Exercises 2

We’ve seen that the set of operations \{+, \cdot, -\} are sufficient to represent any boolean function. Using DeMorgan’s laws, prove that we actually only need \{\cdot, -\} or \{+, -\} to represent an arbitrary boolean function. Is the same thing true for the set \{+, \cdot\}?

Prove that any boolean circuit can actually be constructed using only NAND gates.
In this exercise, you will construct a circuit called a full-adder. Unlike the half-adder, a full-adder has three boolean inputs that we will call \( x, y, c_1 \) that are to be added and two outputs representing the answer called the sum and the carry. Here the sum is the lower order bit and the carry is the higher order bit (i.e. the amount that carries over). Write down a truth table for the full-adder and then construct its circuit. You may use any of the gates we have discussed as well as the half-adder itself.