

### 7.3.xa. Exercise answers

1. a. *Not everyone was enthusiastic but no one was disappointed*

*Not everyone was enthusiastic*  $\wedge$  *no one was disappointed*

$\neg$  *everyone was enthusiastic*  $\wedge$  ( $\forall x$ : *x is a person*)  $\neg$  *x was disappointed*

$\neg$  ( $\forall x$ : *x is a person*) *x was enthusiastic*  $\wedge$  ( $\forall x$ : *x is a person*)  $\neg$  *x was disappointed*

$\neg$  ( $\forall x$ : Px) Ex  $\wedge$  ( $\forall x$ : Px)  $\neg$  Dx

$\neg$   $\forall x$  (Px  $\rightarrow$  Ex)  $\wedge$   $\forall x$  (Px  $\rightarrow$   $\neg$  Dx)

[D:  $\lambda x$  (*x was disappointed*); E:  $\lambda x$  (*x was enthusiastic*);

P:  $\lambda x$  (*x is a person*)]

- b. *Any defective unit will be repaired or replaced*

( $\forall x$ : *x is a defective unit*) *x will be repaired or replaced*

( $\forall x$ : *x is a unit*  $\wedge$  *x is defective*) (*x will be repaired*  $\vee$  *x will be replaced*)

( $\forall x$ : Ux  $\wedge$  Dx) (Px  $\vee$  Lx)

$\forall x$  ((Ux  $\wedge$  Dx)  $\rightarrow$  (Px  $\vee$  Lx))

[D:  $\lambda x$  (*x is defective*); L:  $\lambda x$  (*x will be replaced*); P:  $\lambda x$  (*x will be repaired*); U:  $\lambda x$  (*x is a unit*)]

- c. *The bill will pass quickly if every member of the committee supports it*

The bill will pass quickly  $\leftarrow$  *every member of the committee will support the bill*

Pb  $\leftarrow$  ( $\forall x$ : *x is a member of the committee*) *x will support the bill*

Pb  $\leftarrow$  ( $\forall x$ : Mxc) Sxb

( $\forall x$ : Mxc) Sxb  $\rightarrow$  Pb

$\forall x$  (Mxc  $\rightarrow$  Sxb)  $\rightarrow$  Pb

[M:  $\lambda xy$  (*x is a member of y*); P:  $\lambda x$  (*x will pass quickly*);

S:  $\lambda xy$  (*x will support y*); b: *the bill*; c: *the committee*]

- d. *Nothing suited both Ann and Bill.*

$\forall x$   $\neg$  *x suited both Ann and Bill*

$\forall x$   $\neg$  (*x suited Ann*  $\wedge$  *x suited Bill*)

$\forall x$   $\neg$  (Sxa  $\wedge$  Sxb)

[S:  $\lambda xy$  (*x suited y*); a: *Ann*; b: *Bill*]

- e. *Tom didn't sign up anyone; however, he didn't contact everyone*

*Tom didn't sign up anyone*  $\wedge$  *Tom didn't contact everyone*  
*everyone is such that (Tom didn't sign up him or her)  $\wedge$*   
 $\neg$  *Tom contacted everyone*

$(\forall x: \underline{x} \text{ is a person}) \neg \underline{\text{Tom}} \text{ signed up } \underline{x} \wedge \neg (\forall x: \underline{x} \text{ is a person}) \underline{\text{Tom}} \text{ contacted } \underline{x}$

$(\forall x: Px) \neg Stx \wedge \neg (\forall x: Px) Ctx$

$\forall x (Px \rightarrow \neg Stx) \wedge \neg \forall x (Px \rightarrow Ctx)$

[C:  $\lambda xy$  (x contacted y); P:  $\lambda x$  (x is a person); S:  $\lambda xy$  (x signed up y)]

- f. *If a bill arrives, it will be forwarded to you*

*Every bill is such that (if it arrives, it will be forwarded to you)*

$(\forall x: x \text{ is a bill})$  (if x arrives, x will be forwarded to you)

$(\forall x: Bx)$  ( $\underline{x}$  will arrive  $\rightarrow$   $\underline{x}$  will be forwarded to you)

$(\forall x: Bx) (Ax \rightarrow Fxo)$

$\forall x (Bx \rightarrow (Ax \rightarrow Fxo))$

[A:  $\lambda x$  (x will arrive); B:  $\lambda x$  (x is a bill); F:  $\lambda xy$  (x will be forwarded to y); o: you]

- g. *If the prize isn't won by anyone, it will be added to the next drawing*

*the prize won't be won by anyone  $\rightarrow$  the prize will be added to the next drawing*

*everyone is such that (the prize won't be won by him or her)  $\rightarrow$  Apn*

$(\forall x: x \text{ is a person})$  the prize won't be won by x  $\rightarrow$  Apn

$(\forall x: Px) \neg$  the prize will be won by  $\underline{x} \rightarrow$  Apn

