

## Assignment 1

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

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

(b)  $p \rightarrow (q \rightarrow r)$ ,       $(p \rightarrow q) \rightarrow r$

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

2. Determine whether or not the statement  $\sim q \wedge p \rightarrow \sim q$  is a tautology.
3. Let  $p$  and  $q$  be statements such that  $p \leftrightarrow q$  is true. Find the truth values of each of the followings statement forms and provide some justifications.
- (a)  $p \rightarrow q$       (b)  $\sim p \rightarrow \sim q$       (c)  $\sim p \wedge q$       (d)  $p \vee \sim q$       (e)  $\sim p \leftrightarrow q$
4. Consider the following statement.

*If its color is green and it is edible, then it is a vegetable or it is a fruit.*

- (a) Write the **negation** of the above statement.
- (b) Write the **contrapositive**, **inverse**, and **converse** of the above statement.
5. 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 it rains, then I stay home.  
          If it does not rain, then I go shopping.  
       $\therefore$  I stay home or I go shopping.

(d)      If it rains, then I stay home.  
          If it does not rain, then I go shopping.  
          I do not go shopping.  
       $\therefore$  It rains.

6. 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?