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MLA 321

Handout #4
January 19, 2016

Assignment #3

Due: Tuesday, January 26

Write out answers to each of these problems. You can write up your answers either on paper or using a word processor.

Problem 1—Binary representation

Answer all six exercises in the puzzle box on page 75.

Problem 2—Binary representation of perfect numbers

Greek mathematicians took a special interest in numbers that are equal to the sum of their ***proper divisors,*** which are simply those divisors less than the number itself. They called such numbers ***perfect numbers.*** For example, 6 is a perfect number because it is the sum of 1, 2, and 3, which are the integers less than 6 that divide evenly into 6. The next three perfect numbers—all of which were known to the Greeks—are 28, 496, and 8128.

Write out the binary representation of the first four perfect numbers. How would you describe the binary form of these perfect numbers? Although the proof is well beyond the scope of this class, it turns out that *all* even perfect numbers have this form; the question of whether any odd perfect numbers exist remains open in mathematics.

Problem 3—Binary arithmetic

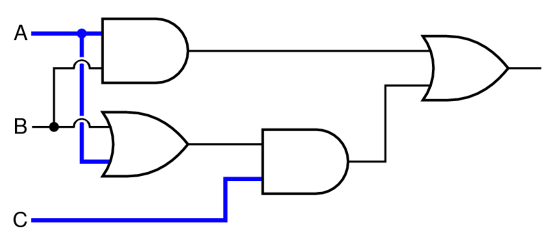
Complete the three calculations in the puzzle box on page 76.

Problem 4—Hexadecimal notation

Answer parts (a) and (b) of the puzzle box on page 80. We'll do part (c) in class.

Problem 5—Logic gates

Although the puzzle box on page 95 asks you for a complete analysis, tracing all possible signals through the majority circuit is tedious. Using thicker lines to indicate signals that have the value **1**, trace the signals that flow through the majority circuit only for the following arrangement, when **A** and **C** are on and **B** is off:



Problem 6—Using NAND gates

As noted in the chapter, the **NAND** gate is complete, which means you can use some combination of **NAND** gates to implement any logical function. How would you build an **XOR** gate using only a combination of **NAND**s?