$(\forall x: Px) \neg Wpx \rightarrow Apn$

$\forall x (Px \rightarrow \neg Wpx) \rightarrow Apn$

[A:  $\lambda xy$  (x will be added to y); P:  $\lambda x$  (x is a person); W:  $\lambda xy$  (x will be won by y); n: the next drawing; p: the prize]

- h. *Ralph looked in every closet and cabinet*

*Ralph looked in every closet  $\wedge$  Ralph looked in every cabinet*

$(\forall x: \underline{x} \text{ is a closet})$  Ralph looked in  $\underline{x} \wedge (\forall x: \underline{x} \text{ is a cabinet})$   
Ralph looked in  $\underline{x}$

$$(\forall x: Sx) Lrx \wedge (\forall x: Bx) Lrx$$

$$\forall x (Sx \rightarrow Lrx) \wedge \forall x (Bx \rightarrow Lrx)$$

or:  $(\forall x: Sx \vee Bx) Lrx$

[B:  $\lambda x (x \text{ is a cabinet})$ ; L:  $\lambda xy (x \text{ looked in } y)$ ; S:  $\lambda x (x \text{ is a closet})$ ; r: *Ralph*]

- i. *The alarm will sound if anyone who doesn't have the combination tries to open the door*  
*everyone who doesn't have the combination is such that*  
*(the alarm will sound if he or she tries to open the door)*

$(\forall x: x \text{ is a person who doesn't have the combination})$  *the alarm will sound if x tries to open the door*

$(\forall x: x \text{ is a person} \wedge x \text{ doesn't have the combination})$  (the alarm will sound  $\leftarrow$  x will try to open the door)

$(\forall x: \underline{x} \text{ is a person} \wedge \neg \underline{x} \text{ has the combination})$  ( $Sa \leftarrow Txd$ )

$$(\forall x: Px \wedge \neg Hxc) (Sa \leftarrow Txd)$$

$$(\forall x: Px \wedge \neg Hxc) (Txd \rightarrow Sa)$$

$$\forall x ((Px \wedge \neg Hxc) \rightarrow (Txd \rightarrow Sa))$$

[H:  $\lambda xy (x \text{ has } y)$ ; P:  $\lambda x (x \text{ is a person})$ ; S:  $\lambda x (x \text{ will sound})$ ; T:  $\lambda xy (x \text{ will try to open } y)$ ; a: *the alarm*; c: *the combination*; d: *the door*]

2. a.  $\neg (\forall x: x \text{ glitters}) x \text{ is gold}$   
 $\neg$  *everything that glitters is gold*

*Not everything that glitters is gold*

or: *All that glitters is not gold*

[However, negating the main the verb is not always the clearest way of denying a generalization; for example, *Everyone was not in the best of moods* could be understood either as saying that not everyone was in the best of moods or as saying that no one was.]

Note also that we here treat the restricting predicate *glitters* as if it were *x is a thing that glitters*; this sort of use of the class indicator *thing* is always possible when the restricting predicate does not already provide a common noun.

- b.  $(\forall x: x \text{ is a dog} \wedge x \text{ was in the cage}) x \text{ barked} \wedge (\forall x: x \text{ is a dog} \wedge x \text{ was in the cage}) x \text{ wagged } x\text{'s tail}$   
 $(\forall x: x \text{ is a dog that was in the cage}) x \text{ barked} \wedge (\forall x: x \text{ is a dog that was in the cage}) x \text{ wagged } x\text{'s tail}$

*Every dog that was in the cage barked  $\wedge$  every dog that was in the cage wagged its tail*

*Every dog in the cage barked, and each wagged its tail*  
or: *Every dog in the cage barked and wagged its tail*

[However, the latter sentence would be more naturally analyzed as having the form  $(\forall x: Dx \wedge Nxc) (Bx \wedge Wx)$ .]

c.  $\forall x \neg$  *Tom let x stop Tom*

$\forall x$  *Tom didn't let x stop him*

*Tom didn't let anything stop him*

or: *Tom let nothing stop him*

d.  $(\forall x: x$  *is a federal project  $\wedge \neg$  x is a road)  $\neg$  x is finished*

$(\forall x: x$  *is a federal project that is not a road) x is unfinished*

*Every federal project that is not a road is unfinished*

or: *No federal projects except roads are finished*

[The latter approach—capturing the negation by a negative generalization—helps to avoid ambiguity in cases where an explicit negation would have to apply to the main verb, as in  $(\forall x: x$  *is a federal project  $\wedge \neg$  x is a road)  $\neg$  x is under way*]

e.  $\forall x (x$  *was left on the roof  $\rightarrow$  x is gone for good)*

$\forall x$  *(if x was left on the roof then x is gone for good)*

*If anything was left on the roof then it is gone for good*

or: *Anything that was left on the roof is gone for good*

f.  $(\forall x: x$  *is a person  $\wedge$  Tom met x) (Tom knew x  $\vee$  x knew Tom)*

$(\forall x: x$  *is a person Tom met) Tom knew or was known by x*

*Tom knew or was known by everyone he met*