**ICS 6B, Homework 1**

1. Re-write the English propositions below using the following variables:

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.

* 1. You get an A in this class, but you do not do every exercise in this book.
  2. You get an A on the final, you do every exercise in this book, and you get an A in this class.
  3. To get an A in this class, it is necessary for you to get an A on the final.
  4. 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.
  5. Getting an A on the final and doing every exercise in this book is sufficient for getting an A in this class.
  6. 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.

1. Determine whether each of these conditional statements is true or false.
   1. If 1 + 1 = 3, then unicorns exist.
   2. If 1 + 1 = 3, then dogs can fly.
   3. If 1 + 1 = 2, then dogs can fly.
   4. If 2 + 2 = 4, then 1 + 2 = 3.
2. Construct a truth table for each of these compound propositions.
   1. p →￢p
   2. p ↔￢p
   3. p ⊕ (p ∨ q)
   4. (p ∧ q) → (p ∨ q)
   5. (q →￢p) ↔ (p ↔ q)
   6. (p ↔ q) ⊕ (p ↔￢q)
3. Use truth tables to verify the following laws (called the associative laws).
   1. (p ∨ q) ∨ r ≡ p ∨ (q ∨ r)
   2. (p ∧ q) ∧ r ≡ p ∧ (q ∧ r)
4. Show that each of these conditional statements is a tautology by using truth tables.
   1. [p ∧ (p → q)] → q
   2. [(p ∨ q) ∧ (p → r) ∧ (q → r)] → r
5. Show that (p ∧ q) → r and (p → r) ∧ (q → r) are not logically equivalent.
6. Write each of these statements in the form “if p then q” in English.
   1. It is necessary to wash the boss’s car to get promoted.
   2. Winds from the south imply a spring thaw.
   3. A sufficient condition for the warranty to be good is that you bought the computer less than a year ago.
   4. Willy gets caught whenever he cheats.
   5. You can access the website only if you pay a subscription fee.
   6. Getting elected follows from knowing the right people.
   7. Carol gets seasick whenever she is on a boat.
7. State the converse, contrapositive, and inverse of each of these conditional statements.
   1. If it snows tonight, then I will stay at home.
   2. I go to the beach whenever it is a sunny summer day.
   3. When I stay up late, it is necessary that I sleep until noon.
8. Show without using truth tables that each of these conditional statements is a tautology.
9. [￢p ∧ (p ∨ q)] → q
10. [p ∧ (p → q)] → q
11. Show without using truth tables that (p ∧ q) → r and (p → r) ∧ (q → r) are not logically equivalent.