Assignment 1:

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Q.1

a.) 128 K bits

$1K = 2^{10} = 1024$

$128K = 128 \times 2^{10} = 131072$ bits

b.) 32M bits

$1M = 2^{20} = 1048576$

$32M = 32 \times 2^{20} = 33554432$ bits

c.) 8G bits

$1G = 2^{30} = 1073741824$

$8G = 8 \times 2^{30} = 8589934592$ bits

Q.2

a.) 64 K bits = (?) M bits

$\therefore 1024K = 1M$

$1K = \frac{1M}{1024}$

$64K = \frac{1M}{1024} \times 64$

$64K = 0.0625M$

b.) 9 G bits = (?) M bits

$\therefore 1G$ bit $= 1024M$ bits

9G bits $= 9216M$ bits

Q.3

a.) $(369.3125)_{10}$

Decimal → Binary

2	369
2	184 - 1
2	92 - 0
2	46 - 0
2	23 - 0
2	11 - 1
2	5 - 1
2	2 - 1
	1 - 0

$0.3125 \times 2 = 0.625$ | 0
$0.625 \times 2 = 1.25$ | 1
$0.25 \times 2 = 0.5$ | 0
$0.5 \times 2 = 1.00$ | 1
$0.00 \times 2 = 0$

Ans: (101110001.0101)

Decimal → Octal

8	369
8	46 - 1
	5 - 6

$0.3125 \times 8 = 2.5$ | 2
$0.5 \times 8 = 4.00$ | 4
$0.00 \times 8 = 0$

Ans: (561.24)

Decimal → Hexadecimal

16	369
16	23 - 1
	1 - 7

$0.3125 \times 16 = 5.00$ | 5
$0.00 \times 16 = 0$

Ans: (171.5)

b.) $(10111101.101)_2$

Binary → Decimal

$1\times2^7+0\times2^6+1\times2^5+1\times2^4+1\times2^3+1\times2^2+0\times2^1+1\times2^0+1\times2^{-1}+0\times2^{-2}+1\times2^{-3}$

$= 128+32+16+8+4+1+\frac{1}{2}+\frac{1}{8}$

$= 189.625$

Binary → Octal

$(010\ 111\ 101\ .\ 101) = 275.5$

Binary → Hexadecimal

$(1011\ 1101.1010) = BD.A$

c.) $(326.5)_8$

Octal → Decimal

$3\times8^2+2\times8^1+6\times8^0+5\times8^{-1} = 214.625$

Octal → Binary

$326.5 = (011\ 010\ 110.101)$

Octal → Hexadecimal

$(0000\ 1101\ 0110.1010) = D6.A$

d.) $(F3C7.A)_{16}$

Hexadecimal → Decimal

$$F\times16^3+3\times16^2+C\times16^1+7\times16^0+A\times16^{-1}$$
$$=15\times16^3+3\times16^2+12\times16+7+\frac{10}{16}$$
$$=62407.625$$

Hexadecimal → Binary

$(F3C7.A) = (1111\ 0011\ 1100\ 0111.1010)$

Hexadecimal → Octal

$(001\ 111\ 001\ 111\ 000111.101\ 000) = 171707.5$

Q.4

a.) 7562.45 to octal

8 |	7562	$0.45\times8=3.6$ 3
8 |	945 - 2	$0.6\times8=4.8$ 4
8 |	118 - 1	$0.8\times8=6.4$ 6
8 |	14 - 6	$0.4\times8=3.2$ 3
|	1 - 6	$0.2\times8=1.6$ 1
|		$0.6\times8=4.8$ 4

Ans: (16612.346314)

b.) 1938.257 to hexadecimal

16 | 1938	0.257 x 16 = 4.112	4
16 | 121 - 2	0.112 x 16 = 1.792	1
7 - 9	0.792 x 16 = 12.67	12
	0.67 x 16 = 10.72	10

Ans: 792.41CA

c.) 175.175 to binary

2 | 175	0.175 x 2 = 0.35	0
2 | 87 - 1	0.35 x 2 = 0.7	0
2 | 43 - 1	0.7 x 2 = 1.4	1
2 | 21 - 1	0.4 x 2 = 0.8	0
2 | 10 - 1	0.8 x 2 = 1.6	1
2 | 5 - 0		
2 | 2 - 1	Ans: (10101111.00101)	
1 - 0		

d.) 25.305 to base 8

8 | 25	0.305 x 8 = 2.44	2
3 - 1	0.44 x 8 = 3.52	3
	0.52 x 8 = 4.16	4
	0.16 x 8 = 1.28	1

Ans: (31.2341)

