Math 243: Mathematical Structures, Spring 2020 **Prof. Ballantine**

Homework Assignment # 1
DUE: Thursday, January 30, at the **beginning** of class

Write up your solutions clearly and in complete sentences. Leave a few lines empty between problems (or parts of problems) for comments form the grader.

The numbered exercises refer to the manuscript *Mathematical Structures*. Always justify all assertions.

1. Exercises 1.1. For this exercise, the part of the statement that comes before "Therefore" is the hypothesis of the implication and the part that comes after "Therefore" is the conclusion. For each statement, first determine whether the hypothesis and the conclusion are true. Then decide if the implication is true and give an explanation for your decision.
2. Exercise 1.9
3. Exercise 1.12 (Note that only gray squares can contain a mine.)
4. Recall that $P \wedge Q$ stands for "P and Q" and $P \vee Q$ stands for "P or Q." If we write $P \wedge Q \vee R$, this may be ambiguous. One can think of this statement as $(P \wedge Q) \vee R$, or as $P \wedge (Q \vee R)$. Create truth tables for each option, to show whether the choice of parentheses matters. Explain.
5. For each of the following statements, determine its truth value. Then write out its contrapositive and its converse, and determine the truth value of each. Justify your answers.
   (a) If my car is out of gas, then my car won't start.
   (b) If I am within 30 miles of my house, then I am within 20 miles of my house.
   (c) If x is a positive real number, then x^2 is a positive real number.
   (d) Let x denote a real number. If $x < 1$, then $x^2 < x$.