

Section 01: Propositional Logic Translation

1. Translation

Translate each sentence into logic, using atomic propositions as necessary.

- (a) Define and use the same set of atomic propositions for each of these sentences.
 - (i) You will do well in this class if you study.
 - (ii) You will do well in this class only if you study.
 - (iii) You will do well in this class if and only if you study.

- (b) If someone is cooking in the kitchen, then my dog will be there if and only if he is awake.

- (c) Again define and use the same set of atomic propositions for each of these sentences. Recall from your introductory programming course, the stack data structure.
 - (i) If the stack is empty, you can push but not pop.
 - (ii) If the stack is full, you can pop but not push.
 - (iii) If the stack is neither full nor empty, you can both push and pop.

2. Reverse Translation

Consider the following atomic propositions:

p := "The berries are ripe along the trail."

q := "The bears have seen the berries."

r := "Hiking is safe."

Translate this proposition back to English from logic:

$$p \rightarrow (\neg q \leftrightarrow r).$$

3. Review From Lecture

Remember in lecture we translated the following sentence "Unless I go to a café or to campus, I do not drink coffee, but also I don't go to cafés"

(a) Define atomic propositions and translate this sentence into formal logic.

(b) Now fill in the truth table for this expression

p	q	r	$p \vee q$	$\neg(p \vee q)$	$\neg r$	$\neg(p \vee q) \rightarrow \neg r$	$\neg p$	$(\neg(p \vee q) \rightarrow \neg r) \wedge (\neg p)$
T	T	T						
T	T	F						
T	F	T						
T	F	F						
F	T	T						
F	T	F						
F	F	T						
F	F	F						

4. Truth Tables

Write a truth table for each of these propositions:

(a) $(p \vee q) \rightarrow p$

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

(c) $\neg(p \vee (q \wedge r)) \leftrightarrow (\neg p \vee (\neg q \wedge \neg r))$

5. Translation with Tricky Words

Translate the following sentences to logic, defining atomic propositions as necessary.

(a) In order to complete my homework it is sufficient to drink a lot of coffee.

(b) I am a student because I go to the university and pay tuition.

(c) In order to catch my flight it is necessary to be at the airport when it departs or it has been delayed.

(d) For a function to be analytic it is sufficient and necessary for it to be holomorphic. **Note:** You do not need to know what these words mean to translate them to logic!