CSC 1301 – Spring 2020
Homework #2
Due 02/11/2020
Binary Calculation, Data Manipulation & Representation

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You must show all work for all problems -failure to show work results in Zero points

Complete the following problems for the other values.

	Decimal	Hexadecimal	Binary
1. 10111010_2	186_{10}	BA_{16}	272_8 (Octal)
2. 11110011_2	243_{10}	$F3_{16}$	363_8 (Octal)
3. 10101010_2	170_{10}	AA_{16}	252_8 (Octal)
4. 11111110_2	254_{10}	FE_{16}	376_8 (Octal)
5. 11011011_2	219_{10}	DB_{16}	333_8 (Octal)
6. $2E_{16}$	46_{10}	56_8 (Octal)	101110_2
7. 16_{16}	22_{10}	26_8 (Octal)	10110_2
8. AA_{16}	170_{10}	252_8 (Octal)	10101010_2

1. $2^7\ 2^5\ 2^4\ 2^3\ 2^1$ — $128+32+16+8+2=186$; 1011 | 1010 (8421 | 8421); 11→B 10→A; 010 | 111 | 010 (421 | 421 | 421); 2 7 2
2. $2^7\ 2^6\ 2^5\ 2^4\ 2^1\ 2^0$ — $128+64+32+16+2+1=243$; 1111 | 0011 (8421 | 8421); 15→F 3; 011 | 110 | 011 (421 | 421 | 421); 3 6 3
3. $2^7\ 2^5\ 2^3\ 2^1$ — $128+32+8+2=170$; 1010 | 1010 (8421 | 8421); 10→A 10→A; 010 | 101 | 010 (421 | 421 | 421); 2 5 2
4. $2^7\ 2^6\ 2^5\ 2^4\ 2^3\ 2^2\ 2^1$ — $128+64+32+16+8+4+2=254$; 1111 | 1110 (8421 | 8421); 15→F 14→E; 011 | 111 | 110 (421 | 421 | 421); 3 7 6
5. $2^7\ 2^6\ 2^4\ 2^3\ 2^1\ 2^0$ — $128+64+16+8+2+1=219$; 1101 | 1011 (8421 | 8421); 13→D 11→B; 011 | 011 | 011 (421 | 421 | 421); 3 3 3
6. $2E_{16}$ → 2 (8421: 0010); E→14 (8421: 1110)
7. 16_{16} → 1 (8421: 0001); 6 (8421: 0110); 101 | 110 (421 | 421); 5 6; Octal 26_8; 10110_2 ($2^5\ 2^3\ 2^2\ 2^1$; $32+8+4+2=46$)
8. AA_{16} → 170_{10}; 010 | 110 (421 | 421); 2 6; Octal 252_8; 10101010_2 ($2^4\ 2^2\ 2^1$; $16+4+2=22$)

Short Answers

1. What are the 4-bit patterns used to represent each of the characters in the string "1302"? ******Only represent the characters between the quotation marks.) Note: There is space between 1302.*** 2^{11} 2^{10} 2^{9} 2^{8} 2^{7} 2^{6} 2^{5} 2^{4} 2^{3} 2^{2} 2^{1} 2^{0}
2048 1024 512 256 128 64 32 16 8 4 2 1
10100010110

1302 − 1024 = 278; 278 − 256 = 22; 22 − 16 = 6; 6 − 4 = 2; 2 − 2 = 0

2. What is the biggest value we can express in 4 bits ? Express it in both binary and in decimal:

binary 1111 decimal 15

3. What is the smallest value we can express in 4 bits if we use unsigned numbers? Express it in both binary and in decimal:

binary 0000 decimal 0

FLOATING POINT BINARY CONVERSIONS

Sample Table

**** **This table shows the smallest fraction that can be stored in a 23-bit mantissa**. This table shows a few simple examples of binary floating-point numbers alongside their equivalent decimal fractions and decimal values:

Binary	Decimal Fraction	Decimal Value
.1	1/2	.5
.01	1/4	.25
.001	1/8	.125
.0001	1/16	.0625
.00001	1/32	.03125

1. Convert the following to binary:

a) 9.027 = 1001.000001101111010011

(9) + 0.027

9 ÷ 2 = 4 R 1
4 ÷ 2 = 2 R 0
2 ÷ 2 = 1 R 0
1 ÷ 2 = 0 R 1

9 = 1001

0.027 × 2 = 0.054
0.054 × 2 = 0.108
0.108 × 2 = 0.216
0.216 × 2 = 0.432
0.432 × 2 = 0.864
0.864 × 2 = 1.728

0 0 0 0 0 1 → cont...

b) 13.0920 =

(13) + 0.0920 → 1101.000101111000110101010

13 ÷ 2 = 6 R 1
6 ÷ 2 = 3 R 0
3 ÷ 2 = 1 R 1
1 ÷ 2 = 0 R 1

13 = 1101

0.0920 × 2 = 0.184
0.184 × 2 = 0.368
0.368 × 2 = 0.736
0.736 × 2 = 1.472

0 0 0 1 → cont...

2. Find and bring in a URL that explains floating point representation

if URL works, 3 points - only 1 if it's just present but doesn't work

geeksforgeeks.org/floating-point-representation-basics/

3. Convert the following to decimal

a) $2^2\ 2^1\ 2^{-2}\ 2^{-5}$
0110.01001

$4 + 2 + \frac{1}{4} + \frac{1}{32} = 6.28125$

b) $2^3\ 2^1\ 2^{-1}\ 2^{-5}$
1010.10001

$8 + 2 + \frac{1}{2} + \frac{1}{32} = 10.53125$

$1+2+9 = 12 \rightarrow C_{16}$

$8+1 = 9_{16}$

Bonus

1) Demonstrate how to solve the hexadecimal Arithmetic **(Show work)**

a) $\overset{1}{8}2CD + 1982 = 9C4F_{16}$

$D+2 = 13+2 = 15 = F_{16}$

$C+8 = 12+8 = 20 = 16+4 = 14_{16}$

b) A31 + E2C = $1185D_{16}$

$1+C = 1+12 = 13 = D_{16}$

$3+2 = 5_{16}$

$A+E = 10+14 = 24 = 16+8 = 18_{16}$

2) Show the unsigned binary number 1010 1010 1010.1010 in decimal? **(Show work)**

$2^{11}\ 2^{9}\ 2^{7}\ 2^{5}\ 2^{3}\ 2^{1}\ 2^{-1}\ 2^{-3}$

$2048 + 512 + 128 + 32 + 8 + 2 + \frac{1}{2} + \frac{1}{8} = 2730.625$