Instructions: Work these problems carefully on your own paper. As usual, you may collaborate with your classmates and ask for assistance from the TA. But don’t copy anyone else’s answer. Each problem is worth the same number of points (more or less).

1. Write the truth table and a C expression for NAND. Show how you could implement NAND using gates from the set \{OR, NOT\}.

2. Show that \{NAND\} is functionally complete by implementing \{OR, NOT\} using only NAND.

3. Design a 3-bit even parity circuit (i.e., returns 1 if an even number of the 3 bits are 1, and 0 otherwise). Zero is even.
   (a) Show the truth table.
   (b) Show a circuit implementation using only gates from the set \{AND, OR, NOT\}.
   (c) Show a circuit implementation using only NAND gates.

4. Given your even parity circuit above, explain how you could implement an odd parity circuit using only one additional gate.

5. Give the truth table for a half-adder (computes the sum bit and carry-out bit for two input bits, but ignores the carry in). Show a gate graph for a circuit to implement it using NAND gates. Try it before you look it up.

6. Complete the leet code easy problem Remove Element located at leetcode.com/problems/remove-element in C. Include the function in your submission for this homework. Hint: Check your answer on leet code before submitting.

7. Extra credit (challenging) Is \{XOR, NOT\} a functionally complete set of gates? Give a rigorous argument.