

5.2.xa. Exercise answers

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

$$\begin{aligned} L &\leftarrow \neg E \\ \neg E &\rightarrow L \\ \text{if not } E &\text{ then } L \end{aligned}$$

[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*

$$\begin{aligned} \neg P &\leftarrow \neg C \\ \neg C &\rightarrow \neg P \\ \text{if not } C &\text{ then not } P \end{aligned}$$

[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*

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

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

$$\begin{aligned} (P \leftarrow S) &\leftarrow \neg A \\ \neg A &\rightarrow (S \rightarrow P) \\ \text{if not } A &\text{ then if } S \text{ then } P \end{aligned}$$

[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*

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

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

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 *Bob was under an obligation to help* \rightarrow (\neg *Bob worked* \leftarrow \neg *Bob was in a good mood and had nothing to do*)
 \neg O \rightarrow (\neg W \leftarrow \neg (*Bob was in a good mood* \wedge *Bob had nothing to do*))
 \neg O \rightarrow (\neg W \leftarrow \neg (G \wedge \neg *Bob had something to do*))

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

\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'll see it* \rightarrow \neg *I'll believe it*
Unless I see it, I won't believe it
or: *I'll believe it only if I see it*
- b. \neg *the set works* \leftarrow \neg (*the set is plugged in* \wedge \neg *the set is broken*)
 \neg *the set works* \leftarrow \neg (*the set is plugged in* \wedge *the set isn't broken*)
 \neg *the set works* \leftarrow \neg (*the set is plugged in and isn't broken*)
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*

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