7.2.xa. Exercise answers

1. **a.** $\forall x\,(Fx \to Gx)$
      `Everything`, x, `is such that if` Fx [*or:* F `fits` x] `then` Gx

    b. $(\forall x: Fx)\, \neg\, Gx$
      `Everything`, x, `such that` F x `is such that not` Gx

    c. $\forall x\,((Fx \wedge \neg\, Gx) \to Hx)$
      `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. $\forall x\,((Rxa \wedge \neg\, Rbx) \to \neg\,(Fx \vee Gx))$
      `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)
      $(\forall x:$ <u>x *is a person*</u>$)$ <u>x</u> *had heard about* <u>*the accident*</u>

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

      [H: λxy (x *had heard about* y); P: λx (x *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)
      $(\forall x:$ <u>x *is a relative of* <u>Sam</u></u>$)$ <u>x</u> *agreed with* <u>Sam</u> *about* <u>*the issue*</u>

      $$(\forall x: Rxs)\, Axsi$$
      $$\forall x\,(Rxs \to Axsi)$$

      [A: λxyz (x *agreed with* y *about* z); R: λxy (x *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)
(∀x: x *is a possession of* <u>Edna</u>) ¬ <u>Edna</u> *took pleasure in*
<u>x</u>

$$(\forall x: Pxe) \neg Lex$$
$$\forall x (Pxe \rightarrow \neg Lex)$$

[L: λxy (x *took pleasure in* y); P: λxy (x *is a possession*
of y); e: *Edna*]

d. *Tom found only* <u>empty</u> *boxes*
Among boxes, only empty ones are such that (Tom
found them)
(∀x: x *is a box* ∧ ¬ x *is empty*) ¬ <u>Tom</u> *found* <u>x</u>

$$(\forall x: Bx \wedge \neg Ex) \neg Ftx$$
$$\forall x ((Bx \wedge \neg Ex) \rightarrow \neg Ftx)$$

[B: λx (x *is a box*); E: λx (x *is empty*); F: λx (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)
(∀x: x *is a member of* <u>the organization</u> ∧ ¬ <u>x</u> *is an*
officer of <u>the organization</u>) <u>the survey</u> *was sent to* <u>x</u>

$$(\forall x: Mxo \wedge \neg Oxo) Ssx$$
$$\forall x ((Mxo \wedge \neg Oxo) \rightarrow Ssx)$$

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

f. *Only countries* <u>bordering the Pacific</u> *will prosper*
Among countries, only those bordering the Pacific are
such that (they will prosper)
(∀x: x *is a country* ∧ ¬ <u>x</u> *borders* <u>the Pacific</u>) ¬ <u>x</u> *will*
prosper

$$(\forall x: Cx \wedge \neg Bxp) \neg Px$$
$$\forall x ((Cx \wedge \neg Bxp) \rightarrow \neg Px)$$

[B: λxy (x *borders* y); C: λx (x *is a country*); P: λx (x

will prosper); p: *the Pacific*]

3. **a.** (∀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. (∀x: x *is a hole*) *Holly patched* x
Every hole is such that (Holly patched it)
Holly patched every hole (*or: Holly patched each hole*)

c. (∀x: x *is a person*) ¬ x *volunteered*
No one is such that (he or she volunteered)
No one volunteered.

d. (∀x: ¬ x *is a cockroach*) ¬ x *will survive*
Only cockroaches are such that (they will survive)
Only cockroaches will survive

e. ∀x ¬ x *seemed right*
Nothing is such that (it seemed right)
Nothing seemed right

f. (∀x: x *was a reviewer* ∧ ¬ x *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. (∀x: x *is a bird* ∧ ¬ x *is an early bird*) ¬ x *gets a worm*
Among birds, only early ones are such that (they get
worms)
Only <u>early</u> birds get worms (*or: No birds except early*
ones get worms)

h. (∀x: ¬ x *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