

CSE 311: Foundations of Computing I

Section 1: Logic Solutions

0. Exclusive Or

For each of the following, decide whether inclusive-or or exclusive-or is intended:

- (a) Experience with C or Java is required.

Solution:

Inclusive Or.

- (b) Lunch includes soup or salad.

Solution:

Exclusive Or.

- (c) Publish or perish

Solution:

Exclusive Or.

- (d) To enter the country you need a passport or voter registration card.

Solution:

Inclusive Or.

1. Translations

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

- (a) I will remember to send you the address only if you send me an e-mail message.

Solution:

p : I will remember to send you the address

q : You send me an e-mail message

$$\boxed{p \rightarrow q}$$

- (b) If berries are ripe along the trail, hiking is safe if and only if grizzly bears have not been seen in the area.

Solution:

p : Berries are ripe along the trail

q : Hiking is safe

r : Grizzly bears have been seen in the area

$$\boxed{p \rightarrow (q \leftrightarrow \neg r)}$$

- (c) Unless I am trying to type something, my cat is either eating or sleeping.

Solution:

p : My cat is eating
 q : My cat is sleeping
 r : I'm trying to type

$$\boxed{\neg r \rightarrow (p \oplus q)}$$

2. Teatime

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.

Solution:

p : I am drinking tea
 q : I am eating a cookie

$$\boxed{(p \rightarrow q) \vee (q \rightarrow p)}$$

- (b) Fill out a truth table for your expression.

Solution:

p	q	$(p \rightarrow q)$	$(q \rightarrow p)$	$(p \rightarrow q) \vee (q \rightarrow p)$
T	T	T	T	T
T	F	F	T	T
F	T	T	F	T
F	F	T	T	T

- (c) Based on your truth table, classify the original sentence as a contingency, tautology, or contradiction.

Solution:

Tautology

3. Truth Tables

Write a truth table for each of the following:

(a) $(p \oplus q) \vee (p \oplus \neg q)$

Solution:

p	q	$p \oplus q$	$p \oplus \neg q$	$(p \oplus q) \vee (p \oplus \neg q)$
T	T	F	T	T
T	F	T	F	T
F	T	T	F	T
F	F	F	T	T

(b) $(p \vee q) \rightarrow (p \oplus q)$

Solution:

p	q	$p \vee q$	$p \oplus q$	$(p \vee q) \rightarrow (p \oplus q)$
T	T	T	F	F
T	F	T	T	T
F	T	T	T	T
F	F	F	F	T

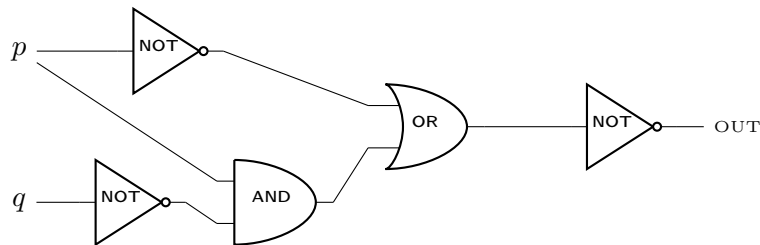
(c) $p \leftrightarrow \neg p$

Solution:

p	$\neg p$	$p \leftrightarrow \neg p$
T	F	F
F	T	F

4. Circuitous

Translate the following circuit into a logical expression.



Solution:

$\neg(\neg p \vee (p \wedge \neg q))$