ASSIGNMENT

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) $4 + x = 5$.
   d) The moon is made of green cheese.
   e) $2^n \geq 100$.

2. What is the negation of each of these propositions?

   a) Steve has more than 100 GB free disk space on his laptop.
   b) Steve blocks emails and texts from Jennifer.
   c) Jennifer sent more than 100 text messages yesterday.
   d) Jennifer rode her bicycle 100 miles on Sunday.

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. Let p, q, and r be the propositions
   p: You get an A on the final exam.
   q: You do every exercise in this book.
   r: You get an A in this class.

   Write these propositions using p, q, and r and logical connectives (including negations).

   a) You get an A in this class, but you do not do every exercise in this book.
   b) You get an A on the final, you do every exercise in this book, and you get an A in this class.
   c) To get an A in this class, it is necessary for you to get an A on the final.
   d) You get an A on the final, but you don’t do every exercise in this book; nevertheless, you get an A in this class.
   e) Getting an A on the final and doing every exercise in this book is sufficient for getting an A in this class.
   f) You will get an A in this class if and only if you either do every exercise in this book or you get an A on the final.

5. For each of these sentences, determine whether an inclusive or, or an exclusive or, is intended. Explain your answer.

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

6. Write each of these propositions in the form “p if and only if q” in English.

   a) If it is hot outside you buy an ice cream cone, and if you buy an ice cream cone it is hot outside.
   b) The trains run late on exactly those days when I take it.

7. 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.

8. Construct a truth table for each of these compound propositions.

   a) $p \wedge \neg p$
   b) $(p \vee \neg q) \rightarrow q$
   c) $p \oplus (p \vee q)$
   d) $(p \leftrightarrow q) \oplus (p \leftrightarrow \neg q)$
   e) $p \rightarrow (\neg q \vee r)$
   f) $(p \rightarrow q) \wedge (\neg p \rightarrow r)$
   g) $(p \leftrightarrow q) \vee (\neg q \leftrightarrow r)$

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