89 Formalize each of the following statements as a binary expression.

(a) Everybody loves somebody sometime.

(b) Every 10 minutes someone in New York City gets mugged.

(c) Every 10 minutes someone keeps trying to reach you.

(d) Whenever the altitude is below 1000 feet, the landing gear must be down.

(e) I'll see you on Tuesday, if not before.

(f) No news is good news.

(g) I don't agree with anything you say.

(h) I don't agree with everything you say.

After trying the question, scroll down to the solution.

(a) Everybody loves somebody sometime.

§ $\forall p: people\cdot \exists q: people\cdot \exists t: time\cdot (\ p\ \text{ loves }\ q\ \text{ at time }\ t\ )$

(b) Every 10 minutes someone in New York City gets mugged.

§ $\forall t: (\text{10 minute intervals})\cdot \exists p: (\text{people of New York City})\cdot (\ p\ \text{ gets mugged at time }\ t\ )$

More likely the speaker is trying to say

(a long time in minutes)

/ (the number of people in New York City who get mugged during that time)

= 10 approximately

(c) Every 10 minutes someone keeps trying to reach you.

§ $\exists p: people\cdot \forall t: (\text{10 minute intervals})\cdot (\ p\ \text{ tries to reach you at time }\ t\ )$

(d) Whenever the altitude is below 1000 feet, the landing gear must be down.

§ $\forall a: real\cdot a<1000 \Rightarrow (\text{gear down})$

(e) I'll see you on Tuesday, if not before.

§ Let s be a predicate of time, so that $s\ t$ means I'll see you at time t . If the given statement means I'll see you on Tuesday regardless of whether I see you before, then

s Tuesday

But if it means I'll see you sometime between now and then,

$\exists t\cdot \text{now} < t \le \text{Tuesday} \ \wedge\ s\ t$

(f) No news is good news.

§ Maybe this means the same as “There's no such thing as good news.”. If so, we might formalize it as

$\neg\exists n: news\cdot good\ n$

where *news* is all the news and *good* is a predicate over *news* . But I think it was intended to mean the same as “The fact that there isn't any news is a piece of good news.”. I'll let *news*: **char* be a bunch of texts. Then we might formalize it as

“*news=null*”: *news* $\wedge$ *good* “*news=null*”

Or it might mean “If there isn't any news then that will be a piece of good news.”.

news=null $\Rightarrow$ “*news=null*”: *news* $\wedge$ *good* “*news=null*”

If “*news=null*”: *news* then *news=null* is false, so “*news=null*” is false news, but there's no logical inconsistency.

(g) I don't agree with anything you say.

§ Introduce prefix operators *Iagreewith* and *Yousay* .

$\forall x\cdot\ \neg(Iagreewith\ x) \ \Leftarrow\ (Yousay\ x)$

(h) I don't agree with everything you say.

§ Introduce prefix operators *Iagreewith* and *Yousay* . It seems to me there are two possible interpretations for the sentence. One is the same as part (g).

$\forall x\cdot\ \neg(Iagreewith\ x) \ \Leftarrow\ (Yousay\ x)$

The other is

$\neg\forall x\cdot\ (Iagreewith\ x) \ \Leftarrow\ (Yousay\ x)$

They are not equivalent. To decide between them requires more context.