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### Assignment 1

#### Question 1

a) 128 Kbits

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

b) 32 Mbits

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

c) 8 Gbits

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

#### Question 2

a) 64 Kbits =  $x$  Mbits.

$$x = \frac{64 \times 2^{10}}{2^{20}}$$

$$x = 0.0625$$

b) 9 Gbits =  $x$  Mbits.

$$x = \frac{9 \times 2^{30}}{2^{20}}$$

$$x = 9216$$

### Q3a) Question 3

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

Binary

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

$$\begin{aligned} 0.3125 \times 2 &= 0.625 \\ 0.625 \times 2 &= 1.25 \\ 0.25 \times 2 &= 0.5 \\ 0.5 \times 2 &= 1.0 \end{aligned}$$

$(01011100011.0101)_2$

Octal

8	369	1
8	46	6
8	5	5
	0	

$$\begin{aligned} 0.3125 \times 8 &= 2.5 \\ 0.5 \times 8 &= 4.0 \end{aligned}$$

$(561.24)_8$

Hexadecimal

16	369	1
16	23	7
16	1	1
	0	

$$0.3125 \times 16 = 5.0$$

$(171.5)_{16}$

b)  $(10111101.101)_2$

Octal

010 111 101 . 101

$(275.5)_8$



Decimal.

$9 \times 2^7 + 1 \times 2^6 + 1 \times 2^5 + 1 \times 2^4 + 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^{-1} + 1 \times 2^{-2}$   
 $10111101.101$

$$(1 \times 2^7) + (1 \times 2^6)$$

$$(1 \times 2^7) + (1 \times 2^6) + (1 \times 2^5) + (1 \times 2^4) + (1 \times 2^3) + (1 \times 2^2) + (1 \times 2^1) + (1 \times 2^0)$$

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

$$= (189.625)_{10}$$

Hexadecimal

$\begin{array}{ccc} 1011 & 1101 & 1010 \\ \hline B & D & A \end{array}$

$$(BD.A)_{16}$$

(C)  $(326.5)_8$

Binary

$\begin{array}{cccc} 3 & 2 & 6 & . & 5 \\ 011 & 010 & 110 & & 101 \end{array}$

$$(011010110.101)_2$$

Decimal

$162.326.5$

$$(3 \times 8^2) + (2 \times 8^1) + (6 \times 8^0) + (5 \times 8^{-1})$$

$$= 192 + 16 + 6 + \frac{5}{8}$$

Hexadecimal

$$(326.5)_8$$

→ to Binary

$$\begin{array}{ccccccc} 0 & 1 & 1 & 0 & 1 & 1 & 0 \\ \hline & \underbrace{\phantom{011}}_D & \underbrace{\phantom{0110}}_6 & \underbrace{\phantom{0110}}_A & & & \end{array}$$

to Hexadecimal

$$(D6A)_{16}$$

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

Binary

$$(1111 \ 0011 \ 1100 \ 0111 \cdot 1010)_2$$

Decimal.

$$\begin{array}{cccc} 3 & 2 & 1 & 0 \\ F & 3 & C & 7 \end{array} \cdot A$$

$$(15 \times 16^3) + (3 \times 16^2) + (12 \times 16^1) + (7 \times 16^0) + (10 \times 16^{-1})$$

$$= 61440 + 768 + 192 + 7 + \frac{10}{16}$$

$$= (62407.625)_{10}$$

Octal

to Binary.

$$(1111 \ 0011 \ 1100 \ 0111 \cdot 1010)_2$$

to Octal.

$$\begin{array}{ccccccc} 001 & 111 & 001 & 111 & 000 & 111 & 101 \\ \hline & \underbrace{\phantom{001}}_1 & \underbrace{\phantom{111}}_7 & \underbrace{\phantom{001}}_1 & \underbrace{\phantom{111}}_7 & \underbrace{\phantom{000}}_0 & \underbrace{\phantom{111}}_7 \end{array}$$

$$(171707.5)_8$$



# Question 4

a) 7562.45 to octal

8	7562	2	$0.45 \times 8 = 3.6$
8	945	1	$0.6 \times 8 = 4.8$
8	118	6	$0.8 \times 8 = 6.4$
8	14	6	$0.4 \times 8 = 3.2$
8	1	1	
	0		

