

## 7.2.xa. Exercise answers

1. a.  $\forall x (Fx \rightarrow Gx)$   
Everything, x, is such that if Fx [or: F fits x] then Gx
- b.  $(\forall x: Fx) \rightarrow Gx$   
Everything, x, such that Fx is such that not Gx
- c.  $\forall x ((Fx \wedge \neg Gx) \rightarrow Hx)$   
Everything, x, is such that if both Fx and not Gx then Hx
- d.  $(\forall x: Px \wedge \neg Rxx) Rxa$   
Everything, x, such that both Px and not Rxx is such that Rxa
- e.  $\forall x ((Rxa \wedge \neg Rbx) \rightarrow \neg (Fx \vee Gx))$   
Everything, x, is such that if both Rxa and not Rbx then not either Fx or Gx
- f.  $(\forall x: Fx \vee Gx) (Hx \wedge \neg Kx)$   
Everything, x, such that either Fx or Gx is such that both Hx and not Kx

2. a. *Everyone had heard about the accident*  
*Everyone is such that (he or she had heard about the accident)*  
 $(\forall x: \underline{x} \text{ is a person}) \underline{x} \text{ had heard about } \underline{\text{the accident}}$

$$(\forall x: Px) Hxa$$

$$\forall x (Px \rightarrow Hxa)$$

[H:  $\lambda xy (x \text{ had heard about } y)$ ; P:  $\lambda x (x \text{ is a person})$ ; a: *the accident*]

- b. *Every relative of Sam agreed with him about the issue*  
*Every relative of Sam is such that (he or she agreed with Sam about the issue)*  
 $(\forall x: \underline{x} \text{ is a relative of } \underline{\text{Sam}}) \underline{x} \text{ agreed with } \underline{\text{Sam}} \text{ about } \underline{\text{the issue}}$

$$(\forall x: Rxs) Ahsi$$

$$\forall x (Rxs \rightarrow Ahsi)$$

[A:  $\lambda xyz (x \text{ agreed with } y \text{ about } z)$ ; R:  $\lambda xy (x \text{ is a relative of } y)$ ; i: *the issue*; s: *Sam*]

- c. *Edna took pleasure in none of her possessions*  
*No possession of Edna is such that (Edna took pleasure in it)*  
*( $\forall x$ : x is a possession of Edna)  $\neg$  Edna took pleasure in x*

$$\begin{aligned} & (\forall x: Pxe) \neg Lex \\ & \forall x (Pxe \rightarrow \neg Lex) \end{aligned}$$

[L:  $\lambda xy$  (x took pleasure in y); P:  $\lambda xy$  (x is a possession of y);  
e: Edna]

- d. *Tom found only empty boxes*  
*Among boxes, only empty ones are such that (Tom found them)*  
*( $\forall x$ : x is a box  $\wedge$   $\neg$  x is empty)  $\neg$  Tom found x*

$$\begin{aligned} & (\forall x: Bx \wedge \neg Ex) \neg Ftx \\ & \forall x ((Bx \wedge \neg Ex) \rightarrow \neg Ftx) \end{aligned}$$

[B:  $\lambda x$  (x is a box); E:  $\lambda x$  (x is empty); F:  $\lambda x$  (x found y); t:  
Tom]

- e. *The survey was sent to all members of the organization except its officers*  
*All members of the organization except the organization's officers are such that (the survey was sent to them)*  
*( $\forall x$ : x is a member of the organization  $\wedge$   $\neg$  x is an officer of the organization) the survey was sent to x*

$$\begin{aligned} & (\forall x: Mxo \wedge \neg Oxo) Ssx \\ & \forall x ((Mxo \wedge \neg Oxo) \rightarrow Ssx) \end{aligned}$$

[M:  $\lambda xy$  (x is a member of y); O:  $\lambda xy$  (x is an officer of y); S:  
 $\lambda xy$  (x was sent to y); o: the organization; s: the survey]

- f. *Only countries bordering the Pacific will prosper*  
*Among countries, only those bordering the Pacific are such that (they will prosper)*  
*( $\forall x$ : x is a country  $\wedge$   $\neg$  x borders the Pacific)  $\neg$  x will prosper*

$$\begin{aligned} & (\forall x: Cx \wedge \neg Bxp) \neg Px \\ & \forall x ((Cx \wedge \neg Bxp) \rightarrow \neg Px) \end{aligned}$$

[B:  $\lambda xy$  (x borders y); C:  $\lambda x$  (x is a country); P:  $\lambda x$  (x will prosper); p: the Pacific]

3. a. *( $\forall x$ : x is a dog) x chases cats*  
*Every dog is such that (it chases cats)*  
*Every dog chases cats (or: All dogs chase cats; or: Dogs chase cats)*

- b.**  $(\forall x: x \text{ is a hole})$  Holly patched x  
*Every hole is such that (Holly patched it)*  
*Holly patched every hole (or: Holly patched each hole)*
- c.**  $(\forall x: x \text{ is a person}) \neg x$  volunteered  
*No one is such that (he or she volunteered)*  
*No one volunteered.*
- d.**  $(\forall x: \neg x \text{ is a cockroach}) \neg x$  will survive  
*Only cockroaches are such that (they will survive)*  
*Only cockroaches will survive*
- e.**  $\forall x \neg x$  seemed right  
*Nothing is such that (it seemed right)*  
*Nothing seemed right*
- f.**  $(\forall x: x \text{ was a reviewer} \wedge \neg x \text{ was a friend of the director}) x$   
 panned the movie  
*All reviewers except friends of the director are such that*  
*(they panned the movie)*  
*All reviewers except friends of the director panned the movie*  
*(or: Among reviewers, all but friends of the director panned*  
*the movie)*
- g.**  $(\forall x: x \text{ is a bird} \wedge \neg x \text{ is an early bird}) \neg x$  gets a worm  
*Among birds, only early ones are such that (they get worms)*  
*Only early birds get worms (or: No birds except early ones*  
*get worms)*
- h.**  $(\forall x: \neg x \text{ is a small child})$  the movie bored x  
*All things except small children are such that (the movie*  
*bored them)*  
*The movie bored all but small children*