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. (5 points) What decimal value is represented by the following bit string when interpreted as a single precision floating point value: 0x43F48000

2. (5 points) Show (in hex) the representation for decimal −512.0 as a single precision floating point value.

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

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

5. Design a 3-bit even parity circuit (i.e., returns 1 if an even number of the 3 bits are 1, and 0 otherwise).
   (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.

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

7. (10 points) Consider the following circuit diagram with boolean inputs A, B, C, D. Say what signal is on the line at points: T₁, T₂, T₃, T₄, T₅, F₁, F₂. (E.g., what boolean function of inputs B and C is on the line at the point marked T₁?) Use earlier results in later results. For example, express T₃ as a function of A and T₁. (That way you can get T₃ right, even if you missed T₁.) Use C logical notation to describe each signal.

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