

Translating Between English and Propositional Logic

Scott Martin

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English Sentences Expressing Complex Propositions and Their Usual PL Counterparts

Translating the Connectives

Negation

(In the following, E and F abbreviate English declaratives that are translated into PL as P and Q , respectively.)

- Negation is easy to recognize because it almost always includes the word *not* or morphemes like *un-*, *ir-*, etc.
- For example, *it's not the case that E* or *it's not true that E* .
- Other instances include declarative expressions containing an embedded *not*. Example:
 - (1) a. Clint went to the Chatterbox Cafe.
b. Clint did not go to the Chatterbox Cafe.
- If (1a) is translated as P , then (1b) is translated as $\neg P$.

Conjunction

- Conjunction sometimes involves the word *and*, **but not always**.
- If E and F are English declaratives, then *E and F* , *E but F* , *E nonetheless F* , *E however F* , *E nevertheless F* , and *E moreover F* are all translated as PL conjunctions. For example:
 - (2) Pastor Ingqvist is a Lutheran but Father Wilmer is not.
- If *Pastor Ingqvist is a Lutheran* is translated as P and *Father Wilmer is a Lutheran* as Q , then (2) is translated as $P \wedge \neg Q$.

Disjunction

- Disjunction usually involves the word *or* (but is inclusive in PL). Sentences like *E or F* and *either E or F* are translated using *or* as $P \vee Q$.

Implication

- Implication is used to capture conditionality.
- English sentences like the following are all translated using PL implication: *if E then F*; *F provided that E*; *assuming E, F*; *E only if F*; *F if E*; and *F given E*.
- (3) Wally eats Powdermilk biscuits only if Evelyn makes them.
- With *Wally eats Powdermilk biscuits* as P and *Evelyn makes them* as Q , we translate (3) into PL as $P \rightarrow Q$.

Biimplication

- Biimplication makes a stronger claim than the conditional. It's used to translate English sentences of the form *E if and only if F* and *E just in case F*.

Note

Translating certain English constructions into PL may involving combining one or more of the approaches described above.

Common Combinations

Negated Disjunction

- English sentences like *neither ... nor ...* are essentially a negated disjunction, a negative version of *either ... or ...*.
- (4) Florian neither washed the car nor went to the mercantile.
- With *Florian washed the car* as P and *Florian went to the mercantile* as Q , we translate (4) as $\neg(P \vee Q)$.

Negated Conjunction

- Sometimes we also negate conjunctions in English. This kind of sentence usually takes the form *it's not true that both E and F* or *not E and F*.
- (5) It's not true that Clint owns both a Ford and a Chevy dealership.
- Given that *Clint owns a Ford dealership* is translated as P and *Clint owns a Chevy dealership* is translated as Q , a translation of (5) would be $\neg(P \wedge Q)$.

Unless ...

- One of the more confusing English words to translate is *unless*.
- This word expresses a dependency between two propositions, but one which is not always as straight-forward as the conditional with *if ... then ...*.
- For example:
 - (6) Myrtle doesn't cook a Walleye unless Clint catches it.
- If *Myrtle cooks a Walleye* is P and *Clint catches a Walleye* is Q , then (6) can be translated as either $\neg Q \rightarrow \neg P$, $P \rightarrow Q$, or $\neg P \vee Q$.
- Why can we choose any of these three?

Homework

Exercises

Problem 1. Come up with a translation of each of the following English sentences into PL:

- a. It didn't rain in Lake Wobegon, however it did snow there.
- b. Provided the lutefish shipment arrives on time, Pastor Ingqvist can have the festival on Sunday.
- c. Clarence goes down the fish shack just in case the weather is perfect.
- d. Myrtle didn't make it to the Sidetrack Tap today.
- e. Either the mercantile is closed for repairs, or it's not a weekday.
- f. Neither Clint nor Clarence were able to catch a Walleye.
- g. Wally and Evelyn don't both have to show up to work the beer cart.