Prof. M. Mansour

American University of Beirut
Department of Electrical and Computer Engineering
EECE 320 – Digital Systems Design

Homework 1

Problem 1 [10 pts]: List the octal and hexadecimal numbers from 16 to 32. Using A and B for the last two digits, list the numbers from 10 to 26 in base 12.

Problem 2 [10 pts]: What is the largest binary number that can be expressed with 13 bits? What is the equivalent decimal and hexadecimal? What is the largest binary number that can be expressed with *n* bits?

Problem 3 [10 pts]: Convert the following numbers with the indicated base to decimal: $4310_{(5)}$, $198_{(12)}$.

Problem 4 [10 pts]: Determine the base of the numbers in each case for the following operations to be correct: (a) 14/2 = 5; (b) 54/4 = 13; (c) 24 + 17 = 40.

Problem 5 [10 pts]: The solution to the quadratic equation $x^2 - 11x + 22 = 0$ is $x = 3$ and $x = 6$. What is the base of the numbers?

Problem 6 [10 pts]: Express the following numbers in decimal: $10110.0101_{(2)}$, $16.5_{(16)}$, $26.24_{(8)}$.

Problem 7 [10 pts]: Convert the following binary numbers to hexadecimal and decimal: (a) 1.11010, (b) 1110.10.

Problem 8 [10 pts]: Find the 9's- and the 10's-complement of the following decimal numbers: (a) 98127634; (b) 72049900; (c) 10000000; (d) 00000000.

Problem 9 [10 pts]: Find the 1's- and 2's-complement of the following binary numbers: (a) 11101010; (b) 01111110; (c) 00000001; (d) 10000000; (e) 00000000.

Problem 10 [10 pts]: Perform subtraction on the following unsigned numbers using 10's-complemnt of the subtrahend. Where the result should be negative, 10's complement it and affix a minus sign. Verify your answers. (a) 7188 – 3049; (b) 150 – 2100; (c) 2997 – 7992; (d) 1321 – 375.

Problem 11 [10 pts]: Perform subtraction on the following unsigned numbers using 2's-complemnt of the subtrahend. Where the result should be negative, 2's complement it and affix a minus sign. Verify your answers. (a) 11011 – 11001; (b) 110100 – 10101; (c) 1011 – 110000; (d) 101010 – 101011.

Problem 12 [10 pts]: The following decimal numbers are shown in sign-magnitude form: +9826 and +801. Convert them to signed 10's complement form and perform the following operations. (Note that the sum requires six digits). (a) (+9826) + (+801); (b) (+9826) + (-801); (c) (-9826) + (+801); (d) (-9826) + (-801).

Problem 13 [10 pts]: Convert decimal 9126 to both BCD and ASCII codes. For ASCII, add an extra bit to the left so that the total number of ones in the binary representation of each character is odd.

Problem 14 [10 pts]: Represent the decimal 6027 in (a) BCD, (b) excess-3 code, and (c) 2421 code.

Problem 15 [10 pts]: Decode the following ASCII code: 1001010 1100001 1101110 1100101 0100000 1000100 1101111 1100101.

Problem 16 [10 pts]: Device an algorithm to add two *n*-bit unsigned BCD numbers. Explain your algorithm using 345 + 916 (in BCD) as an example.