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Q1.

a) $(735)_8 = (7\times 8^2)+(3\times 8^1)+(5\times 8^0) = 448+24+5 = (477)_{10}$

b) $(525)_6 = (5\times 6^2)+(2\times 6^1)+(5\times 6^0) = 180+12+5 = 197$

Q2.

a) 1.10010

$\Downarrow$

$\underbrace{0001}_{1}.\underbrace{1001}_{9}0000 = (1.9)_{16}$

$1.10010 = 1\times 2^0 + 1\times 2^{-1} + 0\times 2^{-2} + 0\times 2^{-3} + 1\times 2^{-4} + 0\times 2^{-5}$

$= 1 + 1/2 + 1/16$

$= (1.5625)_{10}$

b) 110.010

$\Downarrow$

$\underbrace{0110}_{6}.\underbrace{0100}_{4} = (6.4)_{16}$

$110.010 = (1\times 2^2)+(1\times 2^1)+(0\times 2^0)+(0\times 2^{-1})+(1\times 2^{-2}) + (0\times 2^{-3})$

$= 4+2+1/4 = (6.25)_{10}$

$\Rightarrow$ 110.010 is four times 1.10010 because we shifted the dot 2 digit right. So our number grows $2^2$ times.

Q3.

a) 10000000

1's 01111111

\+ 1

2's 10000000

b) 00000000

1's 11111111

\+ 1

2's ~~1~~00000000

c) 11011010

1's 00100101

\+ 1

2's 00100110

d) 01110110

1's 10001001

\+ 1

2's 10001010

Q4.

a) 10011 - 10001

2's complement of 10001 => 01110 + 1 => 01111

$$\begin{array}{r} 10011 \\ -\ 10001 \\ \hline \end{array} \equiv \begin{array}{r} 10011 \\ +\ 01111 \\ \hline \cancel{1}00010 \end{array}$$

b) 100010 - 100011

2's complement of 100011 => 011100 + 1 => 011101

$$\begin{array}{r} 100010 \\ -\ 100011 \\ \hline \end{array} \Rightarrow \begin{array}{r} 100010 \\ +\ 011101 \\ \hline 111111 \end{array} \Rightarrow -000001$$

c) 1001 - 101000

2's complement of 101000 => 010111 + 1 => 011000

$$\begin{array}{r} 001001 \\ -\ 101000 \\ \hline \end{array} = \begin{array}{r} 001001 \\ +\ 011000 \\ \hline 100001 \end{array} \Rightarrow -011111$$

d) 110000 - 10101

2's complement of 010101 => 101010 + 1 = 101011

$$\begin{array}{r} 110000 \\ -\ 010101 \\ \hline \end{array} = \begin{array}{r} 110000 \\ +\ 101011 \\ \hline \cancel{1}011011 \end{array}$$

Q5.

5.137

0101 0001 0011 0111

$(5.137)_{10} = (0101.0001\ 0011\ 0111)_{BCD}$

For excess-3 add 3 to BCD,

$$\begin{array}{r} 0101 \\ +\ 0011 \\ \hline 1000 \end{array} \quad \begin{array}{r} 0001 \\ +\ 0011 \\ \hline 0100 \end{array} \quad \begin{array}{r} 0011 \\ +\ 0011 \\ \hline 0110 \end{array} \quad \begin{array}{r} 0111 \\ +\ 0011 \\ \hline 1010 \end{array} \Rightarrow (5.137) = (1000.0100\ 0110\ 1010)_{XS3}$$

CamScanner ile tarandı