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Comp Arch Lab Report

1.) 1.1

a.) 0b 1000 1110

decimal = $(2^0 \times 0) + (2^1 \cdot 1) + (2^2 \cdot 1) + (2^3 \cdot 1) + (2^4 \cdot 0) + (2^5 \cdot 0)$

$+ (2^6 \cdot 0) + (2^7 \cdot 1) = 0+2+4+8+0+0+0+128$

$\boxed{= 142}$

hexadecimal 1000 1110 = $\boxed{8E}$

b.) 0x C3BA C=1100 3=0011 B=1011 A=1010

$\boxed{\text{binary} = 1100\ 0011\ 1011\ 1010}$

decimal = $(2^0 \cdot 0) + (2^1 \cdot 1) + (2^2 \cdot 0) + (2^3 \cdot 1) + (2^4 \cdot 1)$

$+ (2^5 \cdot 1) + (2^6 \cdot 0) + (2^7 \cdot 1) + (2^8 \cdot 1) + (2^9 \cdot 1)$

$(2^{10} \cdot 0) + (2^{11} \cdot 0) + (2^{12} \cdot 0) + (2^{13} \cdot 0) + (2^{14} \cdot 1)$

$+ (2^{15} \cdot 1) = \boxed{50106}$

c.) 81

binary
81/2 = 40 R1
40/2 = 20 R0
20/2 = 10 R0
10/2 = 5 R0
5/2 = 2 R1
2/2 = 1 R0
1/2 = 0 R1

$\boxed{\text{ans} = 1010001}$

hex. 101 0001
5 1

$\boxed{\text{hex} = 51}$

d.) 0b 1001 001001

0010 0100 1001

hex = 2 4 9 => $\boxed{249 = \text{hex}}$

decimal = $(2^0 \cdot 1) + (2^1 \cdot 0) + (2^2 \cdot 0) + (2^3 \cdot 1) + (2^4 \cdot 0)$
$+ (2^5 \cdot 0) + (2^6 \cdot 1) + (2^7 \cdot 0) + (2^8 \cdot 0) +$
$(2^9 \cdot 1) = 1 + 8 + 2^6 + 2^9 = \boxed{585}$

e.) BCA1 B = 11 C = 12 A = 10 1 = 1

binary 1011 1100 1010 0001

$= 1 + 2^5 + 2^7 + 2^{10} + 2^{11} + 2^{12} + 2^{13} + 2^{15}$
$= 48289$

f.) 0 binary = 0000 0000
hex = 0

g.) 42

binary $42/2 = 21$ R0
$21/2 = 10$ R1
$10/2 = 5$ R0
$5/2 = 2$ R1
$2/2 = 1$ R0
$1/2 = 0.5$ R1

$\boxed{\text{ANS} = 101010}$

hex = 0010 1010 => $\boxed{2A}$

h.) BAC4 B=11 A=10 C=12 4=4

binary = 1011 1010 1100 0100

decimal = 47812

1.2

a.) $2^{14} = 16Ki$

b.) $2^{43} = 8Ti$

c.) $2^{23} = 8Mi$

d.) $2^{58} = 256Pi$

e.) $2^{64} = 16Ei$

F.) $2^{42} = 4Ti$

1.3.)

a.) $2Ki = 2^{11}$

b.) $512Pi = 2^{59}$

c.) $256Ki = 2^{18}$

d.) $32Gi = 2^{35}$

e.) $64Mi = 2^{26}$

F.) $8Ei = 2^{63}$.

Section 2

1.) The largest 8bit unsigned number is 1111 1111 = 255 when all bits are 1's. When we add 1 to the largest 8 bit integer we get an overflow.

```
  1111 1111
         +1
 ----------
1 0000 0000
```

the largest 8bit ~~strg~~ signed number is 0111 1111 = 127 where the 0 means it's positive. When we add 1 to this number we get

```
  0111 1111
         +1
 ----------
  1000 0000   = 128
```

2.)

```
0  =  0000 0000 - unsigned
      0000 0000 - two's complement
3 =   0000 0011 - unsigned
      0000 0011 - two's complement
```

-3 = ~~does not apply~~ ~~unsigned~~

Not applicable for unsigne.

```
  0000 0011 ->
         +1
 ----------
  0000 0100   flip => 1111 1011  -3 two's complement
```

```
  1111 1100
         +1
 ----------
  1111 1101
```

3.) 42 = 00101010 unsigned
00101010 two's complement

-42 = Not applicable for unsigned.

00101010 → flip = 11010101

+1

11010110

Two's complement signed.

ans = 10101010 = -4

4.) the largest integer that can represent by 8 bits could be as large as infinity depending on how large your encoding sheme can go up to. The larger range of the encoding scheme the larger the 8 bit number, therefore if we have a really large encoding scheme then our largest 8 bit number can be infinity.

5.) if ~~x = 0101~~

~~x' = 1010 + 1 → 0~~ ~~1010 +1 1011~~ ~~0101 +1 0110~~

X = 1111

X + X' = 1111

X + X' + 1 = 10000 with overflow.

6.) Binary numbers shine because they are very useful for computer and machine learning. where 1 = ON ON 0 = OFF or 1 = true and 0 = false. It has many meanings and uses for computers.

Decimal numbers shine in the human world where it is easier for us to record ~~on~~ most things using decimal numbers.

Hexadecimal numbers ~~are use~~ shine when binary numbers become too large. we are able to use Hexadecimal in order to shorten the binary length seeing that ~~the~~ it is a higher use of encoding scheme.

A = 10 = 1010 B = 11 = 1011 C = 12 = 1100

D = 13 = 1101 E = 14 = 1110 F = 15 = 1111

Section 3.

1.) we need at most 2 bits which can go as high as 3 in decimal which is as high as need because $0=0$ $\pi = 3.14$ and $e = 2.7$.

2.) $2 \text{TiB} = 2^{41}$ so 41 bytes long.

3.) I would say we need 2 bits be 1 bit which is $(2^0 \cdot 1) = 1$ which is not enough because $e = 2.7$ there for we would need the 2 bits which go to 3 in decimal value which is ~~enough~~ enough to represent e.

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