

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 $(\forall x: x \text{ is a person}) \neg x \text{ was disappointed}$
 $\neg (\forall x: x \text{ is a person}) x \text{ was enthusiastic} \wedge (\forall x: x \text{ is a person}) \neg x \text{ was disappointed}$

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

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

[D: λx (x was disappointed); E: λx (x was enthusiastic); P: λx (x is a person)]

- b. *Any defective unit will be repaired or replaced*
 $(\forall x: x \text{ is a defective unit}) x \text{ will be repaired or replaced}$
 $(\forall x: x \text{ is a unit} \wedge x \text{ is defective}) (x \text{ will be repaired} \vee x \text{ will be replaced})$

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

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

[D: λx (x is defective); L: λx (x will be replaced); P: λx (x will be repaired); U: λx (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*
 $Pb \leftarrow (\forall x: \underline{x} \text{ is a member of the committee}) \underline{x} \text{ will support the bill}$

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

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

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

[M: λxy (x is a member of y); P: λx (x will pass quickly); S: λxy (x will support y); b: the bill; c: the committee]

- d. *Nothing suited both Ann and Bill.*
 $\forall x \neg x \text{ suited both Ann and Bill}$
 $\forall x \neg (\underline{x} \text{ suited Ann} \wedge \underline{x} \text{ suited Bill})$

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

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

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

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

[C: λxy (x contacted y); P: λx (x is a person); S: λxy (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: λx (x will arrive); B: λx (x is a bill); F: λxy (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
 $(\forall x: Px) \neg \underline{\text{the prize will be won by } x} \rightarrow \text{Apn}$

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

$$\forall x (Px \rightarrow \neg Wpx) \rightarrow \text{Apn}$$

[A: λxy (x will be added to y); P: λx (x is a person); W: λxy (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: λx (x is a cabinet); L: λxy (x looked in y); S: λx (x 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)*
 $(\forall x: \underline{x} \text{ is a person} \wedge \neg \underline{x} \text{ has } \underline{\text{the combination}})$ $(Sa \leftarrow Txd)$

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

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

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

[H: λxy (x has y); P: λx (x is a person); S: λx (x will sound); T: λxy (x will try to open y); a: *the alarm*; c: *the combination*; d: *the door*]

2. a. $\neg (\forall x: x \text{ glitters})$ *x 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 x *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 barked* \wedge $(\forall x: x \text{ is a dog} \wedge x \text{ was in the cage})$ *x wagged x's tail*
 $(\forall x: x \text{ is a dog that was in the cage})$ *x barked* \wedge $(\forall x: x \text{ is a dog that was in the cage})$ *x wagged x's tail*
Every dog that was in the cage barked \wedge *every dog that was in the cage wagged it's tail*

Every dog in the cage barked, and each wagged it's tail
or: Every dog in the cage barked and wagged it's 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