$$(16612.3463...)_{8}$$

b) 1938.257

16	1938	2	$0.257 \times 16 = 4.112$
16	121	9	$0.112 \times 16 = 1.792$
16	7	7	$0.792 \times 16 = 12.672$

$$(792.41C...)_{16}$$

c) 175.175 to binary

2	175	1	$0.175 \times 2 = 0.35$
2	87	1	$0.35 \times 2 = 0.7$
2	43	1	$0.7 \times 2 = 1.4$
2	21	1	$0.4 \times 2 = 0.8$
2	10	0	
2	5	1	
2	2	0	
2	1	1	
2	0		

$$(10101111.0010...)_{2}$$

d) 25.305 to base 8

8	25	1	$0.305 \times 8 = 2.44$
8	3	3	$0.44 \times 8 = 3.52$
			$0.52 \times 8 = 4.16$

$$(31.235...)_{8}$$

## Question 5

~~(a)  $(BEE)_r = (2699)_{10}$~~

~~$r = 16$~~

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

~~a)  $(BEE)_r = (2699)_{10}$~~

~~$(B \times r^2) + (E \times r^1) + (E \times r^0) = 2699$~~

~~$11r^2 + 14r + 14 = 2699$~~

~~$11r^2 + 14r - 2685 = 0$~~

~~(a)  $(BEE)_r = (2699)_{10}$~~

~~$r = 15$~~

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

~~$r = 7$~~

## Question 6

a) 6<sup>th</sup> bit

e.g.  $B = 01000010$

$b = 01100010$

b) 1001000 1100101 1101100 1101100 1101111 0101110

H E L L O .



## Question 7

a) Decimal Number : 6

7-bit binary : 0000110

8-bit binary with parity bit: 10000110Hexadecimal :  $(86)_{16}$ 

b) Decimal number : 15

7-bit binary : 0001111

8-bit binary with parity : 10001111

Hexadecimal :  $(8F)_{16}$ 

c) Decimal Number : 24

7-bit binary : 0011000

8-bit binary with parity : 10011000Hexadecimal :  $(98)_{16}$ 

## Question 8

a) 255  $\rightarrow$  Binary $(11111111)_2$ 

b) BCD

0010 0101 0101

c) ASCII

00110010 00110101 00110101

d) ASCII with odd parity  
 10110010 10110101 10110101

Q9 & Question 9

a)  $56 + 227$

56: 111000

226: 11100011

$$\begin{array}{r} 00111000 \\ + 11100011 \\ \hline (100011011)_2 = 282 \end{array}$$

b)  $246 + 25$

~~246 + 25~~

246: 11110110

25: + 11001  
 24 10001111

c)  $2110 + 284$

2110: 100000111110

284: + 000100011100

2394 100101011010

Question 10

a) 01110000

+ 10101111

(100011111)<sub>2</sub>

b) 11011001

+ 11100111

(11100000)<sub>2</sub>



Day: \_\_\_\_\_

Date: \_\_\_\_/\_\_\_\_/20\_\_

$$c) \quad 01100101 - 11101000$$

$$A = 11101000$$

$$A' = 00011000$$

$$\begin{array}{r} 01100101 \\ + 00011000 \\ \hline 01111101 \end{array}$$

Question 11

$$\begin{aligned} \bar{A}(A+B) + (B+A.A)(A+\bar{B}) &= (A+B) \\ &= \bar{A}(A+B) + (A+B)(A+\bar{B}) \quad \because (A.A = A) \\ &= \bar{A}(A+B) + (A+B.B) \quad \because \text{Distributive law} \\ &= \bar{A}(A+B) + (A+0) \quad \because (B.B = 0) \\ &= \bar{A}A + \bar{A}B + A \quad \because (\bar{A}A = 0) \\ &= A + \bar{A}B + 0 \quad \because \text{Distributive law} \\ &= (A+\bar{A})(A+B) \quad \because (A+\bar{A} = 1) \\ &= (1)(A+B) \\ &= (A+B) \end{aligned}$$

Hence proven.