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Translate English sentences with no ambiguity into compound propositions.

1. Eleanor is clever but not hard working.

c: Eleanor is clever. h: Eleanor is hard working.

$(c \wedge (\neg h))$

2. Sean will eat an apple or an orange but not both.

a: Sean will eat an apple. o: Sean will eat an orange.

There are many solutions: (It's an exclusive or.)

$((a \vee o) \wedge (\neg(a \wedge o)))$

$\equiv ((a \vee o) \wedge ((\neg a) \vee (\neg o)))$ "$\equiv$" means "is logically equivalent to".

$\equiv ((a \wedge (\neg o)) \vee ((\neg a) \wedge o))$

$\equiv (\neg(a \leftrightarrow o))$

3. If Tom does not study hard, then he will fail.

if a then b $\equiv (a \rightarrow b)$

s: Tom studies hard. f: Tom will fail.

$((\neg s) \rightarrow f) \equiv ((\neg(\neg s)) \vee f) \equiv (s \vee f)$

↑ definition of $\rightarrow$ ↑ double negation.

4. Tom will fail unless he studies hard.

unless $\equiv$ or

We use the same definitions as 3.

$(f \vee s) \equiv (s \vee f)$ (by commutativity.)

5. Tom will not fail only if he studies hard.

We use the same definitions as 3.

$((\neg f) \rightarrow s) \equiv ((\neg(\neg f)) \vee s) \equiv (f \vee s) \equiv (s \vee f)$

↑ definition of $\rightarrow$ ↑ double negation ↑ commutativity.

a only if b $\equiv (a \rightarrow b)$