2. 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) \(2^n \geq 100\).

4. Let \(p\) and \(q\) be the propositions
   \(p\) : I bought a lottery ticket this week.
   \(q\) : I won the million dollar jackpot on Friday.
Express each of these propositions as an English sentence.
   a) \(\neg p\)  
   b) \(p \lor q\)  
   c) \(p \rightarrow q\)  
   d) \(p \land q\)  
   e) \(p \leftrightarrow q\)  
   f) \(\neg p \rightarrow \neg q\)  
   g) \(\neg p \land \neg q\)  
   h) \(\neg p \lor (p \land q)\)

6. 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) \(p \lor q\)  
   c) \(\neg p \land q\)  
   d) \(q \rightarrow p\)  
   e) \(\neg q \rightarrow \neg p\)  
   f) \(\neg p \rightarrow \neg q\)  
   g) \(p \leftrightarrow q\)  
   h) \(\neg q \lor (\neg p \land q)\)

10. 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.
   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.
14. Determine whether each of these conditional statements is true or false.
   a) If $1 + 1 = 3$, then unicorns exist.
   b) If $1 + 1 = 3$, then dogs can fly.
   c) If $1 + 1 = 2$, then dogs can fly.
   d) If $2 + 2 = 4$, then $1 + 2 = 3$.

16. For each of these sentences, determine whether an inclusive 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.

22. Write each of these propositions in the form “$p$ if and only if $q$” in English.
   a) For you to get an A in this course, it is necessary and sufficient that you learn how to solve discrete mathematics problems.
   b) If you read the newspaper every day, you will be informed, and conversely.
   c) It rains if it is a weekend day, and it is a weekend day if it rains.
   d) You can see the wizard only if the wizard is not in, and the wizard is not in only if you can see him.

24. 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.

28. Construct a truth table for each of these compound propositions.
   a) $p \rightarrow \neg p$
   b) $p \leftrightarrow \neg p$
   c) $p \oplus (p \lor q)$
   d) $(p \land q) \rightarrow (p \lor q)$
   e) $(q \rightarrow \neg p) \leftrightarrow (p \leftrightarrow q)$
   f) $(p \leftrightarrow q) \oplus (p \leftrightarrow \neg q)$

38. Evaluate each of these expressions.
   a) $11000 \land (01011 \lor 11011)$
   b) $(01111 \land 10101) \lor 0100$
   c) $(01010 \oplus 11011) \oplus 0100$
   d) $(11011 \lor 01010) \land (10001 \lor 11011)$