

## Assignment 1

1. Determine whether the statement forms are logically equivalent. In each case, construct a truth table to justify your answer.

(a)  $p \rightarrow q \vee r$ ,       $p \wedge \sim q \rightarrow r$ ,       $p \wedge \sim r \rightarrow q$ .

(b)  $(p \wedge q) \vee r$ ,       $p \wedge (q \vee r)$

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

2. Determine whether  $(p \rightarrow (q \rightarrow r)) \leftrightarrow ((p \wedge q) \rightarrow r)$  is a tautology.
3. Construct truth tables for the statement form  $p \wedge \sim r \leftrightarrow q \vee r$ .
4. Suppose that  $p$  and  $q$  are statements so that  $p \rightarrow q$  is false. Find the truth values of each of the following: (a)  $\sim p \rightarrow q$       (b)  $p \vee q$       (c)  $q \rightarrow p$
5. Consider the following statement:

*Catching the 8:05 bus is a sufficient condition for my being on time for work.*

- (a) Write the above statement in **if-then** form.
- (b) Write the **contrapositive**, **inverse**, and **converse** of the above statement.
6. Use truth tables to determine whether the argument forms are valid. Indicate which columns represent the premises and which represent the conclusion, and include a sentence explaining how the truth table supports your answer.

(a)       $p \rightarrow q$

$q \rightarrow p$

$\therefore p \vee q$

(b)       $p$

$p \rightarrow q$

$\sim q \vee r$

$\therefore r$

(c)      If  $x$  is divisible by 9, then  $x$  is divisible by 3

$x$  is divisible by 3

$\therefore x$  is divisible by 9

7. Suppose that you discover a note written by a pirate. In the note he wrote that he had hidden treasure somewhere on the property. He listed five true statements (a-e below) and challenged the reader to use them to figure out the location of the treasure.
- a. If this house is next to a lake, then the treasure is not in the kitchen.
  - b. If the tree in the front yard is a lemon tree, then the treasure is in the kitchen.
  - c. This house is next to a lake.
  - d. The tree in the front yard is a lemon tree or the treasure is buried under the flagpole.
  - e. If the tree in the back yard is a coconut tree, then the treasure is in the garage.

Where is the treasure hidden?