CS311, Fall 2003
Homework 2. Due Tuesday September 9

Question 1 Expand \((2x - 1)^4\) using the binomial theorem.

Question 2 What is the coefficient of \(x^3y^2\) in \((3x - y)^5\)? Show your work.

Question 3 Give the converse and contrapositive for each of the following statements:
   (a) If \(x = 5\) then \(x^2 = 25\).
   (b) If you pay me one million dollars, then I will join your team.
   (c) If it is Tuesday or Thursday, then CS311 meets.

Question 4 For each of the following say whether or not it is a tautology.
   Use a truth table to justify your answer.
   (a) \(p \land (p \rightarrow q) \rightarrow q\)
   (b) \(q \land (p \rightarrow q) \rightarrow p\)

Question 5 Show that this is a tautology by simplifying using the laws of logic:
   \((p \land q) \rightarrow (p \lor q)\)

Question 6 Write each of the following arguments in logical notation and prove or disprove.
   (a) If my dog is happy, then he wags his tail.
      My dog is wagging his tail.
      Therefore my dog is happy.
   (b) If I play football, then I will eventually get hurt.
      I have not gotten hurt.
      Therefore I did not play football.
   (c) My computer cannot work unless it has power.
      My computer cannot work if it has a bug.
      My computer is not working.
      Therefore either the power is out or my computer has a bug.
   (d) My computer cannot work if it has a bug or if the power is out.
      The power is out.
      Therefore my computer cannot work.