CLA CS-101 (B1)
Introduction to Computers
Fall 1995

Homework # 5
Due on Tuesday 12/12/95

Note:
There are 7 problems in this Homework; each is worth 20 points. Yet, the total for this homeowrk will be out of 100 points. Any grades you get above 100 points will count as extra credit.

1 Give the truth table for the 3-input "equivalence" circuit (also known as the "unanimous" circuit), which is defined as follows.. It accepts three inputs W, X, and Y and produces one output Z. The output of the circuit should be 1 only when W, X, and Y are the same (i.e. all three are 0 or all three are 1).

2 Using the truth table you obtained in the previous question, construct a logical circuit (using only `AND`, `OR`, and `NOT` gates) that implements the 3-input "equivalence" circuit.

3 Let `A` and `B` be two bytes, where `A = 01101011` and `B = 00111011`. What is the decimal value of `A`? What is the decimal value of `B`? Perform an addition of `A` and `B` in binary showing the sum and carry for each bit. What is the decimal value of the sum? Does it check with the sum of the decimal values of `A` and `B`?

4 Give the representation of the decimal number 176 in binary (radix = 2), in ternary (radix = 3), and in octal (radix = 8). How many digits would you need to represent the number 1234 in hexadecimal (radix = 16)?

5 When you ran a particular program on the computer with an input of size 10, it took the computer 5 seconds to finish. Give your best estimate for how long it would take the computer to run the same program on an input of size 20. Solve for the following 3 cases (*i.e.* submit an answer for each case).

(a) The complexity of the program is constant.
(b) The complexity of the program is linear.
(c) The complexity of the program is quadratic.

6 An analog voice signal is to be digitized. The sampling rate is set at 22 Khz (i.e. 22,000 samples per second) where each sampled value is approximated to an integer between 0 and 255. How many bytes will be needed to store a 2-minute signal digitally on a computer?

7 What is the function of a computer "modem"? What does it mean that a modem operates at a rate of 9,600 bps? How long would it take to transfer a file consisting of 360 Kilo Bytes (1 Kilo Bytes = 1,024 Bytes) over a modem whose rate is 9,600 bps?

Good Luck!