HW 1

Tuesday, January 31, 2017 5:27 PM

1)

a) 3 bytes = 3*8 = 24 bits.

So 2^{24} = 16,777,216 possible combinations.

b) 2017314

Division:

2	2017314	0	
2	1008657	1	
2	504328	0	
2	252164	0	
2	126082	0	
2	63041	1	
2	31520	0	
2	15760	0	
2	7880	0	
2	3940	0	
2	1970	0	
2	985		2

2	985	1	
2	492	0	
2	246	0	
2	123	1	
2	61	1	
2	30	0	
2	15	1	
2	7	1	
2	3	1	
2	1	1	
2	0	0	1

= 00 01111 011 001 00000 1 00010

-2017314 =

1110000 10011 0 11111 0111 0 1
\+ 1

1110000 1 00110 1111 1 0111 1 0

c) 0010 1110 0011 1101 0101 1001

21   19 18 17   13 12 11 10 8   6 4   3   0

$2^{22}+2^{20}+2^{19}+2^{18}+2^{14}+2^{13}+2^{12}+2^{11}+2^{9}+2^{7}+2^{5}+2^{4}+2^{0}$

= $\boxed{3030361}$

1111 0101 1101 1001 1100 0011

0000 1010 0010 0110 0011 1100
\+ 1

0000 1010 0010 0110 0011 1101.

19 17   13   10 9   5 4   3 2   0

= 665149.

So = $\boxed{-665149}$

d)

0010 1110 0011 1101 0101 1001
\+ 1111 0101 1101 1001 1100 0011

~~1~~ 0010 0100 0001 0111 0001 1100

Flip + add 1:

1101 1011 1110 1000 1110 0011
\+ 1

1101 1011 1110 1000 1110 0100

= -2365212.

✓ since 3030361 + -665149 = -2365212

2) a) 101101_2 * 1001_2.

```
      101101
   x    1001
-----------
     1101101
    1000000
   000000
+ 101101
-----------
   110010101
```

b)

```
          11001
110 | 10011010
      110
      ---
       111
     - 110
     -----
        1010
         110
        ----
         100
```

So: 11001, R: 100

3) 3201_4 * 1323_4

```
      3201
    x 1323
    ------
     22203
    13002
  22203
  3201
----------
 123001231
```

$\boxed{123001231}$

4) a) 4120_{10} in Octal.

8	4120	2
8	526	6
8	65	1
8	8	0
8	1	1
	0	

→ $\boxed{10162_8}$

b) 8362 in Hex.

16	8362	10 = A
16	522	10 = A
16	32	0
16	2	= 2
	0	

$\boxed{8362 = 20AA}$

c) 1) 10162_8 to binary.

1 0 1 6 2
001 000 001 110 010 ⇒ 3 digits b/c $2^3 = 8$.

= 001000001110010

2) $20AA_{16}$ to binary

2 0 A A
0010 0000 1010 1010

= 0010 0000 1010 1010.

5)

a) "e3!*"

e = 101 = 01100101
3 = 51 = 00110011
! = 33 = 00100001
* = 42 = 00101010.

= 01100101 00110011 00100001 00101010.

b) $DF2A_{16}$

D = 13 = 1101
F = 15 = 1111
2 = 2 = 0010
A = 10 = 1010.

= 1101111100101010.

c) -172. 2's comp.

172 = 10101100

Flip +1 = 01010011
\+ 1

01010100

Plus preceding 1's: (were 0's but flipped).

$\boxed{1111111101010100.}$

d) -172, excess-2^{15}.

Excess $2^{15} = 2^{16-1}$, where n = 16 bits.

2^{15} = 32,768., so 0000000000000000 = -32,768.

∴ -172 =

```
  1000000000000000
- 1111111101010100  ⇒ -172.
------------------
  0111111101010100  → Flip +1 =
```

1000000010101011
\+ 1

$\boxed{1000000010101100}$

e) 31.75 as binary.

1) 31 in binary = 11111.

2) 0.75 · 2 = 1.5.
0.5 · 2 = 1.

3) 1.111111 · 2^4 = 131 = 1000 0011.

Put together: 0 ⇒ sign
10000011 ⇒ val
mantissa ⇒ 11111.11

31.75 = 0 10000011 1111111 0000000000000000.

f) -14.8125 as binary.

1) 14 in binary = 1110.

2) 0.8125 · 2 = 1.625 = 1
1.625 · 2 = 1.25 = 1
0.25 · 2 = 0.5 = 0
0.5 · 2 = 1 = 1

Put together: 1 ⇒ sign
10000010 ⇒ val
mantissa ⇒ 1110.1101

-14.8125 = 1 10000010 1101101 0000000000000000.