C.W ☐
H.W ☐
TEST ☐

Day: ☐☐☐☐☐☐
Date: ☐☐☐☐☐☐☐

Umar Hayyat
2019-EE-360

Homework 1

Part 1- Number System

1)

Convert value from binary to decimal

(a) $1010\,1111_2$

$= 1\times2^7 + 0\times2^6 + 1\times2^5 + 0\times2^4 + 1\times2^3 + 1\times2^2 + 1\times2^1 + 1\times2^0$

$= 128 + 32 + 8 + 4 + 2 + 1$

$= 175_{10}$

(b) $11010\,10110\,1_2$

$= 1\times2^{10} + 1\times2^9 + 0\times2^8 + 1\times2^7 + 0\times2^6 + 1\times2^5 + 0\times2^4 + 1\times2^3 + 1\times2^2 + 0\times2^1 + 1\times2^0$

$= 1024 + 512 + 128 + 32 + 8 + 4 + 1$

$= 1709_{10}$

(2)

Convert value from decimal to binary.

(a) 823_{10}

2	823
2	411 – 1
2	205 – 1
2	102 – 1
2	51 – 0
2	25 – 1
2	12 – 1
2	6 – 0
2	3 – 0
	1 – 1

$= 1100110111_2$

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(b) 234185340_{10}

2	234185340
2	117092670 – 0
2	58546335 – 0
2	29273167 – 1
2	14636583 – 1
2	7318291 – 1
2	3659145 – 1
2	1829572 – 1
2	914786 – 0
2	457393 – 0
2	228696 – 1
2	114348 – 0
2	57174 – 0
2	28587 – 0
2	14293 – 1
2	7146 – 1
2	3573 – 0
2	1786 – 1
2	893 – 0
2	446 – 1
2	223 – 0
2	111 – 1
2	55 – 1
2	27 – 1
2	13 – 1
2	6 – 1
2	3 – 0
	1 – 1

$234185340_{10} = 1101111101010110000100111100_2$

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(3)

Unsigned largest no $= 2^n - 1$

When $n = 8$

largest integer $= 2^8 - 1$

$= 256 - 1$

$= 255_{10}$

When $n = 13$, then

largest integer that stored $= 2^{13} - 1$

$= 8191_{10}$

When $n = 24$, then

largest integer that stored $= 16777215_{10}$

When $n = 8$

Smallest non-zero fraction that can stored $= 0.00000001$

When $n = 13$, then

Smallest non-zero fraction $= .0000000000001$

When $n = 24$ then

Smallest non-zero fraction $= 0.000000000000000000000001$

$= 1 \times 10^{-24}$

(4)

Convert number to BCD code

(a) 23456_8

$= 2 \times 8^4 + 3 \times 8^3 + 4 \times 8^2 + 5 \times 8^1 + 6 \times 8^0$

$= 8192 + 1536 + 256 + 40 + 6$

$= 10030_{10}$

$(0001\ 0000\ 0000\ 0011\ 0000)_{BCD}$

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(b) 23456_{10}

$= (0010\ 0011\ 0100\ 0101\ 0110)_{BCD}$

(C) $2CAB_{16}$

$= 2\times16^3 + 12\times16^2 + 10\times16^1 + 11\times16^0$

~~$= 4098 +$~~

$= 8192 + 3072 + 160 + 11$

$= 11435_{10}$

$= (0001\ 0001\ 0100\ 0011\ 0101)_{BCD}$

Part 2 - Binary Arithmetic

(7)

A = 1001001010

B = 0001100011

C = 1100000101

A+B

$$\begin{array}{r} 1001001010 \\ +\ 0001100011 \\ \hline 1010101101_2 \end{array}$$

$= 1\times2^9 + 0\times2^8 + 1\times2^7 + 0\times2^6 + 1\times2^5 + 0\times2^4 + 1\times2^3 + 1\times2^2 + 0\times2^1 + 1\times2^0$

