

## 1.1 Propositional Logic and 1.2 Applications of Prop. Logic - Worksheet

1. Which of these are propositions? What are the truth values of those that are propositions?
  - a. Do not pass go.
  - b. What time is it?
  - c. There are no black flies in Maine.
  - d.  $4 + x = 5$ .
  - e. The moon is made of green cheese.
  - f.  $2n \geq 100$ .
2. What is the negation of each of these propositions?
  - a. Jennifer and Teja are friends.
  - b. There are 13 items in a bakers dozen.
  - c. Abby sent more than 100 text messages yesterday.
  - d. 121 is a perfect square.
3. Let  $p$  and  $q$  be the propositions The election is decided and The votes have been counted, respectively. Express each of these compound propositions as an English sentence.
  - a.  $\neg p$
  - b.  $p \vee q$
  - c.  $\neg p \wedge q$
  - d.  $q \rightarrow p$
  - e.  $\neg q \rightarrow \neg p$
  - f.  $\neg p \rightarrow \neg q$
  - g.  $p \leftrightarrow q$
  - h.  $\neg q \vee (\neg p \wedge q)$
4. Write each of these statements in the form if  $p$ , then  $q$  in English. [Hint: Refer to the list of common ways to express conditional statements provided in this section.]
  - a. It is necessary to wash the boss's car to get promoted.
  - b. Winds from the south imply a spring thaw.
  - c. A sufficient condition for the warranty to be good is that you bought the computer less than a year ago.

- d. Willy gets caught whenever he cheats.
  - e. You can access the website only if you pay a subscription fee.
  - f. Getting elected follows from knowing the right people.
  - g. Carol gets seasick whenever she is on a boat.
5. State the converse, contrapositive, and inverse of each of these conditional statements.
- a. If it snows tonight, then I will stay at home.
  - b. I go to the beach whenever it is a sunny summer day.
  - c. When I stay up late, it is necessary that I sleep until noon.
6. Construct a truth table for each of these compound propositions.
- a.  $(p \vee \neg q) \rightarrow q$
  - b.  $(p \oplus q) \vee (p \oplus \neg q)$
  - c.  $(p \leftrightarrow q) \vee (\neg q \leftrightarrow r)$
7. Express these system specifications using the propositions  $p$  The user enters a valid password,  $q$  Access is granted, and  $r$  The user has paid the subscription fee and logical connectives (including negations).
- a. The user has paid the subscription fee, but does not enter a valid password.
  - b. Access is granted whenever the user has paid the subscription fee and enters a valid password.
  - c. Access is denied if the user has not paid the subscription fee.
  - d. If the user has not entered a valid password but has paid the subscription fee, then access is granted.