

CSE 311: Foundations of Computing I

Section: Logic Solutions

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.

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 not been seen in the area

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

(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

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

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: $5p \quad q \quad (p \rightarrow q) \quad (q \rightarrow p) \quad (p \rightarrow q) \vee (q \rightarrow p) \quad T \quad T \quad T \quad T \quad T$

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

Truth Tables

Write a truth table for each of the following:

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

Solution: 5 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: 5 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

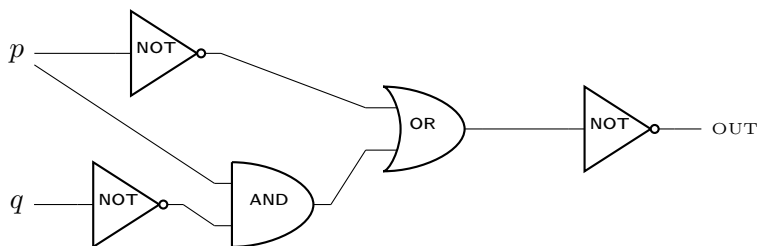
(c) $p \leftrightarrow \neg p$

Solution: 4 p $\neg p$ $p \leftrightarrow \neg p$ T F F

F T F

Circuitous

Translate the following circuit into a logical expression.



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