Computer architecture lab 1

1.1 Conversions

- **0b1000 1110**

Hexadecimal:
We first split into groups of 4 so: 1000 1110 these correspond to respectively 8 and E so **0x8E**
Decimal:
We multiply every digit with 10 to the power of its respective location.
So, (0*2^0)+(1*2^1)+(1*2^2)+(1*2^3)+(0*2^4)+(0*2^5)*(0*2^6)+(1*2^7)= **142**

- **0xC3BA**

Decimal:
To get from hexadecimal to decimal, we multiply every digit with 16 to the power of its respective location
So in the example C 3 B A, A Is in location 0, B is in location 1...and so on. Note that A is 10 and B is 11 C is 12 so we get the following: 10*(16^0) + 11*(16^1) +3*(16^2) +12*(16^3) =**50196**
Binary:
Ans **= 1100 0011 1011 1010**
Because, A-->10 (1010), and B--> 11 (1011), 3--> (0011), and C--> (1100), so we put them next to each other, we split them up in groups of “4” bits.

- **81**

Hexadecimal:

We will divide th number by 16 (radix) and take the integer part and the decimal part would be multiplied by 16 as shown below:

81/16	5	0.0625*16= 1
5/16	0	0.3125*16=5

Reading from bottom up. The hex equivalent is **0x51**.

Binary:

Same process but we multiply by 2:

81/2	40	0.5*2=1
40/2	20	0
20/2	10	0
10/2	5	0
5/2	2	0.5*2=1
2/2	1	0
1/2	0	0.5*2=1

Once we get zero, we are done. So, from down to up, we read **0b1010001**

- **0b100100100**

Hexadecimal:

We split into groups of 4 digits, so we have 0001 0010 0100 , these correspond to 1 2 4 so we have **0x124**.

Decimal:

We multiply every digit with 10 to the power of its respective location.
So, (0*2^0)+(0*2^1)+(1*2^2)+(0*2^3)+(0*2^4)+(1*2^5)*(0*2^6)+(0*2^7)+ (0*2^8)= **292**

- **0XBCA1**

Binary:

B is 11 → 1011

C is 12 → 1100 putting it all together 1011 1100 1010 0001

A is 10 → 1010

1 → 0001

Decimal:

(1*16^0)+(10*16^1)+(12*16^2)+(11*16^3)= 48289

- **0**

Binary:

00000000

Hexadecimal :

0

- **42**

Hexadecimal:

42/16	2	0.625*16=10
2/16	0	0.125*16=2

So **0x2A**

Binary:

42/2	21	0
21/2	10	0.5*2=1
10/2	5	0
5/2	2	0.5*1=1

2/2	1	0
1/2	0	0.5*2=1

So, **0b101010**

- **0xBAC4**

<u>Binary</u>:

4 → 0100

C → 1100

A → 1010

B → 1011

Answer: 0b1011101011000100

<u>Decimal:</u>

(4*16^0)+ (12*16^1)+(10*16^2)+(11*16^3)= **47812**

1.1 (b)

2^14
= **16 Ki**
2^43
= **8 Ti**
2^23
= **8 Mi**
2^58
= **256 Pi**
2^64
= **16 Ei**
2^42
= **4 Ti**

1.1(c)

2 Ki
= **2^11**
512 Pi
= **2^59**
256 Ki
= **2^18**
32 Gi
= **2^31**
64 Mi
= **2^26**

8 Ei
= **2^63**

2.2

1. Unsigned: largest int= 255 (11111111) largest int +1 = 0 (00000000)
   Two's Complement: largest int= +127 (01111111) largest int +1=-128 (10000000)
2. Unsigned: 0= 00000000,3= 00000011, -3 cannot be represented as an unsigned number
   Two's Complement: 0= 00000000, 3=00000011, -3=11111101
3. Unsigned: 42=00101010, -42 cannot be represented
   Two's Complement: 42=00101010, -42=11010110
4. No such integer exists.
5. x+x' will always equal 1111...1 so x+x' +1= 1111...1+01= 0
6. Binary numbers are the preferred radix for computers because on and off are the easiest signals for computers to understand. Decimal numbers are preferred for hand calculations. Hexadecimal numbers are popular for computer data sizes since they are in multiples of 4.

3.1

1. A variable that can only take on values 0, pi, or e would need **2 bits**.
2. To address 2 TiB of memory, the address would need to be **41 bits** long.
3. **0 bits**