

## Section 1: Logic

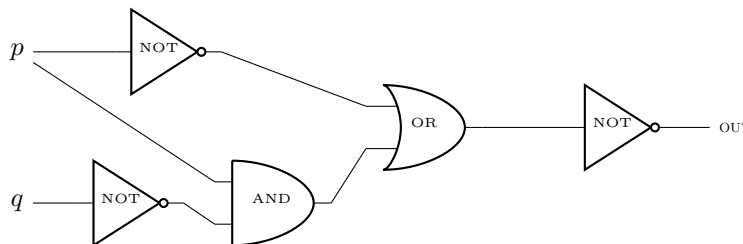
### 1. Exclusive Or

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

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

### 2. Circuitous

Translate the following circuit into a logical expression.



### 3. Translations

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

- If berries are ripe along the trail, hiking is safe and grizzly bears have not been seen in the area.
- Unless I am trying to type something, my cat is either eating or sleeping.
- If it's on sale, I'll buy canned cat food. Otherwise, I'll buy dry cat food.

### 4. Truth Tables

Write a truth table for each of the following:

- $p \rightarrow \top$
- $\text{F} \rightarrow p$
- Explain, in English, what the truth tables for (a) and (b) tell us?
- $(p \oplus q) \vee (p \oplus \neg q)$
- $(p \vee q) \rightarrow (p \oplus q)$

### 5. 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.

- Define propositional variables and translate the sentence into an expression in logical notation.
- Fill out a truth table for your expression.
- Based on your truth table, classify the original sentence as a contingency, tautology, or contradiction.

## 6. Interview Question

The following is an old interview question:

*There are three boxes, one contains only apples, one contains only oranges, and one contains both apples and oranges. The boxes have been incorrectly labeled such that no label identifies the actual contents of its box. Opening just one box, and without looking in the box, you take out one piece of fruit. By looking at the fruit, how can you immediately label all of the boxes correctly?*

- (a) Create a table showing all the logical possibilities for what could be in each of the boxes. Then indicate which possibilities are consistent with the description in the problem. To simplify the table, you need only list those possibilities where each fruit combination (apples, oranges, or both) appears in exactly one box.
- (b) If you take a fruit from the box labelled “Apples”, will you always know what is in the other boxes? Why or why not?
- (c) How do you solve the problem?