Q.5

a.) $(BEE)_x = (2699)_{10}$

$B \times x^2 + E \times x^1 + E \times x^0 = 2699$

$11x^2 + 14x + 14 = 2699$

$11x^2 + 14x - 2685 = 0$

Using the Quadratic formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-14 \pm \sqrt{14^2 - 4(11)(-2685)}}{2(11)}$$

$$x = \frac{-14 \pm \sqrt{196 + 118140}}{22} = \frac{-14 \pm 344}{22}$$

$$x = \frac{-14 + 344}{22} \qquad x = \frac{-358}{22} = \frac{-179}{11}$$

$x = 15$

The radix is 15 which is also called pentadecimal

b.) $(365)_r = (194)_{10}$

$3r^2 + 6r + 5 = 194$

$3r^2 + 6r - 189 = 0$

$$r = \frac{-6 \pm \sqrt{6^2 - 4(3)(-189)}}{2(3)} = \frac{-6 \pm \sqrt{2304}}{6} = \frac{-6 \pm 48}{6}$$

$r = \frac{42}{6}$ or $r = -\frac{54}{6}$

$r = 7$ $\quad$ $r = -9$

The radix is 7 which is also called "septenary".

Q.6

a.) What bit position must be complemented in an ASCII code to change from uppercase to lowercase

In ASCII, if we move from right to left, we'll see that for lowercase letters the 6th bit is always set to 1 whereas for uppercase the 6th bit is 0. Changing the 6th bit or complementing it can convert lowercase to uppercase and vice versa.

a = 01100001 $\quad$ b = 01100010

A = 01000001 $\quad$ B = 01000010

b.) Decode

1001000 1100101 1101100 1101100

1101111 0101110

1.) Convert all binary numbers to decimal equivalent
2.) Search decimal number in ASCII table to check what letter/number/symbol it is assigned to

Binary → Decimal

$1001000 = 2^6\times1+2^5\times0+2^4\times0+2^3\times1+2^2\times0+2^1\times0+2^0\times0 = 72$ H

$1100101 = 2^6\times1+2^5\times1+2^4\times0+2^3\times0+2^2\times1+2^1\times0+2^0\times1 = 101$ e

$1101100 = 2^6\times1+2^5\times1+2^4\times0+2^3\times1+2^2\times1+2^1\times0+2^0\times0 = 108$ l

$1101100 = 2^6\times1+2^5\times1+2^4\times0+2^3\times1+2^2\times1+2^1\times0+2^0\times0 = 108$ l

$1101111 = 2^6\times1+2^5\times1+2^4\times0+2^3\times1+2^2\times1+2^1\times1+2^0\times1 = 111$ o

$0101110 = 2^6\times0+2^5\times1+2^4\times0+2^3\times1+2^2\times1+2^1\times1+2^0\times0 = 46$.

Ans: Hello.

Q.7

Decimal Number	7-bit binary	8-bit including PB	Hexadecimal Equivalent
6	0000110	10000110	D
15	0001111	10001111	1F
24	0011000	10011000	31

Q.8 Bit Configuration : 255

a.) Binary (11111111)

b.) BCO: 0010 0101 0101

c.) ASCII (1111 1111) / nbsp also used as non-breaking space " ".

d.) ASCII with odd parity: 1111 1111 1

Q.9

a.) 56 and 227

56 = 111000

227 = 11100011

```
  1 1
  1 1 1 0 0 0 1 1
      1 1 1 0 0 0
-------------------
1 0 0 0 1 1 0 1 1
```

b.) 246 and 25

246 = 11110110
25 = 11001

```
  1 1 1 1 1 0 1 1 0
      1 1 0 0 1
-----------------
1 0 0 0 0 1 1 1 1
```

c.) 2110 and 284

2110 = 100000111110
284 = 100011100

```
  1 0 0 0 0 0 1 1 1 1 1 0
        1 0 0 0 1 1 1 0 0
-------------------------
1 0 0 1 0 1 0 1 1 0 1 0
```

Q.10

a.) 01110000 + 10101111

```
  0 1 1 1 0 0 0 0
  1 0 1 0 1 1 1 1
-----------------
1 0 0 0 1 1 1 1 1
```

b.) 11011001 + 11100111

```
  1 1 0 1 1 0 0 1
  1 1 1 0 0 1 1 1
-----------------
1 1 1 0 0 0 0 0 0
```

c.) 01100101 − 11101000

A B

Two's Comp of B: 00011000

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

Q.11

$$\overline{A}(A+B)+(B+AA)(A+\overline{B})=A+B$$

distributive law: $X(Y+Z)=XY+XZ$

$= A\overline{A}+\overline{A}B+(B+A)(A+\overline{B})$ $\quad \therefore A.\overline{A}=0 \ ; \ A\overline{A}=0$

$= \overline{A}B+(B+A)(A+\overline{B})$

$= \overline{A}B+AB+B\overline{B}+A.A+A\overline{B}$ $\quad B\overline{B}=0 \ ; \ A.A=A$

$= \overline{A}B+A\overline{B}+AB+A$

$= B(A+\overline{A})+A\overline{B}+A$ $\quad \therefore A+\overline{A}=1$

$= B+A\overline{B}+A$

$= B+A(\overline{B}+1)$ $\quad \therefore \overline{B}+1=1$

$= A+B$