

## 5.2.xa. Exercise answers

1. a. *Tom was late*  $\leftarrow \neg$  *Tom left early*

$$L \leftarrow \neg E$$

$$\neg E \rightarrow L$$

if not E then L

[E: *Tom left early*; L: *Tom was late*]

- b.  $\neg$  *you'll get a good picture*  $\leftarrow \neg$  *you'll take the cap off the lens*

$$\neg P \leftarrow \neg C$$

$$\neg C \rightarrow \neg P$$

if not C then not P

[C: *you'll take the cap off the lens*; P: *you'll get a good picture*]

- c. *Neither Ann nor Bill knew of it*  $\leftarrow \neg$  *Ann and Bill both knew of it*

$$\neg (A \vee B) \leftarrow \neg (A \wedge B)$$

$$\neg (A \wedge B) \rightarrow \neg (A \vee B)$$

$$\neg (A \wedge B) \rightarrow \neg (A \vee B)$$

if not both A and B then not either A or B

[A: *Ann knew of it*; B: *Bill knew of it*]

- d. *The bill will pass if the chairman supports it*  $\leftarrow \neg$  *public opinion will run heavily against the bill*  
(*the bill will pass*  $\leftarrow$  *the chairman will support the bill*)  $\leftarrow \neg$  A

$$(P \leftarrow S) \leftarrow \neg A$$

$$\neg A \rightarrow (S \rightarrow P)$$

if not A then if S then P

[A: *public opinion will run heavily against the bill*; P: *the bill will pass*; S: *the chairman will support the bill*]

- e.  $\neg$  *Ed will be late*  $\rightarrow$  *we'll get started on time and finish early if there isn't a lot of business*

$$\neg L \rightarrow (T \wedge (we'll get started on time \wedge we'll finish early if there isn't a lot of business))$$

$$\neg L \rightarrow (T \wedge (we'll finish early \leftarrow there won't be a lot of business))$$

$$\neg L \rightarrow (T \wedge (F \leftarrow \neg there will be a lot of business))$$

$$\neg L \rightarrow (T \wedge (F \leftarrow \neg B))$$

$$\neg L \rightarrow (T \wedge (\neg B \rightarrow F))$$

if not L then both T and if not B then F  
 [B: *there will be a lot of business*; F: *we'll finish early*; L: *Ed will be late*; T: *we'll get started on time*]

It would be possible to understand the sentence to make the whole of *we'll get started on time and finish early* conditional on *there won't be a lot of business*. On that interpretation, the form would be  $\neg L \rightarrow (\neg B \rightarrow (T \wedge F))$ . However, the interpretation used above fits better with common sense expectations concerning the content, and that is often the grounds on which ambiguous sentences are understood in a particular way.

- f. *Bob was under no obligation to help*  $\rightarrow$  *Bob worked only if he was in a good mood and had nothing to do*

$$\neg O \rightarrow (\neg W \leftarrow \neg (G \wedge \neg S))$$

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$$\neg O \rightarrow (\neg (G \wedge \neg S) \rightarrow \neg W)$$

if not O then if not both G and not S then not W

[O: *Bob was under an obligation to help*; G: *Bob was in a good mood*; S: *Bob had something to do*; W: *Bob worked*]

3. a.  $\neg I \rightarrow \neg B$   
*Unless I see it, I won't believe it*  
 or: *I'll believe it only if I see it*

- b.  $\neg W \leftarrow \neg (P \wedge \neg B)$   
*the set works*  $\leftarrow$   $\neg$  (*the set is plugged in*  $\wedge$   $\neg$  *the set is broken*)

$$\neg W \leftarrow \neg (P \wedge \neg B)$$

$$\neg W \leftarrow \neg (P \wedge \neg B)$$

*The set works only if it is plugged in and isn't broken*

or: *The set doesn't work unless it is plugged in and isn't broken*

c.  $\neg$  (*Adams will back out*  $\vee$  *Brown will back out*)  $\rightarrow$  (*the deal will go through*  $\leftarrow$   $\neg$  (*Collins will have trouble with financing*  $\vee$  *Davis will have trouble with financing*))

$\neg$  *Adams or Brown will back out*  $\rightarrow$  (*the deal will go through*  $\leftarrow$   $\neg$  *Collins or Davis will have trouble with financing*)

*Unless Adams or Brown backs out, the deal will go through if neither Collins nor Davis has trouble with financing*

**or:** *If neither Adams nor Brown backs out, the deal will go through unless Collins or Davis has trouble with financing*

**or:** *Unless Adams nor Brown backs out, the deal will go through unless Collins or Davis has trouble with financing*