx: x is a merchant      Kxy: x knows y.  
b: Betty      Px: x is a plumber.      Lxy: x likes y.  
c: Chris      Tx: x is tall.      Oxy: x is older than y.

1. Anyone who like Alice also likes some bouncer older than Chris.  
 $\forall x(Lxa \rightarrow (x \text{ likes some bouncer older than Chris}))$   
 $\forall x(Lxa \rightarrow \exists y(By \ \& \ Oyc \ \& \ Lxy))$
2. No bouncer whom Betty knows likes anyone whom Alice likes.  
 $\neg \exists x(Bx \ \& \ Kbx \ \& \ (x \text{ likes someone Alice likes}))$   
 $\neg \exists x(Bx \ \& \ Kbx \ \& \ \exists y(Lxy \ \& \ Lay))$
3. Only tall plumbers introduced merchants to Betty.  
 $\forall x((x \text{ introduced merchants to Betty}) \rightarrow (Px \ \& \ Tx))$   
 $\forall x(\exists y(My \ \& \ Ixyb) \rightarrow (Px \ \& \ Tx))$
4. Everyone knows someone who knows someone who knows Chris.  
 $\forall x(x \text{ knows someone who knows someone who knows Chris})$   
 $\forall x(\exists y[Kxy \ \& \ (y \text{ knows someone who knows Chris})])$   
 $\forall x(\exists y[Kxy \ \& \ \exists z(Kyz \ \& \ Kzc)])$
5. Some bouncer who's liked by a merchant is older than every plumber.  
 $\exists x(Bx \ \& \ (x \text{ is liked by a merchant}) \ \& \ (x \text{ is older than every plumber}))$   
 $\exists x(Bx \ \& \ \exists y(My \ \& \ Lyx) \ \& \ \forall y(Py \rightarrow Oxy))$
6. Betty doesn't like any merchants who were introduced to her by a tall plumber.  
 $\neg \exists x(Mx \ \& \ (x \text{ was introduced to Betty by a tall plumber}) \ \& \ Lbx)$   
 $\neg \exists x(Mx \ \& \ \exists y(Py \ \& \ Ty \ \& \ Iyxb \ \& \ Lbx))$
7. If any merchant likes every tall bouncer, then Alice knows every plumber.  
 $\exists x[Mx \ \& \ (x \text{ likes every tall bouncer})] \rightarrow \forall x(Px \rightarrow Kax)$   
 $\exists x[Mx \ \& \ \forall y((By \ \& \ Ty) \rightarrow Lxy)] \rightarrow \forall x(Px \rightarrow Kax)$
8. Chris was introduced to everyone he knows.  
 $\forall x(Lcx \rightarrow (\text{someone introduced Chris to } x))$   
 $\forall x(Lcx \rightarrow \exists y(Iycx))$
9. Not everyone whom Alice likes knows someone older than Chris who likes Betty.  
 $\neg \forall x(Lax \rightarrow (x \text{ knows someone older than Chris who likes Betty}))$   
 $\neg \forall x(Lax \rightarrow \exists y(Kxy \ \& \ Oyc \ \& \ Lyb))$
10. Some bouncers who where introduced to everyone are older than Betty.  
 $\exists x(Bx \ \& \ (x \text{ was introduced to everyone}) \ \& \ Oxb)$   
 $\exists x(Bx \ \& \ \forall y(\text{someone introduced } x \text{ to } y) \ \& \ Oxb)$   
 $\exists x(Bx \ \& \ \forall y(\exists z(Izxy)) \ \& \ Oxb)$
11. No plumber who's tall is older than everyone whom Chris knows.  
 $\neg \exists x(Px \ \& \ Tx \ \& \ (x \text{ is older tan everyone whom Chris knows}))$

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12. Some merchant likes everyone they know who likes someone older than Alice.  
 $\exists x(Mx \& (x \text{ likes everyone they know who likes someone older than Alice}))$   
 $\exists x(Mx \& \forall y[(Kxy \& (y \text{ likes someone older than Alice})) \rightarrow Lxy])$   
 $\exists x(Mx \& \forall y[(Kxy \& \exists z(Oza \& Lyz)) \rightarrow Lxy])$
  13. Unless some bouncer knows everyone who likes them, Alice doesn't like any merchants.  
 $\exists x(Bx \& (x \text{ knows everyone who likes } x)) \vee \neg \exists x(Mx \& Lax)$   
 $\exists x(Bx \& \forall y(Lyx \rightarrow Kxy)) \vee \neg \exists x(Mx \& Lax)$
  14. If any plumber who likes Alice also likes themselves, they are older than Chris.  
 $\forall x[(Px \& Lxa \& Lxx) \rightarrow (Oxc)]$
  15. Someone who was introduced to Betty likes every merchant.  
 $\exists x((\text{someone introduced } x \text{ to Betty}) \& (x \text{ likes every merchant}))$   
 $\exists x(\exists y(Iyxb) \& \forall y(My \rightarrow Lxk))$
  16. No tall person likes every plumber, unless that person is older than Alice.  
 $\neg \exists x(Tx \& (x \text{ likes every plumber}) \& \neg Oxa)$   
 $\neg \exists x(Tx \& \forall y(Py \rightarrow Lxy) \& \neg Oxa)$
  17. Any bouncers who likes everyone they know are older than everyone who likes them.f  
 $\forall x([Bx \& (x \text{ likes everyone } x \text{ knows})] \rightarrow (x \text{ is older than everyone who likes } x))$   
 $\forall x([Bx \& \forall y(Kxy \rightarrow Lxy)] \rightarrow \forall y(Lyx \rightarrow Oxy))$
  18. Alice introduced Betty to all the plumbers she knows.  
*This is ambiguous, depending on whether "she" refers to Betty or to Alice:*  
 $\forall x((Px \& Kax) \rightarrow Iabx)$   
 $\forall x((Px \& Kbx) \rightarrow Iabx)$