Sameed Ahmed -- 300366534

Q1.3 Convert the Following numbers with the indicated bases to decimal:

a) $(4310)_5$

$= 4\times5^3 + 3\times5^2 + 1\times5^1 + 0\times5^0$

$= 500 + 75 + 5$

$= (580)_{10}$

b) $(198)_{12}$

$= 1\times12^2 + 9\times12^1 + 8\times12^0$

$= 144 + 81 + 1$

$= (226)_{10}$

c) $(445)_8$

$= 4\times8^2 + 4\times8^1 + 5\times8^0$

$= 256 + 32 + 5$

$= (293)_{10}$

d) $(345)_6$

$= 3\times6^2 + 4\times6^1 + 5\times6^0$

$= 108 + 24 + 5$

$= 137$

Q1.7 Convert 64CD to binary, then convert it from binary to octal

64CD

6 4 12 13

(0110 0100 1100 1101)

$(0110010011001101)_2$

000 110 010 011 001 101

6 2 3 1 5 $\longrightarrow (62315)_8$

Express the following number as decimal:

a) $(1011\,0.0101)_2$

$2^4\ 2^2\ 2^1\ \ 2^{-2}\ \ 2^{-4}$

$16 + 4 + 2 + 0.25 + 0.0625$

$= (22.315)_{10}$

b) $(16.5)_{16}$

$= 1\times16^1 + 6\times16^0 + 5\times16^{-1}$

$= 16 + 6 + 0.3125$

$= (22.3125)_{10}$

c) $(26.24)_8$

$= 2\times8^1 + 6\times8^0 + 2\times8^{-1} + 4\times8^{-2}$

$= 16 + 6 + 0.25 + 0.0625$

$= (22.3125)_{10}$

d) $(DABA.B)_{16}$

$= 13\times16^3 + 10\times16^2 + 11\times16^1 + 10\times16^0$

$= 53248 + 2560 + 176 + 10$

$= (55994)_{10}$

e) $(1011.1001)_2$

$= 2^3 + 2^1 + 2^0 + 2^{-1} + 2^{-4}$

$= (11.5625)_{10}$

Do the following conversions:

g) $(27.315)_{10\rightarrow 2}$

27/2	= 13	r 1
13/2	= 6	r 1
6/2	= 3	r 0
3/2	= 2	r 1
2/2	= 1	r 0
1/2	= 0	r 1

$(1\,0\,1\,0\,1\,1)_2$

.315	x 2	= 0.63
.63	x 2	= 1.26
.26	x 2	= 0.52
.52	x 2	= 1.02
.02	x 2	= 0.04
.04	x 2	= 0.08
.08	x 2	= 0.16
.16	x 2	= 0.32
.32	x 2	= 0.64
.64	x 2	= 1.28
.28	x 2	= 0.56
.56	x 2	= 1.12
.12	x 2	= 0.24
.24	x 2	= 0.48
.48	x 2	= 0.96
.96	x 2	= 1.92
.92	x 2	= 1.84
.84	x 2	= 1.68
.68	x 2	= 1.36
.36	x 2	= 0.72
.72	x 2	= 1.44
.44	x 2	= 0.88
.88	x 2	= 1.76

$\therefore (101011.0101000001010001111101)_2$

b) $\frac{2}{3} = 0.66667$

$0.66667 \times 2 = 1.33334$
$0.3334 \times 2 = 0.66668$
$0.6668 \times 2 = 1.33336$
$0.33336 \times 2 = 0.66672$
$0.66672 \times 2 = 1.33344$
$0.33344 \times 2 = 0.66688$
$0.66688 \times 2 = 1.33376$
$0.33376 \times 2 = 0.66752$

$= (.10101010\overline{10})_2$

$= 1\times2^{-1} + 1\times2^{-3} + 1\times2^{-5} + 1\times2^{-7}$

$= (0.6640625)_{10}$

C) $(.10101010)_{2 \to 16 \to 10}$

$= .1010 \quad 1010$
$\quad\ A \quad\ A$

$= (.AA)_{16} \longrightarrow 10\times16^{-1} + 10\times16^{-2}$

$= 0.6640625$

Q1.14 Obtain the 1's and 2's complements of the following binary numbers:

a) 10010000

$(100000000 - 1)_2 - (10010000)_2$

$= (01101111)_2$ (1's complement)

