Homework 1 (Fall 2001)

Homework 1 covers materials in Chapter 1 and Sections 2.1 to 2.4 of the textbook and Supplement 1. You need NOT turn in the homework. However, you are strongly advised to do it. Short solutions will be posted on the course website home page shortly. We encourage you to work collaboratively with your classmates to the degree that it facilitates your learning. Target Completion Date: September 16, 2001.

Problems with a * have a solution available on the Prentice Hall Companion Website Gallery (http://www.prenhall.com/mano). Problems with a + are old exam problems.

1. (number systems) Problem 1-2 in text, p. 24.
5. (base conversion) Perform the following base conversions without executing actual divisions and multiplications:
   a. \((10010101.10011)_2\) to \((N)_8\)
   b. \((111010110011.101101)_2\) to \((N)_{16}\)
   c. \((ABACFBA.D0)_{16}\) to \((N)_8\) by using \((N)_2\) as an intermediate step.
   d. \((ECE.ABCD)_{16}\) to \((N)_2\)
   e. \((12346.64)_8\) to \((N)_{16}\)
6. (base conversion) A new technology provides three values, 0, 1, and 2.
   a. What base would be appropriate for this technology?
   b. In this technology, the number 11001221 is given. What is the value of this number in base 10?
   c. Assuming a byte (8 bits) representing an integer without sign in this new technology, express as a percentage (e.g., 132.1%) the ratio of the number of values that can be represented by the new technology compared to binary.
8. (binary codes) Perform the following BCD additions showing the carries and digit corrections in detail:
   a. \(3378 + 5348\)
   b. \(7495 + 1373\)
9. (binary codes) a. Assuming A is a 16-bit unsigned BCD number, how many different integers can be represented as A? b. Express as a percentage, the ratio of this number of integers to the same measure for B, a 16-bit unsigned binary number.
10. A low-resolution analog-to-digital converter (converts an analog sound waveform to digital form) uses a 4-bit code to provide 16 discrete values 0 through 15.
    a. Find a Gray code for use with this converter. Assign code 0000 to value 0.
    b. Suppose that instead the usual binary code is used. What erroneous code words can appear between the code 1101 for 13 and the code 1110 for 14.
11. (binary codes) Find the parity bits for the binary numbers given:
    
    \begin{tabular}{ccc}
    Number & Even & Odd \\
    \hline
    a. & 10111001 & \_ & \_ \\
    b. & 11111011 & \_ & \_ \\
    \end{tabular}

12. + (conversion)
    a. Convert the following decimal number to radix 9 representation, rounding the fractional part to two digits.
       \[(89.600)_{10} = N_9\]
b. Convert \((31223.023)_{10}\) to \(N_{16}\).

c. Convert \((3DF.EA)_{16}\) to \(N_{2}\).

d. Find the radix \(r\) such that \((125)_{r} = (200)_{10}\)

13. (BCD addition) Perform BCD addition corresponding to the decimal addition, showing ALL details in the following table:

\[
\begin{array}{ccc}
\text{BCD Carry} & 0 \\
\text{A operand} & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\
\text{+ B operand} & 0 & 0 & 1 & 1 & 1 & 0 & 0 & 1 & 0 & 1 & 1 & 1 \\
\text{Binary Sum} & 0 & 1 & 1 & 0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 \\
\text{+6?} & \\
\text{BCD Sum} & \\
\text{BCD Answer} & \\
\end{array}
\]

14. Each of the following codes began as an eight bit byte with an odd parity bit added on the right. Each byte code + one parity bit has been pass through a modem, sent through a telephone line, and passed back through a modem. Which of the received codes has a parity error?

\[
\begin{align*}
101011011 & \quad \text{Parity Error? (Circle one) YES NO} \\
001110011 & \quad \text{Parity Error? (Circle one) YES NO}
\end{align*}
\]

15. (Boolean Algebra/Theorems) *Problem 2-1 (a), 2-1(c) in text, p. 83.
16. (Boolean Algebra/Theorems) *Problem 2-2(a), 2-2(d) in text, p. 83.
17. (Boolean Algebra/Theorems) Problem 2-4 in text, p. 84; hint: use substitution
18. (Algebraic Simplification) *Problem 2-7 (a), 2-7 (b), 2-7(c) in text, p. 84.
19. (Complement of Boolean Function) *Problem 2-9 (b), 2-9(c) in text, p. 84.
20. (Sum of Minterms, Product of Maxterms) Problem 2-10 (b) in text, p. 85.
22. (Sum of Products, Product of Sums) *Problem 2-12 (a), 2-1(b) in text, p. 85.
23. (Logic Diagram from Expression) Problem 2-13 (b) in text, p. 85.
24. (K-Map, 3 variables) *Problem 2-15(b) in text, p. 86.
25. (K-Map, 4 variables) *Problem 2-16(b) and 2-16(c) in text, p. 86.
27. +

a. Find the algebraic expression for the sum of minterms (SOM) canonical form for the given function:

\[F (V, W, X, Y, Z) = V W X + W X Y Z\]

b. Find the algebraic expression for the product of maxterms (POM) canonical form for the given function:

\[F (A, B, C, D) = \Sigma m (0,1,2,3,5,6,7,8,10,11,14,15)\]