

Section 01: Propositional Logic Translation

1. Warm-Up

Translate the English sentences below into symbolic logic.

- (a) If I am lifting weights this afternoon, then I do a warm-up exercise.
- (b) If I am cold and going to bed or I am two-years old, then I carry a blanket.

2. If I can translate, then...

For each of the following more obscure English ways to write an implication, define atomic propositions and write a symbolic representation of the sentence.

- (a) whenever I walk my dog, I make new friends.
- (b) I will drink coffee, if Starbucks is open or my coffeemaker works.
- (c) Being a U.S. citizen and over 18 is sufficient to be eligible to vote.
- (d) I can go home only if I have finished my homework.
- (e) Having an internet connection is necessary to log onto zoom.
- (f) I am a student because I attend university.

3. I can rewrite these formulas in English, only if...

Given propositions and a logical formula, write **two** potential English translations. The meanings of the sentences will be the same (They represent the same formula!), but they can still look quite different.

- (a) p : The sun is out
 q : We have class outside

$$p \rightarrow q$$

- (b) p : the book has been out for a week.
 q : I don't have homework.
 r : I have finished reading the book.

$$(p \wedge q) \rightarrow r$$

- (c) p : I have read the manual
 q : I operate the machine

$$q \rightarrow p$$

4. Look Both Ways

For each of the following, define propositional variables and translate the sentences into logical notation.

- (a) Watching Naruto is necessary and sufficient to having a good weekend only if I got less than 7 hours of sleep.
- (b) If berries are ripe along the trail, hiking is safe if and only if grizzly bears have not been seen in the area.
- (c) Unless I am trying to type something, my cat is either eating or sleeping.

5. Tea Time

Consider the following sentence:

If I am drinking tea then I am eating a cookie, or, if I am eating a cookie then I am drinking tea.

- (a) Define propositional variables and translate the sentence into an expression in logical notation.
- (b) Fill out a truth table for your expression.

6. Exclusive Or

Exclusive or (\oplus) and inclusive or (\vee) both can be translated as “or” in English. For each of the following ambiguous phrases, decide which type of “or” is likely meant and why, then translate the sentence to symbolic logic.

- (a) Experience with C or Java is required.
- (b) Lunch includes soup or salad.
- (c) Publish or perish.
- (d) To enter the country, you need a passport or voter registration card.

$$p \rightarrow q$$

Implication:

p implies q

whenever p is true q must be true

if p then q

q if p

p is sufficient for q

p only if q

q is necessary for p

p	q	$p \rightarrow q$
T	T	T
T	F	F
F	T	T
F	F	T