$= 512 + 128 + 32 + 8 + 4 + 1$

$= 685_{10}$

$A+B = 685_{10}$

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A-B

$B = 0001100011_2$

Take 2's complement

$B = 1110011101_2$

$A + (-B)$

$$\begin{array}{r} 1\,0\,0\,1\,0\,0\,1\,0\,1\,0 \\ 1\,1\,1\,0\,0\,1\,1\,1\,0\,1 \\ \hline 1\,0\,1\,1\,1\,1\,0\,0\,1\,1\,1 \end{array}$$

$A - B = 0111100111_2$

$= 0 + 256 + 128 + 64 + 32 + 0 + 0 + 4 + 2 + 1$

$A - B = (487)_{10}$

B+C

$$\begin{array}{rr} B. & 0\,0\,0\,1\,1\,0\,0\,0\,1\,1 \\ C. & 1\,1\,0\,0\,0\,0\,0\,1\,0\,1 \\ \hline & 1\,1\,0\,1\,1\,0\,1\,0\,0\,0 \end{array}$$

$B + C = 1101101000_2$

$= 512 + 256 + 0 + 64 + 32 + 0 + 8 + 0 + 0 + 0$

$B + C = 872_{10}$

B-C

$C = 1100000101$

Take 2's complement

$-C = 0011111011$

$$\begin{array}{rr} B + (-C) = & 0\,0\,0\,1\,1\,0\,0\,0\,1\,1 \\ & 0\,0\,1\,1\,1\,1\,1\,0\,1\,1 \\ \hline & 0\,1\,0\,1\,0\,1\,1\,1\,1\,0 \end{array}$$

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B+(-C) = 0|0|0|1|1|0

= 0+256+0+64+16+8+4+2+0

= 350

B-C = -(2^10 - 350)

= -(1024-350)

B-C = -674_{10}

C-B

B= 0001100011

Take 2's complement:

-B = 1110011101

C+(-B)

1100000101 ~~1000000101~~

1110011101 ~~0001110001~~

1101010010 ~~1000~~

C-B = 1010100010

= 512+0+128+0+32+0+0+0+2+0

C-B = 674_{10}

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(6)

N = 1101001010 01

N=? if

(a)

i) an unsigned binary number.

N= 1101001001

N= 2048+1024+0+256+0+0+32+0+8+0+0+1

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$N = 2048 + 1024 + 256 + 32 + 8 + 1$

$\boxed{N = 3369_{10}}$

ii) A number in two's complement code.

$N = 110100101001$

Take 2's complement of N =

$N = 001011010111$

$N = 0 + 0 + 512 + 128 + 64 + 0 + 16 + 0 + 4 + 2 + 1$

$N = 512 + 128 + 64 + 16 + 4 + 2 + 1$

$\boxed{N = 727_{10}}$

iii) a number in sign and magnitude code

In sign and magnitude the first left give the sign, if it is ~~zero~~ (1) then it show negative and if it is ~~zero~~ zero (0) then show sign is positive.

$N = 110100101001$

First left number is 1 that show negative sign

$N = 1024 + 0 + 256 + 0 + 0 + 32 + 0 + 8 + 0 + 0 + 1$

$\boxed{N = -1321_{10}}$

(b)

Leftmost bit is changed from 1 to 0.

$N = 010100101001$

i) An unsigned binary number.

$N = 010100101001$

$N = 1024 + 256 + 32 + 8 + 1$

$\boxed{N = 1321_{10}}$

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ii) a number in two's complement code.

$N = 0101001010011_2$

Take 2's complement.

$N = 1010110101101_2$

$N = 2048+0+512+0+128+64+0+16+0+4+2+1$

$\boxed{N = 2775_{10}}$

iii) a number in sign and magnitude code

$N = 0101001010011.$

N is a positive.

$N = 1010010100 1$

$N = 1024+256+32+8+1$

$\boxed{N = +1321_{10}}$