$(01101111)_2 + 1$

$= (01110000)_2$ (2's complement)

b) 00000000

$(100000000 - 1)_2 - (000000000)_2$

$= (11111111)_2$ (1's complement)

$(11111111)_2 + 1$

$= (000000000)_2$ (2's complement)

c) 11011010

$(100000000 - 1)_2 - (11011010)_2$

$= (00100101)_2$ (1's complement)

$(00100101)_2 + 1$

$= (00100110)_2$ (2's complement)

d) 10101010

$(1\ 0000\ 0000 - 1)_2 - (10101010)_2$

$= (01010101)_2$ (1's complement)

$01010101 + 1$

$= (01010110)_2$ (2's complement)

e) 10100101

$(100000000 - 1)_2 - (10100101)$

$= (01011010)_2$ (1's complement)

$01011010 + 1$

$= (01011011)_2$ (2's complement)

f) 1111 1111

$(1\ 0000\ 0000 - 1)_2 - 1111\ 1111$

$= (00000000)_2$ (1's complement)

00000000 + 1

$= (00000001)_2$ (2's complement)

Q1.16A Find 16's complement of C3AF

15's complement = FFFF − C3AF

= 3CD0

16's complement = 3CD0 + 1

= 3CD1

15 15 15 15
12 3 10 15
3 12 5 0
3CD0

Q1.16BC Convert C3AF to Binary and find complement

C3AF

1100 0011 1010 1111

$= (1100001110101111)_2$

1st complement is $(0011110001010000)_2$

2nd complement is $(0011110001010001)_2$

Q1.16D Convert previous answer to hexadecimal

0011 1100 0101 0001

3 C 5 1

$(3C51)_2$ ∴ Same

Q1.17 Perform substraction on the unsigned numbers using 10's complement of the subtrahend. Where the results should be negative, affix a minus sign.

a) 6473 − 5297

Subtrahend is $(5297)_{10}$

9's complement of 5297 → 9999 − 5297 = 4702 ← 9's; 4702 + 1 = 4703 ← 10's

6473 + 4703 = ①1176

∴ 6473 − 5297 = 1176

b) 125 − 1800

Subtrahend is $(1800)_{10}$

9's complement of 1800: 9999 − 1800 = 8199 ← 9's; 8199 + 1 = 8200 ← 10's

125 + 8200 = 8325

9999 − 8325 = 1674; 1674 + 1 = 1675

∴ 125 − 1800 = −1675

c) 1076 − 3217

Subtrahend is $(3217)_{10}$

9's complement of 3217 → 9999 − 3217 = 6782 ← 9's; 6782 + 1 = 6783 ← 10's

9999 − 7859 = 2140

1076 + 6783 = 7859

∴ 1076 − 3217 = −2140

d) 1631 − 745

Subtrahend is 745

9's complement of 745: 9999 − 745 = 9254 ← 9's; 9254 + 1 = 9255 ← 10's

1631 + 9255 = 10886

1635 − 745 = 886

Q1.18 Perform substraction on the unsigned binary numbers using 2's complement of the subtrahend. Where the results should be negative, find it's 2's complement affix a minus sign.

a) 10011 − 10010

1's complement of 10010 → 01101 + 1 = 01110

10011 + 01110 = 00001

10011 − 10010 = 00001

b) 100010 − 100110

1's complement of 100110 → 011001

011001 + 1 = 011010

∴ 100010 − 100110 ≡ −00100

```
  10 00 10
+ 01 10 10
-----------
  11 11 00
```

1's complement

00011 + 1 = 00100

c) 1001 − 110101

1's complement of 110101 → 001010

001010 + 1 = 001011

```
   1001
+ 001011
---------
  010100
```

→ 1's complement

101011 + 1 = 101100

∴ 1001 − 110101 ≡ −101100

d) 101000 − 10101

1's complement of 10101 → 01010 + 1 = 01011

```
  101000
+ 01011
--------
 1011011
```

101000 − 10101 = 011011