Homework 1

ECE2504 CRN:82729

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August 29, 2017

Question 1 Convert the following binary numbers to decimal. (Put the integer portion of your answer before the radix point, and the fractional portion after, as you usually do.)

a) $1101100.01 = 64 + 32 + 8 + 4 + 0.25 = 108.25$

b) $1011101.101 = 64 + 16 + 8 + 4 + 1 + 0.5 + 0.125 = 93.625$

c) $10110010.1011 = 128 + 32 + 16 + 2 + 0.5 + 0.125 + 0.0625 = 178.6875$

Question 2 Convert the following numbers with the indicated bases to decimal.

a) $(20121)_3 = (81 \times 2) + (9 \times 1) + (3 \times 2) + (1 \times 1) = 178_{10}$

b) $(13201)_6 = (1296 \times 1) + (216 \times 3) + (36 \times 2) + (1 \times 1) = 2017_{10}$

c) $(1492)_{11} = (1331 \times 1) + (121 \times 4) + (11 \times 9) + (1 \times 2) = 1916_{10}$

Question 3 Convert the following decimal numbers to binary. (Put the integer portion of your answer before the radix point, and the fractional portion after, as you usually do.)

a) $493.6015625_{10} = 2^8 + 2^7 + 2^6 + 2^5 + 2^3 + 2^2 + 2^0 + 2^{-1} + 2^{-4} + 2^{-5} + 2^{-7} = 0b111101101.1001101$

b) $1989.28515625_{10} = 2^{10} + 2^9 + 2^8 + 2^7 + 2^6 + 2^2 + 2^0 + 2^{-2} + 2^{-5} + 2^{-8} = 0b11111000101.01001001$

c) $10052.58203125_{10} = 2^{13}+2^{10}+2^9+2^8+2^6+2^2+2^{-1}+2^{-4}+2^{-6}+2^{-8} = 0b10011101000100.10010101$

Question 4 Convert the decimal numbers given in Problem 3 to hex. (Put the integer portion of your answer before the radix point, and the fractional portion after, as you usually do.)

a) $493.6015625_{10} = (16^2 \times 1) + (16^1 \times 14) + (16^0 \times 13) + (16^{-1} \times 9) + (16^{-2} \times 10) = 0x2ED.9A$

b) $1989.28515625_{10} = (16^2 \times 7) + (16^1 \times 12) + (16^0 \times 5) + (16^{-1} \times 4) + (16^{-2} \times 9) = 0x7C5.49$

c) $10052.58203125_{10} = (16^3 \times 2)+(16^2 \times 7)+(16^1 \times 4)+(16^0 \times 4)+(16^{-1} \times 9)+(16^{-2} \times 5) = 0x2744.95$

Question 5 Complete the table by converting the numbers from the given base to the other three bases. (Put the integer portion of your answer before the radix point, and the fractional portion after, as you usually do. Depending on the width of your screen, it's possible that the fields for the integer and fraction portions may show up on separate lines.)

Decimal	Binary	Octal	Hex
523.60546875	1000001011.10011011	1013.466	20B.9B
173.4375	10101101.0111	255.34	AD.7
469.46875	111010101.011110	725.36	1D5.78
2771.5	101011010011.1	5323.4	AD3.8

To Binary
$523.60546875 = 2^9 + 2^3 + 2^1 + 2^0 + 2^{-1} + 2^{-4} + 2^{-5} + 2^{-7} + 2^{-8} = 0b1000001011.10011011$
$725.36_8 = (7)111\ (2)010\ (5)101\ .\ (3)011\ (6)110 = 0b111010101.011110$
$0xAD3.8 = (A)1010\ (D)1101\ (3)0011\ .\ (8)1000 = 0b101011010011.1$
To Hex
$523.60546875 = (0010)2\ (0000)0\ (1011)B\ .\ (1001)9\ (1011)B = 0x20B.9B$
$0b10101101.0111 = (1010)A\ (1101)D\ .\ (0111)7 = 0xAD.7$
$725.36_8 = (0001)1\ (1101)D\ (0101)5\ .\ (0111)7\ (1000)8 = 0x1D5.78$
To Octal
$523.60546875 = (001)1\ (000)0\ (001)1\ (011)3\ .\ (100)4(110)6(110)6 = 1013.466_8$
$0b10101101.0111 = (010)2\ (101)5\ (101)5\ .\ (011)3\ (100)4 = 255.34_8$
$0xAD3.8 = (5)101\ (3)011\ (2)010\ (3)011\ .\ (4)100 = 5323.4_8$
To Decimal
$0b10101101.0111 = 2^7 + 2^5 + 2^3 + 2^2 + 2^0 + 2^{-2} + 2^{-3} + 2^{-4} = 173.4375_{10}$
$725.36_8 = (8^2 \times 7) + (8^1 \times 2) + (8^0 \times 5) + (8^{-1} \times 3) + (8^{-2} \times 6) = 469.46875_{10}$
$0xAD3.8 = (16^2 \times 10) + (16^1 \times 13) + (16^0 \times 3) + (16^{-1} \times 8) = 2771.5_{10}$

Question 6 What is the decimal equivalent of the largest (unsigned) binary integer that can be obtained with

a) 12 bits? $2^{12} - 1 = 4095$

b) 22 bits? $2^{22} - 1 = 4194303$

Question 7 A number system uses base 12 (duodecimal). There are at most four integer digits. The weights of the digits are 123, 122, 12, and 1. Special names are given to the weights as follows:
12 = 1 dozen
12^2 = 1 gross
12^3 = 1 great gross

a) How many beverage cans are in 6 great gross, 11 gross, 7 dozen and 5?
$(12^3 \times 6) + (12^2 \times 11) + (12^1 \times 7) + (12^0 \times 5) = 12041$ (in decimal)

b) Find the representation in base 12 for 7496_{10} beverage cans.
$(12^3 \times 4) + (12^2 \times 4) + (12^0 \times 8) = 7496$
4 great gross, 4 gross, 0 dozen, 8 cans